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IN THREE VOLUMES.
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By WILLIAM HENRY HALL, ESQ. *Millman Place, Bedford Row, London.*
AND OTHER GENTLEMEN OF SCIENTIFIC KNOWLEDGE, WHOSE NAMES AND ADDRESSES APPEAR IN THE WORK.

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THE NEW ROYAL
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D

D, THE fourth letter of the alphabet, and the third conſonant. Grammarians generally reckon D among the lingual letters, as ſuppoſing the tongue to have the principal ſhare in the pronunciation thereof; though the Abbot de Dangeau ſeems to have reaſon in making it a palate letter. The letter D is the fourth in the Hebrew, Chaldee, Samaritan, Syriac, Greek, and Latin alphabets; in the five firſt of which languages it has the ſame name, though ſomewhat differently ſpoke, *e. g.* in Hebrew and Chaldee *Daleth*, in Syriac *Doleth*, and in Greek *Delta*.

The form of our D is the ſame with that of the Latins, as appears from all the ancient medals and inſcriptions; and the Latin D is no other than the Greek Δ, rounded a little, by making it quicker and at two ſtrokes. The Δ of the Greeks, again, is borrowed from the ancient character of the Hebrew *Daleth*; which form it ſtill retains, as is ſhewn by the Jeſuit Souciet, in his Diſſertation on the Samaritan Medals.

D is alſo a numeral letter, ſignifying *five hundred*; which ariſes hence, that, in the Gothic characters, the D is half the M, which ſignifies a *thouſand*. Hence the verſe,

Litera D *velut* A *quingentos ſignificabit*.

A daſh added a-top, D̄, denotes it to ſtand for five thouſand.

Uſed as an abbreviation, it has various ſignifications: thus, D ſtands for Doctor; as, M. D. for Doctor of Medicine; D. T. Doctor of Theology; D. D. implies Doctor of Divinity, or "dono dedit;" D. D. D. is uſed for "dat, dicat, dedicat;" and D. D. D. D. for "dignum Deo donum dedit."

DAB, in ichthyology, the Engliſh name of a ſpecies of pleuronectes. See PLEURONECTES.

DACE, in ichthyology, a ſpecies of cyprinus. See CYPRINUS.

DACTYL, DACTYLUS, a foot in the Latin and Greek poetry, conſiſting of a long ſyllable, followed by two ſhort ones: as *cārmĭnĕ*. The dactyl and ſpondee are the moſt conſiderable of theſe poetical feet; as being the meaſures uſed in heroic verſe by Homer, Virgil, &c. Theſe two are of equal time, but not equal motion. The ſpondee has an even, ſtrong, and ſteady pace, like a trot; the dactyl reſembles the nimbler ſtrokes of a gallop.

DACTYLIC *Verſes*, are hexameter verſes, ending in a dactyl inſtead of a ſpondee; as ſpondaic verſes are thoſe which have a ſpondee in the fifth foot inſtead of a dactyl. An inſtance of a dactylic verſe we have in Virg. Æn. lib. vi. 33.

Bis patriæ cecidere manus: quin protinus omnia
Perlegerent oculis ——

DADO, in architecture, is by ſome writers uſed for that part in the middle of the pedeſtal of a column between its baſe and cornice. It is of a cubic form, whence it is alſo denominated dye.

DADUCHI, in antiquity, prieſts of Ceres. That goddeſs, having loſt her daughter Proſerpine, ſay mythologiſts, began to make ſearch for her at the beginning of the night. In order to do this in the dark, ſhe lighted a torch, and thus ſet forth on her travel throughout the world: for which reaſon it is, that ſhe is always ſeen repreſented with a lighted torch in her hand.

DÆMON, Δαιμων, a name the ancients gave to certain ſpirits, or genii, which they ſay appeared to men, either to do them ſervice, or to hurt them. According to the philoſophers, dæmons held a middle rank between the celeſtial gods and men on earth. It was the opinion of many, that the celeſtial divinities did not themſelves interpoſe in human affairs, but committed the entire adminiſtration of the government of this lower world to theſe ſubaltern deities. Several of the heathen philoſophers held, that there were ſeveral kinds of dæmons; that ſome of them were ſpiritual ſubſtances of a more noble origin than the human race, and that others had once been men. But thoſe dæmons that were the more immediate objects of the eſtabliſhed worſhip amongſt the ancient nations were human ſpirits, ſuch as were believed to become dæmons or deities after their departure from their bodies.

Heſiod, and other poets, who have recorded the ancient hiſtory or traditions, on which the public faith and worſhip were founded, aſſert, that the men of the golden age, who were ſuppoſed to be very good, became dæmons after death, and diſpenſers of good things to mankind. Though dæmon is often uſed, in a general ſenſe, as equivalent to a deity; and is accordingly applied to fate or fortune, or whatever elſe was regarded as a god, yet thoſe dæmons who were the more immediate objects of divine worſhip amongſt the heathens, where human ſpirits; as is ſhewn in Farmer on Miracles, chap. iii. ſect. 2. The word dæmon is uſed indifferently in a good and in a bad ſenſe. In the former ſenſe it was very commonly uſed amongſt the ancient heathens. It has been generally thought, that by dæmons we are to underſtand devils, in the Septuagint verſion of the Old Teſtament; but it has been ſhewn, that the word is in that verſion certainly applied to the ghoſts of ſuch dead men as the heathens deified, in Deut. xxxii. 17. Pſ. cvi. 37. Different orders of dæmons had different ſtations and employments aſſigned them. Good dæmons were conſidered as the authors of good to mankind; evil dæmons brought innumerable evils both upon men and beaſts.

DEMONIAC, Δαιμονιζομενος, one poſſeſſed by a dæmon. Dæmoniacs were ſuch as were thought to have a dæmon or dæmons inſpiring and actuating them, ſuſpending the faculties of their minds, and governing the members of their bodies.

We find in the New Teſtament, that what was ſaid and done by the dæmoniacs themſelves, is (in conformity to the vulgar language) very often referred to the dæmons by whom they were ſuppoſed to be inſpired and actuated. And dæmoniacs having been educated in the common opinion concerning the nature and reality of poſſeſſions, did (as it is natural to ſuppoſe they would) frequently fancy themſelves to be poſſeſſed by dæmons, or that they were dæmons themſelves, and ſpoke and acted in conformity to the apprehended ſentiments and inclinations of thoſe ſpirits. Hence their dread of Chriſt's power, and their treaties and expoſtulations with him. See Farmer's Letters in anſwer to Dr. Worthington, p. 98. and p. 139.

The peculiar ſymptoms of the dæmoniacs were certain kinds of inſanity, ſuch as the ancients could not account for by natural cauſes, and deemed to argue the ſeizure of the underſtanding by a malevolent dæmon, who inſtigated the unhappy patient to every thing that was extravagant and injurious to himſelf and others.

Among the Greeks, the Latins, the Jews, and other Eaſtern people, none were thought to be poſſeſſed whoſe underſtandings were not diſturbed. Amongſt the primitive Chriſtians alſo, reputed dæmoniacs were all mad, melancholy, or epileptic perſons; and ſuch likewiſe were all the dæmoniacs of the New Teſtament, as is ſhewn by Dr. Sykes in his Inquiry, and Farther Inquiry concerning this ſubject, and by Mr. Farmer in his Eſſay upon it, chap. ii. ſect. 5, 6. Both theſe writers have alſo taken much pains to ſhew, that the dæmons to whom poſſeſſions were referred by the ancients, were conſidered as human ſpirits.

In the tranſlation of the new teſtament in vulgar uſe, we frequently read of perſons having or being poſſeſſed by a devil or devils, and of Chriſt's caſting out devils. But the Scripture never deſcribes more than one evil ſpirit by the word devil; and never repreſents any perſons as poſſeſſed by the devil, or by devils, not even in a ſingle inſtance, notwithſtanding the great frequency with which the evangeliſts ſpeak on the ſubject of poſſeſſions. In all the inſtances in which the term devil occurs in the Engliſh tranſlation of the New Teſtament, the word is dæmons (δαιμονες, δαιμονια, δαιμονιζομενοι) and not that from whence comes the Engliſh word *devil* (διαβολος). As poſſeſſing dæmons were in the age of the goſpel univerſally regarded as human ſpirits, it is very reaſonable to ſuppoſe that the ſacred writers employ the term dæmon in reference to poſſeſſions, in the ſame ſenſe in which all other perſons did; eſpecially as they have given us no notice of their uſing the word in a new or peculiar ſenſe, and have even themſelves certainly uſed it on other occaſions to deſcribe ſuch dead men as the ſuperſtition of the heathens deified, and corrupt Chriſtians have propoſed as objects of worſhip. 1 Cor. x. 20, 21. 1 Tim. iv. 1. Rev. ix. 20.

DÆMONIACAL *Poſſeſſion*. In the ages of ignorance and ſuperſtition, the credulous part of mankind were eaſily perſuaded to believe, that maniacs and epileptics were really poſſeſſed by dæmons;

dæmons: but thoſe who conſulted their reaſon, and gained an inſight into nature, pronounced what commonly paſſed for dæmoniacal poſſeſſions, to be mere natural diſorders. Indeed the doctrine of dæmoniacal poſſeſſions is manifeſtly repugnant to the perfections of God, and to that fixed order of cauſes and effects which we diſcover in every part of nature, and particularly in the human ſyſtem.

Various expreſſions uſed by Chriſt and his apoſtles are thought by ſome to aſſert or imply the reality of poſſeſſions. We are told, that the people brought to Jeſus were ſuch as were *poſſeſſed and vexed with unclean* ſpirits; and that he *caſt out ſpirits with his word.* But perhaps theſe learned writers do not ſufficiently conſider, that the reality of poſſeſſions and diſpoſſeſſions was never taught by Chriſt and his apoſtles as a doctrine; and that they could not, with propriety, interpoſe their authority in eſtabliſhing the reality of poſſeſſions, conſidered as the ſecret cauſe of thoſe diſorders imputed to them: for the miraculous cure of theſe diſorders being a part of that evidence which was deſigned for the conviction of of unbelievers, we are to judge of the nature of the miracle in queſtion by reaſon alone, not by any authority which cannot be admitted previous to its performance.

DAFFODIL, in botany. See NARCISSUS.

DAFFODIL *Lady*. See AMARYLLIS.

DAGON, in mythology, an idol of the Philiſtines, repreſented under the figure of a man without thighs, with his body ending in the tail of a fiſh bending up backward; and covered with ſcales from the reins to the lower part of the belly. *Dagon* ſignifies *fiſh* in Hebrew.

DAGYSA, a marine animal with which the ſea abounds, not twenty leagues from the coaſt of Spain, firſt diſcovered by Mr. Banks and Dr. Solander, who to this new genus of marine animals gave the name of *dagyſa* from the likeneſs of one ſpecies of them to a gem. Several ſpecimens of them were taken, adhering together, ſometimes to the length of a yard or more, and ſhining in the water with very beautiful colours.

DAIRY, or DAIRO, in the Hiſtory of Japan, is the ſovereign pontiff of the Japaneſe; or, according to Kæmpfer, the hereditary eccleſiaſtical monarch of Japan. In effect, the empire of Japan is at preſent under two ſovereigns, viz. an eccleſiaſtical one, called the *dairo*, and a ſecular one, who bears the title of *kubo.* The laſt is the emperor, and the former the oracle of the religion of the country.

DAIRY, or DAIRY *Houſe*, where milk, butter, cheeſe, whey, &c. are made or kept. See HUSBANDRY.

DAIS, in botany, a genus of the decandria monogynia claſs: the characters of which are, that it has a four leaved involucrum, the corolla is divided into five parts, and the fruit is a ſingle ſeeded berry.

DAISY, in botany. See BELLIS.

DAM, a boundary or confinement, as to dam up, or dam out: *infra damnum ſuum*, within the bounds or limits of his property or juriſdiction.

DAMAGE, is generally taken for any hurt, or hindrance, that a man receives in his eſtate; but more particularly for a part of what the jurors are to enquire of in paſſing verdict for the plaintiff, or defendant, in a civil action, be it perſonal or real. After verdict given of the principal cauſe, they are aſked their conſciences touching coſts and damages, which contain the hindrances that the plaintiff or demandant hath ſuffered by means of the wrong done him by the defendant or tenant.

DAMASCUS *Steel*, a very fine kind of ſteel, made in ſome parts of the Levant, and particularly at Damaſcus, remarkable for its excellent temper; and uſed chiefly in making of ſword blades.

DAMASK, a ſort of ſilken ſtuff, having ſome parts raiſed above the ground, repreſenting flowers or other figures. It has its name from its being originally brought from Damaſcus, in Syria. There is alſo a ſtuff in France called the caffart damaſk, made in imitation of the true damaſk, having the woof of hair, coarſe ſilk, thread, wool, or cotton. Some have the warp of ſilk and the woof of thread; others are all thread, or all wool.

DAMASK is alſo a kind of wrought linen, made in Flanders, ſo called, becauſe its large flowers reſemble thoſe of damaſks. It is chiefly uſed for tables: a table-cloth, and a dozen of napkins are called a damaſk-ſervice.

DAMASKEENING, the art, or act, of adorning iron, ſteel, &c. by making inciſions therein, and filling them up with gold or ſilver wire; chiefly uſed in enriching ſword blades, guards, and gripes, locks of piſtols, &c. Damaſkeening is partly moſaic work, partly engraving, and partly carving; as moſaic work it conſiſts of pieces inlaid; as engraving, the metal is intended, or cut in *creux*; and as carving, gold and ſilver are wrought therein in *relievo*.

DAME was formerly a title of honour, and is ſtill uſed in the Engliſh law to denote a lady; but in common acceptation it ſignifies the miſtreſs of a family of the lower rank in the country.

DAMELOPRE, a kind of bilander uſed in Holland, for conveying merchandize from one canal to another, and contrived for commodious paſſage under the bridges.

DAMIANISTS, a branch of the ancient Acephalous Severites; who agreed with the Catholics in admitting the fourth council; but diſowned any diſtinction of perſons in the Godhead, and profeſſed one ſingle nature incapable of any difference; and yet they called God, the Father, Son, and Holy Ghoſt. They took their name from Damianus, a biſhop of Alexandria, who was originally their leader, in the ſixth century.

DAMPS, in natural hiſtory, are noxious ſteams, or exhalations, frequently found in cloſe ſubterraneous places, particularly mines, pits, and wells.

Damps, with reſpect to their nature and effects may be diſtinguiſhed into two kinds: the firſt is heavier than common air, and therefore chiefly lies at the bottom of pits and mines. It extinguiſhes flame, precipitates the lime of lime water, and is noxious, and often fatal to animals, and on this account called the *choke damp*. It is a ſpecies of fixed air, and has been deſcribed by modern writers under that name. It reſembles thoſe uninflammable vapours, that are produced by the combuſtion of inflammable bodies, as charcoal, and by fermenting and efferveſcing ſubſtances. See AEROLOGY. Definition XII. This damp is ſometimes viſible, and appears in form of a fog, as in a cavern near Pyrmont: and it hangs ſo near the ſurface, that a perſon may ſtand upright, without any other inconvenience than uncommon heat of his lower extremities, but he cannot without danger bend down his head.

Miners try the ſalubrity of the air in pits where they work, by carrying down with them a lighted candle; they ſoon diſcover the effects of the noxious vapour in its diminiſhing, and gradually extinguiſhing the flame; however they remain ſafely for ſeveral hours in pits where a candle cannot burn; but when the damp is ſo ſtrong, that not only the flame of the candle, but alſo the redneſs of the burning wick is extinguiſhed, they never venture to remain a minute, knowing that ſuch a degree of damp will be ſoon fatal to animal life.

The ſecond kind of noxious vapour, though leſs dangerous than the former, is called the fulminating, or fire damp; becauſe when touched by the flame of a candle, it takes fire, and explodes like gun powder. This is chiefly found in coal mines, and ſometimes in lead mines, as in thoſe of Mendip hills. It is lighter than common air, and therefore floats near the roof of ſubterraneous places; and miners, when it is accidentally inflamed, or when they deſignedly ſet fire to it, in order to deſtroy it, lie flat on the ground, and thus eſcape injury. This inflammable vapour may probably be produced by the decompoſition of pyritous matters, with which moſt mines, and eſpecially coal mines, abound.

In ſome of the coal pits in the neighbourhood of Mendip-hills, fire damps almoſt continually happen, ſo that great numbers have been killed, maimed, and burnt by them. The colliers however continue their work notwithſtanding, only uſing the caution of renewing their air very quick, and uſing no candles in their work but thoſe of a ſingle wick, and of ſixty or ſeventy to the pound; which notwithſtanding will give as good a light there, as others of ten or twelve to the pound in other places. They always have the caution to place even theſe behind them, and never preſent them to the breaſt of the work.

The pernicious damps in mines ſhew abundantly, that nature affords us inflammable air in ſome caſes; and we have found by experiments that art can do the ſame, and that very probably on the ſame principles with the natural. Sir James Lowther having collected the air of ſome of theſe damps in bladders, preſerved it ſo well, that, when brought up to London, it would take fire at the flame of a candle, on being let out by the orifice of a piece of tobacco pipe.

It is well known to all that are verſed in chymical experiments, that moſt metals emit a great quantity of ſulphureous vapours during the efferveſcence they undergo in the time of their ſolutions in their reſpective menſtruums. On this principle many have produced an inflammable air by art, like the natural one. It is obſerved that iron, while under ſolution with oil of vitriol, emits a very great quantity of theſe vapours, which are very ſubtile, and not eaſily condenſed. This vapour being received into bladders, in the ſame manner with the natural air of Sir James Lowther, took fire in the ſame manner, on being let out in a ſmall ſtream, and anſwered all the phenomena of the natural kind. See Syſtem of AEROLOGY.

“ Almoſt all chymiſts and metallurgiſts agree in believing, that mineral exhalations contribute to the production of metals. This opinion is ſo much more probable, that as phlogiſton is one of the principles of metals, (if it be true that theſe mineral exhalations are nothing elſe than phlogiſton), and as this principle is then in a ſtate of vapour, and conſequently much divided, perhaps reduced to its ſmalleſt integrant particles, it is then in its moſt favourable ſtate for combination: it is therefore probable, that when theſe exhalations meet earths diſpoſed to receive them, they combine more or leſs intimately with thoſe earths, according to their nature. Perhaps this is the chief operation of the grand myſtery of metalliſation.”

There is a vapour called the peas bloom damp, on account of its ſmell. It always comes in the ſummer time, and hath never been known to be mortal. The miners in the Peak of Derby fancy that it ariſes there from the multitude of red trefoil flowers, called by them honey ſuckles, with which the lime ſtone meadows of the Peak much abound; the ſmell of this gives timely notice to get out of the way.

DAMSEL, Damoisel, or Damoiseau, an appellation anciently given to all young people of genteel or noble extraction of either ſex, e. gr. to the ſons and daughters of knights, barons, and even of kings. Thus, in hiſtory, we read of the damſel Pepin, damſel Louis le Groſs, damſel Richard, prince of Wales. From the ſons of kings, the appellation paſſed to thoſe of great lords and barons; and, at length, to thoſe of gentlemen who were not yet knights.

Damsel, at preſent, is applied to all maids, or girls, not yet married; provided they be not of the loweſt claſs of people.

DANCE, or Dancing, as at preſent practiſed, may be defined, "an agreeable motion of the body, adjuſted by art to the meaſures or tune of inſtruments, or of the voice." But, according to what ſome people reckon more agreeable to the true genius of the art, dancing is "the art of expreſſing the ſentiments of the mind, or the paſſions, by meaſured ſteps or bounds that are made in cadence by regulated motions of the body, and by graceful geſtures; all performed to the ſound of muſical inſtruments, or of the voice."

There is no account of the original of the practice of dancing among mankind. It is found to exiſt among all nations whatever, even the moſt rude and barbarous; and, indeed, however much the aſſiſtance of art may be neceſſary to make any one perfect in the practice, the foundation muſt certainly lie in the mechaniſm of the human body itſelf.

The connection that there is between certain ſounds and thoſe motions of the human body called dancing, hath ſeldom or never been inquired into by philoſophers, though it is certainly a very curious ſpeculation. The power of certain ſounds not only over the human ſpecies, but even over the inanimate creation, is indeed very ſurpriſing. It is well known, that the moſt ſolid walls, nay the ground itſelf, will be found to ſhake at ſome particular notes in muſic. This ſtrongly indicates the preſence of ſome univerſally diffuſed and exceedingly elaſtic fluid, which is thrown into vibrations by the concuſſions of the atmoſphere upon it, produced by the motion of the ſounding body. If theſe concuſſions are ſo ſtrong as to make the large quantity of elaſtic fluid vibrate, that is diſperſed through a ſtone wall; or a conſiderable portion of earth, it is no wonder they ſhould have the ſame effect upon that inviſible and exceedingly ſubtile matter that pervades and ſeems to reſide in our nerves. The conſequence in both caſes is preciſely the ſame; the inanimate bodies tremulate, i. e. dance, to the ſound of the inſtrument; and the perſon who hears the ſounds, has an inclination to move his limbs in proportion to the meaſure or ſucceſſion of the muſical notes. It would ſeem, therefore, that the origin of dancing lies entirely in the mechaniſm of the nerves of the body.

Some great maſters in the art of dancing, having obſerved that muſic, which is inſeparable from it, was capable of being preſerved and conveyed by the muſical characters, imagined by analogy, that the like advantage could be procured to the compoſition of dances. Upon this plan they attempted what is called the chorography, an art which they ſuppoſe was either utterly unknown to the ancients, or not tranſmitted to us from them.

It may indeed be eaſily allowed, that the track or figure of a dance may be determined by written or engraved lines; but thoſe lines will neceſſarily appear ſo perplexing, ſo intricate, ſo difficult, if not impoſſible to ſeize, in their various relations, that they are only fit to diſguſt and diſcourage, without the poſſibility of their conveying a ſatisfactory or retainable inſtruction. Thence it is, that the article of Chorography in the French Encyclopédie is univerſally exploded as unintelligible and uſeleſs: though nothing more than an elementary indication of the art; and an explanation, ſuch as it is, of ſome of the technical terms of it.

Dancing is uſually an effect and indication of joy among moſt nations: though M. Palleprat aſſures us, that there are people in South America, who dance to ſhew their ſorrow; and it likewiſe made a part of the funeral ſolemnities of the ancients.

DANCER, *Rope*, a perſon who walks on a thick rope faſtened to two oppoſite poſts; which is preciſely what is expreſſed by the Latin word *funambulus*. But our rope dancers do more; for they not only walk, but dance and leap upon the rope. They occaſionally exhibit at Sadler's Wells in the vicinity of Iſlington, where their vaultings, and other feats, are truly extraordinary.

DANDELION, in botany, a genus of the polygamia equalis order, belonging to the ſyngeneſia claſs of plants. See Leontodon.

DANEGELT, or Dane-geld from *Dane* and *Gelt*, ſignifying in Dutch, money, an annual tax laid on our anceſtors, firſt of 1*s.* afterwards 2*s.* for every hide of land through the realm, for maintaining ſuch a number of forces as were thought ſufficient to clear the Britiſh ſeas of Daniſh pirates, which heretofore greatly annoyed our coaſts.

In the reign of Henry I. it was accounted among the king's ſtanding revenues; it was levied by king Stephen, and paid in the 1ſt, 2d, 20th, and 21ſt years of Henry II. ſoon after the name was loſt. No church or church land paid a penny to the danegelt; becauſe, as is ſet forth in ancient Saxon law, the people of England placed more confidence in the prayers of the church than in any military defence they could make. Camd. ap. Magn. Brit. p. 68.

DANIEL, or *Book of* Daniel, a canonical book of the Old Teſtament, ſo denominated from its author Daniel, who was a very extraordinary perſon, and was favoured of God, and honoured by men, beyond any who lived in his time. His propheſies concerning the coming of the Meſſiah, and the other great events of after-times, are ſo clear and explicit, that, as St. Jerom tells us, Porphyry objected to them, that thoſe which related to the kings of Syria and Egypt, chap. xi. muſt have been written after the times of Antiochus Epiphanes; whereas this prophecy was tranſlated into Greek a hundred years before his time, and the tranſlation was in the hands of the Egyptians, who had no great kindneſs for the Jews, and their religion. And thoſe prophecies foretelling the ſucceſſes of Alexander, chap. viii. 5. xi. 3. were ſhewn to Alexander by the Jews, in conſequence of which they obtained ſeveral privileges from him. Ant. lib. xi. c. 8. The ſtyle of Daniel is not ſo lofty and figurative as that of the other prophets; it is clear and conciſe, and his narrations and deſcriptions ſimple and natural: in ſhort, he writes more like a hiſtorian than a prophet.

The Jews do not reckon Daniel among the prophets; part of his book, that is, from the fourth verſe of his ſecond chapter, to the end of the ſeventh chapter, was originally written in the Chaldee language; the reaſon of which was, that in that part he treats of the Chaldean or Babyloniſh affairs: all the reſt of the books are in Hebrew. The ſix firſt chapters of the Book of Daniel are a hiſtory of the kings of Babylon, and what befel the Jews under their government. In the ſix laſt he is altogether prophetical, foretelling not only what ſhould happen to his own church and nation, but events in which foreign princes and kingdoms were concerned.

DANK, in commerce, a piece of ſilver current in Perſia, and in ſome parts of Arabia, weighing the ſixteenth part of a drachm. It is alſo a weight uſed by the Arabians to weigh jewels and drugs.

DANZETTE, in heraldry, when the teeth of a line is large.

DAPHNE, in botany, ſpurge laurel; a genus of the monogynia order, belonging to the octandria claſs of plants. There are 11 ſpecies, of which the two following are the moſt remarkable. 1. The laureola, or common ſpurge laurel, a native of the woods in many parts of England. 2. The mezereon, or ſpurge olive, a native of England, Germany, &c. and is a very ornamental ſhrub in gardens.

DAPHNELÆON, in medicine, Δαφνηλαιον (from δάφνη, the *bay tree*, and ελαιον, *oil*), laurinum or oil of bay. This is prepared of the berries, when full ripe and ready to fall off, by boiling them in water.

Laurinum has heating and mollifying virtues, opens the mouths of the veſſels (αναϛοματικην), and removes laſſitudes. It is beneficial in all nervous diſorders, pains and diſtillations of the ears; and is inferior to no other remedy in diſtempers of the kidneys, contracted from cold, the parts being anointed with it: but taken inwardly, it excites a nauſea.

DAPHNIUS, *Lapis*, in natural hiſtory, the name of a ſtone, the veins of which repreſent the grain of the wood of the bay tree.

DAPIFER, the dignity or office of grand-maſter of a prince's houſehold. This title was given by the emperor of Conſtantinople to the Czar of Ruſſia, as a teſtimony of favour. In France the like officer was inſtituted by Charlemagne, under the title of *dapiferat*; and the dignity of dapifer is ſtill ſubſiſting in Germany, the elector of Bavaria aſſuming the title of *arch-dapifer of the empire*, whoſe office is, at the coronation of the emperor, to carry the firſt diſh of meat to table, on horſe-back.

DARAPTI, in logic, a mode of ſyllogiſm in the third figure, wherein the major and minor are univerſal affirmative propoſitions, and the concluſion a particular affirmative. E. gr.

DA *Every truly religious man is virtuous.*
RA *Every truly religious man is hated by the world.*
PTI *Therefore, ſome virtuous men are hated by the world.*

DARDANARIUS, uſurer, monopoliſt; a name anciently attributed to ſuch as cauſed a ſcarcity, and dearneſs of proviſions, particularly corn, by buying and hoarding it up, to raiſe its value, and ſell it again at an extravagant rate. We have had too many modern Dardanarius's, who have attempted to cauſe artificial ſcarcities in times of the moſt luxuriant natural produce. The name Dardanarius was given from one Dardanus, who is ſaid to have made a practice of ſpoiling and deſtroying the fruits of the earth by a ſort of ſorcery. Hof. Lex. in voc.

DARII, in logic, a mode of ſyllogiſms in the firſt figure, wherein the major propoſition is an univerſal affirmative, and the minor and concluſion particular affirmatives. E. gr.

DA *They who ſpeak well of every body have many friends,*
RI *Some ſpeak well of every one.*
I *Therefore ſome have many friends.*

DARTOS, or Dartus, in anatomy, the inner coat of the ſcrotum, compoſed of a great number of muſcular fleſhy fibres: whence ſome conſider it as a cutaneous muſcle. Dr. Hunter ſays no no ſuch muſcle can be found, and Albinus takes no notice of it in his tables. The word is pure Greek, *δαρτος*, *excoriatus*, *pelle nudatus*, of *δερω*, *excorio*; probably becauſe it lies cloſe under the ſkin, or from its excoriated appearance.

DASYPUS, the Armadillo, or Tatou, in tetrapodology, a genus of quadrupeds, belonging to the order of bruta. The daſypus has neither fore-teeth nor dog-teeth; it is covered with a hard bony ſhell, interſected with diſtinct moveable zones or belts; this ſhell covers the head, the neck, the back, the flanks, and extends even to the extremity of the tail; the only parts to which it does not extend, are the throat, the breaſt, and the belly, which are covered with a whitiſh ſkin of a coarſe grain, reſembling that of a hen after the feathers are pulled off. The ſhell does not conſiſt of one entire piece, like that of the tortoiſe; but is divided into ſeparate belts, connected to each other by membranes, which enable the animal to move it, and even to roll itſelf up like a hedge-hog. The number of theſe belts does not depend on the age of the animal, as ſome have imagined; but is uniformly the ſame at all times, and ſerves to diſtinguiſh the different ſpecies. All the ſpecies of this animal were originally natives of America: they were entirely unknown to the ancients; and modern travellers mention them as peculiar to Mexico, Braſil, and the ſouthern parts of America; though ſome indeed have confounded them with two ſpecies of manis, or ſhell-lizard, which are found in the Eaſt Indies: others report that they are natives of Africa, becauſe ſome of them have been tranſported from Braſil to the coaſt of Guinea, where a few have ſince been propagated: but they were never heard of in Europe, Aſia, or Africa, till after the diſcovery of America. They are all endowed with the faculty of extending and contracting their bodies, and of rolling themſelves up like a ball, but not into ſo complete a ſphere as the hedge-hog. They are very inoffenſive animals, excepting when they get into gardens, where they devour the melons, potatoes, and other roots. They walk quickly; but can hardly be ſaid to run or leap, ſo that they ſeldom eſcape the purſuit either of men or dogs. But nature has not left them altogether defenceleſs. They dig deep holes in the earth; and ſeldom go very far from their ſubterraneous habitations: upon any alarm, they immediately go into their holes; but, when at too great a diſtance, they require but a few moments to make one. The hunters can hardly catch them by the tail before they ſink their body in the ground; where they ſtick ſo cloſe, that the tail frequently comes away and leaves the body in the earth; which obliges the hunters, when they want to take them alive and immutilated, to dilate the ſides of the hole.

When they are taken, and find that there is no reſource, they inſtantly roll themſelves up, and will not extend their bodies, unleſs they are held near a fire. When in deep holes, there is no other method of making them come out, but by forcing in ſmoke or water. They keep in their holes through the day, and ſeldom go abroad in queſt of ſubſiſtence but in the night. The hunters uſually chaſe them with ſmall dogs, which eaſily come up with them. When the dogs are near, the creatures inſtantly roll themſelves up, and in this condition the hunters carry them off. However, if they be near a precipice they often eſcape both the dogs and hunters: they roll themſelves up, and tumble down like a ball, without breaking their ſhell, or receiving any injury. The daſypus is a very fruitful animal: the female generally brings forth four young ones every month; which is the reaſon why the ſpecies are ſo numerous, notwithſtanding they are ſo much ſought after on account of the ſweetneſs of their fleſh. The Indians likewiſe make baſkets, boxes, &c, of the ſhells which cover their heads.

Linnæus enumerates ſix ſpecies of daſypus, principally diſtinguiſhed by the number of their moveable belts.

DATA, in mathematics, certain things, or quantities, ſuppoſed to be given, or known, in order, from them, to find out other things or quantities, which are unknown, or ſought for. A problem, or queſtion, generally conſiſts of two parts; *data* and *quæſita*. From the primary uſe of the word *data* in mathematics, it has been tranſplanted into other arts; as philoſophy, medicine, &c.

DATE, an addition, or appendage, in writings, acts, inſtruments, letters, &c. expreſſing the day and month of the year, when the act, or letter, was paſſed or ſigned; together with the place where the ſame wss done. The word is formed from the Latin *datum, given*, the participle of *do, I give*. In writings of importance, the date ſhould be written in words at length; dated or given at London this twenty fifth day of September, in the year of our Lord one thouſand ſeven hundred and ninety. In letters, the date is uſually in figures; London, September 25, 1790. An antedate is a falſe date, prior to the real time when the inſtrument was paſſed, or ſigned. A poſt date, is that poſterior to the real time, &c.

Blackſtone ſays, that a deed is good though it mentions no date, or hath a falſe date: or even if it hath an impoſſible date, as the 30th of February; provided the real day of its being dated or given, that is, delivered, can be proved.

Date, dactylus, the fruit of the palm-tree. See Phoenix.

DATISI, in logic, a mode of ſyllogiſms in the third figure, wherein the major is an univerſal affirmative, and the minor and concluſion are particular affirmative propoſitions. E. gr.

DA *All God's friends are kings.*
TI *Some of God's friends are poor.*
SI *Therefore, ſome poor are kings.*

DATIVE, in grammar, the third caſe in the declenſion of nouns; expreſſing the ſtate or relation of a thing, to whoſe profit or loſs ſome other thing is referred. In Engliſh, where we have properly no caſes, this relation is expreſſed by the ſign *to* or *for*.

DATURA, in botany, the thorn-apple; a genus of the monogynia order, belonging to the pentandria claſs of plants. There are ſix ſpecies. The ſtramonium, or common thorn-apple, riſes a yard high, with an erect, ſtrong, round, hollow, green ſtalk, branching luxuriantly. An ointment prepared from the leaves gives eaſe in external inflammations and in the hæmorrhoids. The ſeeds were lately recommended by Dr. Storck to be taken internally in caſes of madneſs; but they ſeem to be a very unſafe remedy. Taken even in a ſmall doſe, they bring on a delirium, and in a large one would certainly prove fatal. Cows, horſes, ſheep, and goats, refuſe to eat this plant.

DAUCUS, the Carrot; a genus of the digynia order, belonging to the pentandria claſs of plants. There are five ſpecies; but the only one which merits attention is the carota, or common carrot. This is ſo well known as to need no deſcription. There are ſeveral varieties, as the white, the orange, and the purple carrot; but of theſe the orange carrot is the moſt eſteemed. It grows longer, larger, and is commonly more handſome than the others, being often 15 or 18 inches long in the eatable part, and from two to four in diameter at top. Carrots are propagated by ſeeds, which are ſown at different ſeaſons of the year, in order to procure a ſupply of young roots for the table at all times. They were firſt introduced into England, by the Flemings, in the reign of Queen Elizabeth.

In the Syſtem of Agriculture, Sect. 13. we have taken notice of the good properties of carrots as a food for cattle. They have been greatly recommended as proper for fattening hogs; but from ſome experiments mentioned in the Georgical Eſſays, it appears, that though the bacon thus fed is of excellent quality, the feeding is conſiderably dearer than that fed with peaſe, pollard, &c. In the ſame eſſays the following experiment is mentioned by Dr. Hunter, concerning the propriety of raiſing carrots for the uſe of the diſtiller "In the month of October (1773), I took 24 buſhels of carrots. After being waſhed, topped, and tailed, I put them into a large brewing copper with four gallons of water; and covering them up with cloths to haſten the maceration, I ordered a fire to be kindled underneath, which in a ſhort time reduced the whole into a tender pulp. They were then put into a common ſcrew-preſs, and the juice taken from them; which, together with the liquor left in the copper, was run through a flannel bag. The juice was returned into the copper; and, as it was my deſign to make it into ale, I put to it a proportionable quantity of hops. The liquor was then boiled about an hour, when it acquired both the taſte and colour of wort. It was next put into a cooler, and afterwards into the working veſſel, where the yeaſt was added to it. It worked kindly, and in all reſpects was treated as ale. I allowed it to remain in the caſk about four months, when I broached it, but found it of a thick, muddy appearance. I attempted to fine it, but in vain. The taſte was by no means diſpleaſing, as it much reſembled malt liquor. My firſt intention being fruſtrated, I threw it into the ſtill, being about 40 gallons in meaſure, and by two diſtillations obtained four gallons of a clean proof-ſpirit. It had, however, contracted a flavour from the hop, which ſhould be left out when the intention is to reduce the liquor into ſpirit. From a groſs calculation I am induced to think that a good acre of carrots manufactured in this manner, will leave a profit of £.40, after deducting the landlord's rent, cultivation, diſtillation, and other incidental expences. In this calculation, I preſume that the ſpirit is worth ſix ſhillings per gallon, and not exciſed. An acre of barley will by no means produce ſo much ſpirit. A rich ſandy loam is the beſt land for carrot; which, after the crop is removed, will be in high cultivation for corn."

Attempts have alſo been made to prepare ſugar from carrots, but without ſucceſs; a thick ſyrupy matter like treacle being only obtainable. Raw carrots are given to children troubled with worms. They paſs through moſt people but little changed. A poultice made of the roots hath been found to mitigate the pain and abate the ſtench of foul and cancerous ulcers. Crickets are very fond of carrots; and are eaſily deſtroyed by making a paſte of powdered arſenic, wheat-meal, and ſcraped carrots, which muſt be placed near their habitations. By their ſtrong antiſceptic qualities, a marmalade made from carrots has alſo been found uſeful in preventing and curing the ſea ſcurvy.

DAUPHIN is a title given to the eldeſt ſon of France, and preſumptive heir of the crown; on account of the province of of Dauphiné, which in 1343 was given to Philip de Valois, on this condition, by Humbert, *dauphin* of the Viennois. The *dauphin*, in his letters patent, ſtyles himſelf, "By the grace of "God, eldeſt ſon of France, and *dauphin* of Viennois." Dauphin was anciently the title, or appellation of the prince of Viennois in France.

The immediate predeceſſor of the preſent preſumptive heir to the crown of France, or Dauphin, died June 4, 1789, aged 7 years and 9 months, of a very painful and lingering illneſs, which baffled the ſkill of the moſt able phyſicians.

DAY, according to the moſt natural and obvious ſenſe of the word, ſignifies that ſpace of time during which it continues to be light; in contradiſtinction to night, being that partition of time wherein it is dark: but the ſpace of time in which it is light, being ſomewhat vague and determinate, the time between the riſing and the ſetting of the ſun is uſually looked on as the day; and the time which lapſes from its ſetting to its riſing again, the night.

The word day is often taken in a large ſenſe, ſo as to include the night alſo; or to denote the time of a whole apparent revolution of the ſun round the earth; in which ſenſe it is called by ſome a natural day, and by others an artificial one: but, to avoid confuſion, it is uſual to call it in the former ſenſe ſimply the day, and in the latter a nychthemeron; by which term that acceptation of it is aptly denoted, as it implies both day and night. The nychthemeron is divided into twenty-four parts, called hours; which are of two ſorts, equal and unequal or temporary. See the article HOUR.

Different nations begin their day at a different hour. Thus the Egyptians began their day at midnight; from whom Hippocrates introduced that way of reckoning into aſtronomy, and Copernicus and others have followed him: but the greateſt part of aſtronomers reckon the day to begin at noon, and ſo count twenty four hours, till the noon of the next day; and not twice twelve, according to the vulgar computation. The method of beginning the day at midnight prevails alſo in Great Britain, France, Spain, and moſt parts of Europe. The Babylonians began their day at ſun-riſing; reckoning the hour immediately before its riſing again, the twenty-fourth hour of the day; from whence the hours reckoned in this way are called the Babylonic. In ſeveral parts of Germany, they begin their day at ſun ſetting, and reckon on till it ſets next day, calling that the twenty-fourth hour: theſe are generally termed Italian hours. The Jews alſo began their nychthemeron at ſun ſetting: but then they divided it into twice twelve hours, as we do; reckoning twelve for the day, be it long or ſhort, and twelve for the night; ſo that their hours continually varying with the day and night, the hours of the day were longer than thoſe of the night for one half year, and the contrary the other; from whence their hours are called temporary: thoſe at the time of the equinoxes became equal, becauſe then thoſe of the day and night are ſo. The Romans alſo reckoned their hours after this manner, as do the Turks at this day.

DAY, in law, is frequently uſed for the day of appearance in court, either originally, or upon aſſignation. We ſay, he had a day by the rolls; i. e. he had a day of appearance aſſigned him. If a fact be done in the night, you muſt ſay in law proceedings, *in nocte ejuſdem diei*. There are ſeveral return days in the terms; and if either of them happen upon a Sunday, the day following is taken inſtead of it: for Sunday is *dies non juridicus*: and ſo is Aſcenſion day in Eaſter term, St. John the Baptiſt in Trinity term, All Saints and All Souls in Michaelmas term, and the purification of the Virgin Mary in Hilary term. 2 Inſt. 264.

DAY's *Work*, in ſea language, denotes the reckoning or account of the ſhip's courſe, during twenty four hours, or between noon and noon, according to the rules of trigonometry.

DAYS *of Grace*, are thoſe granted by the court at the prayer of the defendant or plaintiff in whoſe delay it is.

DAYS *of Grace*, in commerce, are a number of days allowed by cuſtom for the payment of a bill of exchange after the ſame becomes due; i. e. after the time it was accepted for is expired. In England, three days of grace are allowed: ſo that a bill accepted, in order to be paid, e. gr. ten days after ſight, is not to be paid till thirteen days. Throughout France, they allow ten days of grace; as many at Dantzic; eight at Naples; ſix at Venice, Amſterdam, Rotterdam, and Antwerp; four at Francfort; five at Leipſic; twelve at Hamburgh; ſix in Portugal; fourteen in Spain; thirteen in Genoa, &c. Note, Sundays, and holidays are included in the number of days of grace.

DAZE, in natural hiſtory, a name given by our miners to a ſort of glittering ſtone, which often occurs in their works; and, as it is an unprofitable ſubſtance, is one of thoſe things which they call weeds. Theſe daze are generally of the poorer part of the vein. The ſhoad ſtones are many of them of this nature, and the ends of the veins degenerate again into them. Phil. Tranſ. N° 69.

DEACON, *Dæconus*, a perſon in the loweſt degree of holy orders, whoſe buſineſs is to baptize, read in the church, and aſſiſt at the celebration of the euchariſt. The word is formed from the Latin *diaconus*, of the Greek *διακονος*, *miniſter*, *ſervant*.

Deacons were firſt inſtituted, ſeven in number, by the apoſtles, Acts, chap. vi. which number was retained a long time in ſeveral churches. The office of a deacon, in the church of England, according to the form of ordination, is to baptize, preach, and aſſiſt in the adminiſtration of the Lord's ſupper; and, in ſhort, to perform all the other offices in the liturgy, which a prieſt can do, except that of conſecrating the elements of the Lord's ſupper, and pronouncing the abſolution. No perſon can be ordained a deacon under the age of twenty-three years, unleſs by a faculty or diſpenſation obtained from the archbiſhop of Canterbury: and in order to this, he muſt be provided with a title to a cure, or be a fellow or chaplain in ſome college in Cambridge or Oxford, or a maſter of arts of five years ſtanding, living at his own charge in either of the univerſities, or be admitted by the biſhop who ordains him to ſome benefice or curacy then void. Otherwiſe the ordaining biſhop ſhall maintain him, till he is preferred to ſome eccleſiaſtical living. And by ſtat. 13 and 14 Car. II. c. 4. no perſon is capable of being admitted to any benefice or eccleſiaſtical promotion, till he be ordained a prieſt; nor is a deacon capable of a donative, but is only allowed to uſe his orders as a chaplain to ſome family, a curate to ſome prieſt, or a lecturer without a title.

DEAD *Beat*, in horology, is a general term for a particular conſtruction of pallets; the firſt applied by Mr. Graham to clocks, to prevent the retrograde motion of the wheels, and to remedy the imperfections ariſing from the recoil of the common pallets. The principle of this eſcapement is the ſame as the horizontal wheel in watches, and what the French call *echapement à repos*.

DEAD *Lights*, are wooden ports made to faſten in the cabin windows, to prevent the waves from breaking into the ſhip in a high ſea.

DEAD *Reckoning*, in navigation, the judgment or eſtimation which is made of the place where a ſhip is ſituated; without any obſervation of the heavenly bodies. It is diſcovered by keeping an account of the diſtance ſhe has run by the log, and of her courſe ſteered by the compaſs; and by rectifying theſe data by the uſual allowances for drift, lee-way, &c. according to the ſhip's known trim. This reckoning, however, is always to be corrected, as often as any good obſervation of the ſun can be obtained.

DEAD *Languages*. See PHILOLOGY.

DEAFNESS, the ſtate of a perſon who wants the ſenſe of hearing; for the diſeaſe of the ear, which prevents its due reception of ſounds. Deafneſs generally ariſes either from an obſtruction, or a compreſſion, of the auditory nerve; or from ſome collection of matter in the cavities of the inner ear; or from the auditory paſſage being ſtopped up by ſome hardened excrement; or, laſtly, from ſome excreſcence; a ſwelling of the glands, or ſome foreign body introduced within it.

Thoſe born deaf are alſo dumb, as not being able to learn any language; at leaſt in the common way. However, as the eyes in ſome meaſure ſerve them for ears, they may underſtand what is ſaid by the motion of the lips, tongue, &c. of the ſpeaker; and even accuſtom themſelves to move their own, as they ſee other people do; and by this means learn to ſpeak. Thus it was that Dr. Wallis taught two young gentlemen born deaf, to know what was ſaid to them, and to return pertinent anſwers. Digby gives us another inſtance of the ſame, within his own knowledge. And there was a Swiſs phyſician living at Amſterdam, one John Conrad Amman, who effected the ſame in ſeveral children born deaf, with ſurpriſing ſucceſs. He has reduced the thing to a fixed art or method, which he has publiſhed in his Surdus Loquens, Amſtelod. 1692, and de Loquela, ibid. 1700.

In the Phil. Tranſ. N° 312, we have an account by Mr. Waller, R. S. Secr. of a man and his ſiſter, each about 50 years old, born in the ſame town with Mr. Waller, who had neither of them the leaſt ſenſe of hearing; yet both of them knew, by the motion of the lips only, whatever was ſaid to them, and would anſwer pertinently to the queſtion propoſed. It ſeems they could both hear and ſpeak when children: but loſt their ſenſe afterwards whence they retained their ſpeech, which, though uncouth, was yet intelligible. Such another inſtance is that of Mr. Goddy's daughter, miniſter of St. Gervais in Geneva, related by biſhop Burnet. "At two years old they perceived ſhe had loſt her hearing; and ever ſince, though ſhe hears great noiſes, yet hears nothing of what is ſaid to her. But by obſerving the motions of the mouth and lips of others, ſhe acquired ſo many words, that out of theſe ſhe has formed a ſort of jargon, in which ſhe can hold converſation whole days with thoſe that can ſpeak her language. She knows nothing that is ſaid to her, unleſs ſhe ſees the motion of their mouths that ſpeak to her; ſo that in the night they are obliged to light candles to ſpeak to her. One thing will appear the ſtrangeſt part of the whole narration: ſhe has a ſiſter, with whom ſhe has practiſed her language more than with any body elſe; and in the night, by laying her hand on her ſiſter's mouth, ſhe can perceive by that what ſhe ſaith, and ſo can diſcourſe with her in the dark."

It is obſervable that deaf perſons, and ſeveral others thick of hearing, hear better and more eaſily if a loud noiſe be raiſed at the time when you ſpeak to them: which is owing, no doubt, to the greater tenſion of the ear drum on that occaſion. Dr. Willis mentions a deaf woman, who, if a drum were beat in the room, could hear very clearly; ſo that her huſband hired a drummer for a ſervant, that by this means he might hold converſation with his wife. The ſame author mentions another, who, living near a ſteeple, could always hear very well if there was a ringing of three or four bells, but never elſe. See Syſtem of ANATOMY, Part VI, Sect. X.

DEAL, is a well known kind of wood, of great uſe. A very good method of ſeaſoning planks of deal and fir, is to throw them into ſalt water as ſoon as they are ſawed, and keep them there three or four days, frequently turning them. In this caſe they will be rendered much harder, by drying afterwards in the air and ſun; but neither this nor any other means yet known, will preſerve them from ſhrinking.

Deals, called Bulgendrop deals, the hundred containing ſix ſcore, pay on importation 3*l.* 8*s.* 8 $\frac{40}{100}$ and drawback 3*l.* 3*s.* the rate 12*l.* Meabro deals, ſix ſcore, pay 1*l.* 2*s.* 10$\frac{80}{100}$*d.* and drawback 1*l.* 1*s.* the rate 4*l.* Norway deals, ſix ſcore, pay 1*l.* 8*s.* 7½*d.* and drawback 1*l.* 6*s.* 3*d.* the rate of 5*l.* Spruce deals, ſix ſcore, pay 4*l.* 5*s.* 10½*d.* and drawback 3*l.* 18*s.* 9*d.* the rate 15*l.* Deals from Ruſſia, and all other countries not particularly rated, exceeding twenty feet in length, pay 4*l.* 5*s.* 10*d*½. and drawback 3*l.* 18*s.* 9*d.* the rate 15*l.* Deals from Sweden, or any other country, of twenty feet in length or under, not otherwiſe rated, the hundred and twenty, pay 1*l.* 8*s.* 7½*d.* and drawback 1*l.* 6*s.* 3*d.* the rate 5*l.* Rods of deal expand laterally, or croſs the grain, in moiſt weather, and contract again in dry; and thence have been found to make uſeful hygrometer.

DEAN, a prime dignitary in moſt cathedral and collegiate churches; being uſually the preſident of the chapter. He is called *dean*, *decanus*, of the Greek δεκα, *ten*, as being ſuppoſed to preſide over ten canons or prebendaries at leaſt.

In England, as there are two foundations of cathedral and collegiate churches, the old and the new (the latter being thoſe founded by Henry the Eighth, on the ſuppreſſion of the abbots and priors, when their convents were turned into *dean* and chapter); ſo there are two ways of creating the *deans*. Thoſe of the old foundation, as the *deans* of St. Paul's, York, &c. are raiſed to their dignity much like a biſhop; the prince firſt ſending out his conge d'eſlire to the chapter; the chapter then chooſing, the king yielding his royal aſſent, and the biſhop confirming him, and giving his mandate to inſtal him. Thoſe of the new foundation, as the *dean* of Canterbury, Durham, Ely, Norwich, Wincheſter, &c. are donative, and are inſtalled by a ſhorter courſe; only by the king's letters patent, without either election or confirmation. There are ſome cathedral churches, which never had a *dean*; as that of St. David and Landaff, where the biſhop is the head of the chapter, and in his abſence the archdeacon.

DEAN is alſo applied among us to divers perſons that are the chief of ſome peculiar churches, or chapels: as the *dean* of the King's chapel, who has no juriſdiction.

DEANERY, the office of a dean. Deaneries and prebends may become void, like a biſhoprick, by death, by deprivation, or by reſignation either to the king or biſhop. If a dean, prebendary, or other ſpiritual perſon, be made a biſhop, all the preferments of which he was before poſſeſſed are void; and the king may preſent to them, in right of his prerogative royal. But they are not void by the election, but only by the conſecration.

DEAN *and Chapter*. Anciently, biſhops did not ordinarily tranſact matters of moment *ſine conſilio preſbyterorum principalium*, who were then called *ſenatores eccleſiæ*, and colleagues of the biſhops; repreſented, in ſome meaſure, by our chapters of cathedrals, wherein the *dean* and ſome of the prebends are, upon the biſhop's ſummons, to aſſiſt him in ordinations, deprivations, condemnations, excommunications, and other weighty concerns of the church.

DEATH, *Mors*, is generally conſidered as the ſeparation of the ſoul from the body; in which ſenſe it ſtands oppoſed to life, which conſiſts in the union thereof. Phyſicians have uſually defined death by a total ſtoppage of the circulation of the blood; and a ceſſation of the animal and vital functions conſequent thereon; as reſpiration, ſenſation, &c. An animal body, by the actions inſeparable from life, undergoes a continual change: in time its ſmalleſt fibres become rigid; its minute veſſels grow into ſolid fibres no longer pervious to the fluids; its greater veſſels grow hard and narrow; and overy thing becomes contracted, cloſed, and bound up; whence the dryneſs, immobility, and extenuation, obſerved in old age. By ſuch means, the offices of the minuter veſſels are deſtroyed, and the humours ſtagnate, harden, and at length coaleſce with the ſolids: thus are the ſubtleſt fluids in the body intercepted and loſt, the concoction weakened, and the reparation prevented; only the coarſer juices continue to run ſlowly through the greater veſſels, to the preſervation of life, after many of the animal functions are deſtroyed. At length, in the proceſs of theſe changes death itſelf becomes inevitable, as the neceſſary conſequence of life. But it is rare, that life is thus long protracted, or death ſucceeds merely from the decays and impairments of old age; diſeaſes in a long and horrid train, uſually precipitate diſſolution.

Dr. Stevenſon is of opinion, that after the motion of the heart, arteries, and lungs ceaſes, there often remains a ſmall degree of vital principle, deſerving attention. After a full ſtop of all thoſe organic motions on which life is ſaid to depend, the juices frequently retain ſo much of the animal proceſs, as frequently ſerves to keep up warmth for a long time; which, with proper cheriſhing, might perhaps reſtore life entirely. Every age and country affords inſtances of ſurpriſing recoveries after lying long for dead. From the number of thoſe preſerved by lucky accidents, we may conclude a far greater number might have been preſerved by timely pains and ſkill. Med. Eſſ. Edinb. Vol. V. Art. 77.

This ingenious author hopes, from his theory, that one who from all the above mentioned motions ceaſing, may with propriety be called dead, may recover, and be properly ſaid to come to life again. His theory is, that the cauſe of animal heat, or of the inteſtine motion which has been going on proſperouſly, while the progreſſive motion of the fluids in the veſſels continued, is now checked; yet ſtill proceeds in a lower manner, perhaps like the beginning of fermentation or putrefaction. By this degree of the animal proceſs, the maſs of fluids, particularly in the great reſervoir of venous blood, the heart, rarefying, preſſing every way, and being reſiſted by the valves, ſwells ſo as to fill the flaccid right auricle of the heart, which had been ſome time empty; and thus ſtimulating its fibres, which were at reſt, puts them into motion again; as we ſee the heart, after being taken out of the body, by being pricked, or having warm water thrown on it, beats afreſh, though it has been for ſome time motionleſs. The right auricle being thus filled, and ſtimulated into a contraction, fills the ventricle: which being irritated, likewiſe contracts and empties itſelf into the pulmonary artery; whereby the circulation begins where it left off, and life is reſtored, if the organs and juices are in a fit diſpoſition for it, as they perhaps are much oftener than is imagined. From hence it ſeems, that death does not inevitably attend an entire organic reſt of what we call the fluids of the body; nay, that one cannot be called dead till the energy of the blood is ſo far gone, that, though aſſiſted by all poſſible means, it can never be again able to fill, and ſtimulate into contraction, the right *ſinus venoſus* and auricle of the heart. See a remarkable caſe, in ſupport of this opinion, in Med. Eſſ. Edinb. Vol. V. Art. 55.

The ſigns of death are in many caſes very uncertain. If we conſult what Winſlow or Brachir have ſaid on this ſubject, we ſhall be convinced, that between life and death the ſhade is ſo very undiſtinguiſhable, that even all the powers of art can ſcarcely determine where the one ends and the other begins. The colour of the viſage, the warmth of the body, and ſuppleneſs of the joints, are but uncertain ſigns of life ſtill ſubſiſting; while, on the contrary, the paleneſs of the complexion, the coldneſs of the body, the ſtiffneſs of the extremities, the ceſſation of all motion, and the total inſenſibility of the parts, are but uncertain marks of death begun. In the ſame manner alſo, with regard to the pulſe and breathing: theſe motions are often ſo kept under, that it is impoſſible to perceive them. By bringing a looking-glaſs near to the mouth of the perſon ſuppoſed to be dead, people often expect to find whether he breathes or not. But this is a very uncertain experiment: the glaſs is frequently ſullied by the vapour of the dead man's body; and often the perſon is ſtill alive, though the glaſs is no way tarniſhed. In the ſame manner, neither burning nor ſcarifying, neither noiſes in the ears nor pungent ſpirits applied to the noſtrils, give certain ſigns of the continuance of life; and there are many inſtances of perſons who have endured them all, and afterwards recovered, without any external aſſiſtance, to the aſtoniſhment of the ſpectators. This ought to be a caution againſt haſty burials, eſpecially in caſes of ſudden death.

The law diſtinguiſhes between natural and civil death: the former is the actual termination of life: the latter, when a perſon is not actually dead, but adjudged ſo by law. Thus, if a perſon for whoſe life an eſtate is granted remains beyond ſea, or is otherwiſe abſent ſeven years, and no proof be made of his being alive, or becomes a profeſſed monk, he ſhall be accounted naturally dead. However, the latter diſability, ſince the reformation, is held to be aboliſhed.

DEATH *Watch*, in entomology, the Engliſh name of the pediculus of old wood, a ſpecies of the termes, belonging to the order of aptera and claſs of inſects in the Linnæan ſyſtem. It is nearly of the ſize of the common louſe; and the noiſe, reſembling the beating of a watch, is made by the male or female, when wooing each other. This ticking noiſe the populace have long taken for a preſage of death, in the family where it is heard.

There are two kinds of death watches: of the firſt we have a good account in the Philoſophical Tranſactions, by Mr. Allen. It is a ſmall beetle, five ſixteenths of an inch long, of a dark brown colour, ſpotted; having pellucid wings under the vagina, a large cap, or helmet, on the head, and two antennæ proceeding from beneath the eyes. The part with which it beats, he obſerved, was the extreme edge of the face, which he chooſes to call the upper lip; the mouth being protracted by this bony part, and lying underneath, out of view. Its figure, as it appears in a microſcope, ſee repreſented in Tab. Nat. Hiſt. *Fig.* 2.

This account is confirmed by Mr. Derham, with this difference, that, inſtead of ticking with the upper lip, he obſerved the inſect to draw back its mouth, and beat with its forehead. That author had two death watches, a male and female, which he kept alive in a box, ſeveral months; and could bring one of them to beat whenever he pleaſed, by imitating its beating; and by this ticking noiſe he could frequently invite the male to get up upon the other, in the way of coition. When the male found he got up in vain, he would get off again, beat very eagerly, and then up again: whence the ingenious author concludes thoſe pulſations to be the way whereby thoſe inſects woo one another, and find out, and invite each other to copulation.

The ſecond kind of death-watch is an inſect in appearance quite different from the firſt. The former only beats ſeven or eight ſtrokes at a time, and quicker: the latter will beat ſome hours together, without intermiſſion; and his ſtrokes are more leiſurely, and like the beat of a watch. This latter is a ſmall greyiſh inſect, much like a louſe when viewed with the naked eye. This inſect is at firſt a minute white egg, much ſmaller than the nits of lice; though the inſect is near as big as a louſe. In March it is hatched, and creeps about with its ſhell on. When it firſt leaves its ſhell, it is even ſmaller than its egg; though that is ſcarce diſcernible without a miſcroſcope. In this ſtate it is ſomewhat like the mites in cheeſe: from this ſmall ſtate they grow gradually to their mature or perfect ſize: when they become like the old one, they at firſt run about much more ſwiftly than before. Philoſoph. Tranſ. abr. vol. v. p. 26. &c.

DEBENTURE, a term of trade uſed at the cuſtom-houſe for a kind of certificate ſigned by the officers of the cuſtoms, which entitles a merchant exporting goods to the receipt of a bounty or draw back. All merchandizes that are deſigned to be taken on board for that voyage being entered and ſhipped, and the ſhip being regularly cleared out, and ſailed out of port on her intended voyage, debentures may be made out from the exporter's entries, in order to obtain the drawbacks, allowances, bounties, or premiums; which debentures for foreign goods are to be paid within one month after demand. And in making out theſe debentures, it muſt be obſerved, that every piece of vellum, parchment, or paper, containing any debentures for drawing back cuſtoms or duties, muſt, before writing, be ſtamped, and pay a duty of eight pence. The form of debentures varies, according to the merchandiſe exported. In debentures for foreign goods, no perſon may be admitted to ſwear to the exportation, but the true exporter, either as a proprietor, or who being employed by commiſſion, is concerned in the direction of the voyage. All kinds of debentures, before delivered or paid to the exporters, are entered into a ſeparate book kept for that purpoſe by the collector or comptroller of the cuſtoms.

DEBET, among merchants, ſignifies the ſums due to them for goods ſold on credit, for which they have charged their journal or ledger. Among book keepers, it is uſed to expreſs the left hand page of the ledger, to which are carried all articles ſupplied or paid, on the ſubject of an account.

DEBILITY, in a medicinal ſenſe, is a relaxtion of the ſolids, which often induces weakneſs and fainting.

DEBRUISED, in heraldry, a term peculiar to the Engliſh, by which is intimated the grievous reſtraint of any animal, debarred of its natural freedom, by any of the ordinaries being laid over it. Thus when a pale, &c. is borne upon a beaſt in an eſcutcheon, the beaſt is ſaid to be debruiſed by the pale.

DEBT, a thing due to another, whether it conſiſt of money, goods, or ſervices. The legal acceptation of debt is a ſum of money due by certain and expreſs agreement: as, by a bond for a determinate ſum; a bill or note; a ſpecial bargain; or a rent reſerved on a leaſe, that is fixed and unalterable. We meet with divers kinds of debts: *active debts*, are thoſe whereof a perſon is creditor; *paſſive debts*, thoſe whereof he is debtor. There are alſo *real debts*, *perſonal debts*, and *mixed debts*. It behoves an executor or adminiſtrator to pay regard to the priority of debets in diſcharging them; otherwiſe, on deficiency of aſſets, he muſt anſwer thoſe of a higher nature out of his own eſtate: ſuch are funeral charges, and expence of proving the will; debts to the king on record or ſpecialty; debts, which by particular ſtatutes are to be preferred to all others, as forfeiture for not burying in woollen, money due on poor's rates, letters to the poſt office, and ſome others; debts of record, as judgments, ſtatutes, and recognizances; debts due on ſpecial contracts, as for rent, on bonds, covenants, &c. under ſeal; and laſtly, debts on ſimple contracts, as notes and verbal promiſes, and ſervant's wages.

Debt, *National*. See Fund.

DEBTOR, a perſon who owes ſomething to another: in oppoſition to creditor, which is he to whom it is owing.

DECAGON, a plain figure in geometry, having ten ſides and angles. If all the ſides and angles be equal, it is called a regular decagon, and may be inſcribed in a circle. A fortification conſiſting of ten baſtions, is ſometimes called a decagon.

DECAGYNIA, (from δεκα, *ten*, and γυνη, a *woman*;) the name of the fifth order, or ſecondary diviſion, in the tenth claſs decandria, of the ſexual method, conſiſting of plants, whoſe flowers are furniſhed with ten ſtamina and the ſame number of ſtyles; which laſt are conſidered by Linnæus, and the ſexualiſts, as the female organs of generation in plants. Neurada, and American night ſhade, furniſh examples. See Claſs X. Order V. in Syſtem of Botany, and Plate IV.

DECALOGUE, the ten commandments of God, engraven on two tables of ſtone and given to Moſes, the word is Greek, compoſed of δεκα, *ten*, and λογος, *word*, *ten words*. Accordingly, the Jews call them עשרה הדברים, *the ten words*, which appellation is very ancient. Though both Jews and Chriſtians agree in the number of ten commandments, there is ſome difference as to the manner of dividing them.

The Talmudiſts, and Poſtellus after them, in his treatiſe De Phoenicum Literis, ſay, that the Decalogue, or ten commandments, were engraven quite through the tables which God gave to Moſes; but that nevertheleſs the middle of the ם *Mem* final, and and ס *Samech*, remained miraculouſly ſuſpended without adhering to any thing. See the diſſertation on the Samaritan medals, printed at Paris in 1715. They add, that the Decalogue was written in letters of light, i. e. in luminous ſhining letters.

The Decalogue was originally delivered in two tables; one of which contains our duty to God, expreſſed in the four firſt commandments; and the ſecond, our duty to our neighbour, enforced in the ſix laſt. The church of Rome, for a very obvious reaſon, hath omitted the ſecond commandment in many of her books; and in order to preſerve the number complete, divided the laſt into two.

DECAMP. When an army raiſes its camp, or breaks up from the place where it lay before, they ſay it is decamped.

DECANDRIA, (δεκα, *ten*, and ανηρ, a *huſband*) Linnæus's tenth claſs, comprehending thoſe hermaphrodite plants which bear flowers with ten ſtamina. Of this claſs of plants there are five orders; viz. the monogynia, containing fifty three genera; the digynia, comprehending twelve genera; the trigynia, eleven; the pentagynia, fourteen; and the decagynia, two genera. See Claſs 10, in Syſtem of Botany, and Plate IV.

DECANTATION, in chymiſtry, the act of pouring off a liquor from the fæces, &c. by gently inclining the lip, or canthus of the veſſel; whence the word is derived. See Canthus.

DECEIT, in law, a ſubtle trick, or device, to which may be added all manner of craft and colluſion, or underhand practice, uſed to defraud another, by any means whatever.

DECEMBER, the laſt month of the year, conſiſting of thirty one days; and ſo called as being the tenth month in the Roman year, which commenced with March.

DECEM-TALES, in law, a writ that iſſues directed to the ſheriff, whereby he is commanded to make a ſupply of jurymen, when a ſufficient number does not appear on a trial at bar.

DECEMVIRI, in Roman antiquity, ten magiſtrates choſen annually at Rome, to govern the commonwealth inſtead of conſuls, with an abſolute power to draw up and make laws for the people.

One of the decemvirs had all the enſigns and honours of the function, and the reſt had the like in their turn, during the year of their decemvirate. In them was veſted all the legiſlative authority ever enjoyed by the kings, or, after them, by the conſuls. It was the decemviri that drew up the laws of the twelve tables, thence called *leges decemvirales*, which were the whole of the Roman law for a conſiderable time.

DECHAUSEE', in heraldry, a beaſt diſmembered at all his joints, but not removed from their places.

DECIDUOUS, an appellation chiefly uſed in reſpect to plants: thus, the calix or cup of a flower is ſaid to be deciduous, when it falls along with the flower petals; and, on the contrary, it is called permanent, when it remains after they are fallen. Again, deciduous leaves are thoſe which fall in autumn; in contradiſtinction to thoſe of the ever greens, which remain all the winter.

DECIL, *Decilis*, in aſtronomy, an aſpect or poſition of two planets, when they are diſtant from each other a tenth part of the zodiac, i. e. thirty ſix degrees.

DECIMAL *Arithmetic*, the art of computing by decimal fractions. See the Syſtem of Arithmetic, Article XII.

DECIPHERING, or Decyphering, the art, or act, of finding the alphabet of a cipher, or of explaining a letter written in cipher. Every language has peculiar rules of deciphering: which depend not only on the form of its characters, but likewiſe on the place, order, combination, frequency, and number of the letters. The curious, who deſire farther information on this ſubject, may conſult the art of deciphering deduced from principles, and explained by examples in the German, Dutch, Latin, Engliſh, French, Italian, and Greek languages, by David Arnold Conradus, in the twelfth volume of the Gentleman's Mag. for 1742. See alſo M. s'Graveſande Introd. ad Philoſophiam, cap. xxxv. Leyden, 1737. B. Porta publiſhed a treatiſe on this ſubject; and a collection of letters written in cipher, and deciphered by Dr. Wallis, are now in the library of Oxford.

DECK *of a Ship*, from decker, Dan. *to cover*; a kind of planked floor, connecting the ſides, and ſerving as different platforms to ſupport the artillery, to lodge the men, and to preſerve the cargo.

Half Deck, is a ſpace under the quarter deck of a ſhip of war, between the foremoſt bulk head of the ſteerage, and the fore part of the quarter deck. In the Northumberland colliers, the ſteerage is called the half deck, and is uſually the habitation of the ſhip's crew.

DECLAMATION, a diſcourſe or ſpeech made in public, in the tone and manner of an oration. Among the Greeks, declamation was the art of ſpeaking indifferently on all ſubjects, and on all ſides of a queſtion; of making a thing appear juſt that was unjuſt; and of triumphing over the beſt and ſoundeſt reaſons. Such ſort of declamations, M. de St. Evremond obſerves, were only fit to corrupt the mind, by accuſtoming men, to cultivate their imagination, rather than to form their judgment, and to ſeek for veriſimilitudes to impoſe upon, rather than ſolid reaſons to convince the underſtanding. Among us, declamation is reſtrained to certain exerciſes, which ſcholars perform, to teach them to ſpeak in public.

In the Britiſh ſenate there have been ſome very diſtinguiſhed ſpecimens of the powers of declamation. Even Voltaire has been candid enough to acknowledge, that the ſenatorial orators, in the time of Lord Chatham's adminiſtration, were equal to thoſe of Greece and Rome.

DECLARATION, in the cuſtom houſe and commerce of France, contains a particular account or invoice of what is contained in the bales or caſes, brought to the officer for entrance inward or outward.

Declaration, in law, the act of ſhewing in writing the cauſe of complaint of the demandant, or plaintiff, againſt the defendant, where he is ſuppoſed to have received ſome wrong.

Declaration *of Fidelity*, is uſed for a confeſſion, which the Quakers, who ſcruple taking the oaths of ſupremacy, &c. are obliged to make and ſubſcribe in lieu thereof. Its tenor is a ſolemn promiſe to be true and faithful to king George; with a deteſtation and horror of that damnable poſition, that princes excommunicated by the pope, or any other power, may be depoſed or murdered; and a declaration, that no foreign prince, or power, has any right, juriſdiction, or authority, in this kingdom.

There is alſo a declaration againſt tranſubſtantiation made and ſubſcribed by thoſe who qualify for offices; and a declaration againſt popery to be made and ſubſcribed by the members of both houſes of parliament, by diſſenters qualified according to the toleration act, &c. &c.

DECLARATORY *Part of a Law*, is that by which the rights to be obſerved, and the wrongs to be avoided, are clearly defined and laid down. This depends not ſo much on the law of revelation or of nature, as on the wiſdom and will of the legiſlator.

DECLENSION, in grammar, the inflexion of a noun, according to its diverſe caſes. See Grammar.

DECLINATION, in aſtronomy, the diſtance of the ſun, a ſtar, planet, or other point of the ſphere of the world, from the equator, either northward, or ſouthward. It is the ſame with Latitude in geography. See Syſtem of Astronomy. Sect. VIII.

Circle of **Declination**, is a great circle of the ſphere paſſing through the poles of the world; and on which the declination of a ſtar is meaſured.

Parallax of **Declination**, is an arch of the circle of declination, whereby the parallax of the altitude increaſes or diminiſhes the declination of a ſtar.

Refraction of the **Declination**, an arch of the circle of declination, whereby the declination of a ſtar is increaſed or diminiſhed by means of the refraction.

Declination *of a Vertical Plane*, or *Wall*, in dialling, is an arch of the horizon, comprehended either between the plane and the prime vertical circle, if you account it from eaſt to weſt; or between the meridian and the plane, if you account it from north to ſouth.

DECLINATOR, or **Declinatory**, an inſtrument in dialling, whereby the declination, inclination, and reclination of planes is determined.

DECLINERS, or **Declining** *Dials*, are thoſe which cut either the plane of the prime vertical circle, or the plane of the horizon, obliquely.

DECOCTION, the act of boiling any ſubſtance in water, to extract the virtues out of the ſame for ſome medicinal purpoſe; or the water itſelf, in which the ſubſtance has been boiled. Decoction is moſtly employed about balſamics, detergents, and cathartics; for it is not ſo proper for cephalics, &c. as it exhales the more volatile parts, in which the virtues of all thoſe ingredients conſiſt. The harder bodies, as woods, dried roots, &c. require moſt boiling; but herbs and ſeeds need only be ſcalded. All thoſe decoctions which are reſtringent, and moſt of the cathartics, may for the greater elegance be clarified: but all ſuch as are emollient, and intended to conſiſt of the ſoft and mucilaginous parts of ſimples, are by no means to be ſo managed.

DECOMPOSITION, in chymiſtry and pharmacy, the ſame with analyſis or reſolution; viz. the reduction of a body into its principles, or component parts.

Decomposition is ſometimes taken for any ſort of reſolution, or ſeparation of parts; but, in propriety, decompoſition is a chymical proceſs, in order to a ſeparation of the heterogeneities, or impurities, from any matter.

Decomposition is uſed by Boyle, Newton, and other Engliſh authors, to ſignify the compoſition or junction of two or more bodies, which were previouſly compounded of other parts.

DECORATION, in architecture, any thing that adorns and enriches a building, church, triumphal arch, or the like.

Decoration, is more properly applied to the ſcenes of theatres, which muſt be frequently changed, conformably to the ſubject.

DECORTICATION, the act of peeling, or unhuſking roots, ſeeds, fruits, branches, &c. or of freeing them from their barks, rinds, huſks, or ſhells.

DECOUPLE, in heraldry, the ſame as uncoupled, i. e. parted, or ſevered. Thus, a chevron *decouplé* is a chevron wanting ſo much towards the point, that the two ends ſtand at a diſtance from each other.

DECOY, a place made for catching of wild fowl. Hence alſo a decoy-duck is one that flies abroad, and lights into company of wild ones, and, being become acquainted with them, by her allurement draws them into the decoy place, where they become a prey.

The decoy is uſually made where there is a large pond, ſurrounded with wood, and behind it a marſhy and uncultivated country, where the wild-fowl may ſecurely ſleep during the daytime. The decoy conſiſts of ſeveral pipes, as they are called, which lead up a narrow ditch, that cloſes at laſt with a funnelnut. Over theſe pipes, which become narrow from the firſt entrance, is fixed a continued arch of netting ſuſpended on hoops. There is uſually a pipe or ditch for almoſt every wind that can blow, as the wild-fowl are determined by this circumſtance which pipe to chooſe; and the decoy man always keeps on the leeward ſide of the ducks to prevent his effluvia from reaching their ſagacious noſtrils. Skreens made of reeds are placed at certain diſtances along each pipe, in ſuch a manner, that it is impoſſible for the wild-fowl to ſee the decoy man, before they have paſſed towards the end of the pipe where the net is fixed. In the evening, when the wild-fowl begins to feed, the decoy riſes, and the noiſe of their wings, in their flight, may be heard at a great diſtance. The riſing of the decoy is in Somerſetſhire called *rodding*. The decoy-ducks are fed with hemp-ſeed, which is thrown in ſmall quantities over the ſkreens, to bring them forwards into the pipes, and to allure the wild-fowl to follow. They are ſo trained as to lead the way, after hearing the whiſtle of the decoy man, and enticed by the hemp-ſeed, and to dive under water, whilſt the wild-fowl fly on, and are taken in the net. When they are in ſuch a ſleepy ſtate as not to follow the decoy ducks, a ſmall dog is made to paſs between the ſkreens, approaching gradually nearer and nearer to to the purſe-net; which draws the attention of the wild-fowl, and makes them advance forward; at length the decoy man appears behind a ſkreen, and drives them into the net.

The general ſeaſon for catching wild fowl in decoys is from the latter end of October till February. The act of 10 Geo. II. cap. 32. forbids taking them from June 1. to Oct. 11. under a penalty of five ſhillings for every bird deſtroyed within that time.

The Lincolnſhire decoys are commonly ſet at a certain annual rent, from 15 to 20 pounds a year: and there is one in Somerſetſhire that pays 30l. The former contribute principally to ſupply the markets in London. Amazing numbers of ducks, wigeons, and teal, are taken: by an account of the number caught a few winters paſt, in one ſeaſon, and in only ten decoys, in the neighbourhood of Wain-fleet, it appeared to amount to 31,200, in which are included ſeveral other ſpecies of ducks: it is alſo to be obſerved, that, in the above particular, wigeon and teal are reckoned but as one, and conſequently ſell but at half price of the ducks. Pennant's Zoology, Vol. II. p. 594.

DECREES *of Council*, are the laws made by them, to regulate the doctrine and policy of the church.

Decrees *in Chancery*, are the determination of the lord chancellor, upon a full hearing of a cauſe.

DECREET, in the law of Scotland, a final decree or judgment of the lords of ſeſſion, from which an appeal only lies to parliament.

Decreet-*Arbitral*, in Scots law, the ſentence or judgment of one to whom parties voluntarily ſubmit the determination of any queſtion betwixt them.

DECREMENT, in heraldry, ſignifies the wane of the moon from the full to the new. The moon in this ſtate is called *moon decreſcent*, or in *decours*; and when borne in coat-armour, faced to the left ſide of the eſcutcheon, as ſhe does to the right ſide when in the increment.

DECREPITATION, in chymiſtry, the operation of drying and calcining ſalts over the fire, continuing till ſuch time as they ceaſe to crackle.

Decripitation is alſo applied to the noiſe or crackling of the ſalts during the operation.

DECREPITUDE, in medicine, the conſequence of the infirmities of old age: which by degrees leads to death.

DECRETAL, in the canon law, a letter of a pope determining ſome point or queſtion in the eccleſiaſtical law. The decretals compoſe the ſecond part of the canon law. Gratian publiſhed a collection of decretals, containing all the ordinances made by the popes till the year 1150. Gregory IX. in 1227, following the example of Theodoſius and Juſtinian, formed a conſtitution of his own, collecting into one body all the deciſions and all the cauſes which ſerved to advance the papal power; which collection of decretals was called the *Pentateuch*, becauſe it contains five books.

DECUPLE, in arithmetic, a term of relation, or proportion, implying a thing to be ten times as much as another.

DECURY, ten perſons ranged under one chief, or leader, called the *Decurio*. The Roman cavalry was divided into decuries, which were ſubdiviſions of a century, each century containing ten decuries.

DECUSSATION, a term in geometry, optics, and anatomy, ſignifying the croſſing of two lines, rays, or nerves, when they meet in a point, and then go on ſeparately from one another.

DECUSSORIUM, a ſurgeon's inſtrument, wherewith the *dura mater* is preſſed down in trepanning to ſecure it from damage in operation.

DEDICATION, the act of conſecrating a temple, altar, ſtatue, place, &c. to the honour of ſome deity. The uſe of dedications is very ancient, both among the worſhippers of the true God, and among the heathens: the Hebrews call it חנכה, *bhanuahah*, *initiation*; which the Greek tranſlators render εγκαινια, and εγκαινισμος, *renewing*. In the ſcripture we meet with *dedications* of the tabernacle, of altars, of the firſt and ſecond temple, and even the houſes of private perſons. Numb. vii. 10, 11, 84, 88. Deut. xx. 5. 1 Kings viii. 63. 2 Chron. vii. 5, 9. Ezra vi. 16, 17. 1 Eſd. vii. 7. Pſalm xxx. 1. Heb. ix. 18. There are alſo *dedications* of veſſels and garments of the prieſts and Levites, and even of the men themſelves. Under the Chriſtian diſpenſation, we call the like ceremonies *conſecrations*, *benedictions*, *ordinations*, &c. and not dedications, which is only applied to places, as to church; and is properly the conſecration thereof performed by a biſhop, and a number of ceremonies preſcribed by the church. The cuſtom is ſtill retained in diverſe places, under the name of *feaſts*, *wakes*, or *vigils*. The Jews celebrated the anniverſary of the dedication of their temple every year, for eight days; this was firſt enjoined by Judas Maccabæus, and the whole ſynagogue, in the year of the Syro-Macedonian æra 148, i. e. 165 years before Chriſt, on occaſion of the victory obtained by the Maccabees over the Greeks. It began every year on the twenty-fifth day of Ciſleu, and was continued to the eighth day, during all which time they illuminated their houſes, by ſetting up candles at every man's door, whence it was called the feaſt of lights. This feſtival Chriſt honoured with his preſence at Jeruſalem. John x. 22. Leo of Modena ſays, that they begun with one lamp, and added to the number, according to the day of the feaſt; ſo that on the laſt day they had eight lamps in their houſes.

The heathens had alſo dedications of temples, altars, and images of their gods, &c. Nebuchadnezzar had a ſolemn dedication of his ſtatue, Daniel iii. 2. Pilate dedicated gilt bucklers at Jeruſalem, to Tiberius; Philo de Legat. Petronius would have dedicated a ſtatue to the emperor in the ſame city, ibid. p. 791. Tacitus, Hiſt. lib. iv. cap. 53. mentions the dedication of the Capitol upon rebuilding it by Veſpaſian, &c. The heathen temples were dedicated with many ceremonies, the principal of which were the following. The pontiffs and people encompaſſed the temple with garlands and feſtoons of flowers; the veſtal virgins, holding branches of olive-trees in their hands, ſprinkled the outſide of the temple with the luſtral water; then the perſon who conſecrated, being the prætor, cenſor, &c. drew near the gate with a pontiff at his ſide, who directed him in pronouncing the words of conſecration; after which they ſacrificed a beaſt in the courts of the temple.

DEDICATION, in literature, is an addreſs prefixed to a book, ſoliciting patronage, or teſtifying reſpect for the perſon to whom it was made. The dedication of the fourth part of Mr. Edwards's Hiſtory of Birds is curious: *To* GOD *! the* ONE *eternal! the incomprehenſible! the omnipreſent! omniſcient and Almighty Creator of all things that exiſt! from orbs immeaſurably great, to the minuteſt points of matter, this* ATOM *is dedicated and devoted, with all poſſible gratitude, humiliation, and worſhip, and the higheſt adoration both of body and mind, by his moſt reſigned, low, and humble creature*, G. E.

DEDUCTION, in commerce, a ſubtracting, or retrenching, a little ſum paid, from a greater remaining to pay.

DEDUCTION, in logic and ſcience, denotes a proceſs or chain of reaſoning, where from principles ſuppoſed and allowed, we arrive at the truth of any propoſition.

DEDUCTIVE *Evidence*, in ethics, is derived either from the invariable properties or relations of general ideas, or from the actual, though perhaps variable, connections ſubſiſting among things. The former is called *demonſtrative*, and the latter *moral*.

DEED, in law, an inſtrument written on paper or parchment, comprehending ſome contract, bargain or agreement between the parties thereto, in relation to the matter therein contained.

DEEMSTERS, or **DEMSTERS**. All controverſies in the Iſle of Man are decided, without proceſs, writings, or any charges, by certain judges, choſen yearly from among themſelves, called deemſters. They ſit as judges in all courts, either for life or property; and with the advice of the twenty-four keys, declare what is law in uncommon emergencies.

DEEP *Waiſted*, in naval architecture, denotes the ſtructure of a ſhip's deck, when the quarter-deck and fore-caſtle are elevated from four to ſix feet above the level of the upper-deck, ſo as to leave a vacant ſpace, called the waiſt, on the middle of the upper-deck.

DEER, *Cervus*, in tetrapodology, the name of a genus of animals, the characters of which are, that the horns fall off every year, that they are ſolid and branched, and that the animal has eight cutting teeth in the lower jaw, and none in the upper. The word *cervus*, uſed alone, is underſtood by authors to mean the ſtag, or red-deer, the others being all diſtinguiſhed by their ſeveral adjectives; the common fallow-deer being called *cervus platyceros*, or the broad horned deer. The common deer is more preſerved in England than in any other part of the world, and carries its diſtinction from the red deer, in its ſize, and in the falcated figure of its horns. They are ſaid to have been firſt introduced here by king James I. out of Norway, who firſt brought them into Scotland, and from thence into his chaſes of Enfield and Epping. They are ſcarcely known in France, but are ſometimes found in the north of Europe. In Spain they are extremely large: they are met with in Greece, the Holy Land, and China; but, in every country except our own, are in a ſtate of nature, unconfined by man.

The method of hunting deer in the iſland of Ceylon is very particular. The huntſmen go out in the night, and only two uſually go together; the one of theſe carries upon his head an earthen veſſel, in which there is ſome fire burning and flaming; the ingredients are generally ſmall ſticks cut into pieces, and common roſin; of this the other man carries a ſupply about him to repleniſh the pot when it becomes low. The perſon who has the fire upon his head carries in one hand a ſtaff, on which there are fixed eight bells, and the larger theſe are the better. The man goes firſt into the woods, and the other follows cloſe behind, with a ſpear in his hand. As ſoon as the deer hears the noiſe of the bells, he turns toward the place whence the ſound comes, and ſeeing the fire, he eagerly runs up to it, and ſtands gazing at a ſmall diſtance; the ſecond man has then nothing to do but to kill him with the ſpear, for he ſees neither of them. Not only deer, but elks, and even hares, are thus taken; for they gaze at the fire, and never ſee the men. The profits of this ſort of hunting are very large, without any danger; for though there are great numbers of tygers, elephants, and wild boars in thoſe woods, the huntſmen are in no danger of them while the fire burns, for they all run away from it. Phil. Tranſ. N° 278. p. 1094.

Rein **DEER**, in tetrapodology, an animal very common in all the northern nations, and called by ſome authors *tarandus* and *machlis*. It is of the ſhape of a ſtag, but its body is thicker, and its whole make much more robuſt and ſtrong. The breaſt is thick, covered with very long hairs. The legs very hairy, and the hoofs moveable; for the creature expands and opens them in going; its horns are very long and finely branched. They differ from the horns of the elk in their length, and from thoſe of the ſtag or red-deer in their breadth, and from both, in the multitude of branches, and in their colour, which is white. The lower branches, which fall very near the forehead, are ſaid to be uſed by the creature to break the ice, when the waters are frozen over, that he may get drink. It feeds on ſhrubs and plants, and on the moſs which it finds on the earth, and upon the barks of trees. It is of prodigious uſe, as a beaſt of carriage, to the Laplanders; and almoſt all the other nations far north. Its horns and hoofs are of uſe in ſpaſmodic affections.

DE FACTO, ſomething actually in fact, or exiſting: in contradiſtinction to *de jure*, where a thing is only ſo in juſtice, or equity, but not in fact.

DEFAMATION, in law, the ſpeaking ſlanderous words of another; for which the ſlanderer is puniſhable, according to the nature of his offence, either by action upon the caſe at common law, or by ſtatute in the eccleſiaſtical court.

DEFAMATORY, a term chiefly uſed in the phraſe *defamatory* libel, ſignifying a writing intended to ſcandalize, or diſcredit a perſon, &c.

DEFAULT, in law, non-appearance, or an omiſſion of what a perſon ought to do, particularly before a court of juſtice, at a day aſſigned; for which judgment may be given againſt the defaulter. Jurors making default in their appearance for trying of cauſes ſhall loſe and forfeit iſſues, unleſs they have a reaſonable excuſe proved by witneſſes.

DEFEASANCE, in law (from the French *defaire*, *to defeat*), ſignifies a condition relating to a deed, which being performed the deed is defeated, and rendered void, as if it had never been made.

DEFECTIVE, or **DEFICIENT** *Nouns*, in grammar, are ſuch as want either a whole number or a particular caſe, or are totally indeclinable.

DEFENCE, in ſieges, is uſed for any thing that ſerves to preſerve or ſcreen the ſoldiers, or the place. See FORTIFICATION.

Line of **DEFENCE**, is that which flanks a baſtion, being drawn from the flank oppoſite thereto.

DEFENCE, in its true legal ſenſe, denotes an oppoſing or denial of the truth or validity of the complaint, anſwering to the *conteſtatio litis* of the civilians. It is a general aſſertion which the defendant makes immediately after the count of declaration, that the plaintiff hath no ground of action; which aſſertion is afterwards extended and maintained in his plea.

DEFENDANT, a term in law, ſignifying him who is ſued in an action perſonal; a tenant is he who is ſued in an action real.

DEFENDER *of the Faith (Fidei Defenſor)*, is a peculiar title belonging to the king of England; as Catholicus to the king of Spain; and Chriſtianiſſimus to the king of France, &c. Theſe titles were given by the popes of Rome; and that of *fidei defenſor* was firſt conferred by Leo X. on king Henry VIII. for writing againſt Martin Luther; and the bull for it bears date *quinto idus Octob.* 1521. It was afterwards confirmed by Clement VII.

Lord Herbert's Hiſt. Henry VIII. 105. But the pope, on Henry's ſuppreſſing the houſes of religion, at the time of the Reformation, not only deprived him of his title, but depoſed him from his crown alſo; though in the thirty-fifth year of his reign, this title, &c. was confirmed by parliament; and hath continued to be uſed by all ſucceeding kings to this day. Lex Conſtitutionis, 47, 48. Chamberlayne ſays, the title belonged to the kings of England before that time; and for proof hereof appeals to ſeveral charters granted to the univerſity of Oxford. So that pope Leo's bull was only a renovation of an ancient right. Pref. ſtat. lib. i. cap. 2.

DEFENDING, in fortification, is ordinarily ſynonimous with flanking. Thus we ſay the flank defends the curtin, and the oppoſite face of the baſtion; this demilune flanks, or defends, the horn, or crown-work. The ancient fortifications are eaſily taken; there being nothing to defend, that is, to flank them.

DEFENSITIVE, in medicine and ſurgery, denotes a bandage, plaſter, or the like; uſed in the cure of a wound, to moderate the violence of the pain, the flux of blood, and the acceſs, or impreſſion, of the external air.

DEFERENT, Deferens, in anatomy, is applied to certain veſſels of the body, appointed for the conveyance of humours from one place to another.

Vaſa Deferentia are two white ſolid flatted tubes, one lying on the right ſide, and the other on the left; from the epididymis, of which they are continuations; each of them runs up in the cellula vagina of the ſpermatic veſſels; as high as the openings in the abdominal muſcles, the blood veſſels lying forward, and the vas deferens behind them. Theſe veſſels convey the ſeed as faſt as it is ſecreted and prepared in the teſticles, &c. into the veſiculæ ſeminales; there to be depoſited till an emiſſion is required.

The paſſage of the *vaſa deferentia* into the *veſiculæ ſeminales* is very particular. Theſe canals are incurvated behind the bladder, and their contracted extremities unite at that place. They unite in an angle, and run between the contiguous extremities of the *veſiculæ*; and this union is ſo cloſe, that the adhering portions ſeem only to form the middle ſeptum, between two ſmall tubes; ſee Syſtem of Anatomy, Part III. Sect. II. and the Plate on the Male Organs of Generation, *Fig.* 1, 66.

Deficient *Numbers*, are ſuch whoſe parts, added together, make leſs than the integer, whoſe parts they are. Such, e. gr. is 8; whoſe quota parts are 1, 2, and 4; which together, only make 7.

DEFILE, in fortification, a narrow paſs or way through which a company of horſe, or foot, can paſs only in file, by making a ſmall front; ſo that the enemy may take an opportunity to ſtop their march, and to charge them with ſo much the more advantage, becauſe the front and rear cannot reciprocally come to the relief of one another.

DEFINITE, in grammar, is applied to an article that has a preciſe, determinate ſignification. Such are, the article *the* in Engliſh, *le* and *la* in French, &c. which fix and aſcertain the noun they belong to, to ſome particular; as, *the* king *le* roy: whereas, in the quality *of*, king, *de* roy, the articles *of*, and *de*, mark nothing preciſe; and are therefore called indefinite.

DEFINITION, in logic, an enumeration of the chief ſimple ideas, whereof a compound idea conſiſts; in order to aſcertain, or explain, its nature and character. Definitions are of two kinds; the one *nominal*, or, *of the name*: the other *real*, or, *of the thing*.

Definition *of the Name*, or, *Nominal* Definition, is that which explains the ſenſe or ſignification appropriated to a word: or, as Wolfius more accurately conſiders it, it is an enumeration of certain marks, or characters, ſufficient to diſtinguiſh the thing defined from any other thing; ſo as to leave it out of doubt, what the ſubject is that is intended, or denoted by the name. This is what is meant by definition in mathematics. Such is the definition of a ſquare, when it is ſaid to be a quadrilateral, equilateral, rectangular figure.

Definition *of a Thing*, or *Real* Definition, is properly an enumeration of the principal attributes of a thing, in order to convey or explain its nature. Thus, a circle is defined a figure, whoſe circumference is every where equidiſtant from its centre.

Definition, in rhetoric, is one of the common places, and is defined by Tully, a ſhort comprehenſive explanation of a thing.

The definitions of the orator, it muſt be obſerved, differ much from thoſe of the logician and philoſopher: theſe latter define a thing cloſely and drily by genus and difference; e. gr. man is a reaſonable animal, &c. The orators take a larger compaſs and define things more ornamentally from the places of rhetoric, thus: man is a curious work of an Almighty Creator, framed after his own image, endued with reaſon, and born for immortality. But this rhetorical definition, in ſtrictneſs, comes nearer to the nature of a deſcription, than an accurate definition.

DEFINITIVE is applied to ſomewhat that terminates or decides a queſtion, or proceſs. Thus we ſay; the houſe of lords have paſſed a definitive ſentence in ſuch a cauſe: the church has given a definitive judgment on ſuch an article of faith. The word ſtands in oppoſition to proviſional, and interlocutory.

DEFLAGRATION, in chymiſtry, the kindling, or ſetting fire to a ſalt, a mineral, or other matter, either alone, or mixed for that purpoſe, with a ſulphureous one, in order to purify it. As is done in the preparing of Æthiops mineral by fire, or ſal prunellæ, &c. The word is formed of the Latin *de*, and *flagrare*, *to burn*. This ſhort proceſs has been often recommended to the world as of great uſe in trying the ſtrength of brandies, and other vinous ſpirits, and has been greatly improved in this reſpect by Mr. Geoffroy.

The common way of trying ſpirits by deflagration, is to meaſure out any quantity of it, then to heat it, and ſet it on fire; if after it will no longer burn, the remainder is half as much as the quantity meaſured out for the trial was, then the ſpirit tried is found to conſiſt of half water, and half totally inflammable ſpirit, that is, it is exactly what we underſtand by the term perfect proof, and according as the remainder is more or leſs than half the original quantity, it is ſo much below or ſo much above proof, or the due ſtrength of brandy. See Syſtem of Chymiſtry, Part II.

DEFLECTION, the turning any thing aſide from its former courſe, by ſome adventitious or external cauſe. The word is often applied to the tendency of a ſhip from her true courſe, by reaſon of currents, &c. which divert her, and turn her out of her right way.

Deflection *of the Rays of Light*, is a property which Dr. Hooke obſerved in 1674-5, and read an account of before the Royal Society, March 18, the ſame year. He ſays, he found it different both from reflection, and refraction; and that it was made towards the ſurface of the opacous body perpendicularly. This is the ſame property which Sir Iſaac Newton calls Inflection. It is called by others Diffraction.

DEFLORATION, or Deflowering, the act of violating, or taking away a woman's virginity. Death, or marriage, are decreed by the civil law in caſe of defloration. Many anatomiſts make the hymen a real proof of virginity, perſuaded that where it is not found, the girl muſt have been deflowered. The natives of the coaſt of Malabar hold virginity in ſo little eſtimation, that they pay ſtrangers to come and deflower their brides. Among the Scots, it was a privilege of the lords of the manor, that they ſhould have the firſt night's lodging with their tenant's wives. See Culliage.

DEFLUXION, or Fluxion, a falling, or flowing of ſome humour to any part of the body; as of rheum on the trachea, and œſophagus, in a catarrh. The word is formed from the Latin *defluo*, *I flow down*, the humours falling upon ſome part, where they are gathered together. Defluxions on the lungs are of dangerous conſequence. Defluxions on the eyes produce a weakneſs of ſight, and frequently blindneſs.

DEFOLIATION (from *de*, and *folium* a leaf); the fall of the leaves. A term oppoſed to *frondeſcentia*, the annual renovation of the leaves, produced by the unfolding of the buds in ſpring.

Moſt plants in cold and temperate climates ſhed their leaves every year; this happens in autumn, and is generally announced by the flowering of the common meadow ſaffron. The term is only applied to trees and ſhrubs; for herbs periſh down to the root every year, loſing ſtem, leaves, and all. All plants do not drop their leaves at the ſame time. Among large trees, the aſh and walnut, although lateſt in unfolding, are ſooneſt diveſted of them; the latter ſeldom carries its leaves above five months.

Some trees and ſhrubs preſerve their leaves conſtantly through the whole year; and are not in the leaſt influenced by the clemency or inclemency of ſeaſons. Such are the firs, juniper, yew, cedar, cypreſs, and many other trees, hence denominated *evergreens*. Theſe preſerve their old leaves a long time after the formation of the new, and do not drop them at any determinate time.

Some herbaceous perennials, as the houſe-leeks and navelworts, enjoy the ſame privilege with the ever-green trees, and reſiſt the ſeverities of winter: ſome even can diſpenſe with the earth for ſome time; being replete with juices, which the leaves imbibe from the humidity of the atmoſphere, and which, in ſuch plants, are, of themſelves, ſufficient for effecting the purpoſes of vegetation. It is for this reaſon, that, unleſs in exceſſive hot weather, gardeners are ſeldom wont to water fat ſucculent plants, as the aloes, which rot, when they are moiſtened, if the ſun does not quickly dry them up.

The leaves of all the ever-green ſhrubs and trees, have a thin compact ſkin, or cover, over their ſurface; as is eaſily diſcovered by macerating them in water, in order to ſeparate the parenchyma, or pulp, from the veſſels of the leaves; which cannot be effected in any of theſe ever-greens, till a thin parchment-like cover is taken off. Theſe trees and ſhrubs are found by experiment to perſpire but little, when compared with others which ſhed their leaves; and it is, perhaps, principally owing to this cloſe covering, as alſo to the ſmall proportion of moiſture contained in their veſſels, that they retain their verdure, and continue through the winter on the trees. The nutritive juices of theſe plants always abound, more or leſs, with an oily quality, which ſecures them from being injured by ſevere froſts; ſo that many of theſe ever-green trees are adapted to grow in the coldeſt parts of the habitable world.

With reſpect to deciduous trees, the falling off of the leaves ſeems principally to depend on the temperature of the atmoſphere, which likewiſe ſerves to haſten or retard the appearance in queſtion. An ardent ſun contributes to haſten the dropping of the leaves. Hence in hot and dry ſummers, the leaves of the lime-tree and horſe-cheſnut turn yellow about the firſt of September; whilſt in other years, the yellowneſs does not appear till the beginning of October. Nothing, however, contributes more to haſten the fall of the leaves, than immoderate cold or moiſt weather in autumn; moderate droughts, on the other hand, ſerve to retard it. As a proof of this poſition, Mr. Adanſon relates, that in the year 1759, the leaves of the elm-tree, which generally fall off about the 25th of November, continued in verdure and vigour at Paris, where the autumn was remarkably dry, till the 10th of the following month.

It deſerves to be remarked, that an ever-green tree grafted upon a deciduous, determines the latter to retain its leaves. This obſervation is confirmed by repeated experiments; particularly by grafting the laurel, or cherry-bay, an ever-green, on the common cherry; and the ilex, or ever-green oak, on the oak.

DEFORCEMENT, in law, a with-holding lands, or tenements, by force, from the right owner. Deforcement, in the law of Scotland, is uſed for the reſiſting, or offering violence to the officers of the law, while they are actually employed in the exerciſe of their functions.

DEFORMITY is immediately oppoſed to beauty, and denotes the want of that uniformity, ſymmetry, and variety, neceſſary to conſtitute beauty. Accordingly, Dr. Hutcheſon defines it by the abſence of beauty, or a deficiency in the beauty expected in any ſpecies. Deformity and beauty may be conſidered either as natural or moral. Theſe are both referred by the above mentioned ingenious writer to an internal ſenſe; and our perceptions of them, as he ſuppoſes, ariſe from an original, arbitrary ſtructure of our own minds, by which certain objects, when obſerved, are rendered the occaſions of certain ſenſations and affections. There are many faces which, at firſt view, are apt to raiſe diſlike. But this is generally not from any poſitive deformity, but either from want of expected beauty, or from the carrying ſome natural indications of morally bad diſpoſitions, which we all acquire a faculty of diſcerning in countenances, airs, and geſtures.

The caſual conjunction of ideas gives us diſguſt, where there is nothing diſagreeable in the form itſelf. And this, in effect, is the cauſe of moſt of our fantaſtic averſions to the figures of divers animals. Thus ſerpents of all kinds, and many inſects really beautiful, are beheld with averſion by many people, who retain ſome accidental ideas of miſchief aſſociated to them. A ſimilar reaſoning is applied to our perception of moral beauty and deformity. But it is more juſt to diſtinguiſh between the ſentiments of delight or diſguſt, excited in us by beautiful or deformed objects, which are effects of ſome cauſes, and the natural and real qualities of the perceived objects by which they are produced. What is right in actions and characters is beautiful and amiable, and gives pleaſure; what is wrong is deformed and odious, and excites diſguſt: right and pleaſure, wrong and pain, are as diſtinct as cauſe and effect. Moral beauty and deformity are real qualities of certain actions; in which conſiſts their aptitude to pleaſe or diſguſt. With reſpect to natural beauty, uniformity amidſt variety pleaſes, becauſe of the natures of variety and uniformity, which are ſuch, that whenever united, they are adapted to pleaſe every free, unbiaſſed mind, that diſcerns them. Diſorder and confuſion, whence deformity ariſes, denote only the negation of regularity and order; or any arrangement and diſpoſition of things, which are not according to a law, rule, or plan, and prove not deſign. Theſe are not poſitively diſpleaſing; except where we previouſly expected order, or where impotence or want of ſkill appear, and the contriver has either failed of his deſign, or executed it ill. See on this ſubject Dr. Price's Review of the principal Queſtions and Difficulties in Morals, ch. ii. paſſim. See an admirable Eſſay on bodily Deformity, by Mr. Hay, in the Fugitive Pieces, vol. i. p. 93, &c.

DEGENERATION, or **DEGENERATING**, in general, denotes the growing worſe, or loſing ſome valuable qualities whereof a thing was formerly poſſeſſed. Some naturaliſts have been of opinion, that things are capable of degenerating into quite a diſtinct ſpecies; but this is a mere chimera. All that happens in the degeneration of a plant, for inſtance, is the loſing its uſual beauty, colour, ſmell, &c. a misfortune entirely owing to its being planted in an improper ſoil, climate, &c.

DEGLUTITION, in medicine, the act of ſwallowing the food. Deglutition is performed, in the firſt place, by means of the tongue, driving the aliment into the œſophagus, or gullet; and then, by the contraction of the ſphincter, and the fleſhy fibres of the ſame œſophagus, which, leſſening the bore, or aperture thereof protrude the contents downwards into the ſtomach, in our eating. Deglutition ſucceeds maſtication, and is followed by concoction. A difficulty of ſwallowing may be occaſioned by ulcers of the œſophagus, by a ſchirrous, bronchocelle, by a thickening of the mucus in the œſophagus, by induration of the œſophagus, by a fungus in it, by a ſacculus formed by ſome hard ſubſtance lodged in it, and weakening its coats, and by ſpaſms. Dr. Duncan, in his Medical Caſes, 1778, mentions the caſe of a difficult deglutition, ſuppoſed to ariſe from a venereal infection, in which electrical ſparks, applied to the fauces, were of conſiderable ſervice, and by degrees removed the complaint.

DEGRADATION, in our law-books called diſgradation, and depoſition, the act of depriving, or ſtripping a perſon for ever of a dignity, or degree of honour; and taking away the title, badge, and privileges thereof.

Sir Andrew Harela, Earl of Carliſle, being attainted and convicted of treaſon, 18 Edw. II. *coram rege*; after judgment was pronounced on him, his ſword was broken over his head, and his ſpurs hewn off his heels; Sir Antony Lucy, the judge, ſaying to him, "Andrew, now art thou no knight, but a knave." By ſtat. 13. Car. II. William lord Monſon, Sir Henry Mildmay, and others, were degraded from all titles of honour, dignities, and pre-eminences, and prohibited to bear, or uſe, the title of lord, knight, eſquire, or gentleman, or any coat of arms, for ever afterwards. It has been maintained that the king may degrade a peer; but it appears from later authorities, that he cannot be degraded but by act of parliament. When Cranmer, archbiſhop of Canterbury, was degraded, by order of queen Mary, they dreſſed him in epiſcopal robes made only of canvas, put the mitre on his head, and the paſtoral ſtaff in his hand; and in this attire ſhewed him to the people. Which done, they ſtripped him again, piece by piece. With us, a prieſt, after having been delivered to his ordinary, if he cannot purge himſelf of the crime laid at his door, has his gown, and other robes, ſtripped over his ears by the common hangman; by which he is declared diveſted of his orders.

DEGRADATION *of Tints*, in painting, expreſſes degrees of colour in the diſtant objects, in order to give them a natural effect.

DEGREE, quality, rank, condition, or dignity, ſtate or condition of a thing, which may be either heightened or lowered, increaſed or diminiſhed; meaſure; proportion; or quantity. In geometry, the 360th part of the circumference of a circle. In chymiſtry, a greater or leſs intenſeneſs of heat. In canon law, an interval in kinſhip, from whence nearneſs or remoteneſs of blood are computed. In muſic, the little intervals which compoſe the concords. The different orders or claſſes of the angelic bodies.

DEGREE *of Latitude* is, on the ſuppoſition of the ſphericity of the earth, the 360th part of the meridian; or more generally, it is that ſpace through which an obſerver muſt move on the meridian, in order to increaſe or diminiſh the diſtance of a ſtar from the zenith by one degree. See Syſtem of GEOGRAPHY.

DEGREE *of Longitude*, is the ſpace between two meridians; the quantity of which is variable according to the latitude. See Syſtem of GEOGRAPHY.

DEGREE, in univerſities, denotes a quality conferred on the ſtudents, or members of them, as a teſtimony of their proficiency in the arts or faculties; and entitling them to certain privileges, precedencies, &c. The degrees are much the ſame in the ſeveral univerſities: but the laws of them, and the diſcipline or exerciſe previous to their being obtained, differ. The degrees are, bachelor, maſter, and doctor; inſtead of the ſecond, in ſome foreign univerſities, they have licentiate. In each faculty there are but two degrees, viz. bachelor and doctor, which were antiently called bachelor and maſter: nor do the arts admit of more than two, which ſtill retain the denomination of the ancient degrees, viz. bachelor and maſter. At Oxford, degrees of maſter and doctor are only conferred once a year, viz. on Monday after the ſeventh of July, when a ſolemn act is held for the purpoſe.

The expences of a degree of doctor in any of the faculties, in treats and ſet fees, uſually amount to 100*l.* and that of a maſter of arts to 20 or 30*l.* The degree of bachelor is only conferred in Lent. To take the degree of bachelor of arts, four years are required, and three more for maſter of arts. At Cambridge, matters are nearly on the ſame footing, only the diſcipline is ſomewhat more ſevere, and the exerciſes more difficult. The commencement, which anſwers to the act of Oxford, is the Monday before the firſt Tueſday in July. The degrees of bachelor are taken up in Lent, beginning on Aſh Wedneſday.

The degree of maſter of arts is not given till above three years after that of a bachelor; during which time, the candidate is obliged, three ſeveral times, to maintain two philoſophical queſtions in the public ſchools, and to anſwer the objections raiſed againſt him by a maſter of arts. He muſt alſo keep two acts in the bachelor's ſchool, and declaim one. To paſs the degree of doctor in divinity at Oxford, it is neceſſary that the candidate has been four years bachelor of divinity. For doctor of laws, he muſt have been ſeven years in the univerſity to commence bachelor of law; five years after which he may be admitted doctor of laws. Otherwiſe, in three years after taking the degree of maſter of arts, he may take the degree of bachelor in law; and in four years more, that of LL. D. which ſame method and time are likewiſe required to paſs the degree of doctor in phyſic.

At Cambridge, to take the degree of doctor in divinity, it is required that the candidate has been ſeven years bachelor of divinity. Though in ſeveral of the colleges, the taking of the bachelor of divinity's degree is diſpenſed with, and they may go out *per ſaltum*. To commence doctor in laws, the candidate muſt have been five years bachelor of law, or ſeven years maſter of arts. To paſs doctor in phyſic, he muſt have been bachelor in phyſic five years, or ſeven years maſter of arts. A doctor of the civil law, may exerciſe eccleſiaſtical juriſdiction, though a layman, ſtat. 37 Hen. VIII. cap. 17. ſect. 4.

DEJECTION, in medicine, the act of avoiding the excrements

ments by the anus. When the fæces are accumulated in the inteſtinum rectum in ſufficient quantity to become troubleſome either by their weight or acrimony, they excite a certain uneaſineſs, which produces an inclination to go to ſtool. The efforts for this purpoſe are begun by a conſiderable inſpiration, in conſequence of which the diaphragm is carried down towards the lower belly; the abdominal muſcles are at the ſame time contracted in obedience to the will; and the inteſtines being compreſſed on all ſides, the reſiſtance of the ſphincters is overcome, and the fæces paſs out at the anus: which is afterwards drawn up by its longitudinal fibres, which are called *levatores ani*, and then by means of its ſphincter is again contracted: but it ſometimes happens, as in dyſenteries, for inſtance, that the fæces are very thin, and have conſiderable acrimony; and then the irritation they occaſion is more frequent, ſo as to promote their diſcharge without any preſſure from the diaphragm or abdominal muſcles; and ſometimes involuntarily, as is the caſe when the ſphincters become paralytic.

DEIFICATION, in antiquity. See Apotheosis.

Deification, in the pagan theology, the act, or ceremony, of deifying their emperors, i. e. of placing them among the gods, and decreeing divine honours to be rendered them. See God, and Consecration.

DEISM, the doctrine, or belief of the deiſts. Deiſm, from Θεος, *God*, may properly be uſed to denote natural religion, as comprehending thoſe truths which have a real foundation in reaſon and nature; and in this ſenſe it is ſo far from being oppoſite to chriſtianity, that it is one great deſign of the goſpel to illuſtrate and enforce it. Thus ſome of the deiſtical writers have affected to uſe it; but deiſm more preciſely ſignifies that ſyſtem of religion, relating both to doctrine and practice, which every man is to diſcover for himſelf by the mere force of natural reaſon, independent of all revelation, and excluſive of it; and this religion Dr. Tindal, and others, pretend is ſo perfect, as to be incapable of receiving any addition or improvement, even from divine revelation.

DEISTS, a claſs of people known alſo under the denomination of free-thinkers, whoſe diſtinguiſhing character it is, not to profeſs any particular form, or ſyſtem, of religion; but only to acknowledge the exiſtence of a God, and to follow the light and law of nature, rejecting revelation, and oppoſing chriſtianity. This name ſeems to have been firſt aſſumed, as the denomination of a party, about the middle of the ſixteenth century, by ſome gentlemen in France and Italy, who were deſirous of thus diſguiſing their oppoſition to chriſtianity by a more honourable appellation than that of atheiſts. Viret, an eminent reformer, mentions certain perſons in his epiſtle dedicatory, prefixed to the ſecond tom. of his Inſtruction Chretienne, publiſhed in 1563, who called themſelves by a new name, that of deiſts. Theſe, he tells us, profeſſed to believe in God, but ſhewed no regard to Jeſus Chriſt, and conſidered the doctrine of the apoſtles and evangeliſts as fables, and dreams. He adds, that they laughed at all religion, though they outwardly conformed to the religion of thoſe with whom they lived, or whom they wiſhed to pleaſe, or feared to offend. Some, he obſerves, profeſſed to believe the immortality of the ſoul; others denied both this doctrine, and that of providence. Many of them were conſidered as perſons of acute and ſubtile genius, and took pains in diſſeminating their notions. See Bayle's Dict. art. Viret. vol. v. or Leland's View of the Deiſtical Writers, vol. i. p. 2.

The deiſts hold, that, conſidering the multiplicity of religions, the numerous pretences to revelation, and the precarious arguments generally advanced in proof thereof, the beſt and ſureſt way is, to return to the ſimplicity of nature, and the belief of one God; which is the only truth agreed to by all nations. They complain that the freedom of thinking and reaſoning is oppreſſed under the yoke of religion; and that the minds of men are ridden, and tyrannized, by the neceſſity impoſed on them of believing inconceivable myſteries; and contend, that nothing ſhould be required to be aſſented to, or believed, but what their reaſon clearly conceives.

The diſtinguiſhing character of modern deiſts is, that they reject all revealed religion, and diſcard all pretences to it, as the effects of impoſture and enthuſiaſm. They profeſs a regard for natural religion, though they are far from being agreed in their notions concerning it. They are claſſed by ſome of their own writers into mortal and immortal deiſts: the latter acknowledging a future ſtate, and the former denying it, or repreſenting it as very uncertain. Oracles of reaſon, p. 99.

Dr. Clarke diſtinguiſhes four ſorts of deiſts. 1. Thoſe who pretend to believe the exiſtence of an eternal, infinite, independent, intelligent being, who made the world, without concerning himſelf in the government of it. 2. Thoſe who believe the being and natural providence of God, but deny the difference of actions, as morally good or evil, reſolving it into the arbitrary conſtitution of human laws; and therefore they ſuppoſe that God takes no notice of them. With reſpect to both theſe claſſes, he obſerves, that their opinion can conſiſtently terminate in nothing but downright atheiſm. 3. Thoſe who having right apprehenſions concerning the nature, attributes, and all governing providence of God, ſeem alſo to have ſome notion of his moral perfections, though they conſider them as tranſcendant, and ſuch in nature and degree, that we can form no true judgment, nor argue with any certainty concerning them: but they deny the immortality of human ſouls, alledging, that men periſh at death, and that the preſent life is the whole of human exiſtence. 4. Thoſe who believe the exiſtence, prefections, and providence of God, the obligation of natural religion, and a ſtate of future retribution, on the evidence of the light of nature, without a divine revelation: ſuch as theſe, he ſays, are the only true deiſts, but their principle, he apprehends, ſhould lead them to embrace chriſtianity; and therefore he concludes, that there is now no conſiſtent ſcheme of deiſm in the world. Evidence of Nat. and Rev. Religion, p. 12. 27.

The firſt deiſtical writer of any note that appeared in this country, was Herbert baron of Cherbury. He lived and wrote in the laſt century. His book De Veritate was firſt publiſhed at Paris in 1624. This, together with his book De Cauſis Errorum, and his Treatiſe De Religione Laici, were afterwards publiſhed in London. His celebrated work De Religione Gentilium, was publiſhed at Amſterdam in 1663, in 4to. and in 1700 in 8vo. and an Engliſh tranſlation of it was publiſhed at London in 1705. As he was one of the firſt that formed Deiſm into a ſyſtem, and aſſerted the ſufficiency, univerſality, and abſolute perfection of natural religion, with a view to diſcard all extraordinary revelation, as uſeleſs and needleſs, we ſhall ſubjoin the five fundamental articles of this univerſal religion. They are theſe: 1. That there is one ſupreme God. 2. That he is chiefly to be worſhipped. 3. That piety and virtue are the principal part of his worſhip. 4. That we muſt repent of our ſins; and if we do ſo, God will pardon them. 5. That there are rewards for good men, and puniſhments for bad men, both here and hereafter. Our own age has produced a number of advocates in the ſame cauſe; and however they may have differed among themſelves, they have been agreed in their attempts of invalidating the evidence and authority of divine revelation. We might mention Hobbes, Blount, Toland, Collins, Woolſton, Tindal, Morgan, Chubb, lord Bolingbroke, Hume, &c. Some have alſo added lord Shafteſbury to the number.

But the friends of Chriſtianity have no reaſon to regret the free and unreſerved diſcuſſion which their religion has undergone. Objections have been ſtated and urged in their full force, and as fully anſwered; argument and raillery have been repelled; and the controverſy between Chriſtians and Deiſts has called forth a great number of excellent writers, who have illuſtrated both the doctrines and evidence of Chriſtianity in a manner that will ever reflect honour on their names, and be of laſting ſervice to the cauſe of genuine religion, and the beſt intereſts of mankind.

The number of Deiſts is ſaid to be daily increaſing: in England, many men of ſpeculation and letters are ſaid to incline that way; and the like is obſerved in ſome of our neighbouring nations, where freedom of ſpeaking, writing, and thinking, are indulged. Not that unreſtrained liberty in this reſpect can ever injure Chriſtianity, or ſerve the cauſe of Deiſm: truth neither needs nor ſeeks diſguiſe; but where freedom is allowed, men's ſentiments, on the ſubject of religion, are more generally known.

DEITY, *Godhead*; a common appellation given to God; and alſo by the poets to the heathen gods and goddeſſes.

DELEGATES, certain perſons delegated, or appointed by the king's commiſſion, under the great ſeal, to ſit upon an appeal to the king in the court of chancery.

DELEGATION, a commiſſion extraordinary given a judge, to take cognizance of and determine ſome cauſe, which ordinarily does not come before him. In the civil law, delegation alſo denotes a ſort of ſurrender, whereby a perſon ſubſtitutes another debtor in his place.

DELETERIOUS (from δηλεω, *neco*, *I hurt*) a term ſometimes uſed among naturaliſts, for ſuch things as are of a pernicious and poiſonous nature.

DELF *of Coal*, denotes coal lying in veins under ground, before it is dug up.

Delf is alſo uſed in heraldry, for one of the abatements of honour; being a ſquare in the middle of the eſcutcheon.

Delf *Ware*, a kind of pottery of baked earth, covered with an enamel, or white glazing, which gives it the appearance and neatneſs of porcelain. The baſis of this pottery is clay; and the kinds of clay chiefly uſed are the blue and green, with an addition of marle or ſand, in order to leſſen the contraction of the clay, to render it leſs compact, and to afford a better ground for the enamel. Red clay is alſo added, which, on account of its ferruginous matter, binds and gives a greater ſolidity. The proportions of theſe ingredients vary in different works, according to the different qualities of the earths employed. Three parts of blue clay, two of red clay, and five parts of marle, form the compoſition uſed in ſeveral manufactories. Veſſels formed of theſe materials muſt be dried very gently, to avoid cracking. They are then to be placed in a furnace to receive a ſlight baking, and they are laſtly to be covered with an enamel or glazing, which is done by pouring upon the veſſels thus prepared, the enamel, which has been ground very fine, and diluted with water. The glazing, which is nothing but white enamel, ought to be ſo opake as not to ſhew the ware under it. The enamels for delf-ware are compoſed of ſand or flints, vitrifying ſalts, calx of lead, and calx of tin. The vitrification of ſand is effected by ſomewhat leſs than an equal part of alkaline ſalt, or twice its weight of calx of lead, and one part of calx of tin, which is deſigned for giving a white opake colour to the maſs, is to be added to three or four parts of all the other ingredients taken together. M. D'Antic recommends for the white enamel, uſed in glazing, a mixture of an hundred pounds of calx of lead, with about a ſeventh part of that quantity of calx of tin for common delf, or a fourth part of calx of tin for the fineſt delf; a hundred, or a hundred and ten pounds of fine ſand; and about twenty or thirty pounds of ſea-ſalt, or ſalt of glaſs. To make this enamel, lead and tin are calcined together with a ſtrong fire, or the ſand is alſo to be made into a fritt, with the ſalt or aſhes. The whole being well mixed and ground together, is placed under the furnace, where it is melted and vitrified during the baking of the ware. Then it is to be ground in a mill, and applied as above directed. Dict. of Chem. Eng. edit. 1777. See ENAMEL, GLAZING, and PORCELAIN.

DELIA, Δηλια, in antiquity, a quinquennial feſtival in the iſland of Delos, inſtituted by Theſeus in honour of Venus. Pott. Archæol. Græc. lib. ii. cap. 20.

DELIBERATIVE, is applied to that kind, or branch, of rhetoric employed in proving a thing, or convincing an aſſembly thereof, in order to perſuade them to put it in execution.

DELICACY, daintineſs, or taſte ſhewn in eating; any thing which affects the ſenſes with great pleaſure; elegant ſoftneſs of form; nicety, or minute accuracy. Genteel neatneſs, applied to dreſs. Politeneſs of behaviour; indulgence which produces weakneſs; tenderneſs; weakneſs of conſtitution; a diſpoſition which is ſhocked with any ſucceſs.

DELICT, in Scots law, ſignifies ſuch ſmall offences or breaches of the peace as are puniſhable only by fine or ſhort impriſonment.

DELIGATION, *Deligatio*, that part of ſurgery which relates to the binding up of wounds, ulcers, broken bones, &c. See Syſtem of SURGERY.

DELINQUENT, a guilty perſon, or one who has committed ſome fault or offence for which he is puniſhable.

DELIQUESCENCE, in chymiſtry, denotes the property which certain bodies poſſeſs of attracting moiſture from the air, and of thereby becoming liquid. It is peculiar to ſaline ſubſtances, or bodies containing them, and reſults from their affinity with water.

DELIQUIUM, or DELIQUIUM *Animi*, from *delinquo*, *I ſwoon*, a ſwooning, or fainting away; called alſo ſyncope, lypothymia, lypopſychia, eclyſis, and aſphyxia.

DELIQUIUM from *deliqueſco*, *to be diſſolved*, in chymiſtry, is the diſſolution, or melting, of ſalt, or calx, by ſuſpending it in a moiſt cellar. Salt of tartar or any fixed alkali, ſet in a cellar, or other cool moiſt place, and in an open veſſel, reſolves, or runs, into a kind of liquor, called by the chymiſts oil of tartar, *per deliquium*.

DELIRIUM, from *deliro*, to rave or talk idly. When the ideas excited in the mind do not correſpond to the external objects, but are produced by the change induced on the organs of ſenſation, the patient is ſaid to be delirious. The Greeks call it *paraphreneſis*. In the Engliſh there is no word for it, except lightheadedneſs be admitted.

The paraphreneſis, or delirium, differs from a madneſs, in not being perpetual, which happens in delirium without a fever. The proximate cauſe of a delirium is an affection of the brain; but the remote cauſes may be an irritation, ſometimes a very ſlight one, of any part of the nervous ſyſtem.

DELIVERY, *Parturition*, or child-birth, the bringing forth of a perfect fœtus, or child, out of its mother's womb; whether it be living or dead. See Syſtem of MIDWIFRY.

DELPHINIUM, DOLPHIN-FLOWER, or LARK-SPUR; a genus of the triginia order, belonging to the polyandria claſs of plants. There are ſeven ſpecies; four are cultivated in gardens Two of theſe are annual, and two perennial. See Syſtem of BOTANY. Sect. V. and Plate V.

DELPHINUS, the dolphin, in aſtronomy, a conſtellation of the northern hemiſphere. See Syſtem of ASTRONOMY, Sect. VIII.

DELPHINUS, a genus of fiſhes belonging to the order of Cete. There are three ſpecies; 1. The delphis, or dolphin; 2. The phocæna, or porpeſſe, found in vaſt multitudes in the Britiſh ſeas. 3. The orca, or grampus, remarkably thick in proportion to its length, one of 18 feet being in the thickeſt part 10 feet diameter. Theſe fiſhes, and all of the order of Cete are obſerved to ſwim againſt the wind, and to be much diſturbed, and tumble about with unuſual violence, at the approach of a ſtorm.

DELPHOS, in antiquity, now called Caſtri, the capital of Phocis in Achaia, anciently much celebrated for its temple, and oracle of Apollo. This temple was a magnificent ſtructure, enriched with innumerable gifts, in it was the dark cave Pithium, where the prieſteſs, named Pythia, ſitting on a tripos, or three legged ſtool, pretended to receive the inſpiration of the god. The town of Caſtri ſtands between Salena and Livadia, about ten miles diſtant from the ſide of mount Parnaſſus, ſo famous in antiquity, and ſacred to the Muſes and Apollo.

DELTOIDES, in anatomy, a triangular muſcle of the ſhoulder; thus called from the Greek *delta*, Δ, and ειδος, *form*. See Syſtem of ANATOMY. Part III. Sect. XIV.

DISSERTATION ON THE DELUGE.

DELUGE, DILUVIUM, a flood, or inundation of water, covering the earth, either in the whole or part.

We meet with divers accounts of deluges in hiſtory, that which happened in Greece, in the time of Deucalion, called *Diluvium Deucalioneum*: this deluge only overflowed Theſſaly. Its date is fixed to the year before Chriſt 1529, being the third year before the Iſraelites coming out of Egypt, according to the computation of Petavius. Rat. Temp. par. i. lib. i. cap. 7.

The deluge of Ogyges happened near three hundred years before that of Deucalion, 1020 years before the firſt Olympiad, and 1796 before Jeſus Chriſt, according to the ſame author, Rat. Tem. pa. i. cap. 4 par. ii. lib. ii. cap. 5. This only ravaged Attica. Theſe two deluges are frequently mentioned, in ancient Greek authors, under the denomination of *cataclyſmus prior*, and *poſterior*. Of the like kind were thoſe inundations in the Netherlands, which, in 1727, overwhelmed and covered with ſea all that part now called Gulf Dollart in the United Netherlands; and in 1421, all that part between Brabant and Holland. But the moſt memorable deluge is that which we particularly, by way of eminence, call the deluge, or the univerſal deluge, or Noah's flood: recorded in Scripture as a general inundation ſent by God to puniſh the corruption of the world, at that time, by deſtroying every thing from the face of the earth, except Noah and his family, and what was ſhut up with him in the ark. This flood makes one of the moſt conſiderable epochas in chronology. Its hiſtory is given by Moſes, Gen. ch. vi. and vii. Its time is fixed by the beſt chronologer, to the year from the creation 1656, anſwering to the year before Chriſt 2293. From this flood the ſtate of the world is divided into diluvian, and antediluvian. The deluge has been, and remains yet a ſubject of much inquiry and diſpute among naturaliſts, critics, &c. The points chiefly controverted may be reduced to three: firſt, its extent, viz. whether it were general, or partial; ſecondly, its natural cauſe; and thirdly, its effects.

1. The immenſe quantity of water, requiſite to furniſh an univerſal deluge, has occaſioned ſeveral authors to ſuſpect it only partial. An univerſal deluge, they think, had been unneceſſary, conſidering the end for which it was brought, viz. to extirpate the wicked inhabitants. The world was then but new, and the people not many; the holy Scriptures making only eight generations from Adam to Noah. It was but a ſmall part of the earth that could be yet inhabited; the country about the Euphrates, which is ſuppoſed to have been the ſcene of the firſt antediluvian inhabitants, was ſufficient to bear them all. Now Providence, they argue, which ever acts wiſely, and frugally, would never have diſproportioned the means to the end, ſo far as to overflow the whole globe, only to drown a little corner of it. They add, that, in the Scripture language, the whole earth expreſſes no more than all the inhabitants; and on this principle advance, that an overflowing of the Euphrates and Tigris, with a vehement rain, &c. might anſwer all the phenomena of the deluge.

But the deluge was univerſal. God declared to Noah, Gen. vi. 17. that he was reſolved to deſtroy every thing that had breath under heaven, or had life on the earth, by a flood of waters; ſuch was the menace; ſuch the execution. The waters, Moſes aſſures us, covered the whole earth, buried all the mountains, and were no leſs than fifteen cubits above the higheſt of them: every thing periſhed therein; birds, beaſts, men, and all that had life, excepting Noah, and thoſe with him in the ark, Gen. vii. 19, &c. Can an univerſal deluge be more clearly expreſſed? If the deluge had only been partial, there had been no neceſſity to ſpend an hundred years in the building of an ark, and ſhutting up all the ſorts of animals therein, in order to re-ſtock the world: they had been eaſily and readily brought from thoſe parts of the world not overflowed, into thoſe that were; at leaſt, all the birds would never have been deſtroyed, as Moſes ſays they were, ſo long as they had wings to bear them to thoſe parts where the flood did not reach. If the waters had only overflowed the neighbourhood of the Euphrates and Tigris, they could not be fifteen cubits above the higheſt mountains; they could not have riſen to that height, but they muſt ſpread themſelves, by the laws of gravity, over the reſt of the earth: unleſs, perhaps, they had been retained there by a miracle; and, in that caſe, Moſes, no doubt, would have related the miracle, as he did that of the waters of the Red ſea, and the river Jordan, which were ſuſtained in a heap, to give paſſage to the Iſraelites, Exod. xiv. 22. and Joſh. iii. 16. Add, that, in regions far remote from the Euphrates and Tigris, viz. in Italy, France, Switzerland, Germany, England, &c. there are frequently found, in places many ſcores of leagues from any ſea, and even in the tops of high mountains, whole trees ſunk deep under-ground; as alſo teeth and bones of animals, fiſhes entire, ſea-ſhells, ears of corn, &c. petrified; which the beſt naturaliſts are agreed could never have come there but by the deluge; to which may be added the almoſt univerſal traditions of this great event in all countries of the globe.

2. The deluge allowed univerſal, the philoſophers are ſolicitous

to find water to effect it. Moſes brings it from two ſources: *the fountains of the great deep were broken up*; *and the windows of heaven were opened.* Dr. Burnet, in his Telluris Theoria ſacra, ſhews, that all the waters of the ocean were not near enough to cover the earth fifteen cubits above the tops of the higheſt mountains. According to his computation, no leſs than eight oceans were required. Suppoſing the ſea, therefore, drained quite dry, and all the clouds of the atmoſphere diſſolved into rain, we ſhould ſtill want much the greateſt part of the water of a deluge.

To get clear of this embarraſſment, many of our beſt naturaliſts, at Steno, Burnet, Woodward, Scheuchzer, &c. adopt Des Cartes' Syſtem of the formation of the Earth. That philoſopher will have the primitive world to have been perfectly round and equal, without mountains, or vales; and accounts for its formation on mechanical principles, by ſuppoſing it at firſt in the condition of a thick turbid fluid, replete with diverſe heterogeneous matters, which, ſubſiding by ſlow degrees, formed themſelves into different concentric ſtrata, or beds, by the laws of gravity; and thus, at length, left a dry, ſolid earth. Dr. Burnet improves on this theory: he ſuppoſes the primitive earth to have been no more than an orbicular cruſt, inveſting the face of the abyſs, or deep, which grew chinky, clave, burſt, and fell down into the water, and ſo drowned its inhabitants.

The ſame theoriſt adds, that by this cataſtrophe, the globe of the earth was not only ſhaken, and broken in a thouſand places, but the violence of the ſhock it then underwent ſhifted its ſituation; ſo that the earth, which before was placed directly under the zodiac, became thenceforth oblique to the ſame. Whence aroſe the difference of ſeaſons, which the antediluvian earth was not expoſed to.

Dr. Burnet's hypotheſis is very elegantly recited; but it not only contradicts the phyſical principles of nature, but is alſo utterly inconſiſtent with the ſacred text above-cited, which expreſly mentions mountains as the ſtandard of the height of the water; or with that other paſſage, Gen. viii. 22. where God, promiſing not to bring any more deluges, but that every thing ſhould be reſtored to its ancient ſtate, ſays, that *ſeed-time and harveſt, and cold and heat, and ſummer and winter, and day and night, ſhall ceaſe no more.* See Keil's Exam. of the Theory of the Earth.

Other authors, ſuppoſing a ſufficient fund of water in the abyſs, or ſea, are only concerned for an expedient to bring it forth: accordingly, ſome, as Mr. Ray, &c. have recourſe to a ſhifting of the earth's centre, which, drawing after it the water out of its channel, overwhelmed the ſeveral parts of the earth ſucceſſively. But this could only occaſion a partial deluge in that part of the globe towards which the centre of gravity was tranſlated: nor can the poſſibility of ſuch a tranſlation be allowed, ſince the centre of gravity is the neceſſary reſult of the materials compoſing our globe, and not alterable whilſt the parts remained in the ſame poſition.

Dr. Hook's opinion of the compreſſion of a ſhell of earth into a prolate ſpheroid, thereby preſſing out the water of an abyſs under the earth, may very well account for the waters overſlowing two oppoſite zones of the globe; but the middle zone being by much the greater part of the earth's ſurface, muſt by this means be raiſed higher from the centre, and conſequently ariſe more out of the water than before.

3. But the great difficulty ſtill remains. The orderly ſtrata, or layers of the earth, with the exuviæ, or remains of fiſhes, as their teeth, bones, ſhells, &c. both marine, and fluviatile, found in the bodies even of the moſt ſolid ſtrata, and in flints, marbles, &c. are not yet accounted for. Thoſe who adhere to Des Cartes' ſyſtem, as Steno, &c. take the finding of the part of terreſtrial, and aquatic animals, branches of trees, leaves, &c. in the beds, or ſtrata of ſtone, to be a direct proof of the primitive fluidity of the earth. But then they are obliged to have recourſe to a ſecond formation of ſtrata, much later than the firſt; becauſe at the time of the firſt there was neither plant nor animal, in being. Steno, therefore, maintains ſecond formations, occaſioned at different times by extraordinary inundations, earthquakes, volcanos, &c. But Burnet, Woodward, Scheuchzer, &c. chooſe rather to attribute a ſecond general formation to the deluge; without excluding, however, particular ones of Steno. But the great objection againſt this ſyſtem of fluidity, is mountains; for the whole globe being liquid, whence ſhould ſuch inequalities ariſe? Mr. Scheuchzer, rather than part with a ſyſtem which ſeems ſo promiſing, give into the opinion of thoſe who hold, that, after the deluge, God, to remit the waters into their ſubterranean reſervoirs, broke and diſplaced, with his own almighty hand, a great number of ſtrata, that were before horizontal, and raiſed them above the ſurface of the earth; whence it is, that the ſtrata in mountains, though concentrical, are never horizontal. Hiſt. de l'Acad. 1708, p. 32.

According to Mr. de la Pryme, the antediluvian world had an external ſea, as well as land, with mountains, rivers, &c. and the deluge was effected by breaking the ſubterraneous caverns, and pillars thereof, with dreadful earthquakes, and cauſing the ſame to be for the moſt part, if not wholly abſorbed and ſwallowed up, and covered by the ſeas that we now have. Laſtly, this earth of ours aroſe out of the bottom of the antediluvian ſea; and in its room, juſt as many iſlands are ſwallowed down, and others thruſt up in their ſtead. On this, as on all the other hypotheſes, it may be remarked, that it is quite arbitrary, and without the leaſt foundation from the words of Moſes. The ſacred hiſtorian ſpeaks not one word, of earthquakes; nay, from the nature of the thing, we know it is impoſſible that the flood could have been occaſioned by an earthquake, and the ark preſerved, without a miracle. It is certain, that if a ſhip ſinks at ſea, the commotion excited in the water by the deſcent of ſuch a large body, will ſwallow up a ſmall boat that happens to come too near. If the pillars of the earth itſelf then were broken, what muſt the commotion have been, when the continents of Europe, Aſia, and Africa, deſcended into the abyſs at once? Not to mention America, which lying at ſo great a diſtance from Noah, he might be ſuppoſed out of danger from that quarter. By what miracle was the little ark preſerved amidſt the tumult of thoſe impetuous waves which muſt have ruſhed in from all quarters? Beſides, as the ark was built not at ſea, but on dry ground; when the earth on which it reſted ſunk down, the ark muſt have ſunk along with it; and the waters falling in as it were over-head, muſt have daſhed in pieces the ſtrongeſt veſſel that can be imagined. Earthquakes, alſo, operate ſuddenly and violently; whereas, according to the Moſaic account, the flood came on gradually, and did not arrive at its height till ſix weeks, or perhaps five months, after it began.

Having ſtated ſome of the principal arguments advanced by philoſophers, critics, &c. we ſubmit them to the judgment of the reader; and take the liberty of ſubjoining ſome remarks of our own on the ſubject.

We muſt obſerve, that there is a very general miſtake with regard to the air; it being imagined, becauſe the air does not always deluge with exceſſive rains, that it contains but little water. After the atmoſphere has been diſcharging for a number of days ſucceſſively, a quantity of matter 800 times heavier than itſelf, inſtead of being lightened by the diſcharge, it becomes heavier, nay ſpecifically heavier, than it was before. It is alſo certain that very dry air, provided it is not at the ſame time very hot, is always heavieſt; and the drieſt air which we are acquainted with, namely, Dr. Prieſtley's dephlogiſticated air, is conſiderably heavier than the air we commonly breathe. For theſe reaſons we think the quantity of water contained in the whole atmoſphere ought to be conſidered as indefinite, eſpecially as we know that by whatever agent it is ſuſpended, that agent muſt counteract the force of gravity, otherwiſe the water would immediately deſcend; and while the force of gravity in any ſubſtance is counteracted, that ſubſtance cannot appear to us to gravitate at all.

The above conſiderations render it probable at leaſt, that there is in nature a quantity of water ſufficient to deluge the world, provided it was applied to the purpoſe. We muſt next conſider whether there is any natural agent powerful enough to effectuate this purpoſe. We ſhall take the phraſes uſed by Moſes in their moſt obvious ſenſe. The breaking up of the fountains of the deep we may reaſonably ſuppoſe to have been the opening of all the paſſages whether ſmall or great, through which the ſubterraneous waters poſſibly could diſcharge themſelves on the ſurface of the earth. The opening of the windows of heaven we may alſo ſuppoſe to be the pouring out of the waters, contained in the atmoſphere, through thoſe inviſible paſſages by which it enters in ſuch a manner as totally to elude every one of our ſenſes, as when water is abſorbed by the air in evaporation. As both theſe are ſaid to have been opened at the ſame time, it ſeems from thence probable, that one natural agent was employed to do both.

Now it is certain, that the induſtry of modern inquiries hath diſcovered an agent unknown to the former ages, and whoſe influence is ſo great, that with regard to this world it may be ſaid to have a kind of omnipotence. The agent we mean is electricity. It is certain that, by means of it, immenſe quantities of water can be raiſed to a great height in the air. This is proved by the phenomena of water-ſpouts. Mr. Forſter relates, that he happened to ſee one break very near him, and obſerved a flaſh of lightning proceed from it at the moment of its breaking. The concluſion from this is obvious. When the electric matter was diſcharged from the water, it could no longer be ſupported by the atmoſphere, but immediately fell down. Though water-ſpouts do not appear in this country, yet every one muſt have made an obſervation ſomewhat ſimilar to Mr. Forſter's. In a violent ſtorm of thunder and rain, after every flaſh of lightning, or diſcharge of electricity from the clouds, the rain pours down with increaſed violence; thus ſhewing, that the cloud, having parted with ſo much electricity, cannot longer be ſupported in the form of vapour, but muſt deſcend in rain. It is not indeed yet diſcovered that electricity is the cauſe of the ſuſpenſion of water in the atmoſphere; but it is certain that evaporation is promoted by electrifying the fluid to be evaporated. It may therefore be admitted as a poſſibility, that the electric fluid contained in the air is the agent by which it is enabled to ſuſpend the water which riſes in vapour. If therefore the air be deprived of the due proportion of this fluid, it is evident that rain muſt fall in prodigious quantities.

Again, we are aſſured from the moſt undeniable obſervations, that electricity is able to ſwell up water on the ſurface of the earth. This we can make it do even in our trifling experiments; and much more muſt the whole force of the fluid be ſuppoſed capable of doing it, if applied to the waters of the ocean, or any others, The agitation of the ſea in earthquakes is a ſufficient proof of this. It is certain, that at theſe times there is a diſcharge of a vaſt quantity of electric matter from the earth into the air; and as ſoon as this happens, all becomes quiet on the ſurface of the earth.

From a multitude of obſervations, it alſo appears, that there is, at all times, a paſſage of electric matter from the atmoſphere into the earth, and *vice verſa* from the earth into the atmoſphere. There is therefore no abſurdity in ſuppoſing the Deity to have influenced the action of the natural powers in ſuch a manner that for 40 days and nights the electric matter contained in the atmoſphere ſhould deſcend into the bowels of the earth; if indeed there is occaſion for ſuppoſing any ſuch immediate influence at all, ſince it is not impoſſible that there might have been, from ſome natural cauſe, a deſcent of this matter from the atmoſphere for that time. But by whatever cauſe the deſcent was occaſioned, the conſequence would be, the *breaking up of the fountains of the deep*, and the *opening the windows of heaven*. The water contained in the atmoſphere being left without ſupport, would deſcend in impetuous rains; while the waters of the ocean, thoſe from which fountains originate, and thoſe contained in the ſolid earth itſelf, would riſe from the very centre, and meet the waters which deſcended from above. Thus the breaking up of the fountains of the deep, and the opening the windows of heaven, would accompany each other, as Moſes tells us they actually did; for, according to him, both happened on the ſame day. In this manner the flood would come on quietly and gradually, without that violence to the globe which Burnet, Whiſton, and other theoriſts, are obliged to ſuppoſe. The abatement of the waters would enſue, on the aſcent of the electric fluid to where it was before. The atmoſphere would then abſorb the water as formerly; that which had aſcended through the earth would again ſubſide; and thus every thing would return to its priſtine ſtate. For a particular conſideration of theſe matters, ſee the articles EARTH, MOUNTAIN, and VOLCANO.

DEMAIN, or DEMESNE, in its popular ſenſe, denotes the lord's manor-place, with the lands thereto belonging; which he and his anceſtors have from time to time kept in their own manual occupation.

DEMAIN is ſometimes alſo taken, more largely, for lands and tenements held for life, &c. and ſometimes more ſtrictly for ſuch only as are generally held in fee.

DEMAND, in its proper ſenſe, denotes a calling for, or requiring one's due.

DEMAND, in law, has a more ſpecial ſignification, as contradiſtinguiſhed from plaint: for all civil actions are purſued, either by demands or plaints; according to which the purſuer is called either demandant, or plaintiff, viz. in real actions, demandant; and in perſonal actions, plaintiff. Where the party purſuing is demandant, the party purſued is called tenant; and where the former is called plaintiff, the latter is termed defendant. There are two kinds of demands: the one in deed, *de facto*, as in every precipe; the other in law, *de jure*; ſuch is entry in land, diſtreſs for rent, &c.

DEMEMBRE', in heraldry, is when an animal is diſmembered, i. e. the limbs cut off its body.

DEMI, a word of the ſame uſe and effect in the French language with *ſemi*, in the Latin and Engliſh; being formed from *dimidium*; and uſed, in compoſition with other words, to ſignify half. In words borrowed from the Latins, we uſe *ſemi*; and in thoſe from the French, we retain their *demi*.

DEMI *Baſtion*, a kind of fortification, that has only one face, and one flank.

DEMI *Cannon*, a piece of ordnance, uſually about ſix inches bore, 5400 pounds weight, ten or eleven feet long, and carrying a ſhot of 30 pound weight.

DEMI *Croſs*, an inſtrument uſed by the Dutch to take the ſun's altitude, or that of a ſtar, at ſea; but inſtead of which we uſe the croſs ſtaff or fore ſtaff.

DEMI *Culverin*, is a piece of ordnance commonly 4¼ inches bore, ten feet long, 2700 pounds weight; its charge is 7 pounds 4 ounces of powder; and it carries a ſhot of 10 pounds 11 ounces, and ſhoots point blank 175 paces.

DEMI *Gorge*, in fortification, is that part of the polygon which remains after the flank is raiſed, and goes from the curtin to the angle of the polygon. It is half of the vacant ſpace or entrance into a baſtion.

DEMI *Quaver*, is a note in muſic, two of which are equal to the quaver.

DEMISE, in law, is applied to an eſtate either in fee-ſimple, or fee-tail, or for term of life, or years; and ſo it is commonly taken in many writs. The king's death is, in law, termed, the demiſe of the king.

DEMISE *of the King* does not diſcontinue any writ or proceſs. Vide Stat. 1. Ed. VI. cap. 7. ſect. 1, 2, 3. Nor does it determine any commiſſion civil or military, or great office of ſtate, but they ſhall continue in force for ſix months after the ſovereign's demiſe, unleſs made void by the next ſucceſſor. Stat. 7 & 8 Will. III. cap. 27. ſect. 21. 1 Ann. ſtat. 1. cap. 8. 6 Ann. cap. 7. ſect. 8. Neither is a parliament thereby determined till after ſix months. 7 & 8 Will. III. cap. 15. Nor is a defendant, who hath pleaded to an information, obliged to plead to it again upon requeſt made to the court, within five months after the demiſe. 4 & 5 Will. & Mar. cap. 18. ſect. 7.

DEMISE, and REDEMISE, denote a conveyance where there are mutual leaſes made from one to another of the ſame land, or ſomething out of it.

DEMOCRACY, a form of government, wherein the ſovereignty, or ſupreme authority, is lodged in the people, who exerciſe the ſame by perſons of their own order, deputed for that purpoſe. The word is formed of the Greek δημος, *people*, and κρατειν, *to command, govern*.

The moſt flouriſhing democracies were thoſe of Rome and Athens; the modern republics, as Venice, and the United Provinces, are rather ariſtocracies than democracies. The government of Baſil, however, is a democracy; and ſo are ſome of the free cities in Germany. In a democracy, where the right of making laws reſides in the people at large, public virtue, or goodneſs, is more likely to be found than either of the other qualities of government; and therefore it uſually poſſeſſes a conſiderable degree of patriotiſm and public ſpirit. Democracies are uſually the beſt calculated to direct the end of a law; Ariſtocracies to invent the means by which that end ſhall be obtained; and Monarchies to carry thoſe means into execution.

DEMONSTRABLE, a term uſed in the ſchools, to ſignify ſomewhat that may be clearly and evidently proved. It is demonſtrable, that the ſide of a ſquare is incommenſurable with the diagonal.

DEMONSTRATION, in logic, a ſeries of ſyllogiſms, all whoſe premiſes are either definitions, ſelf-evident truths, or propoſitions already eſtabliſhed. See LOGIC.

DEMONSTRATIVE, in rhetoric, uſed for proving or rendering any thing ſelf evident, beyond contradiction, or ſo as to demand aſſent.

DEMONSTRATIVE, in grammar, applied to pronouns which ſerve to ſhew, point out, or indicate a thing: as, *this*, *that*, *thoſe*, &c. They are alſo called definitive, becauſe they define and limit the extent of the common name, or general term, to which they either refer, or are joined.

DEMURRER, in law, a ſtop put to any action upon ſome point of difficulty which muſt be determined by the court, before any further proceedings can be had in the ſuit.

DEN, a ſyllable added to the names of places, and ſhews their ſituation to be in a valley, or near woods, as Tenterden, Biddenden, &c. The word is Saxon, *den*, i. e. *vallis*, or *locus ſylveſtris*.

DENARIUS, in Roman antiquity, the chief ſilver coin among the Romans, worth in our money about ſeven-pence three farthings. As a weight, it was the ſeventh part of a Roman ounce.

DENARIUS is alſo uſed in our law-books for an Engliſh penny.

DENDRACHATES, in natural hiſtory, the name uſed by the ancients for an extremely elegant and beautiful ſpecies of agate, the ground of which is whitiſh, variegated with veins of a brighter white. Theſe veins are beautifully diſpoſed in a number of various figures; but generally in many concentric irregular circles, drawn round one or more points. It is common alſo, in various parts of this ſtone, to find very beautiful delineations of trees, moſſes, ſea-plants, and the like, ſo elegantly expreſſed, that many have erroneouſly taken them for real plants included in the ſubſtance of the ſtone; whence the name dendrachates.

DENDROMETER, from δενδρον, *a tree*, and μετρεω, *I meaſure*, an inſtrument invented by Meſſrs. Duncombe and Whittel; for which they obtained a patent, ſo called from its uſe in meaſuring trees. See Syſtem of GEOMETRY.

DENIER, the French penny; a ſmall copper coin, twelve whereof make a ſol, or French ſhilling. The French *denier* is about the twenty-third part of the Engliſh penny. There are two kinds of *deniers:* the one Tournois, the other Pariſian; whereof the latter was worth a fourth part more than the former, and was called *monnoy royale*, or *fort monnoye*, and ſometimes *denier d'or*, and *denier à valeur d'or*.

DENIZEN, in law, an alien made a ſubject by the king's letters patent; otherwiſe called *donaiſon*, becauſe "his legitimation proceeds *ex donatione regis*, from the king's gift."

DENOMINATION, from *denomino*, of *de* and *nomen*, *a name*; a name impoſed on any thing, uſually expreſſing ſome quality predominant therein. Hence, as the qualities and forms of things are of two kinds, viz. internal and external, denomination becomes two-fold.

Internal DENOMINATION, is that founded on the intrinſic form: thus Peter is denominated learned on account of his learning, which is ſomething internal.

External DENOMINATION, is that founded on, or ariſing from the external form. Thus, a wall is ſaid to be ſeen, and known, from the viſion and cognition employed upon it; and thus Peter is denominated honoured, by reaſon of honour, which is not in the perſon honoured, but in him that honours.

DENOMINATOR, in arithmetic, a term only uſed in ſpeaking of fractions, or broken numbers. See Syſtem of ARITHMETIC, Art. X.

DENSITY, *Denſitas*, that property or habitude of bodies whereby they contain ſuch a quantity of matter, under ſuch a bulk. Accordingly, a body that contains more matter than another, under the ſame bulk, is ſaid to be denſer than the other. Denſity ſtands in oppoſition to rarity. Hence, ſince the maſs is proportional to the gravity, a denſer body is ſpecifically heavier than a rarer; and a ſpecifically heavier is denſer than a ſpecifically lighter.

Density *of the Air* is a property that has much employed the late philoſophers, ſince the diſcovery of the Torricellian experiment, and the air pump. See Syſtem of Pneumatics.

DENTAL, *Dentalis*, from *dens, a tooth*, is applied to certain letters, in the pronunciation whereof the teeth have a principal ſhare. Grammarians, and eſpecially the Hebrew ones, diſtinguiſh the letters into *dental, labial, guttural, lingual, palatal*, &c.

DENTALIUM, a ſhell-fiſh belonging to the claſs of vermes, and the order of teſtacea. The ſhell conſiſts of one tubulous ſtraight valve, open at both ends. There are eight ſpecies, diſtinguiſhed by the angles, ſtriæ, &c. of their ſhells. See Syſtem of Conchology, Genus 33.

DENTARIA, tooth wort, or tooth violet; a genus of the ſiliquoſa order, belonging to the tetradynamia claſs of plants. There are three ſpecies, all of them hardy perennials; producing annual ſtalks 12 or 18 inches high, adorned with many-lobed leaves, and ſpikes of quadrupetalous cruciform flowers of a red or purple colour. See Syſtem of Botany, Sect. V. and Plate V.

DENTEX, in *Ichthyology*, the name of a ſea-fiſh, caught in great plenty in the Mediterranean, and common in the markets of Italy. The teeth are diſpoſed in a ſingle row in each jaw, and there are at diſtances, four, which are longer and broader than the reſt, and look like the canine teeth of men, or of quadrupeds: it is from theſe that it has its name, and theſe as well as the reſt of the teeth are in this fiſh covered with lips, as in quadrupeds; its tail is forked, and its ſcales are very large.

DENTICLES, or Dentils, in architecture, an ornament in cornices, bearing ſome reſemblance to teeth; particularly affected in the Ionic and Corinthian orders; and of late alſo in the Doric. See Syſtem of Architecture. Ionic Order, Plate VI.

DENTIFRICE, from *dens*, a *tooth*, and *frico, I rub*, in medicine, tooth powder; a remedy to rub the teeth, in order to cleanſe, or faſten them. There are various kinds; generally made of earthy ſubſtances finely pounded, and mixed with alum, or ſome other ſaline ſubſtances: but theſe are pernicious, on account of their wearing away the enamel of the teeth; but more eſpecially by the ſeptic quality with which theſe earthy ſubſtances are endowed. On this account, a portion of Peruvian bark finely pounded is now commonly added, which anſwers the double purpoſe of cleaning the teeth, and preſerving them afterwards from corruption.

DENTISCALPRA, from *dens, tooth*, and *ſcalprum, ſcraping, inſtrument*, in ſurgery, an inſtrument for ſcouring yellow, livid, or black teeth; to which being applied near the gums, it ſcrapes off the foul morbid cruſt. Some of theſe inſtruments are furniſhed with narrow points; others with broader, and with edges; and ſome again are falciform; but all of them adapted to one and the ſame handle.

DENTITION, *Dentitio*, the act of cutting the teeth, in children. See Syſtem of Medicine.

DENUNCIATION, *Denunciatio*, a ſolemn publication, or promulgation of any thing. All veſſels of enemies are lawful prize after *denunciation*, or proclamation of war. The deſign of the *denunciation* of excommunicated perſons is, that the ſentence may be the more fully executed; that the perſons may be known.

DEOBSTRUENTS, from *de*, and *obſtruo, I obſtruct*, are ſuch medicines as open obſtructions. There is ſomething farther intimated by *deobſtruent* than by *detergent*; for a medicine may be *deobſtruent* that is not in the ſtricteſt ſenſe *detergent*: as, in effect, are moſt of thoſe which are made of metalline ſubſtances, ſuch as ſteel and mercury; which obtain the appellation *deobſtruents* from their acting by their natural weight, whereby they increaſe the momentum of the circulating fluid, and make it ſtrike againſt the ſecretory outlets with greater force; becauſe the momentum, or *vis percuſſionis*, of all projectiles, of which kind is a circulating fluid, is as their ſolidities, ſuppoſing their velocities equal. The more, therefore, the animal fluids are ſaturated with denſe and ſolid particles, with the greater force they diſtend the veſſels, and the more eaſily break through, where the ſtructure favours their eſcape; and upon that account are medicines which add to theſe qualities in the fluids called *deobſtruents*.

DEPART, a method of refining, or ſeparating gold from ſilver by means of *aqua fortis*.

There are three ways of refining gold; the firſt by antimony, the ſecond by ſublimate; and the third, which is the moſt uſual, by *aqua fortis*. Refining.

DEPARTMENT, in juriſprudence, ſignifies diſtribution, diviſion, or allotment of certain employments among ſeveral perſons. Thus the great officers of ſtate, &c. have each their ſeveral departments: and the buſineſs of the ſecretaries of ſtate in particular, is generally divided into two partitions; the one officiating for the ſouthern, the other for the northern department: though ſometimes another is added on particular occaſions.

Department, in architecture, that part of an edifice, deſtined for ſome peculiar purpoſe: as in a palace, the department of the kitchen, of the ſtables, &c.

DEPARTURE, or Departer, in law, a term properly applied to a perſon, who firſt pleading one thing in bar of an action, and that being replied to, waves it, and inſiſts on ſomething different from his firſt plea. Or, it may be applied to a plaintiff, who in his replication ſhews a new matter different from that in his declaration. So if a man plead a general agreement in bar, and in his rejoinder allege a ſpecial one, it ſhall be adjudged a departure in pleading. The defendant hereupon demurreth, becauſe it was a departure from the declaration. Coke, part ii. fol. 147.

Departure *in Deſpight of the Court*, is when the tenant, or defendant, after appearing to the action brought againſt him, and having a day over in the ſame term, does not appear at the day, but makes a default. This is *departure in deſpight of the court*; and therefore he ſhall be condemned.

Departure, in navigation, is the eaſting, or weſting of a ſhip, with reſpect to the meridian from which it departed or ſailed. Or, it is the difference of longitude, either eaſt or weſt, between the preſent meridian the ſhip is under, and that where the laſt reckoning or obſervation was made. This departure, any where but under the equator, muſt be accounted according to the number of miles in a degree proper to the parallel the ſhip is under.

DEPHLEGMATION, in chymiſtry, is the act of purifying, or clearing a fluid of its phlegm, or water. This is performed either by evaporation, or by diſtilling the ſpirit, or other fluid, ſeveral times; by which means the ſpirituous part ariſes, and leaves the phlegm, or, at leaſt, as much as it can be, it is called a dephlegmated ſpirit.

DEPILATORY *Medicines*, thoſe applied in order to take off the hair: ſuch are lime and orpiment known to be, but which ought to be uſed with great caution. The word is formed of the particle *de*, and *pilus, hair*.

DEPONENT, *Deponens*, in the Latin Grammar, a term applied to verbs which have active ſignifications, but paſſive terminations, or conjugations, and want one of their participles paſſive. They are called *deponents*, as having depoſited, or laid aſide their paſſive ſignification.

Deponent, in a legal ſenſe, a perſon who makes a depoſition or affidavit.

DEPOPULATION, the act of waſting, deſtroying, deſolating, or unpeopling a place. Coke, Inſtitut. part iii. fol. 204.

DEPOSIT, among civilians, ſomething that is committed to the cuſtody of a perſon, to be kept without any reward, and to be returned again on demand. The civilians divide *depoſitum* into *ſimple* and *judiciary*.

Judiciary Deposit, is that whoſe property is conteſted between ſeveral perſons, and depoſited in the hands of ſome third perſon, by decree of a judge.

Simple Deposit, is either voluntary, or neceſſary. Neceſſary is that done in caſe of hoſtility, ſhipwreck, fire, &c. Innholders are reſponſible for the baggage brought to them, as being a neceſſary depoſit.

DEPOSITIO, in grammar, is a name which the Latins gave to the final cadence, which terminates, as it were, the meaſure of the verſe. The Greeks call it αποθεσιν, and καλαλεξιν. Hence ariſeth the diſtinction of verſe into four ſpecies, viz. *acatalectic, catalectic, brachycatalectic* and *hypercatalectic*.

DEPOSITION, in law, a teſtimony given in court by a witneſs upon oath. In chancery, depoſition is a teſtimony ſet down in writing, by way of anſwer to the interrogatories exhibited in chancery, where ſuch witneſs is called *deponent*.

Deposition is alſo uſed for the ſequeſtering, or depriving a perſon of his dignity and office. This depoſition only differs from abdication, in that the latter is ſuppoſed voluntary, and the act of the dignitary, or officer himſelf; and the former of compulſion, being the act of a ſuperior power, whoſe authority extends thereto. Some ſay the depoſition, and ſome the abdication of king James II. Depoſition does not differ from deprivation; we ſay indifferently, a depoſed, or deprived biſhop, official, &c. Depoſition differs from ſuſpenſion, in that it abſolutely and for ever ſtrips or diveſts a prieſt, &c. of all dignity, office, &c. whereas ſuſpenſion only prohibits or reſtrains, the exerciſe thereof.

DEPOT, in military language, denotes a particular place at the tail of the trenches, out of the reach of the cannon of the place, where the troops commonly aſſemble, that are ordered either to attack the outworks, or to ſupport the troops in the trenches, when there is reaſon to imagine that the beſieged intend to make a vigorous attack.

Depot alſo ſignifies a temporary magazine for forage, faſcines, gabions, tools, &c. neceſſary for the ſupport of an army, or for carrying on a ſiege.

DEPRECATION, from *deprecor, I intreat*, in rhetoric, a figure whereby the orator invokes the aid or aſſiſtance of ſome one; or prays for ſome great evil or puniſhment to befall him who ſpeaks falſely, either himſelf, or his adverſary.

DEPRESSION *of the Pole*. So many degrees as you ſail, or travel from the pole towards the equator, ſo many you are to depreſs

preſs the pole, becauſe it becomes reſpectively, ſo much lower, or nearer the horizon.

Depression *of the viſible Horizon*, denotes its ſinking or dipping below the true horizontal plane; whether cauſed by ſome variation of the atmoſphere, or by different height of the obſerver's eye above the ſurface of the ſea. See Robertſon's Elem. of Navigation, book ix. p. 391. and Tables requiſite to be uſed with the Nautical Ephemeris, p. 14.

Depression *of the Sun*, or *of a Star*, is its diſtance from the horizon, below it, meaſured by an arch of the vertical circle, intercepted between it and the horizon.

DEPRESSOR, in anatomy, a name common to divers muſcles, from their office in lowering, or bringing down, the parts they are faſtened to.

Depressor, *Alæ Naſi*, in anatomy, a name given by Albinus to a muſcle of the face, called by Cowper *conſtrictor alæ naſi*, and *depreſſor labii ſuperioris*. See Syſtem of Anatomy. Part III. Sect. IX.

Depressores *Oculi*, a pair of muſcles ſpringing from each corner of the eye, and anſwered by another pair of like figure and ſtructure in the lower eye-lid. Theſe are often conſidered together by anatomiſts as one orbicular muſcle; the fibres environing the eye-lids, and being inſerted into them, not unlike the ſphincters of other parts. See Syſtem of Anatomy. Plate of the Organs of Senſe. *Fig.* 10. *f.*

DEPRIVATION, in the canon law, the act of diveſting, or taking away a ſpiritual promotion, or dignity: as when a biſhop, vicar, prebend, or the like, is depoſed, or *deprived* of his preferment, for ſome matter, or fault, in fact, or in law.

DEPTH, the meaſure of any thing from the ſurface downwards.

Depth, *of a Sail*, denotes the extent of any ſquare or oblong ſail from the head-rope to the foot-rope; or the length of the after-leech of any boom-ſail or ſtay-ſail.

Depth *of a Squadron*, or *Battalion*, is the number of men in a file, or the number of ranks. Infantry is now generally drawn up three deep, and in the defence of a breaſt-work only two deep. The cavalry is commonly drawn up three deep, and ſometimes only two deep.

DEPURATION, from *depurgo, I purify*, in pharmacy, the ſame as clarification, or purification; viz. the purging a body of all the lees, fæces, and other craſs, coarſe, and excrementitious parts contained therein. Fermentation ſerves to *depurate* liquors: ſyrups, juices, &c. are *depurated* by paſſing them through the *minica hippocratis*, or ſtraining-bag.

DEPUTATION, from *deputare, to depute*, a miſſion of certain ſelect perſons out of a company, or body, to a prince, or aſſembly to treat of matters in their name, or to proſecute ſome affair therein. *Deputations* are more or leſs ſolemn, according to the quality of thoſe who ſend them, and the buſineſs they are ſent upon. *Deputation* is not properly applied where a ſingle perſon ſends another with ſuch commiſſion; but only where a body are concerned. The parliament *deputed* the ſpeaker, and ſix members, to preſent their addreſs to his majeſty. The chapter *deputed* two canons to ſolicit their affair in council.

DEPUTY, a perſon ſent, or deputed, by ſome community, in their name and behalf.

Deputy, in law, is one who exerciſes an office in another's right: and the forfeiture or miſdemeanor of ſuch deputy ſhall cauſe the perſon whom he repreſents to loſe his office. A ſuperior officer muſt anſwer for his deputy in civil actions, but not in criminal caſes. Judges have no power to hold their courts by deputy: recorders, however, may do it. Coroners cannot appoint deputies, becauſe theirs is a judicial office of truſt, annexed to their perſons. Sheriffs, ſtewards of a court, bailiffs of a liberty, and conſtables, are allowed to appoint deputies.

DERELICT is applied to ſuch lands, as the ſea receding from, leaves dry, and fit for cultivation. If they are left by a gradual receſs of the ſea, they are adjudged to belong to the owner of the adjoining lands: but when an iſland is formed in the ſea, or a large quantity of new land appears, ſuch derelict lands belong to the king.

DE REVOCATIONE *Parliamenti*, the name of a writ for recalling a parliament. Thus in 5 Edw. III. the parliament being ſummoned, was recalled by ſuch a writ before it met. Vide Pryn's Animad, on the 4 Inſt. f. 44.

DERIVATION, in grammar, the affinity one word has with another, by having been originally formed from it. See Derivative.

Derivation, in medicine, is when a humour which cannot conveniently be evacuated at the part affected, is attracted from thence, and diſcharged elſewhere: thus, a bliſter is applied to the neck to draw away the humour from the eyes.

The doctrine of derivation and revulſion ſo much talked of by the ancients is, in their ſenſe of theſe terms, wholly exploded. By revulſion, they meant the driving back of the fluids from one part to another. The only rational meaning the word *revulſion*, as here applied, can have, is, the preventing too great an afflux of humours to any part, either by contracting the area of the veſſels, or diminiſhing the quantity of what flows from them; the firſt of theſe intentions is anſwered by the application of repellents to the part; the laſt by bleeding, and other evacuations: thus, any medicines promoting the ſecretions, may be ſaid to make a revulſion; and in this ſenſe derivation can only be underſtood.

DERIVATIVE, in grammar, a word which is derived from another called its *primitive*. Thus, *manhood* is derived from *man*; *Deity* from *Deus*.

DERMA, in anatomy, the cutis, or ſkin of an animal; or the tegument inveſting the whole body immediately under the cuticle, or ſcarf-ſkin. The word comes from the Greek δερειν, *to flay*, or *excoriate*. The derma conſiſts of two parts; the *corpus reticulare*, and *papillæ pyramidales*.

DERMESTES, in entomology, a genus of inſects of the order of the coleoptera, the antennæ of which are of a clavated figure, and perfoliated tranſverſely. There are ſeveral ſpecies of this genus, confounded by ſome with beetles, or ſcarabæi.

DEROGATION, an act contrary to a preceding one, and which annuls, deſtroys, and revokes it, either in whole or in part.

DEROGATORY, a clauſe importing derogation. A derogatory clauſe in a teſtament, is a certain ſentence, cipher, or ſecret character, which the teſtator inſerts in his will, and of which he reſerves the knowledge to himſelf alone, adding a condition, that no will he may make hereafter is to be reckoned valid, if this derogatory clauſe is not inſerted expreſly and word for word. It is a precaution invented by lawyers againſt latter-wills extorted by violence, or obtained by ſuggeſtion.

DERVIS, or Dervich, a name given to a ſort of monks among the Turks, who lead a very auſtere life, and profeſs extreme poverty; they are allowed to marry. The word is originally Perſian, דרויש, ſignifying a *beggar*, or perſon who has nothing: and becauſe the religious, and particularly the followers of Mevelava, profeſs not to poſſeſs any thing, they call both the religious in general, and the Mevelavites in particular, Derviſes, or Derviches. The Derviſes affect a great deal of modeſty, patience, humility, and charity. They always go bare-legged, and open-breaſted, and frequently burn themſelves with hot irons, to inure themſelves to patience. They always faſt on Wedneſdays, eating nothing on thoſe days till after ſun-ſet. Tueſdays and Fridays they hold meetings, at which the ſuperior of the houſe preſides. One of them plays all the while on a flute, and the reſt dance, turning their bodies round and round with the greateſt ſwiftneſs imaginable. Long cuſtom to this exerciſe from their youth has brought them to ſuch a habitude, that it does not diſcompoſe them at all. This practice they obſerve with great ſtrictneſs, in memory of Mevelava their patriarch's turning miraculouſly round, as they pretend, for the ſpace of four days, without any food or refreſhment, his companion Hamſa playing all the while on the flute; after which he fell into an extaſy, and therein received wonderful revelations for the eſtabliſhment of his order. They believe the flute an inſtrument conſecrated by Jacob, and the ſhepherds of the Old Teſtament, becauſe they ſang the praiſes of God upon them. They profeſs poverty, chaſtity, and obedience, and really obſerve them while they remain derviſes; but if they chooſe to go out, and marry, they are always allowed.

The derviſes are great travellers; and, under pretence of preaching, and propagating their faith, are continually paſſing from one place to another: on which account they have been frequently uſed as ſpies. There are alſo derviſes in Perſia, called in that country Abdals, q. d. *ſervants of God*. They lead a very penurious, auſtere life, and preach the Alcoran in the ſtreets, coffee-houſes, and wherever they can meet with auditors. The Perſian derviſes retail little but fables to the people, and are in the utmoſt contempt among the men of ſenſe, and letters. There are in Egypt two or three kinds: thoſe that are in convents, are in a manner of the religious order, and live retired; though there are of theſe ſome who travel and return again to their convents. Some take this character, and yet live with their families, and exerciſe their trades: of this kind are the dancing derviſes at Damaſcus, who go once or twice a week to a little inhabited convent, and perform their extraordinary exerciſes: theſe alſo ſeem to be a good people: but there is a third ſort of them who travel about the country, and beg, or rather oblige people to give; for whenever they ſound their horn ſomething muſt be given them. The people of theſe orders, in Egypt, wear an octagonal badge, of a greeniſh white alabaſter, at their girdles, and a high ſtiff cap without any thing round it. Pococke's Egypt, p. 178.

DESART, or Desert, a wild, uncultivated, uninhabited place or country: as the deſarts of Lybia, of the Thebaid, &c. Geographers uſe the word in the general for all countries little, or not at all, inhabited. In Scripture, we find ſeveral places in the Holy Land, or places adjoining thereto, called deſart. The deſart, or wilderneſs, abſolutely ſo called, is that part of Arabia on the ſouth of the Holy Land, wherein the Iſraelites wandered, from the time of their evacuating Egypt to their entry into the Promiſed Land. Whence the Hebrews call them by antiphraſis מרבר, which properly ſignifies *human word*, or *ſpeech*, becauſe there is none heard there.

DESCENDANT, in genealogy, a term relative to aſcendant, and applied to a perſon who is born or iſſued from ſome other referred to. Thus, mankind are ſaid to be deſcendants of Adam.

The deſcents from the brothers of the Maid of Orleans are confirmed in the exemption from all taxes and impoſts, by a regulation of the year 1634.

DESCENDING, ſomething that falls, or moves, from above, downwards. There are *aſcending* and *deſcending* ſtars; and *aſcending* and *deſcending* degrees. There are alſo *aſcending* and *deſcending* veins ſpringing out of the *cava;* and *aſcending* and *deſcending* arteries riſing out of the *aorta*.

Descending *Latitude*, is the latitude of a planet in its return from the modes to the equator. *Deſcending* in heraldry is when the head of the beaſt is turned downward to the baſe of the ſhield.

DESCENSION, in aſtronomy, is either *right* or *oblique*.

Right **Descension** *of a Star*, or *Sign*, is a point, or arch, of the equator, which *deſcends* with the ſtar, or ſign, below the horizon, in a right ſphere.

Oblique **Descension**, is a point, or arch, of the equator, which *deſcends* at the ſame time with a ſtar, or ſign, below the horizon, in an oblique ſphere.

DESCENT, in chemiſtry. The ſeparating mercury from its ore by *deſcent*, is performed in the following manner: take two earthen pots, with orifices of equal diameter: adapt an iron plate to the orifice of one of the two pots, in ſuch a manner that it may reſt upon the brink of it, but not jut out too much all round: let this have ſeveral holes bored here and there in it, but not near its bottom; pour into this pure water, to about two inches high, then ſhut it with the iron plate; put upon this plate a ſmaller veſſel, containing the ore of mercury; then cloſe theſe veſſels, with the ſecond pot inverted, ſtopping the joint well with lute; bury the inferior pot in aſhes, and put about the whole a moderate fire, continue it till the upper veſſel is ſlightly red hot, and the mercury will be driven into the lower, in fumes, which will be condenſed by the water into running quickſilver. Cramer's Art of Aſſaying, p. 352.

Descent, *into a Ditch*, in fortification, is a deep trench, or ſap, cut through the eſplanade, and under the couvert-way; covered above with planks and hurdles, and loaded with earth againſt artificial fires.

In wet ditches the deſcent is made even to the ſurface of the water; in dry ditches, it is carried to the bottom of the moat, where traverſes are made to lodge and ſecure the mines.

Descent, in geneaology, heraldry, and the order, or ſucceſſion, of deſcendants in a line, or family.

Descent is alſo uſed, in heraldry, to expreſs the coming down of any thing from above. Thus, a *lion en deſcent* is a lion with his head towards one of the baſe points, and his heels towards one of the corners of the chief; as if he were leaping from ſome high place.

Descent, or **Discent**, in law, the order, or manner, wherein lands and tenements are derived to any man from his anceſtors; and this is by cuſtom, ſtatute, or common law. By cuſtom, as in GAVELKIND or BOROUGH Engliſh: by ſtatute, as in FEE TAIL; and by common law, when a perſon has lands of inheritance in fee-ſimple, and dies without diſpoſing them; in which caſe the land deſcends in courſe to the eldeſt ſon and heir. Thus, to *make his deſcent* from his anceſtors, is to ſhew how, and by what particular degrees, the land in queſtion came to a perſon from his anceſtors.

Descent, in common law, is either lineal, or collateral.

Lineal **Descent**, is that conveyed down, in a right line, from the grandfather to the father, and from the father to the ſon, from the ſon to the grandſon, &c.

Collateral **Descent**, is that ſpringing out of the ſide of the line, or blood; as from a man to his brother, nephew, or the like.

Fall **Descent**, in mechanics, &c. is the motion, or tendency, of a body towards the centre of the earth, either directly or obliquely. See Syſtem of MECHANICS.

Line of ſwifteſt **Descent**, is that which a body falling by the action of gravity, deſcribes in the ſhorteſt time; which is proved by geometricians to be the cycloid.

DESCRIPTION, in poetry and rhetoric, is a figure which by the aid of imagery and argument, exhibits ſuch a ſtrong and lively repreſentation of a ſubject, as gives a diſtinct view and ſatisfactory notion of it to the reader or hearer; and whilſt it convinces the mind, it moves and ſways the paſſions. This figure is principally uſed by poets, not only with a deſign to move the paſſions, but to pleaſe the fancy. Hiſtorians alſo deſcribe things, places, and perſons; and orators produce the greateſt effect by deſcription. The deſcription of a perſon is called a character.

DESERTER, from *deſero*, *I forſake*, in war, a ſoldier on the muſter-roll, who quits the ſervice without leave, or liſts himſelf under another officer, into a different regiment. All ſoldiers found half a league from a garriſon, or army, going towards an enemy's country, or quarter, without a paſs, are deemed and treated as deſerters. A deſerter is, by the articles of war, puniſhable by death, and after conviction is hanged at the head of the regiment he formerly belonged to, with his crime written on his breaſt; and is ſuffered to hang until the army leave that camp, for a terror to others. By the ancient laws of this kingdom, deſertion was deemed felony; but it is now puniſhed by courts martial, under the annual acts againſt mutiny and deſertion

DESHABILLE, a French term, naturalized of late. It properly ſignifies a night-gown, and other neceſſaries, made uſe of in dreſſing or undreſſing. Mr. ——— is not to be ſpoken with, he is yet in his *diſhabille*, i. e. undreſſed, or in his night-gown. The word is compounded of the privative *de*, and *s'habiller*, *to dreſs, one's ſelf*.

DECHAUSSEE', Fr. from *de* and *hacher*, *to cut*, in heraldry, is when a beaſt has its limbs ſeparated from the body, ſo as they ſtill remain on the eſcutcheon, with only a ſmall ſeparation from their natural places.

DESIDERATUM, from *deſidero*, *I deſire*, is uſed to ſignify deſirable improvements in any art or ſcience, as yet unattained. Thus, it is a *deſideratum* with the blackſmith, to render iron fuſible, by gentle heat, and yet preſerve it hard enough for ordinary uſes; with the glaſs-man and looking-glaſs-maker, to render glaſs malleable; with the clock-maker, to bring pendulums to be uſeful where there are irregular motions, &c. And though, as Mr. Boyle obſerves, the obtaining of theſe *deſiderata* may be thought chimerical, yet it is proper they ſhould be propoſed; for although perfection may not be attainable, yet approaches to it may be made, and arts thereby improved. Vide Boyle's Works abr. vol. i. p. 129, 136. In ſhort, all arts and ſciences have their defects, and it is not at firſt to be gueſſed, how many of theſe remedies may be found, by means of chymical and philoſophical reſearches properly directed.

DESIGN, from *deſigno*, *I mark out*, in a general ſenſe, the plan, order, repreſentation, or conſtruction of a building, book, painting, &c. See ARCHITECTURE, PAINTING, POETRY, ORATORY, HISTORY, &c. In building, we uſe the term ichnography, when by deſign is only meant the plan of a building, or a flat figure drawn on paper. Orthography, when ſome face or ſide of the building is raiſed from the ground. And ſcenography, when both front and ſides are ſeen in perſpective.

Design, in weaving manufactories, expreſſes the figures wherewith the workman enriches his ſtuff, or ſilk, and which he copies after ſome painter, or eminent draughtſman, as in diaper, damaſk, and other flowered ſilk and tapeſtry, and the like. In undertaking ſuch kinds of figured ſtuffs, it is neceſſary, ſays Monſ. Savary, that, before the firſt ſtroke of the ſhuttle, the whole deſign be repreſented on the threads of the warp, we do not mean in colours, but with an infinite number of little packthreads, which, being diſpoſed ſo as to raiſe the threads of the warp, let the workmen ſee, from time to time, what kind of ſilk is to be put in the eye of the ſhuttle for woof. This method of preparing the work is called *reading the deſign*, and *reading the figure*, which is performed in the following manner: A paper is provided, conſiderably broader than the ſtuff, and of a length proportionate to what is intended to be repreſented thereon. This they divide lengthwiſe, by as many black lines as there are intended threads in the warp; and croſs theſe lines, by others drawn breadthwiſe, which, with the former, make little equal ſquares: on the paper thus ſquared, the draughtſman deſigns his figures, and heightens them with colours as he ſees fit. When the deſign is finiſhed, a workman reads it, while another lays it on the ſimblot.

To read the deſign, is to tell the perſon who manages the loom, the number of ſquares, or threads, compriſed in the ſpace he is reading, intimating at the ſame time, whether it is ground or figure. To put what is read on the ſimblot, is to faſten little ſtrings to the ſeveral packthreads, which are to raiſe the threads named; and thus they continue to do till the whole deſign is read.

Every piece being compoſed of ſeveral repetitions of the ſame deſign, when the whole deſign is drawn, the drawer, to re-begin the deſign afreſh, has nothing to do but to raiſe the little ſtrings, with ſlip-knots, to the top of the ſimblot, which he had let down to the bottom: this he is to repeat as often as is neceſſary till the whole be manufactured.

The ribbon-weavers have likewiſe a deſign, but far more ſimple than that now deſcribed. It is drawn on paper with lines and ſquares, repreſenting the threads of the warp and woof. But inſtead of lines, whereof the figures of the former conſiſt, theſe are conſtituted of points only, or dots, placed in certain of the little ſquares, formed by the interſection of the lines. Theſe points mark the threads of the warp that are to be raiſed, and the ſpaces left blank denote the threads that are to keep their ſituation: the reſt is managed as in the former.

Design, is particularly uſed, in painting, for the firſt idea of a large work, drawn roughly, and in little, with intention to be executed, and finiſhed in large.

The qualities, or conditions, required in a deſign, are correctneſs, good taſte, elegance, character, diverſity, expreſſion, and perſpective.

Correctneſs depends principally on the juſtneſs of the proportions, and a knowledge of anatomy. Taſte is an idea, or manner of deſigning, which ariſes either from the complexion, and natural diſpoſition, or from education, one's maſter, ſtudies, &c. Elegance gives the figures a kind of delicacy which ſtrikes people of judgment, and a certain agreeableneſs which pleaſes every body. The character is what is peculiar to each thing, in which there muſt be a diverſity; inaſmuch as every thing has its peculiar character to diſtinguiſh it. The expreſſion is the repreſentation of an object according to its character, and the ſeveral circumſtances it is ſuppoſed to be in. The perſpective is the repreſentation of the parts of a painting, or figure, according to the ſituation they are in, with reſpect to the point of ſight.

The deſign, or draught, is a part of the greateſt import and extent in painting: it is acquired chiefly by habit and application, rules being of leſs avail here than in any of the other branches of the art, as colouring, clair-obſcure, expreſſion, &c. See Treatiſe on the Art of Drawing.

Design, in muſic, is juſtly defined by Rouſſeau to be the invention and the conduct of the ſubject, the diſpoſition of every part, and the general order of the whole.

It is not ſufficient to form beautiful airs, and a legitimate harmony; all theſe muſt be connected by a principal ſubject, to which all the parts of the work relate, and by which they became one. Thus unity ought to prevail in the air, in the movement, in the character, in the harmony; and in modulation. All theſe muſt indiſpenſably relate to one common idea which unites them. The greateſt difficulty is, to reconcile the obſervation of thoſe precepts with an elegant variety; which, if not introduced, renders the whole piece irkſome and monotonic. Without queſtion the muſician, as well as the poet, and the painter, may riſk every thing in favour of this delightful variety; if, under the pretext of contraſting, they do not endeavour to cheat us with falſe appearances, and inſtead of pieces juſtly and happily planned, preſent us with a muſical minced meat, compoſed of little abortive fragments, and of characters ſo incompatible, that the whole aſſembled forms an heterogeneous monſter.

Non ut placidis cœant immitia, non ut
Serpentes avibus geminentur, tigribus agni.

Tranſlated thus:

But not that nature ſhould revers'd appear;
Mix mild with fierce, and gentle with ſevere;
Profane her laws to contradiction's height;
Tygers with lambs, with ſerpents birds unite.

It is therefore in a diſtribution formed with intelligence and taſte, in a juſt proportion between all the parts, that the perfection of deſign conſiſts; and it is above all, in this point, that the immortal Pergoleſo has ſhown his judgment and his taſte, and has left ſo far behind him all his competitors. His *Stabat Mater*, his *Orfeo*, his *Serva Padrona*, are, in three different ſpecies of compoſition, three maſter pieces of deſign equally perfect.

DESIGNATION, the act of marking or indicating, and making a thing known. The deſignation of ſuch an eſtate is made by the tenants, butments, and boundings.

DESIGNING, the art of delineating, or drawing the appearance of natural objects, by lines, on a plain. To deſign, according to the rules of mathematics, makes the object of perſpective. See the Syſtem of Perspective.

DESPOT, a term uſed for an abſolute prince. See the next Article.

DESPOTISM, or Despotic *Government*, a form of government wherein the prince is abſolute and arbitrary, doing whatever he liſts, without being checked by any other power. Such are moſt of the Eaſtern governments; as thoſe of the mogul, grand ſignior, ſophi of Perſia, &c.

DESPUMATION, of *de*, priv. and *ſpuma*, *froth*, the clarification of any liquor, by throwing up its foulneſs in a froth, and taking that off.

DESQUAMATION, from *de*, and *ſquamo*, *I ſcale*, expreſſes the flaking or ſcaling of carious bones.

DESSERT, or Desart, Fr. the laſt ſervice brought on the tables of people of quality, when the meats are all taken off. The *deſſert* conſiſts of fruits, confectionary, &c.

DESICCATIVE, or Desiccative, from *deſicco*, *I dry up*, in medicine, a remedy that has the virtue of drying up ſuperfluous moiſture; uſed to ſkin over old ſores, &c. We ſay, a deſiccative unguent, &c.

DESTINIES, in mythology. See Parcæ.

DESTINY, from *deſtino*, *I order*, the order, diſpoſition, or chain of ſecond cauſes appointed by providence; and importing, or carrying with it, a neceſſity of event. According to many of the heathen philoſophers, deſtiny was a ſecret and inviſible power, or virtue, which, with incomprehenſible wiſdom, conducted what to us appears irregular and fortuitous. This amounts to what we call God.

The ſtoics, by deſtiny, underſtood a certain concatenation of things, which, from all eternity follow each other of abſolute neceſſity, there being no power able to interrupt their connexion. This anſwers, in a great degree, to our idea of providence. But the ſtoics made even the gods themſelves ſubject to the neceſſity of this deſtiny. The truth is, the ſtoics rather define what the word deſtiny ſhould ſignify, than what it did ſignify in common language; for they had no diſtinct idea of this power, to which they attributed thoſe events. They had only a vague, confuſed idea of I know not what chimera, or unknown cauſe, to which they referred that invariable diſpoſition, and the eternal concatenation of all things. There is no real being that the name deſtiny can agree to. The heathen philoſophers, who had framed a notion thereof, ſuppoſed it to exiſt, without knowing preciſely what they meant by it. But men, not daring on the one ſide to impute to providence the evils and misfortunes that befel them, as they imagined, undeſervedly; and, on the other ſide, not being willing to allow that it was their own fault, formed this phantom of deſtiny, to bear the weight of all the evil.

DESTRUCTION, the act of ruining, deſtroying, demoliſhing, or laying waſte; the ſtate of a thing ruined, demoliſhed, or deſtroyed.

DESUDATION, from *deſudo*, *I ſweat much*, expreſſes a profuſe and inordinate ſweating, followed by the irruption of Sudamina, or heat-pimples.

DETACHED *Pieces*, in fortification, are demilunes, ravelins, horn and crown works, and even baſtions, when ſeparated, or at a diſtance from the body of the place.

DETACHMENT, from the French *detacher*, *to part from*, a military term, ſignifying a certain number of ſoldiers, taken our of ſeveral regiment or companies equally, to be employed in ſome particular enterprize; as to form a kind of flying camp, to relieve a party already engaged in battle, to join a ſeparate army, to aſſiſt at the ſiege of a place, or to enter into ſome garriſon. The number depends on the dignity of the officer in command; thus, two thouſand or three thouſand men form a detachment for a general officer, eight hundred for a colonel, five hundred for a lieutenant-colonel, two or three hundred for a major, eighty or a hundred for a captain, forty for a lieutenant or enſign, twelve for a ſerjeant, and ſix for a corporal.

Detachment *of a Fleet or Squadron*, a certain number of ſhips choſen by an admiral or commodore from the reſt of the fleet, and charged to execute ſome particular ſervice.

DETENTION, from *detineo*, *I detain*, the poſſeſſion, or holding of lands, or the like, from ſome other claimant. The word is chiefly uſed in an ill ſenſe, for an unjuſt with-holding, &c. The canons condemn a perſon who has intruded into a benefice, to make reſtitution of all the fruits thereof, during the time of his unjuſt detention.

DETENTS, in a clock, are thoſe ſtops, which by being lifted up or let fall down, lock and unlock the clock in ſtriking.

Detent *Wheel*, or Hoop *Wheel*, in a clock, that wheel which has a hoop almoſt round it, wherein there is a vacancy, at which the clock locks.

DETERGENT, from *detergo*, *I cleanſe*, in medicine, is applied to remedies that cleanſe, and carry off viſcid and glutinous humours.

The plant buckthorn deterges, and conſolidates wounds. Rhaponticum is aperitive, and good againſt the gravel and ſtone: it alſo deterges, and expels poiſon. Detergents are not only ſoftening and adheſive, but alſo, by a peculiar activity, or diſpoſition to motion, joined with a ſuitable configuration of parts, are apt to abrade, and carry along with them, ſuch particles as they lay hold of in their paſſage. All medicines of this intention are ſuppoſed to cleanſe and heal, that is, incarnate, or fill up with new fleſh, all ulcerations and foulneſſes occaſioned thereby, whether internal or external. To do this, in all internal caſes eſpecially, the medicine muſt be ſuppoſed to maintain its primary properties, until it arrives at the place of action: and there it does what entitles into the appellation of a detergent, and a vulnerary: firſt, by its adheſive quality, which conſiſts in the comparative largeneſs of ſurface, and flexibility of its component parts, by which it readily falls into contact with, and adheres to, the ſlough of ulcerous exudations, which, by their looſe ſituations, are eaſily carried along with the medicine; and when ſuch matter is ſo carried away, which is the cleanſing and deterging part, what was inſtrumental in this office, will afterwards ſtick and adhere to the cutaneous filaments, until, by their addition, and the protruſion of proper nouriſhment, *ab interno*, to the ſame place, the waſte is made up, that is, the ulcer is healed.

After the like manner is the operation of detergents to be accounted for in external application. By the warmth of their parts they rarefy, and by their adheſive quality they join with, and take off along with them, in every dreſſing, what is thrown upon the place to which they are applied, until a more convenient matter is brought thither by the circulating juices, which they aſſiſt in adhering to, and incarnating the eroded carities. Only this may be taken notice of, that internally, whatſoever of this kind is mixed with the animal fluids, by the known laws of circulation, will be firſt ſeparated, and left behind; for all thoſe parts which are ſpecifically heavieſt, will move neareſt the axis of the canals, becauſe their moments are the greateſt, and will carry them, as near as can be, in ſtraight lines; but the lighter parts will always be driven to the ſides, where they ſooneſt meet with outlets to get quite off, or are ſtruck into ſuch cavities as we are here ſpeaking of, in which they adhere, and make part of the ſubſtance.

DETERIORATION, the impairing or rendering a thing worſe: it is juſt the reverſe of Melioration.

DETERMINATE *Problem*, is that which has but one, or at leaſt but a certain number of ſolutions; in contradiſtinction to an indeterminate problem, which admits of infinite ſolutions.

Such e. gr. is the problem, To deſcribe an iſoſceles triangle on a given line, whoſe angles at the baſe ſhall be double that at the vertex: which has only one ſolution; as that which follows has two, viz. To find an iſoſceles triangle, whoſe area and perimeter are given. A determinate problem may either be ſimple or linear, plane, ſolid, or ſurſolid.

DETERMINATION, in mechanics, ſignifies much the ſame with the tendency or direction of a body in motion.

Determination is alſo uſed for the action whereby a cauſe or agent is limited, or reſtrained, to act, or not act, in this or in that manner.

A determination to be pleaſed with certain forms, or ideas, an ingenious author calls an internal ſenſe; and a determination to be pleaſed with virtuous actions, characters, manners, &c. a moral ſenſe.

DETERRATION, from *de* and *terra*, is uſed to ſignify a removal of the earth, ſands, &c. from the mountains and higher grounds, down into the valleys and lower parts. This is occaſioned by rains, which waſh the earthy matter down by degrees; but this cannot be very conſiderable, or much raiſe the ſurface of the earth, as ſome have imagined, becauſe a good part of it is ſunk into the clefts and caverns of the rocks and mountains, a great quantity is borne down into rivers, and thence into the ſea, and the richer and finer parts help to compoſe the bodies of plants and vegetables.

DETERSIVES, in medicine, the ſame with detergent. A clyſter is a deterſive medicine, which cleanſes the lower venter. Deterſive unguents are alſo called mundificatives. The leaves and ſummits of the ſtrawberry are deterſive and aſtringent.

DETINUE, in law, a writ or action that lies againſt one who has got goods or other things delivered to him to keep, and afterwards refuſes to deliver them. In this action, the thing detained is generally to be recovered, and not damages; but if one cannot recover the thing itſelf, he ſhall recover damages for the thing, and alſo for the detainer. Detinue lies for any thing certain and valuable, wherein one may have a property or right as for a horſe, cow, ſheep, hens, dogs, jewels, plate, cloth, bags of money, ſacks of corn, &c. It muſt be laid ſo certain, that the thing detained may be known and recovered: and therefore, for money out of a bag, or corn out of a ſack, it lies not; for the money or corn cannot in this caſe be known from other money or corn; ſo that the party muſt have an action on the caſe, &c. Yet detinue may be brought for a piece of gold of the price of 22s. though not for 22s. in money.

Detinue *of Charters*. A man may have *detinue* for deeds and charters concerning land: but if they concern the freehold, it muſt be in C. B. and no other court. Action of *detinue* lies for charters which make the title of lands: and the heir may have *detinue* of charters, although he hath not the land. If my father be diſſeiſed, and dieth, I ſhall have *detinue* for the charters, notwithſtanding I have not the land; but the executors ſhall not have the action for them. New Nat. Br. 308.

Detinue *of Goods in Frank-Marriage*, is on a divorce betwixt a man and his wife; after which the wife ſhall have this writ of *detinue*, for the goods given with her in marriage. Mich. 35 Eliz. 1. New Nat. Br. 308.

DETONATION, in chymiſtry, ſignifies an exploſion with noiſe made by the ſudden inflammation of ſome combuſtible body: Such are the exploſions of gun-powder, fulminating gold, and fulminating powder. As nitre is the cauſe of moſt exploſions, the word *detonation* has been appropriated to the inflammation of the acid of this ſalt with bodies containing phlogiſton; and it is frequently given to thoſe inflammations of nitrous acid which are not accompanied with exploſion. Thus nitre is ſaid to detonate with ſulphur, with coals, with metals; although in the ordinary method of making theſe operations, that is, in open crucibles, and with ſmall quantities of detonating ſubſtances, the nitre does not truly explode. See Nitre.

DETRANCHE', among the French heralds, ſignifies a line bendwiſe, which does not come from the very dexter angle, but either from ſome part of the upper edge, and thence falling athwart, or diagonally; or form part of the dexter ſide. They ſay, *tranché*, *detranché*, and *retranché*; to denote, that there are two diagonal lines, making two partitions in the eſcutcheon, and coming from the angles, and a third from ſome of the other parts above mentioned.

DEUCALION, king of Theſſaly. The flood ſaid to have happened in his time, (1500 C.), was no more than an inundation of Theſſaly, occaſioned by heavy rains, and an earthquake that ſtopped the courſe of the river Peneus, where it uſually diſcharged itſelf into the ſea. On theſe circumſtances the fable of Deucalion's flood is founded. According to the fable, he was the ſon of Prometheus. He governed his people with equity; but the reſt of mankind being extremely wicked, were deſtroyed by a flood, while Deucalion and Pyrrha his queen ſaved themſelves by aſcending mount Parnaſſus. When the waters were decreaſed, they went and conſulted the oracle of Themis, on the means by which the earth was to be repeopled; when they were ordered to veil their heads and faces, to unlooſe their girdles, and throw behind their backs the bones of their great mother. At this advice Pyrrha was ſeized with horror: but Deucalion explained the myſtery, by obſerving, that their great mother muſt mean the earth, and her bones the ſtones; when taking them up, thoſe Deucalion threw over his head became men, and thoſe thrown by Pyrrha, women.

DEVICE, in painting. See Deviſe.

DEVIL, an evil angel, one of thoſe celeſtial ſpirits caſt down from heaven for pretending to equal himſelf with God. The Ethiopians paint the devil white, to be even with the Europeans who paint him black. There is no mention of the word *devil* in the Old Teſtament, but only of the word Satan and Belial; nor do we meet with it in any heathen authors, in the ſenſe it is taken among Chriſtians, that is, as a creature revolted from God. Their theology went no farther than to evil genii, or dæmons. Some of the American idolaters have a notion of two collateral independent beings, one of whom is good, and the other evil; which laſt they imagine has the direction and ſuperintendance of this earth, for which reaſon they chiefly worſhip him: whence thoſe that give us an account of the religion of theſe ſavages give out, with ſome impropriety, that they worſhip the devil. The Chaldeans, in like manner, believed both a good principle and an evil one; which laſt they imagined was an enemy to mankind. Iſaiah, ſpeaking, according to ſome commentators, of the fall ot the devil, calls him Lucifer, from his former elevation and ſtate of glory: but others explain this paſſage of Iſaiah in reference to the king of Babylon, who had been precipitated from his throne and glory. The Arabians call Lucifer, Eblis; which ſome think is only a diminutive or corruption of the word Diabolus.

DEVISE, or Device, in heraldry, painting, and ſculpture, any emblem uſed to repreſent a certain family, perſon, action, or quality; with a ſuitable motto, applied in a figurative ſenſe. See Motto.

The eſſence of a device conſiſts in a metaphorical ſimilitude between the things repreſenting and repreſented: thus, a young nobleman, of great courage and ambition, is ſaid to have borne for his deviſe, in a late carouſal at the court of France, a rocket mounted in the air, with this motto in Italian, "*poco duri purche m'inalzi*;" expreſſing, that he preferred a ſhort life, provided he might thereby attain to glory and eminence.

Deviſe, or Diviſe, in common law, the act whereby a teſtator gives, or bequeaths, his lands, or goods, by his laſt will, in writing. Though, in ſtrictneſs, a deviſe of goods is more properly termed a bequeſt. He who makes the deviſe, is called the deviſor; and he to whom it is made, the deviſee.

DEVOLVED, ſomething acquired by right of devolution. Such a right is devolved to the crown: ſuch an eſtate devolved on M—— by the death of N——. If a patron neglects to preſent a benefice in ſix months, the preſentation lapſes, or devolves upon the biſhop, from thence to the primate, and from thence to the king.

DEVOLUTION, in law, a right acquired by deſcent, or ſucceſſion, from degree to degree.

DEVOTION, of *devoto*, from *devoveo*, *I conſecrate*, a ſincere, ardent worſhip of God. Monſ. Jurieu defines devotion, a ſoftening and yielding heart, with an inward conſolation, which good men feel in the exerciſes of piety. Under the name of devotions are uſually underſtood certain religious practices, which a perſon makes it a rule to diſcharge regularly; and with reaſon, if this exactitude be founded on ſolid piety; otherwiſe it is vanity, or ſuperſtition.

DEVOURING, in heraldry. When fiſhes are borne in an eſcutcheon, in a feeding poſture, the heralds denominate it devouring; becauſe fiſhes ſwallow all their food whole.

DEUTEROCANONICAL, an appellation given to certain books of the Holy Scripture, which were added to the canon after the reſt; either becauſe they were not wrote till after the compilation of the canon, or becauſe of ſame diſputes as to their canonical authority. The word is Greek, being compounded of δευτερος, *ſecond*, and κανονικος, *canonical*. The Jews, it is certain, acknowledge ſeveral books in their canon, which were put there later than the reſt. They ſay, that, under Ezra, a great aſſembly of their doctors, which they call, by way of eminence, the great ſynagogue, made the collection of the ſacred books, which we have now in the Hebrew Old Teſtament: and they agree, that they put books therein which had not been ſo before the Babyloniſh captivity. Such are thoſe of Daniel, Ezekiel, Haggai, &c. and thoſe of Ezra and Nehemiah. And the Romiſh church has ſince added others to the canon, that were not, nor could be, in the canon of the Jews; becauſe ſome of them were not compoſed till after the canon was formed. Such is the book of Eccleſiaſticus; with ſeveral of the apocryphal books, as that of the Maccabees, Wiſdom, &c. Others were added ſtill later, becauſe their canonical authority had not been yet examined; and, till ſuch examen, and judgment, they might be ſet aſide, at pleaſure. But ſince that church has pronounced as to the canonical authority of theſe books, there is no more room now for her members to doubt of them than there was for the Jews to doubt of thoſe of the canon of Ezra: and the deuterocanonical books are, with them as canonical as the protocanonical; the only difference between them conſiſting in this, that the canonical authority of the one was not generally known, examined, and ſettled, ſo ſoon as that of the others.

The deuterocanonical books, in the modern canon, are, the book of Eſther, either the whole, or at leaſt the ſeven laſt chapters of it; the Epiſtle to the Hebrews; that of James; and that of Jude; the ſecond of St. Peter; the ſecond and third of St. John; and the Revelation. The deuterocanonical parts of books are, the Hymn of the Three Children; the Prayer of Azariah; the hiſtories of Suſanna, of Bel and the Dragon; the laſt chapter of St. Mark; the Bloody Sweat, and the appearance of the Angel, related in St. Luke, chap. xxii. and the hiſtory of the Adulterous Woman in St. John, chap. viii.

DEUTERONOMY, one of the ſacred books of the Old Teſtament; being the fifth book of the law, and the laſt of thoſe written by Moſes; cloſing according to the computation of Archbiſhop Uſher, the hiſtory of 2552½ years, from the beginning of the world to the death of Moſes. The word is Greek, compounded of δευτερος, *ſecond*, and νομος, *law*.

It does not appear that Moſes made any diviſion of what he wrote, into books; or that he gave different names and titles to the different parts of his work; nor do the Jews, even at this day, diſtinguiſh them in the copies they uſe in the ſynagogues, but write them all running as one ſingle work, without any other diſtinction beſide that of little and great paraſches. It is true, in the other copies, uſed by private perſons, they are divided into five parts, as among us; but they give them no other name but the firſt word wherewith each diviſion begins; much as we do in quoting a decree, or chapter of the canon law.

The book of Deuteronomy was written in the fortieth year after the delivery from Egypt, in the country of the Moabites beyond Jordan; Moſes being then in the 120th year of his age. It contains, in Hebrew, eleven paraſches, though only ten in the editions of the rabbins at Venice; twenty chapters, and 955 verſes. In the Greek, Latin, and other verſions, it contains thirty-four chapters: the laſt was not written by Moſes. Some ſay it was added by Joſhua, immediately after Moſes's death; others will have it added by Ezra, which is the moſt probable opinion; who likewiſe made ſome interpolations in the book itſelf, as chap. ii. ver. 12. chap. iii. 11. and 14.

DEUTEROSIS, the Greek name by which the Jews called their *miſchna*, or ſecond law. *Deuteroſis* in Greek has the ſame ſignification almoſt as *miſchna* in Hebrew; both ſignify an iteration. Euſebius accuſes the Jews with corrupting the true ſenſe of Scripture with the trifling explanations of their *deuteroſis*. Calmet, Dict. Bibl. in voc.

DEW, *Ros*, a thin, light, inſenſible miſt, or rain, aſcending with a ſlow motion, and falling while the ſun is below the horizon. Caſaubon derives the word from the Greek δευω, *I moiſten*. Naturaliſts uſually rank dew among the number of meteors of the watery kind. Some define it a vapour liquefied, and let fall in drops; others, a vapour having a like relation to froſt as rain has to ſnow, &c. Among the diſſertations of Monſ. Huet, is a letter to ſhew that dews do not fall, but riſes. M. Gerſten likewiſe adopted the ſame opinion. To us, dew appears only to differ from rain as more and leſs. Its origin, and matter, no doubt, is from the vapours and exhalations of the earth and water raiſed, as ſhewn under the article Evaporation, where the theory of its aſcent and precipitation is particularly explained. M. du Fay made ſeveral experiments, firſt with glaſſes, and then with pieces of cloth, faſtened to two ladders, joined at top, and ſpreading wide at bottom, and reaching about thirty-two feet high, in order to evince the aſcent of dew; and he found that the lower bodies, with their under ſurfaces, were wetted before thoſe that were placed higher, or their upper ſurfaces.

From the principles propoſed and illuſtrated, under the article Evaporation the ſeveral phenomena of dews are eaſily accounted for. Hence, e. gr. it is that dews are more copious in the ſpring than in any other ſeaſons; there being then a greater ſtock of vapour in readineſs, through the ſmall expence thereof in the winter's cold and froſt, than at other times. Hence, what Pliny relates of Egypt, that it abounds in dews throughout all the heats of ſummer; for the air there being too hot to conſtipate the vapours in the day time, they never gather into clouds, and hence they have no rain: but we know, that in climates where the days are exceſſive hot, the nights are remarkably cold; ſo that the vapours raiſed after ſun-ſet are readily condenſed into dews. The quantity and quality of the aſcending dew in particular places depend on a variety of circumſtances, as the ſituation, the nature of the ſoil, the ſtate of the air, and the ſeaſon of the year.

The dew of plants is probably only the moiſture that continually exhales through the orifices of their veſſels, aud not a vapour collected by their leaves: for this dew is expired by each plant, according to the peculiar ſtructure of its veſſels, and the ſituation of their orifices. Plants likewiſe that have been ſhut up in veſſels, and covered by glaſſes, have collected a greater quantity of dew in the night than thoſe that ſtood in the open air; and farther the drops are gathered in thoſe parts, where the orifices of the veſſels are manifeſtly open, and not all over the leaves, and not in the upper or lower leaves only, which would be the caſe if they aroſe from ambient vapour, but in all the leaves, without diſtinction. The oily or honey dew, which is ſometimes exhaled in ſummer by trees and herbs, and which has been found to ſettle on the oak, aſh, &c. is of this kind. Muſchenbroeck Introd. ad Philoſ. Nat. vol. ii. p. 987. 995. ed. 1772.

May Dew. The dew that falls in the beginning of ſummer, particularly in this month, has great virtues attributed to it by many authors, when newly gathered and clean filtered. It is not of a watery appearance, or colourleſs, but is yellowiſh, and much reſembles the urine of a healthful perſon. It is uſed for whitening linen and wax.

We have in the Philoſophical Tranſactions, very odd accounts of productions of the animal kingdom, in the ſame dew; which might puzzle any one not verſed in experiments of this kind with other fluids. In one of the veſſels of this dew were found millepedes, differing from the common kind in ſome particulars; theſe were the common water millepedes: and in another, a quantity of green matter, probably a conferva, with numerous eulæ of inſects inhabiting it; for in a few days there were produced from this a vaſt number of flies. Another quantity of the dew, ſet in an open glaſs, was found after ſome days filled with the eulæ of the common gnat, and the flies were hatched from theſe. Phil. Tranſ. N° 3. It is eaſy for a bad philoſopher to infer from theſe accounts the equivocal generation of theſe creatures in the water; but the inſight we have had into the wonders of nature in the inſect-world are ſuch, that at preſent we know their generation to be in many ſpecies, particularly in the gnats and fly kind, from the eggs of their parents depoſited in water, or any watery fluids, and that common ditch water will at any time do what the dew does in this experiment.

Dew *Born*, in the management of cattle, an exceſſive ſwelling of the body, proceeding from the greedineſs of a beaſt, to feed, when put into rank paſture.

This ſwelling is often ſo great that the creature runs the utmoſt hazard of burſting; in which caſe it ſhould be made to ſtir much, and purge well; but the proper cure is to bleed the creature in the tail, then putting a nutmeg into an egg, to thruſt it down the creature's throat, ſhell and all; after which, by walking him up and down, he will ſoon recover.

DEXTER, in heraldry, is applied to the right ſide, as ſiniſter is to the left.

DEY, the title of the ſovereign of Algiers, under the protection of the grand ſeignior. A prince under this title was appointed by the ſultan, at the requeſt of the Turkiſh ſoldiers, in the year 1710. The term *dey*, in the Turkiſh language, ſignifies *an uncle* by the mother's ſide; and the reaſon of the denomination is this; that the Turkiſh military conſider the grand ſeignior as their father, the republic as their mother, by which they are nouriſhed and maintained, and the *dey* as the brother of the republic, and conſequently the uncle of all who are under his dominion. Beſides the age, experience, and valour, which are neceſſary qualifications of a perſon to be elected, he muſt alſo be a native Turk, and have made the voyage to Mecca. He has no guards, nor conſiderable retinue; he preſides at the divan, and is moſt diſtinguiſhed by the reſpect and ſubmiſſion which are paid him.

DIA, Δια, the beginning of divers terms in medicine, ſurgery, pharmacy, &c. Where theſe three letters commence the name of a remedy, unguent, plaſter, cataplaſm, &c. they ſignify compoſition and mixture; as in *diapaſma*, *diachylon*, &c.

Dia is likewiſe the beginning of many terms in the other arts: as diameter, dialogue, &c. on all which occaſions, *dia*, which is an inſeparable particle, or prepoſition, is borrowed from the Greek δια, *ex*, or *cum*; which begins the ſame words in the Greek. Indeed we have words wherein *dia* is no prepoſition borrowed from a foreign language; though it is poſſible, the words themſelves may; as in *diamond*, *dial*, &c.

DIABETES, Διαβητης, in medicine, a haſty and profuſe evacuation of the drink by the urinary paſſages; accompanied with an ardent thirſt, and leanneſs of the whole body. The word is derived from the Greek διαβαινειν, to *pervade*, or *paſs quick*.

The drink, thus diſcharged, is uſually a little altered from what it was when taken down, and turned chylous, and milky; but ſometimes not at all. The diabetes ſeems owing to a too great laxity of the fibres, of the arteries of the kidneys; or too great a quantity of ſharp ſalts in the blood, which diſſolve the maſs of blood, or diſunite the parts thereof, ſo that the ſeroſity is early ſeparated from the thicker parts. According to Quincy, the evident and moſt common cauſe of the diabetes is the too great uſe of ſpirituous liquors, wherewith the ſerum becomes ſo impregnated, that it will not attact and join with the cruor, or globules of the blood, but runs off through the kidneys, ſweet or inſipid.

It happens moſt frequently to thoſe who, without due exerciſe, indulge themſelves with drinking vinous liquors, and then quench their thirſt ariſing from thence by too great a quantity of ſuch as are cooling. In this diſeaſe the urine is thin and pellucid, and has no ſediment, and is of a ſweetiſh taſte; though caſes have occured, in which it has not had this taſte; the quantity voided is always very great; and if the patients endeavour to retain it, they are afflicted with ſwellings about the loins, and a ſenſation of weight and preſſure in the hypochondria. It is attended with thirſt, a hectic heat, a weak but quick pulſe, and gradual waſting of the fleſh.

According to Dr. Mead, the diabetes is a diſeaſe of the liver, and not of the ſecretory veſſels of the kidneys, as has been generally thought. See Monit. and Pract. Medic. cap. ix. ſect. 2. and Mechanic Account of Poiſons, Eſſay. 1. ed. 4.

The doctor recommends the following medicine as efficacious in this diſtemper: take four pints of milk, boil it a little, and turn it with three drams of alum; four ounces of this ſhould be taken three times a day at leaſt. Dr. Brockleſby attributes great efficacy, in a caſe where he was concerned, to alum whey, made by boiling from fifty to thirty grains of powdered roche-alum, in a ſufficient quantity of new milk from the cow, to afford a full pint of whey; half of which was drank by the patient every night and morning, for ſix weeks. Med. Obſ. vol. iii. p. 279.

Dr. Dobſon, of Liverpool, made ſeveral experiments, in order to aſcertain the nature of this diſeaſe; and he conſiders it as a ſpecies of imperfect digeſtion or aſſimilation, and to be more of a diſeaſe of the ſyſtem in general than either of the liver or kidneys. On this ſyſtem he accounts for the different taſte of the urine in different ſubjects, the emaciating effects of this diſeaſe, the acid ſweats, and the ſenſation of hunger that attend it. From hence he infers, that the obvious indications of cure, are to ſtrengthen the digeſtive powers, to promote a due ſanguification, and to eſtabliſh a perfect aſſimilation through the whole œconomy. Med. Obſ. vol. v. art. 27.

Diabetes, in hydraulics, is applied to a ſyphon, the two legs or branches whereof are incloſed in one another; as in the glaſs deſcribed by Hero, which runs itſelf quite empty, without being inverted, as ſoon as the water is arrived at the height of the upper branch of the ſyphon.

DIACAUSTIC *Curve*, or cauſtic by refraction, is a ſpecies of cauſtic curves, whoſe geneſis may be thus conceived.

DIACHYLON, in pharmacy, a name given to divers plaſters on account of the mucilages mixed therein, which are viſcid juices, called by Greeks χυλοι, drawn from certain plants.

DIACODIUM, in pharmacy, ſyrup prepared from poppy-heads, called alſo *ſyrupus de meconio*. The word is formed from the Greek δια, *per*, κωδεια, *poppy-heads*. The ancients had two kinds: *ſimple* and *compound*.

DIACOPE, Διακωπη, from δια and κοπτω, *I cut off*, in grammar, the ſame with what is otherwiſe call tmeſis.

DIACOUSTICS, or Diaphonics, the conſideration of the properties of ſound refracted in paſſing throngh different mediums; that is, out of a denſer into a more ſubtle, or out of a more ſubtle into a denſer medium. The word is formed from the Greek δια, *per*, *through*, which imitates a paſſage; and ακεω, *I hear*, q. d. the conſideration of the paſſage of the ſounds we hear.

DIADELPHIA, in the ſexual ſyſtem of botany, being the ſeventeenth claſs of plants with hermaphrodite flowers, whoſe ſtamina, by the conjunction of their filaments, are formed into two bodies, the one ſtanding about the piſtil, and the other ſurrounding it. The word is formed from the Greek δις, *twice*, and αδελφος, *brother*.

This is a perfect natural claſs of plants, and is the moſt remarkable of all others in the ſtructure of the flower. The common ſituation of the flower is an obliquely pendulous direction, or in an acute angle from a perpendicular line. The former ſyſtematiſts in botany, as Linnæus obſerves, took great notice of the pod in this claſs of plants, and thought it the principal ſubject of diſtinction; but he very judiciouſly makes it but of very little conſequence, and will not allow it ſufficient to diſtinguiſh the genera one from another: but the cup, which had always before his time been diſregarded, he eſteems a very eſſential part of the plant, and ſufficiently certain to erect the different genera upon in many caſes. Some of the old writers had been uſed to take the leaves into their marks, by which to diſtinguiſh genera of this claſs; but Linnæus wholly excludes this part of a plant from this office. Magnol has obſerved, that the carina of the diadelphia, or papilionaceous flowers, is dipetalous, and is compoſed of two diſtinct oblong petals; the lower edges of which join ſo nicely and cloſely together, that they ſeem only one; and are not joined in their ſubſtance, but only in their ſituation. Linnæus has ſtrictly examined this, and finds that the author is ſo far right, that this is really the caſe in many of the papilionaceous flowers, but not in all: ſome not only appearing to have, but really and certainly having a carina compoſed of only one petal.

The conſideration of the ſtigma is of more conſequence in this than in moſt other flowers, and even more than that of any other part of the fructification in this. The ſeeds of all the plants of this claſs are eatable, excepting in a very few particulars: their leaves alſo are a grateful food to cattle. Lin. Gen. Plant. p. 377. Of this claſs there are four orders, viz. the pentandria, comprehending one genus; the hexandria, two; the octandria, two: and the decandria, forty-nine. See Syſtem of Botany, Sect. V. Claſs 17, and Plate V.

DIADEM, in antiquity, a head-band, or fillet, worn by kings as a badge of their royalty. It was made of ſilk, thread, or wool, and tied round the temples and forehead, the ends being tied behind, and let fall on the neck. It was uſually white, and quite plain; though ſometimes embroidered with gold, and ſet with pearls and precious ſtones. In latter times, it came to be twiſted round crowns, laurels, &c. and even appears to have been worn on divers parts of the body. The word comes from the Latin *diadema*; of the Greek διαδημα, *a little band encompaſſing the head*, of the verb διαδεω, *cingo*, "I gird."

Diadem, in heraldry, is applied to certain circles or rims, ſerving to bind or encloſe the crowns of ſovereign princes; and to bear the globe, and croſs, or the fluers-de-lys, for their creſt. The crowns of ſovereigns differ in this, that ſome are bound with a greater, and ſome with a leſs, number of diadems. In blazoning, the bandage about the heads of Moors, on ſhields, is ſometimes alſo called *diadem*.

DIÆRESIS, in ſurgery, the operation of dividing and ſeparating parts, whoſe union and continuity were an obſtacle to the cure; or which were joined and conglutinated contrary to the order of nature. The word, in its original Greek, διαιρεσις, ſignifies *diviſion*.

Diæresis is uſed, in medicine, for deſtroying or conſuming of the veſſels, or canals, of an animal body; when, from ſome cutting, or corroding humour, certain paſſages are made, which naturally ought not to have been; or certain natural paſſages are dilated beyond their ordinary dimenſions; ſo that the juices, which ſhould have been contained therein, extravaſate, or run out.

Diæresis, in grammar, is a figure whereby a diphthong is divided into two ſyllables: as *aulæ* into *aulai*, *pictæ* into *pictai*, *aquæ* into *aquai*.

Diæresis is alſo uſed in a general ſenſe, for any diviſion of one ſyllable into two: as in that verſe of Tibullus, *Stamina non ulli diſſoliinda deo*, for *diſſolvenda*. This is uſually noted by two points placed over a letter, to ſhew that it is to be ſounded by itſelf, and not joined with any other ſo as to make it a diphthong: thus *aëra*, by the points over the *e*, is diſtinguiſhed from *æra*. It is alſo a kind of metaplaſm, or addition to a word, by dividing one ſyllable into two: as *aulae*, by a *diaræſis*, is a word of three ſyllables, inſtead of *aulæ*.

DIAGNOSTIC, in medicine, a term applied to thoſe ſigns or ſymptoms, which indicate, or diſcover, the preſent ſtate of a diſeaſe, its nature and cauſe. The word is compounded of the Greek δια, *per*, *through*, or *by*; and γινωσκω, *I know*. The phyſicians have *diagnoſtic* as well as *prognoſtic* ſigns; the firſt, with regard to the preſent ſtate of the diſeaſe, and the patient; and the ſecond to the future.

DIAGONAL, in geometry, a right line drawn acroſs a parallelogram, or other quadrilateral figure, from the vertex of one angle to that of another. See Syſtem of Geometry.

DIAGRAM, from διαγραφω, *I deſcribe*, in geometry, &c. a ſcheme for the explanation, or demonſtration, of any figure, or the properties thereto belonging. See Syſtem of Geometry.

Diagram, or Diagramma, in the ancient muſic, was what we call the ſcale, or gammut, in the modern. See Syſtem of Music.

DIAH, or Diat, a name given by the Arabs to the puniſhment of retaliation. By the Mahometan law, a brother, or the next relation of a murdered perſon, ought to take part againſt the murderer, and demand his blood in reparation for that which he has ſhed. Before the time of Mahomet, the Arabs had a cuſtom of putting a freeman of their priſoners to death, in lieu of every ſlave they loſt in battle, and a man for every woman that was killed. But Mahomet regulated the laws of repriſal; directing in the Alcoran, by the diat, that a freeman ſhould be required for a freeman, and a ſlave for a ſlave. The Turks, probably in conſequence of this law, formerly maſſacred almoſt all their priſoners of war, but they now content themſelves with enſlaving and ſelling them. French Encyclopædia.

DIAL, or *Sun* Dial, an inſtrument ſerving to meaſure time by means of the ſhadow of the ſun. The word is formed from *dies*, *day*, becauſe indicating the hour of the day. The ancients alſo call it *ſciathericum*, from its doing it by the ſhadow. See Treatiſe on Dialling.

DIALECT, Διαλεκτος, from διαλεγεσθαι, *to diſcourſe*, the peculiar language of ſome province, or part, of a nation, formed by corruption of the general, or national language.

Homer could ſpeak five different languages in one verſe, i. e. five *dialects*; viz. the Attic, Ionic, Æolic, the Doric, and the common *dialect* of the Greeks.

The Attic *dialect* is more particularly uſed by Xenophon and Thucydides; the Ionic by Herodotus and Hippocrates; the Doric by Pindar and Theocritus; the Æolic by Sappho and Alcea, and often by the two former writers. The Bologneſe, Bergamaſque, Tuſcan, &c. are the *dialects* of the Italian; the Gaſcon, and Picard, are *dialects* of the French. In Great Britain, almoſt every county has a *dialect* of its own, all differing conſiderably in pronunciation, accent, and tone, though the language be the ſame. The method which the Gileadites took to prove the Ephraimites, by the pronunciation of *ſhibboleth*, with *ſchin*, or *ſamech*, is well known. Judges xii. 6.

The following Treatiſe of Dialling *is the Production of Mr.* Robert Moody, *of the* Exciſe, Broad Street, *and Author of the Syſtem of* Algebra *in this Work.*

A TREA-

A TREATISE ON DIALLING.

PART I. SECT. I.

DIALLING is the Art of drawing Dials on any given plane, or on the ſurface of any given body.

The Greeks and Latins named this art *gnomonica*, and *ſciatherica*, becauſe through it they were taught to diſcover the hour of the day by the ſhadow of a gnomon. Some have named it *photoſciatherica*, for this reaſon, that the hours are commonly exhibited by the *light*, or rather the *ſhade*, of the ſun. Others have called the art *horologiography*; and others again *ſciographia*, becauſe it treats of ſhadows.

It is uncertain, who was the firſt that found out the art of conſtructing dials. Some attribute the invention to Anaximenes Mileſius, who lived about 556 years before Chriſt; others, to Thales, who flouriſhed about the ſame time, or rather earlier. But to leave the opinions of different authors, I think it is evident, that the art of making dials was known long before the days of either of theſe philoſophers. Witneſs, the dial of Ahaz, mentioned in Iſaiah, chap. xxxviii. ver. 8. which muſt have been at leaſt 150 years prior to the date abovementioned. It appears, however, that the Romans were unacquainted with dials till Papirus Curſor, about 260 years before the Chriſtian æra ſet up a dial at Rome, prior to which, ſays Pliny, there is no mention of any account of time, other than by the ſun's riſing and ſetting.

Clavius is ſaid to be the firſt profeſſed writer on this ſubject. The art has been ſince handled by Dechales, Ozanam, Wolfius, M. Picard, De la Hire, Sturmius, Paterſon, Michael, Leybourn, Leadbetter, Muller, Ferguſon, and many others. But among all the books on dialling, none are more deſervedly eſteemed than that of J. Wells, Eſq. printed at London in 1635, under the title of "The Art of Shadows," and that excellent Treatiſe of the late Mr. Emerſon, printed in 1770.

There are various methods of drawing dials. Some find all the requiſites by means of a terreſtrial globe, and then transfer them to the dial plane, but in the conſtruction of large dials, where accuracy is required, this method is too vague and uncertain. Others find the requiſites by trigonometrical calculations, and inſert them in a table for uſe, and ſo taking off the due meaſure of each from a plain ſcale of proper ſize, they eaſily and accurately form the ſeveral lines on the dial plate.

Others, again, conſtruct from a *dial ſcale* fitted to the particular latitude of the place; but, as in the practice of making dials a variety of latitudes will occur, and it would be exceeding difficult, nay, almoſt an endleſs taſk, to procure ſuch ſcales for all latitudes; or if procured, as the advantage would never compenſate for the expence, this method is not fit for general uſe, and of courſe is not worth notice in this place, as the œconomy of our plan is cautiouſly to avoid extranuous matter and things of ſmall importance, while we wiſh to be copious, and to afford our readers every ſatisfaction in thoſe articles which appear to be of real utility.

Another method of conſtructing dials is by lines drawn purely geometrical, without the help of calculation, and this method being more mechanical and ſcientific than the reſt, would be the beſt for practice; was it not that in ſome caſes the lines become ſo numerous, and their interſections ſo many, as to render it both tedious and inaccurate.

In what follows, I ſhall therefore prefer that method by the ſcale with the help of calculation, it being the moſt general, correct, and expeditious; not, however, omitting the geometrical method, in caſes where it is well adapted for actual uſe.

Before I enter into the practice of deſcribing dials, it will be neceſſary to treat of the gnomonic projection of the ſphere.

SECT. II.

GNOMONIC PROJECTION OF THE SPHERE.

IN the gnomonic projection, the plane projected on, is ſuppoſed to touch the hemiſphere to be projected, in its vertex; the point of contact being the centre of projection. But a projection may be made nothing differing from this, upon any plane parallel to ſuch touching plane; for it is only taking a greater or leſs radius of projection, according to the greater or leſs diſtance, which is in effect projecting a greater or leſs ſphere upon its touching plane.

When the ſphere is to be projected this way upon a given plane, it will aſſiſt the imagination to ſuppoſe the eye placed in the centre of the ſphere and looking on the plane whoſe poſition is given; as by that means, the circles of the ſphere, as projected on the plane, will appear in due order.

In this projection, every great circle as BAD (*Fig.* 1.) is projected into a right line, perpendicular to the line of meaſures, and at a diſtance from the centre equal to the cotangent of its inclination, or the tangent of its neareſt diſtance from the pole of projection.

For let CBED be perpendicular both to the given circle BAD and the plane of projection, then will the interſection CF be the line of meaſures. Now ſince the plane of the circle BD and the plane of projection are both perpendicular to BCDE, the common ſection will alſo be perpendicular to BCDE, and conſequently it will alſo be perpendicular to the line of meaſures CF. Now ſince the projecting point A is in the plane of the circle, all the points of the circle will be projected into that ſection; that is, into a right line paſſing through d, and perpendicular to Cd. And Cd is the tangent of CD, or cotangent of CdA.

Hence a great circle perpendicular to the plane of projection, is projected into a right line; paſſing through the centre of projection, and any arch is projected into its correſpondent tangent. Thus the arch CD is projected into the tangent Cd.

Alſo any point as D, or the pole of any circle, is projected into a point d diſtant from the pole of projection C, the tangent of D's diſtance from the ſaid pole.

If two great circles be perpendicular to each other, and one of them paſſes through the pole of projection, they will be projected into two right lines perpendicular to each other.

Therefore, if a great circle be perpendicular to ſeveral other great circles, and its repreſentation paſs through the centre of projection, then all theſe circles will be repreſented by lines parallel to one another, and perpendicular to the line of meaſure or that firſt circle.

If two great circles interſect in the pole of projection, their repreſentations ſhall make an angle at the centre of the plane of projection, equal to the angle made by thoſe circles on the ſphere.

Any leſs circle parallel to the plane of projection, is projected into a circle, whoſe centre is the pole of projection; and radius, the tangent of the circle's diſtance from the pole of projection. Hence, if a circle be parallel to the plane of projection, and 45° from the pole, it is projected into a circle equal to a great circle of the ſphere, and therefore it may be looked upon as the primitive circle in this projection, and its radius eſteemed, the radius of projection.

Every leſs circle (not parallel to the plane of projection) is projected into a conic ſection, whoſe tranſverſe axis, is the line of meaſures, and whoſe neareſt vertex is at a diſtance from the centre of the plane, equal to the tangent of its neareſt diſtance from the pole of projection; the other centre is diſtant therefrom equal to the tangent of its fartheſt diſtance from the pole of projection.

For let BE (*Fig.* 2.) be parallel to the line of meaſures dp, ſo will any circle be the baſe of a cone whoſe vertex is A, and therefore ſuch cone being produced will be cut by the plane of projection in ſome conic ſection. Thus the circle whoſe diameter is DF, will be cut by the plane in an ellipſis, whoſe tranſverſe axis is df; and Cd is the tangent of CAD, and Cf of CF. In like manner, the cone AFE being cut by the plane f, will be the neareſt vertex, and the other point in which E is projected is at an infinite diſtance. Alſo the cone AFG (whoſe baſe is the circle FG) being cut by the plane f, is the neareſt vertex, and GA, being produced, gives d the other vertex.

It follows from what has been ſaid, that if the diſtance of the fartheſt point of the circle be leſs than 90° from the pole of projection, it will be projected into an ellipſis.

If the fartheſt point be more than 90° from the pole of projection, it will be projected into an hyperbola. Thus the circle FG is projected into an hyperbola, whoſe vertices are f and d, and tranſverſe fd.

In the circle EF, where the fartheſt point E is juſt 90° from C, it will be projected into a parabola, whoſe vertex is f.

Alſo if H be the centre, and K, k, l, the focus of the ellipſis, hyperbola, or parabola, then $HK = \frac{Ad - Af}{2}$, for the ellipſis; $Hk = \frac{Ad + Af}{2}$ for the hyperbola; and (drawing fn perpendicular to AE) $fl = \frac{nE + Ff}{2}$, for the parabola, which are the repreſentations of the circles DF, FG, and FE reſpectively.

Theſe things being premiſed, I proceed to the practical part of projection, in which, for the ſake of brevity and utility, I ſhall confine myſelf as much as poſſible to the method by the plain ſcale, the other methods which depend upon rigid geometrical conſtructions, being in ſome caſes exceeding tedious, and on account of the variety of lines and interſections that occur, the figures when conſtructed are liable to far greater inaccuracy than when they are drawn at once from a correct ſcale of chords, ſines, tangents, &c.

Art. I. *To draw a great Circle, through a given Point, and at a given Diſtance from the Pole of Projection.* (*Fig.* 3.)

Rule. With the radius of projection deſcribe the circle ABD, and with the tangent of the circle's diſtance from the pole of projection C, deſcribe the circle EIF, and draw PK to touch this circle, ſo will PIK be the circle required.

Art. II. *To draw a great Circle perpendicular to a given Circle, that paſſes through the Pole of Projection, and at a given Diſtance from that Pole.* (*Fig.* 3.)

Rule. The primitive circle ABD being drawn in the given circle CI, ſet the tangent of the given diſtance from C to I; through I draw Kp perpendicular to CI, and it will be the repreſentation required.

Art. III. *To meaſure any Part of a great Circle or to ſet any Number of Degrees thereon.* (*Fig.* 4.)

Rule. Let EP be the great circle, EBD be a circle deſcribed with the radius of projection, and let IP be a part of the great circle; draw HD perpendicular to EP; apply CI to the tangents, and ſet the ſemitangent of its complement from C to A, which will be the dividing centre of EP; and drawing AP, the angle IAP will conſequently be the meaſure of the given arch IP.

If the degrees be given, make the angle IAP equal thereto, which, (by drawing AP to meet the circle EP,) will cut off IP, the arch correſpondent thereto.

Art. IV. *To draw a great Circle ſo as to make a given Angle with a given great Circle, at any aſſigned Point; or to meaſure an Angle made by two great Circles.* (*Fig.* 5.)

Rule. Let P be the given point, and PB the given great circle. Draw through P, and C, the centre of projection, the line PCG; to which from C, draw CA perpendicular, and equal to the radius of projection. Draw PA and AG perpendicular to it; at G, erect BD perpendicular to GC, cutting PB in B; draw AO biſecting the angle CAP. Then at the point O make BOD equal the given angle, and from D draw the line DP; ſo will BPD be the angle required. Or, if the degrees in the angle BPD be required; from the points BD, draw the lines BO, and DO, and the angle BOD will be the meaſure of BPD.

Cor. If an angle be required to be made at the pole or centre of projection, equal to a given angle, this will be effected by drawing two lines from the centre, making the angle required.

Also, If one great circle is to be drawn perpendicular to another great circle, it muſt be drawn through its pole.

Art. V. *To project a leſs Circle parallel to the Primitive.*

Rule. With the radius of projection AC (*Fig.* 3.) and centre C, deſcribe the primitive circle ADB, and with the radius CE, equal to the tangent of the circle's diſtance from its pole, deſcribe the circle EFG for the circle required.

Art. VI. *To draw a leſs Circle perpendicular to the Plane of Projection.* (*Fig.* 6.)

Rule. Through the centre of projection C, draw its parallel great circle TI; take the tangent of the circle's diſtance from its parallel great circle, and ſet it from C (the centre of projection) to V, and the ſecant thereof from C to F. Then with the ſemi-tranſverſe CV, and focus F, deſcribe the hyperbola WVHK, which will repreſent the given circle.

Art. VII. *To project any leſs oblique Circle given.* (*Fig.* 7.)

Rule. Having drawn the line of meaſures *dp*, take the tangents of the circles neareſt and fartheſt diſtance from the pole of projection, and ſet from C to *f* and *d*, which will give the vertices, and biſect *df* in H. Take half the difference or half the ſum of the ſecants of the greateſt and leaſt diſtances from the pole of projection, and ſet from H to K or *k*, for the focus of the ellipſis or hyperbola, which may then be deſcribed; and it will repreſent the given circle.

Art. VIII. *To find the Pole of any Circle in the Projection, DMF.* (*Fig.* 8.)

Rule. From the centre of projection C draw the radius of projection C A perpendicular to the line of meaſures D F; apply D C and C F to the tangents, and ſet the tangent of *half the difference* of their degrees from C to P; if D and F lie on contrary ſides of C; but, *half the ſum*, if on the ſame ſide, and it will give P, the pole; or by Art. III. ſet off from D to P, the circle's diſtance from the pole, which will give P as before.

Cor. If it be a great circle as B G (*Fig.* 9.) draw the line of meaſures G C and C A perpendicular to it, and equal to the radius of projection; make G A P a right angle, ſo will P be the pole required.

Art. IX. *To meaſure any Arch of a leſs Circle; or to ſet any Number of Degrees thereon.* (*Fig.* 9.)

Rule, Let C be the centre of projection, F *n* the arch, and P the pole of the given circle: apply C P to the tangents, and ſet the tangent of its half from C to O, and the cotangent of its half from C to D; with the radius G C taken equal to the tangent of the degrees in F P, (the given circle's diſtance from its pole) deſcribe the circle GSH: then D*l* being drawn through *n* or *l* will cut off H*l* = F *n*. Or, O being found as before, erect O S perpendicular to C O; then through the given point *n* draw P Q *n*, and the angle Q C H will be equal F *n*: Or, apply C P to the tangents, and ſet the cotangent thereof from C to G. Erect G B perpendicular to G C. Through *n* draw P *n* B; and join B O, ſo will the angle G O B = F *n*.

Cor. If the leſs circle be perpendicular to the plane of projection as V K K (*Fig.* 6.) it is only drawing the perpendiculars V C, H G, to its parallel great circle C I; and C G (meaſured by Art. III.) will be equal to V H; or the degrees ſet from C to G, will cut off V H equal thereto.

An **Example** illuſtrating the foregoing **Rules.**

Let it be required to project the Sphere on a Plane parallel to the Horizon, for July 31, 1787, *at* 10 *in the Morning. Lat.* 35½ *N.* (*Fig.* 10.)

With the radius of projection and centre C deſcribe the primitive circle A D B. Through C draw the meridian P E, and A S perpendicular to it for the prime vertical. Set off C P = 35½, the latitude, ſo will P be the north pole. Draw P *p* perpendicular to C P, for the 6 o'clock meridian. Set the co-latitude from C to E, and draw E Q perpendicular to C E for the equinoctial. Make E B = 30° (or two hours the time from noon) and draw the 10 o'clock meridian P B. Set the ſun's declination 18° 27′ from B to ⊙, then will ⊙ be the ſun's place at 10 o'clock. Through ⊙ draw the azimuth circle C Q. Alſo through ⊙ may be drawn (by Art. VII.) a parallel to the equinoctial E Q for the ſun's parallel of declination.

C O meaſured by Art. III. = 31° ½, the complement of the ⊙'s altitude; and the angle E C ⊙ meaſured by Art. IV. = 65°, 10′, his azimuth.

In like manner may be drawn any other circles of the ſphere, and the places of moon, ſtars, and planets exhibited.

PART II. SECT. III.

THE PRACTICE OF DRAWING VARIOUS SORTS OF DIALS.

This I ſhall endeavour to methodize, by reducing the different kinds to three claſſes, for all dial planes are either parallel, perpendicular, or inclining to the horizon.

Definitions.

1ſt. *Dial Planes*, are thoſe on which dials are or may be deſcribed.

2d. *The Denomination of any Dial*, is taken from that great circle of the ſphere, to which the dial plane is parallel.

3d. *Declination of a Plane*, is an arch of the horizon, contained between the plane and the prime vertical, or between the meridian and a plane perpendicular to the dial plane, and is always reckoned from the South or North.

4th. *Reclination of a Plane*, is the angle which it makes with a vertical plane.

5th. *Inclination of a Plane*, is the angle which it makes with the horizon.

6th. *The Centre of a Dial*, is the point where all the hour lines meet, or to which they tend.

7th. *The Style or Gnomon of a Dial*, is a pin, or piece of metal or wood, &c. raiſed perpendicular to the plane of the dial, the ſhadow of which, as an index, points out the hour of the day.

8th. *The Subtile*, is the line on which the ſtile is erected. This always paſſes through the centre of the dial.

9th. *The Stiles Height*, is the angle which the upper edge thereof makes with the ſubſtile; but this is to be underſtood when the ſtile is in the form of a triangle, and then the angular point is at the centre of the dial. If the ſtile is a pin, the length thereof is the height. If the ſtile is a parallelogram, the centre is at an infinite diſtance.

10th. *The Subſtiles Diſtance from the Meridian*, is the angle which it makes with the 12 o'clock line.

11th. *Meridian of the Plane*, is the meridian perpendicular to the plane of the dial; it is the ſame as the ſubſtile; but the meridian of the place is perpendicular to the horizon.

12th. *The Height of the Meridian*, is an arch of the great circle, or dial plane, comprehended between the horizon and meridian of the place.

13th. *Plane's Difference of the Longitude*, is the angle on the ſphere, contained between the meridian of the place, and the meridian of the plane. This is alſo called the *Inclination of Meridians*.

14th. *Hour Arch*, is an arch of the Equinoctial anſwering to the time, or the angle at the Pole, thus 15° = 1 hour, 30° = 2 hours, 45° = 3 hours, &c. This takes its beginning at the ſubſtile.

15th. *Hour Angle*, is the angle which any hour line makes with the ſubſtile.

16th. *Horizontal Line*, in any dial, is a line drawn parallel to the plane of the horizon, and is made by the horizontal plane's cutting the dial-plane, and paſſing through that point of the ſtile, whoſe ſhadow ſhews the hours.

17th. *The Equinoctial Line*, is made by the interſection of the plane of the Equinoctial and Dial Plane.

18th. *An Azimuth Line*, is the Interſection of an Azimuth with the dial plane; and ſo for other lines of the like kind.

19th. *The Contingent Line*, is a line drawn through the foot of the ſtile perpendicular to the ſubſtile. It ſerves inſtead of the equinoctial for finding the hour points, through which the hour lines are to be drawn. When the contingent does not paſs through the foot of the ſtile it repreſents the equinoctial.

SECT. IV.

PROPOSITIONS.

Mr. Emerſon has demonſtrated the following Propoſitions reſpecting dials.

Proposition I. If a right line be fixed any where upon the earth, parallel to the earth's axis, the ſhadow thereof by the ſun, will move uniformly about it, deſcribing equal angles in equal times.

2d. If a line be elevated above a plane and fixed there, its ſhadow will be the ſame at the ſame moment of time, in whatever part of the earth it is placed, provided it be in a parallel ſituation.

3d. Hence a dial removed from its true ſituation to any other and placed in a ſituation quite parallel, will, when the ſun ſhines, always ſhew what a clock it is at the place it came from.

4th. In every dial that has a ſtile, the edge of it that gives the ſhadow muſt always be parallel to the earth's axis, and point directly to the two poles.

5th. In any dial, the angle of the ſtile's height above the ſubſtile is equal to the height of the pole above the plane of the dial.

6th. The

Various Dials with the Gnomonic Projection of the Sphere.
See Treatise on Dialling

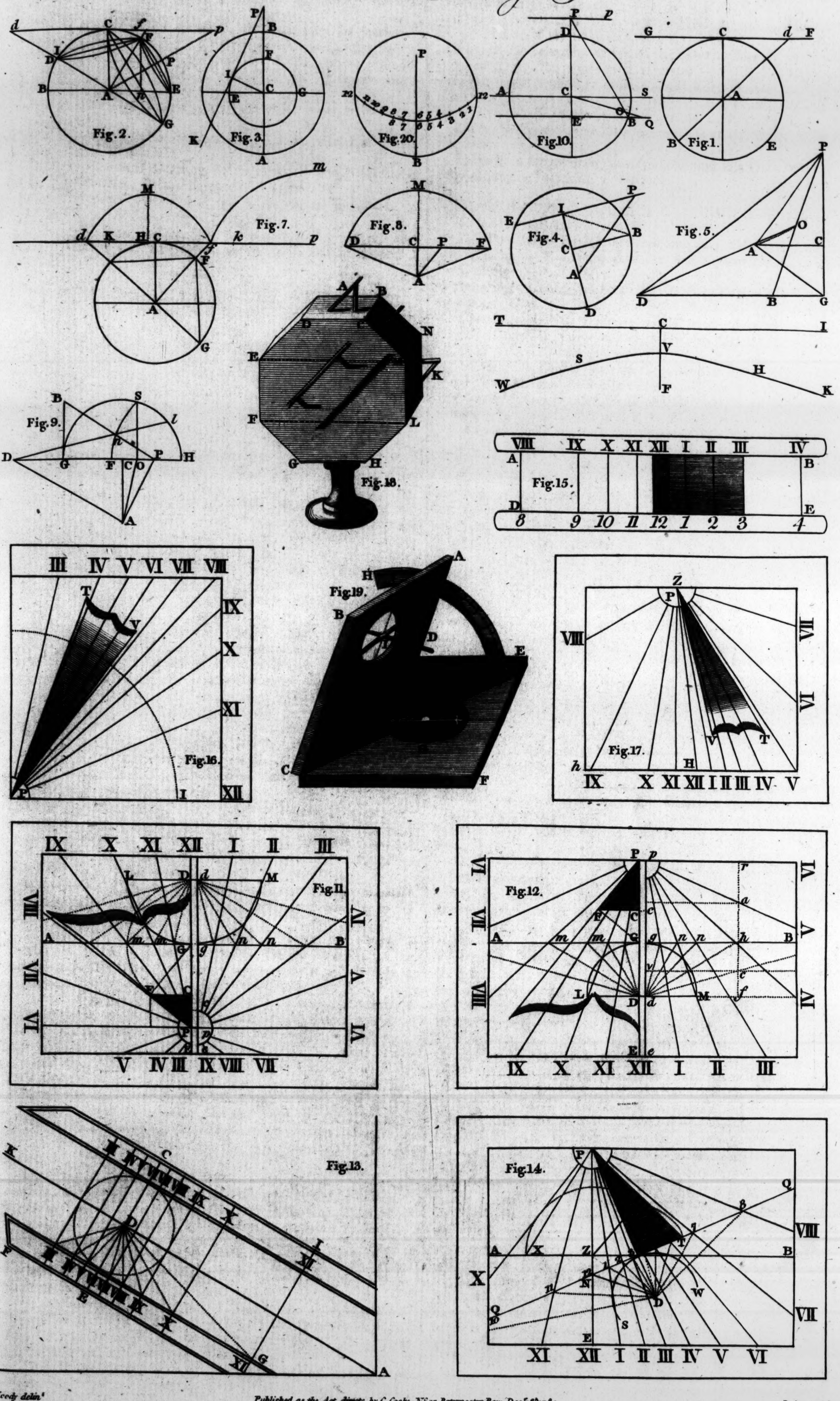

Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.
Fig. 13.
Fig. 14.
Fig. 15.
Fig. 16.
Fig. 17.
Fig. 18.
Fig. 19.
Fig. 20.
VIII IX X XI XII I II III IV
8 9 10 11 12 1 2 3 4
III IV V VI VII VIII IX X XI XII
VIII VII VI IX X XI XII I II III IV V
IX X XI XII I II III
V IIII IX VIII VII
IX X XI XII I II III
XI XII I II III IV V VI
VIII VII

Moody delin.
Published as the Act directs by C. Cooke, No. 17, Paternoster Row. Dec. 28. 1789.
Lodge sculp.

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6th. The interſection of the meridian of the place and the plane of the dial is always the hour line of 12 o'clock; and all the other hour lines are the interſections of the ſeveral meridians or hour circles, with the plane of the dial, all paſſing through the ſtile.

7th. In a dial with a centre, if the hour lines be produced through the centre, ſo as to appear on the other ſide of the plane; and if the ſtile be alſo produced through the plane, there will be a dial formed on the other ſide of the plane, in which the ſame lines produced refer to the ſame hours.

8th. In all upright dials the hour line of 12 is perpendicular to the horizon.

9th. In a direct eaſt or weſt reclining dial the hour line of 12 is parallel to the horizon.

10th. If any erect declining dial be removed along the plane of its great circle, till its difference of longitude be equal to the planes difference of longitude or inclination of meridians, it will become a full ſouth or north erect dial.

11th. A reclining eaſt or weſt dial plane, will be an upright plane under the ſame meridian at 90° diſtance, and in a parallel ſituation.

SECT. V.

DIALS PARALLEL TO THE HORIZON.

Under this deſcription are thoſe dials that are termed horizontal, their planes being always fixed parallel to the horizon, through which, if obſtacles do not intervene, the ſun ſhines upon them on each day of the year from his riſing to his ſetting, whatever may be the latitude of the place, which is not the caſe with any other kind of dials; and therefore this ſort of all others is of the moſt general uſe.

Art. X. *To conſtruct an horizontal Dial for any given Latitude.*

1ſt. Geometrically. Take any Point as P (*Fig.* 11.) for the centre, through P draw the meridian DE; at P make the angle DPR equal to the latitude. Draw a line parallel to DE, at a diſtance equal to the perpendicular height of the ſtile, cutting PR in F, ſo will FC be the height, and C the foot of the ſtile. Draw FG perpendicular to FP. Through G draw the contingent line AGB perpendicular to DE, which in this caſe repreſents the equinoctial.—Let G*g* be the thickneſs of the ſtile, and draw *dge* parallel to DGE. From G take GF, the neareſt diſtance to PR, and ſet from G to D, and from *g* to *d*; and from the centres G and *g* with any radius deſcribe two quadrants, and divide each into ſix equal parts, or hours. Through the points of diviſion draw lines from the centres D and *d*, interſecting AB in the hour points *m*, *m*; *n*, *n*, &c. then from the centres P and *p* draw lines through the points *m*, *n*, &c. and they will be the hour lines, which may be circumſcribed either by a circle, ſquare, or any other figure, at the pleaſure of the artiſt. The 6 o'clock hour line is drawn parallel to AB, and the hours before and after 6 are had by producing the oppoſite hour lines through the centre.—Alſo PFC will be the form of the ſtile which may be longer at pleaſure, by producing FP.—The ſtile muſt be placed perpendicular to the dial plane, one edge thereof being on PG, and the other on *pg*; ſo will the upper edge ſhew the ſhadow.

If no ſpace is allowed for the thickneſs of the ſtile, the lines DP and *dp*, will coincide; D and *d* will be one point, as alſo P and *p*. The two quadrants will fall into one ſemicircle, and the hour lines will all iſſue from one point. But if the dial is thus conſtructed, the ſtile muſt be made either exceeding thin ſo as to occupy no ſenſible ſpace, or the upper edge thereof muſt be made ſharp, and the ſtile ſo fixed, that ſuch edge may be exactly perpendicular to the ſubſtile.

Inſtead of the triangular gnomon PFC, there may be a perpendicular pin, as FC, and then the ſhade of the top F, will ſhew the hour; or the ſtile may be a plate of any form, with a hole in it, at F, perpendicular to C, for the ſun to ſhine through.

If half hours, or quarters, or ſtill ſmaller meaſures of time are to be ſhewn by the dial, then every hour in each quadrant muſt be divided into ſo many equal parts as are the number of ſuch meaſures in an hour; and lines muſt be drawn from the centres D and *d* interſecting AB, and then lines drawn through ſuch interſections from P and *p* as before. To ſave trouble, after the hour lines are drawn on one ſide of the dial, they may be transferred to the other ſide. The hours on the Eaſt ſide muſt be numbered 1, 2, 3, &c. from PD or XII, for the afternoon hours: and thoſe on the Weſt ſide muſt be numbered 11, 10, 9, &c. for the *forenoon* hours.

2d. By calculation of the plain scale.—The Latitude of the place being given, the only requiſites to be found are the hour angles, which are had by the following proportion. As radius : ſine of latitude : : tangent of hour-arch ; tangent of hour angle.

The hour arches are had by allowing 15° for each hour; 7½° for half an hour, 3° 45' for a quarter of an hour, &c. See Definition XIV.

In the latitude of London = 51° 32', the hour angle anſwering to the ſpace of 1 hour = 11° 51'; for two hours = 24° 19'; for 3 hours = 38° 4'; for four hours = 53° 36'; for 5 hours = 71° 6'; and for 6 hours (in all latitudes) 90°.

Theſe being known, take any point P for the centre, and draw PD for the meridian. Take P*p* = to the thickneſs of the ſtile, and draw *p d* parallel to PD. Make the angles DP XI. and *dp* each = 11° 51', for the hour lines of XI. and I; the angles DPX, and *d p* III, each = 24° 9', for the hour lines of X and II. The angles DP IX, and *dp* III = 38° 4', for the hour lines of IX and III, and ſo for the reſt.—Alſo the angles for the half hours, and quarters of hours, muſt be found by the foregoing proportion, and then laid down as above.—If ſmaller diviſions than quarters of hours are required, it will generally be near enough, after the quarters are drawn, to divide them into as many equal parts as you pleaſe, without further trouble of calculation.

Laſtly, make the angle DPR = to the latitude for the ſtile or gnomon.

I have been the more copious in explaining this Dial, that what follows may be the clearer underſtood.

SECT. VI.

DIALS PERPENDICULAR TO THE HORIZON.

Under this deſcription are all dials, whoſe planes are vertical.—Theſe may be diſtinguiſhed into two kinds, viz. *direct*, and *declining*.—A direct dial is one that is drawn on a plane, facing either the Eaſt, Weſt, North, or South; and ſuch a dial is accordingly named, an Eaſt Dial, a Weſt Dial, a North Dial, or a South Dial.

The Eaſt and Weſt Dials are parallel to, or in the plane of the meridian, and the North and South Dials are parallel to or in the plane of the prime vertical.

A Declining Dial is one that faces none of the cardinal points, but declines towards the Eaſt or Weſt.—They come under theſe our denominations, viz. A South-eaſt Decliner, a South-weſt Decliner, a North-eaſt Decliner, and a North-weſt Decliner.

Art. XI. *To conſtruct Dials perpendicular to the Horizon.*

Case I. *To draw a direct Dial, as for Inſtance, an erect direct South Dial.*

1ſt. Geometrically, Take the Point P (*Fig.* 12.) near the top of the plane for the centre of the dial; through P, draw the meridian PE; at P make the angle EPR equal to the complement of the latitude. Take any point G in the line PE, and draw GF perpendicular to PR; and FC perpendicular to GP, and C will be the foot of the ſtile. Through G, draw the contingent line AB, perpendicular to PE, repreſenting the equinoctial.—Take G *g* equal to the thickneſs of the ſtile, and draw *p g q* parallel to PGE.—Make GD and *g q* = GF, and from the centres D and *q* with any radius deſcribe two quadrants LG and M*g*. Divide each quadrant into ſix equal parts or hours. From the centres D *q* draw lines through the points of diviſion, cutting AB in the hour points *m*, *m*; and *n*, *n*, &c. Then lines drawn through the centres P and *p*, through all the points *m*, *n*, &c. will be the hour lines. The half hours, &c. are drawn in the ſame manner. A perpendicular pin FC, or, which is better, the triangle RPG will be the ſtile, which muſt be ſet perpendicular upon the hour lines of XII, PG, and *p g*; the ſtile PR pointing downwards towards the South pole.

When the lines do not interſect within the plane, as at the firſt diviſion towards L and M, biſect the line *q g* in *v*, and draw *v c* parallel to AB, cutting *q c* in *c*; through *c* draw *c h a* parallel to *p q*, and ſet off *h a* = half *gp* drawing *p a* for the hour line.

N. B. The forenoon hours are on the left hand, the afternoon hours on the right.

2d. By calculation and the scale.—The proportion for finding the hour angle in this caſe is. As radius : coſine of latitude : : tangent of hour arch : tangent of hour angle.—In the latitude of London the hour angles for 11 and 1 is 9° 28'; for 10 and 2 = 19°, 45'; for 3, and 9 = 31° 53'; for 4 and 8 = 47° 8'; for 5 and 7 = 66° 42', and for 6 (as uſual) = 90°. Alſo for the half hour, before and paſt 12 = 4° 41'; for half paſt 10, and half paſt 1 = 14° 27'; for half paſt 9 and half paſt 3 = 25° 31' &c.—Theſe being known:

Take any point P near the top of the plane for the centre of the dial; draw the meridian or 12 o'clock line PE, and *p e* parallel to it at a diſtance equal to the thickneſs of the ſtile. With the radius of 60° from a line of chords deſcribe two quadrants from the centres P and *p*; ſet off the ſeveral hour angles, both ways from the lines PE and *p e*, upon the quadrants, viz. 9° 28' for 11 and 1; 19° 45' for 10 and 2, &c. Through the points thus given draw lines from the centres P *p*, for the hour lines.

Laſtly, Make the angle EPR = the complement of the latitude for the ſtile to be ſet upright upon the hour 12.

Case II. *To conſtruct a Direct North Dial.*

The north plane lying in the ſame azimuth with the ſouth, but with its face the oppoſite way, will have the ſame hour angles as a ſouth plane, only the meridian in this will repreſent the midnight hour inſtead of noon; and the hours about it, 11, 10, 9, and 1, 2, 3, are quite uſeleſs, becauſe the ſun in his greateſt north declination riſes but about a quarter before 4 and ſets at a quarter paſt 8.—Alſo the ſun cannot ſhine upon this plane longer than 21 minutes paſt 7 in the morning, nor ſooner than 21 minutes before 5 at night.

To make this dial, is but to turn the ſouth dial upſide down, and leave out all the ſuperfluous hours between 5 and 7, and 4 and 8; and the dial will be complete. There is no reaſon therefore why this ſhould be deemed a different kind of dial to the former, ſeeing that they both agree in the height of the ſtile and hour angles.

N. B. Thoſe hours to the weſt are the morning hours, and thoſe to the eaſt the evening hours.

Case III. *To draw a direct Eaſt Dial. (Fig. 13.)*

A direct eaſt dial is drawn upon the plane of the meridian facing the eaſt. The ſun only ſhines on this plane from his riſing till noon.

On the eaſtern ſide of the plane of the meridian draw a right line AB parallel to the horizon, and to this join AK, making with it an angle KAB, equal to the elevation of the equator: then, with the radius DE, deſcribe a circle, and through the centre D draw EC perpendicular to AK, by which means the circle will be divided into four quadrants. Each of theſe quadrants ſubdivide into ſix equal parts. And from the centre D through the ſeveral diviſions draw the right lines D IV, D V, D VI, D VII, D VIII, D IX, D X, D XI. Laſtly, in D erect a ſtyle equal to the radius D E, perpendicular to the plane; or, on two little pieces perpendicularly fixed in EC, and equal to the ſame radius DE, fit an iron rod, parallel to EC.

Thus will each index at the ſeveral hours project a ſhadow to the reſpective hour lines IV IV, V V, VI VI, &c.

By Calculation and the Scale.

Firſt find the diſtance of the hour lines from 6 o'clock, by this proportion. As radius is to the height of the ſtile in inches, ſo is the tangent of the hour arch from 6, to the diſtance of ſuch hour from the 6 o'clock line.

N. B. If you would have the dial plate juſt to include the 11 o'clock hour, then the height of the ſtile muſt be found by this proportion. As radius is to the length XI E, ſo is the tangent of 15° to the height of the ſtile.

Suppoſe the length of the ſtile to be three inches, then the hour diſtances from VI will be as follow, viz. The diſtance of V and VII. $\frac{4}{5}$ inch; of IV and VIII, 1.73 inches; of III and IX = 3 inches, the height of the ſtile; of X, 5.2 inches; of XI, 11.2 inches.

Theſe being known, and AB and AK being drawn as before, and DC for the 6 o'clock hour line, ſet off the ſeveral diſtances above ſpecified, and they will give the hour lines; alſo DC is the height of the ſtile, which may either be a perpendicular pin or a parallelogram of that height.

N. B. The ſtile muſt either be made exceeding thin on the top part, or a ſpace muſt be left for the thickneſs thereof as has been before ſhewn, and this obſervation is applicable to any other dial.

Case IV. *To draw a direct Weſt Dial.*

A direct weſt dial, is one deſcribed on the weſtern ſide of the meridian. The conſtruction of this dial is perfectly the ſame as that of an eaſt dial, only that its ſituation is inverted. If you look on the back ſide of the paper on which an eaſt dial is drawn, and hold it to the light, you will ſee the true figure of a weſt dial through the paper.

Art. XII. *To draw erect declining Dials.*

Case I. *To draw an erect South declining Dial.*

Geometrically. Let the dial decline to the weſt 36°, and let the latitude of the place be 54°½.

Take the point C, (*Figure* 14.) about the middle of the plane for the foot of the ſtile, through which draw the horizontal line AB, and make CF perpendicular to it, and equal to the perpendicular height of the ſtile. Make the angle CFZ equal to the declination (36°) to the right hand if it decline eaſt; or to the left if weſt, as in this caſe, cutting the horizontal line in Z. Through Z draw PZE perpendicular to AB for the meridian. Take ZF and ſet it from Z to X, in the line AB. Make ∠ZXP = latitude (54½) cutting the meridian in P, the centre of the dial. Through C and P draw PCD for the ſubſtile. Alſo through C draw QQ perpendicular to PD, cutting the meridian in N, for the contingent line. In CQ make CT equal to CF, and draw PT. Take the neareſt diſtance from C to PT, and ſet it from C to D, in the line PD, and draw DN. With the centre D and any radius as DC, deſcribe the ſemicircle SCW. Divide the ſemicircle into parts of 15° for hours. Through theſe points draw lines from the centre D interſecting the equinoctial QQ in the hour points XI, XII, I, II, III. From P, the centre of the dial, draw lines through the hour points, as P XI, P XII, P I, P II, P III, &c. for the hour lines. The ſtile may be either the perpendicular pin FC, or the triangle PCT ſet upright on the ſubſtile PC.

By Calculation and the Scale.

Here there are given the latitude = 54°½, and the declination of the plane = 36°, to find firſt the ſubſtile's diſtance, from XII; 2d, the height of the pole above the plane; and 3d, the plane's difference of longitude.

I. For the diſtance of the ſubſtile, the proportion is, as radius : ſin. declination (36°) :: cotangent latitude (54°½) : tangent of ſubſtile's diſtance, which in this caſe = 22° 45′.

II. For the poles height. As radius : coſine of declination :: coſine of latitude : ſine of the height of the pole, = 28° 1′ = ſtile's height.

III. For the plane's difference of longitude. As ſine latitude : radius :: tangent of declination : tangent of difference of longitude = 41° 45′

Now the hour arches before 12 are found by adding continually 15 to 41° 45′, the difference of longitude; but after 12, by continually ſubtracting 15°, till you come to the ſubſtile; beyond which 15° muſt be continually added to the remainder of the hour in which the ſubſtile falls.

If you calculate for quarters, you muſt add and ſubtract 3° 45′ continually. The hour arches being thus determined, the hour angles are had by the following analogy.

As radius : ſine of ſtile's height :: tangent of hour arch : tangent of hour angle. The hour arches and angles in this caſe are as under:

Hours	Hour Arches	Hour Angles	Hours	Hour Arches	Hour Angles
IX	86° 45′	83° 6	Subſtile	° ′	° ′
X	71 45	54 55	III	3 15	1 32
XI	56 45	35 37	IV	18 15	8 49
XII	41 45	22 45	V	33 15	17 7
I	26 45	13 19	VI	48 15	27 45
II	11 45	5 35	VII	63 15	42 59
Subſtile			VIII	78 15	66 7

The above requiſites being found, take P near the top for the centre of the dial, and draw the meridian PE. Make the angle EPC = 22° 45′, the ſubſtile's diſtance, on the right hand, the declination being weſt; and draw the ſubſtile line PCD. Make the hour angles from the ſubſtile, according to the diſtances in the table, viz. CP IX = 83° 6′; CP X = 54° 55′: CP XI = 35, 37, &c. And thus the hour lines will be formed. Then make the angle CPN = 28° 1′ for the ſtile.

Scholium. The conſtruction would be equally eaſy if the dial declined as much eaſtward; only the forenoon hours, as here deſcribed, would become the afternoon hours on the oppoſite ſide of the dial, and vice verſa; and the ſubſtile which is now placed 3° 15′ before the afternoon hour line of 3, would in that caſe be placed 3° 15′ before the morning hour line of 9. Alſo in finding the hour arches, inſtead of adding or ſubtracting as in the laſt example, the proceſs muſt here be reverſed, uſing ſubtraction in lieu of addition, and addition in the room of ſubtraction.

Case II. *To draw an erect North declining Dial.*

This is done by making a ſouth declining dial, whoſe declination is the ſame and lies the ſame way; for this turned upſide down will be a north declining dial, provided the hours be numbered the contrary way. Thus for a north eaſt decliner make a ſouth eaſt decliner; for a north weſt decliner make a ſouth weſt decliner. The hours before ſun riſe, and ſun ſet muſt be left out. And in drawing the dial the centre H muſt be taken about the middle of the plane, becauſe ſome hours are required here that are not in the ſouth decliner, but theſe will be had by producing the other hour lines through the centre.

SECT. VII.

DIALS INCLINING TO THE HORIZON.

Under this deſcription are all dials whoſe planes are neither horizontal nor vertical, but make with the horizon oblique angles. If the plane of the dial lean forward it is uſually called an incliner; if backward, a recliner. Alſo of each of theſe there are two kinds, viz. direct incliners or recliners; and declining incliners or recliners.

Art. XIII. *To draw a direct inclining or reclining Dial.*

Case I. *To draw a Dial on a plane Parallel to the Equinoctial, or what is uſually called an Equinoctial Dial.*

The plane of this dial reclines from the zenith towards the north in an angle equal to the latitude of the place, and at the poles it becomes an horizontal dial. Wherefore it is only making an horizontal dial by Article I. for the latitude of 90°. In this dial however the hour arches, being equal to the hour angles, which are each = 15°; the dial will be conſtructed by dividing a circle into 24 equal parts, for hour lines, and placing a perpendicular ſtile of any length in the centre.

The ſtile muſt either be a circular pin, of an exceeding ſmall diameter; or otherwiſe an allowance muſt be made for the diameter, by deſcribing a ſmall concentric circle of like radius, and drawing a tangent thereto parallel to the meridian of the plane, for the 12 o'clock hour line, and then the outer circle being divided into parts of 15° each, commencing from the hour line of 12, lines muſt be drawn from each part, to the outer edge of the concentric circle, ſo as to form tangents thereto inclining on each ſide to the 12 o'clock hour line, and to one another, which will be the hour lines required.

N. B. If the dial is conſtructed on the ſouth ſide of the plane, there muſt be hour lines from 6 to 6; but if it is drawn on the north ſide, there need be only the morning and evening hour lines, viz. from the time of ſun riſe (on the longeſt day) till 6; and and from 6 till the time of the ſun's ſetting. The ſun never ſhines on this ſide of the plane, but when he is in north declination.

Case II. *To draw a Dial for any Latitude on a Plane, paſſing through the Poles of the World, and through the Eaſt and Weſt Points of the Horizon, or which is the ſame, an horizontal Dial under the Equinoctial, uſually called a Polar Dial.*

By Art. X. draw an horizontal dial for 0° latitude; or by Art. XI. an erect ſouth dial for the latitude of 90°; or, as the directions in thoſe articles are not ſo well adapted to the preſent caſe, proceed as follows:

By Calculation and the Scale.—As radius is to the ſtile's height, ſo is the tangent of the hour arch, viz. 15°, 30°, 40°, &c. to the diſtance of the hour from the 12 o'clock line. Then thoſe diſtances ſet off on both ſides (*Fig.* 15.) from XII, and C, on the lines AB, and DE, drawn parallel to each other and perpendicular to XII, will give the hour points, and joining I, 1; II, 2; III, 3; &c. and XI, 11; X, 10; IX, 9; &c. they will be the hour lines required; the former being the evening hours, and the latter the morning hours.

N. B. This dial reclines from the zenith towards the north in an angle, equal to the co-latitude.

Case III. *To draw a Dial upon a direct South reclining Plane; or upon a direct North inclining one; whatever may be the Reclination or Inclination.*

1ſt. If it reclines, and the reclination is leſs than the co-latitude, add the reclination to the latitude, and the ſum will be the latitude, where the ſaid dial will become an erect South dial, which may therefore be conſtructed by Article II.

2d. If the reclination be greater than the co-latitude, ſubtract the co-latitude from the reclination, and the remainder will be the latitude, where the dial will be horizontal, which may be made by Article I.

3d. For a North inclining dial, make a dial for the South reclining circle of the plane; then the ſame turned up-ſide down, will be a dial for the North inclining plane; obſerving to number the hours the contrary way from the 12 o'clock hour line.

Case IV. *To make a direct North reclining Dial, or a direct South inclining one, whatever may be the Reclination or Inclination.*

1ſt. If the plane reclines, and the reclination is leſs than the latitude, ſubtract the reclination from the latitude, and the remainder will be the latitude where it will become a direct ſouth dial, to be conſtructed by Art. XI. or add the reclination to the colatitude, and the ſum will be the latitude, where it will be an horizontal dial, to be made by Article X.

2d. If the reclination is greater than the latitude, add the complement thereof to the latitude, and the ſum is the latitude for which an horizontal dial muſt be made by Article X.

3d. In ſouth inclining planes, (by Art. XI.) make a direct ſouth dial, for a latitude which is equal to the difference between the given latitude and proclination. If the proclination be greater than the latitude, the dial will belong to ſouth latitude, and muſt be made by Art. X. but the angle of the ſtile will lie the contrary way upon the meridian. A north reclining dial, becomes a ſouth inclining one when turned upſide down.

Case V. *To make an Inclining or Reclining Eaſt Dial.*

By Calculation and the Scale.—The requiſites to be found are, 1ſt. The height of the pole above the plane. 2d. The ſubſtile's diſtance from 12 o'clock. 3d. The plane's difference of longitude, for which we have the following proportions.—1ſt. As radius : coſine of reclination (or proclination) : : tangent of latitude : tangent of the ſubſtile's diſtance from 12 o'clock, running upwards towards the north, or downwards towards the ſouth.—2d. As radius : ſine of latitude : : ſine of reclination (or proclination) : ſine of ſtile's height.—3d. As radius : coſine of latitude : : tangent of reclination, &c. : cotangent of the plane's difference of longitude. To find the hour angles, the analogy is as radius : ſine of ſtile's height : : tangent of the hour arch from the ſubſtile : tangent of the hour angle. The hour arches are found by continually adding and ſubtracting 15° to and from the plane's difference of longitude; the ſaid difference of longitude being one of the hour arches.

Let the lat. be 54°½, and the reclination 21°, then the ſubſtile's diſtance will be 52° 37′; the ſtile's height 16° 58′; and the plane's difference of longitude 77° 26′. Alſo the hour arches and hour angles are as below.

Hours	Hour Arches	Hour Angles	Hours	Hour Arches	Hour Angles
3	57° 34′	24° 40′	8	17° 26′	5° 14′
4	42 34	15 0	9	32 26	10 30
5	27 34	8 40	10	47 26	17 37
6	12 34	3 43	11	62 26	29 12
	Subſtile		12	77 26	52 37
7	2 26	0 43			

The requiſites being found, draw PI (*Fig.* 16.) parallel to the horizon at the bottom of the plane, for the 12 o'clock line; or at the top of the plane if it inclines, in which take any point, as P, for the centre of the dial, toward the left hand. Make the angle IPV on the right hand = ſubſtile's diſtance from the meridian (= 52° 37′) and draw the ſubſtile PV. Make the angle VPT = ſtile's height = 16° 58′, and draw the ſtile PT. Make the hour angles on each ſide of the ſubſtile according to their proper quantities, as found above, and the ſeveral lines will be the hour lines required.

Case VI. *To make an inclining or reclining Weſt Dial.*

This is made as is the eaſt incliner, &c. only the angle PGH, which is equal to the co-latitude muſt be taken on the right hand for a weſt recliner, but to the left hand for an eaſt recliner; and the meridian PI will be at the bottom of the plane, if it reclines; but at the top if it inclines. The hours alſo muſt be reckoned the contrary way in a weſt recliner. N. B. The back ſide of an eaſt incliner, &c. makes a weſt recliner, &c.

Art. XIV. *To draw a Declining, Inclining, or Reclining Dial.*

Case I. *Let it be required to draw a South declining reclining Dial, viz. one whoſe plane declines weſtward 25°, and reclines 15°, in latitude 54½.*

By Calculation and the Scale.—The requiſites to be found, are 1ſt, the height of the meridian; 2d, the height of the pole above the plane; 3d, the diſtance of the ſubſtile from the hour line of 12; and 4th, the plane's difference of longitude.

1ſt. As ſine of reclination : radius : : cotangent declination : tangent of height of the meridian. 2d. As radius : coſine declination : : cotangent of the reclination : tangent of an arch, A; take the difference between A, and the latitude, which call B. If A is leſs than the latitude, your pole is elevated; if greater, the oppoſite pole is elevated.—Then as the cotangent of B : coſine of reclination : : ſine of declination : tangent of the ſubſtile's diſtance from 12. N. B. The ſubſtile runs upwards towards the north in reclining South plane; and their oppoſite incliners. 3d, As coſine of ſubſtile's diſtance : coſine of B : : radius : ſine of ſtile's height; and 4th, As ſine of B : radius : : ſine of ſubſtile's diſtance : ſine of plane's difference of longitude. The plane's difference of longitude will be the hour arch of 12, and the reſt of the hour arches will be had by adding thereto and ſubtracting therefrom 15°, 30°, 45°, &c. and then the hour angles will be found thus. As radius : ſine of ſtile's height : : tangent of hour arch : tangent of hour angle.

In this example the height of the meridian is 83°, 9′; the ſubſtile's diſtance 8°, 1′; the ſtile's height 17°, 19′, and the plane's difference of longitude, 25°, 19′. The hour arches and angles alſo are as under.

Hours	Hour Arches	Hour Angles	Hours	Hour Arches	Hour Angles
7	79° 41′	58° 33′		Subſtile	° ′
6	64 41	32 11	1	10 19	3 7
5	49 41	19 20	12	25 19	8 1
4	34 41	11 38	11	40 19	14 11
3	19 41	6 5	10	55 19	23 16
2	4 41	1 29	9	70 19	39 46
	Subſtile		8	85 19	74 37

Theſe being known, the conſtruction is as follows, draw the horizontal line *h*H (*Fig.* 17.) near the bottom of the plane, in which take a point H, to the right, if the declination be weſt, but to the left if the declination be eaſt. Draw the line ZH, making the angle *h*HZ = 83, the height of the meridian for the 12 o'clock line. Take any point P near the top, when A is greater than the latitude, otherwiſe near the bottom, and draw the ſubſtile PV (to the right for weſt declination) making the angle HPV = 8° 1′, the ſubſtile's diſtance. From P draw the hour lines, making angles with the ſubſtile at P, according to the reſpective hour angle as above found, for the ſeveral hour lines required. Alſo draw PT, making the angle VPT = 17° 9′, the ſtile's height, ſo will PTC be the ſtile or gnomon.

Case II. *To draw a North declining, reclining, or inclining Dial.*

North declining reclining dials may be made, as deſcribed in the laſt caſe; for a ſouth-weſt recliner turned upſide down becomes a north-weſt *incliner*; and a ſouth-eaſt *recliner* turned upſide down, becomes a north-eaſt *incliner*, and vice verſa; the quantities of the declination and inclination remaining the ſame; but the hours muſt be numbered the contrary way.

Alſo if a dial be turned upſide, the backſide thereof (ſuppoſing the hour lines, &c. to appear through the plane) will be its oppoſite incliner.

Having treated on all the various kinds of dials that come under a methodical deſcription of dial planes, I ſhall add ſome uſeful Articles, with another caſe or two of Dialling, not properly coming under the foregoing heads.

SECT. VIII.

USEFUL ARTICLES, &c.

Art. XV. *Having the Situation of any direct South inclining Dial Plane, to find the Hour of the Day when the Sun leaves the North Side to ſhine on the South Side thereof.*

Say, as radius : tangent of ſun's declination : : tangent of the height of the pole above the plane : coſine of the hour angle at the pole from noon which reduced into time (by allowing 15° to an hour) ſhews how long before or after noon, the ſun begins to ſhine on the South ſide.

Art. XVI. *To find the Hour of the Day when the Sun leaves one Side of a Vertical declining Plane to ſhine on the other.*

Find the time from noon (by the laſt Article) when the ſun leaves one ſide of a direct north or ſouth plane to ſhine on the other; then, if the plane declines eaſt, to the time ſo found, add the plane's difference of longitude in time, and the ſum will be the diſtance of time before noon, when the ſun leaves the north ſide. Alſo ſubtract the plane's difference of longitude from the time found, and you will have the time of leaving the South ſide.—But if the plane declines weſt, the ſaid difference will ſhew the diſtance of time before noon, when the ſun begins to ſhine on the ſouth ſide; and the ſum will be the time when he leaves the ſouth ſide.

Art. XVII. *To find the Hour of the Day when the Sun goes off the Eaſt Side of an Eaſt reclining Dial to ſhine on the Weſt Side.*

Say, as radius : tangent of the ſun's declination : : tangent of the poles height above the plane, to the coſine of the hour angle from 12, at the pole, which will be greater than 90°, when the ſun's declination is North. Then ſubtract the plane's difference of longitude from this angle, and the remaining angle, converted into time, gives the hour after 12 at noon, when the ſun leaves the Eaſt ſide.

Art. XVIII. *To find the Hour on a given Day, when the Sun comes on or goes off the South Side of a South reclining Plane, declining alſo Eaſt or Weſt.*

Find the height of the pole above the plane, and the plane's difference of longitude; and alſo the hour angle, as if it was a direct South plane, by Article XV. to which add the plane's difference of longitude, and it will give the hour angle from noon when the ſun comes upon the given plane, if an Eaſt decliner; alſo from the hour angle ſubtract the plane's difference of longitude for the time of his leaving the plane; the reverſe of theſe caſes will give the hour angles from noon for an Eaſt decliner.

Art. XIX. *Having a North reclining Dial Plane, declining Eaſt or Weſt, to find the Hour of any Day when the Sun goes upon the North Side.*

The hour angle being found, as in the laſt Article, the difference between it and the plane's longitude reduced to time, will ſhew the diſtance of time from noon, when the ſun comes upon the north ſide of a weſt decliner, which is before noon, when the plane's longitude is the greater, otherwiſe after noon. The direct contrary of this obtains in an Eaſt decliner.

Art. XX. *To find what Latitude a Dial is made for.*

Meaſure the angle between 12 and any hour line; take the hour arch belonging to it, and ſay, As the tangent of the hour arch : tangent of the hour angle : : radius : ſine of latitude in an horizontal dial, or the coſine of latitude for a direct ſouth or north dial.

Art. XXI. *To find the Hour of the Night by the Moon's ſhining upon a Sun-Dial.*

From an ephemeris, or almanack, take the time of the moon's ſouthing. Obſerve how many hours, and minutes the ſhadow of the dial wants of 12 o'clock, and ſubtract them from the time of ſouthing for the hour of the night. But if the ſhadow be after 12, add the ſaid hours and minutes to the time of her ſouthing; rejecting 12, if it exceed, and you will have the hour of the night.

Scholium. In fixing any dial, the three following directions muſt be obſerved. 1ſt. That the horizontal line be placed parallel to the horizon. 2d. That it be placed ſo as to have its proper declination; and 3d. That it may alſo have its proper degree of reclination or proclination.

Art. XXII. *To draw all the Primary Dials, on the ſame Block or Poſt.*

1. Let the plane ABCD (*Fig.* 18.) in the proper poſition of the block, be ſuppoſed horizontal; and thereon deſcribe a horizontal dial.

2. Draw the right lines EM and FL parallel to DC, which, accordingly, in the proper poſition of the block, will be parallel to the horizon: then let the plane BNMC make an angle with EM, equal to the elevation of the pole CME; and thereon deſcribe an upper polar dial.

3. Let the oppoſite plane, ADE, make with EM an angle DEM, equal to the elevation of the equator; and on this draw an upper equinoctial dial.

4. Let the plane, KLHI, make with FL an angle HLF, equal to the elevation of the equator; and on this inſcribe a lower equinoctial dial.

5. Let the oppoſite plane, FG, make with FL an angle, GFL, equal to the elevation of the pole; and here draw a lower polar dial.

6. Let the plane MNKL, and the oppoſite one EF, be perpendicular to FL; and on that draw a ſouth dial, and on this a north dial.

7. On the plane EMLF deſcribe a weſt dial; and on the oppoſite plane an eaſt dial.

If, then, the block be ſo placed, as that the plane, MNLK, looks to the ſouth, and the plane of the meridian biſect it in the line of 12 o'clock in the horizontal dial ABCD, and ſouth dial MNKL, all the hours of the day will be indicated by ſeveral planes at once.

Art. XXIII. *To deſcribe an Univerſal Equinoctial Dial,* (*Fig.* 19.)

Join two metal, or ivory planes, ABCD, and CDEF, ſo as to be moveable at the joint. On the upper ſurface of the plane ABCD, deſcribe an *upper equinoctial dial,* and upon the lower a *lower,* as already directed; and through the centre I drive a ſtile. In the plane DEFC cut a box, and put a magnetical needle G therein: fit on the ſame plane a braſs quadrant nicely graduated, and paſſing through a hole cut in the plane ABCD. Now, ſince this may be ſo placed, by means of the needle, as that the line I 12 ſhall be in the plane of the meridian; and, by means of the quadrant, may be ſo raiſed, as that the angle BCF ſhall be equal to the elevation of the equator; it will ſerve as a dial in any part of the world. When the ſun is in the equator, theſe dials can be of no uſe.

Art. XXIV. *To make a Dial on the Surface of a Sphere.* (*Fig.* 20.)

Let AEBQ be a ſphere. Mark two oppoſite points therein for the poles, of which P is one. At an equal diſtance from the poles deſcribe the equinoctial EQ, which divide into 24 equal parts for hours. Then let the point which is on the meridian PB be marked with 6; and the other hour points as in the figure. Thoſe placed above the equinoctial are the forenoon hours; and thoſe below the equinoctial the afternoon hours. The globe muſt be fixed ſo in the ſun that the pole P may be elevated above the horizon, ſo that its axis may point directly to the pole, and the point 6 muſt be on the top, ſo that the circle P 6 B may be in the meridian. Then as the ſun conſtantly illuminates half the globe, the circle, terminating the enlightened part, will ſhew the hour of the day. And 12 o'clock will be ſhewn at two places, namely, at E and Q.

Art. XXV. *To draw a Dial upon the Ceiling of a Room, that will ſhew the Hour by Reflection.*

Place a ſmall piece of a looking glaſs exactly horizontal in a window, on which the ſun ſhines, meaſure the perpendicular diſtance of the glaſs from the ceiling, for the height of the ſtile, and where the perpendicular cuts the ſealing is the foot of the ſtile. Then having the height of the ſtile and its foot, make an horizontal dial thereto upon the ceiling by Art. X. and it is done.

N. B. Inſtead of a glaſs you may uſe a little water, which, if a glaſs is not perfectly horizontal, will be more correct; for water of itſelf will have its ſurface horizontal; alſo water being always in motion by the agitation of the air, will cauſe the point of reflection on the ceiling to be the more eaſily diſtinguiſhed. When a glaſs is uſed, the error, if any, in its horizontal poſition, will be doubled by reflection.

Art. XXVI. *To draw Meridian Lines in a Dial, to ſhew when it is Noon, at any particular Places on the Earth.* (*Fig.* 21.)

The meridian of any place is eaſily drawn in a dial, if the longitude thereof be known. Thus reduce the difference of longitude between that place and the place for which the dial is made into time, and reckon ſo many hours and minutes from 12 upon your dial towards the weſt, if the place lies eaſt; or towards the eaſt if the place is weſt: then from the point to which they reach, draw a line to the center; and when the ſhadow falls upon ſuch line, the ſun is in the meridian of the ſaid place; or having the difference of longitude, or the hour arch, the hour angle may be found, as has been before ſhewn.

In digeſting this Treatiſe, I have ſelected, from the moſt approved authors, every thing that appeared valuable; and notwithſtanding I have ſtudied brevity, have fully enlarged where the ſubject required. And as a neceſſary introduction, have treated amply on the Gnomonic Projection. In this Treatiſe I have conſulted various Authors on the ſubject, particularly Emerſon; nor have I omitted any thing that could illuſtrate the art. I have alſo been ſtudious to ſelect the beſt conſtructions and modes of calculation, and given copious deſcriptions of thoſe Dials which are of moſt general uſe; ſo that I have brought into this compaſs a complete Practical Syſtem.

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DIALOGISM, Διαλογισμος, in rhetoric, is uſed for the ſoliloquy of perſons deliberating with themſelves. We have an inſtance of it in Virgil, where Dido ſays,

> *En quid agam? rurſuſne procos irriſa priores*
> *Experiar?* &c.

In which ſenſe, it is diſtinguiſhed from dialogue. Voſſ. Rhet. lib. v. p. 355.

DIALOGUE, a converſation of two or more perſons, real or feigned, either by word or mouth, or in writing. The word is formed from the Latin *dialogus*, of the Greek διαλογος, which ſignifies the ſame.

Dialogue is greatly recommended by many authors, and is the moſt ancient form of writing, and that wherein the firſt authors wrote moſt of their pieces. The archbiſhop of Cambray gives a fine account of the advantages of dialogue, at the head of his paſtorial inſtruction. The ſacred writers, and the fathers, Athanaſius, Baſil, Chryſoſtom, &c. have uſed this mode of inſtruction.

Antiquity made uſe of dialogue, not only on humorous and comical ſubjects, as Lucian did, but alſo on the moſt ſerious and abſtract; ſuch are the dialogues of Plato, and thoſe of Cicero, which turn altogether on ſubjects of philoſophy, or politics. Among the moderns, the principal dialogiſts are M. de Fenelon, archbiſhop of Cambray; M. Paſchall, in his Provincial Letters; F. Bouhours, in his Entretiens d'Ariſte, and d'Eugene; M. Fontenelle, in his Dialogues of the Dead, and Plurality of Worlds; Addiſon, Hurd, and Lord Lyttelton.

A dialogue conſiſts of two parts, an introduction and the body of the diſcourſe. The introduction acquaints us with the place, time, perſons and occaſion of the converſation. However, the introduction ought not to be too long and tedious. Mr. Addiſon complains of this fault: for though, as he ſays, ſome of the fineſt treatiſes of the moſt polite Latin and Greek writers are in dialogue, as many very valuable pieces, of French, Italian, and Engliſh appear in the ſame dreſs; yet in ſome of them there is ſo much time taken up in ceremony; that before they enter on their ſubject, the dialogue is half over.

In Dialogue, all wrangling, peeviſhneſs, and obſtinacy ſhould be avoided; and nothing appear but good humour and good breeding, with a readineſs to ſubmit to conviction, as evidence preſents itſelf. Cicero has given us two characters of this kind in Craſſus and Antony; from whom Mr. Addiſon ſeems to have taken his Philander and Cynthio, in his Dialogues on the Uſefulneſs of Ancient Medals.

The methods of compoſing dialogues are various: ſometimes a writer relates a diſcourſe by way of narrative, which paſſed between other perſons; ſuch are the dialogues of Cicero, and of Mr. Addiſon laſt mentioned: at other times the ſpeakers are introduced in perſon, Cicero's Dialogues of Old Age, of Friendſhip, and of the Parts of Oratory, are written in this manner. Plato and Lucian generally chuſe this method. As for the ſtile of a dialogue, the eaſy ſtile is the proper character in which they ſhould generally be written. Ward's Orat. vol. ii. p. 221, &c.

DIALTHÆA, in pharmacy, an unguent thus called from its baſis, which is the root of the althæa, or marſhmallow. It conſiſts of mucilages drawn from that root, and from linſeed and fenugreek-ſeed. The other ingredients are common oil, wax, reſine and turpentine.

DIALISIS, in grammar, a character conſiſting of two points placed over two vowels of a word, which would otherwiſe make a diphthong, but are hereby parted into two ſyllables; as in Moſaic. See DIÆRESIS.

DIAMETER, from δια, and μετρειν, to meaſure, in geometry, a right line paſſing through the centre of a circle, and terminated on each ſide by the circumference thereof. See Syſtem of GEOMETRY.

DIAMETER, in aſtronomy. The diameters of the heavenly bodies are either apparent, i. e. ſuch as they appear to the eye; or real, i. e. ſuch as they are themſelves. See Syſtem of ASTRONOMY, Sect. VIII.

DIAMETER *of a Column*, is its thickneſs juſt above the baſe. From this the model is taken, which meaſures all the other parts of the column. See Syſtem of ARCHITECTURE, Plate VI.

DIAMOND, in natural hiſtory, a genus of precious ſtones, of a fine pellucid ſubſtance, of great hardneſs, ſeldom fouled by any admixture of earthy or other coarſe matter, ſuſceptible of elegant tinges from metalline particles, giving fire with ſteel, not fermenting with acid menſtruums, and of one ſimple and permanent appearance in all lights. The goodneſs of diamonds conſiſts in their water, or colour, luſtre, and weight. The moſt perfect colour is the white. Their defects are veins, flaws, ſpecks of red or black ſand, and a bluiſh or yellowiſh caſt.

Diamonds are found in the Eaſt Indies, principally in the kingdoms of Golconda, Viſapour, Bengal, and the iſland of Borneo. There are four mines, or rather two mines and two rivers, whence diamonds are drawn. The mines are, 1. That of Raolconda, in the province of Carnatica, five leagues from Golconda, and eight or nine from Viſapour. It has been diſcovered about 250 years. 2. That of Gani, or Coulour, ſeven days journey from Golconda, eaſtwardly. It was diſcovered about 170 years ago by a peaſant; who, digging in the ground, found a natural fragment of twenty five carats. 3. That of Soumelpour, a large town in the kingdom of Bengal, near the diamond mine: this is the moſt ancient of them all. It ſhould rather be called that of Goual, which is the name of the river, in the ſand whereof theſe ſtones are found. Laſtly, the fourth mine, or rather the ſecond river, is that of Succudan, in the iſland of Borneo.

DIAMOND *Mine of Raolconda*. In the neighbourhood of this mine the earth is ſandy, and full of rocks, and corpſe: in theſe rocks are found ſeveral little veins, of half, and ſometimes a whole inch broad, out of which the miners, with a kind of hooked irons, draw the ſand, or earth, wherein the diamonds are; breaking the rocks when the veign terminates, that the track may be found again, and continued. When a ſufficient quantity of earth, or ſand, is drawn forth, they waſh it two or three times, to ſeparate the ſtones therefrom: the miners work quite naked, except a thin linen cloth before them; and, beſides this precaution, they have likewiſe inſpectors, to prevent their concealing of ſtones; which, however, in ſpite of all their care, they frequently find means to do, by watching opportunities, when they are not obſerved, and ſwallowing them down.

DIAMOND *Mine of Gani or Coulour*. In this mine are found a great number of ſtones from ten to forty carats, and even more; and it was there that the famous diamond of Aureng-Zeb, the great mogul, which, before it was cut, weighed 793 carats, was found. The miners dig twelve or fourteen feet deep, and till ſuch time as they find water; then they ceaſe digging: and the water, thus found, ſerves to waſh the earth two or three times; after which, it is let out at an aperture reſerved for that purpoſe. This earth being well waſhed, and well dried, they ſift it in a kind of open ſieve, or riddle, much as we do corn in Europe; then they thraſh it and ſift it afreſh; and, laſtly, they ſearch it well with the hands, to find the diamonds. They work naked here, as in the mine of Raolconda, and are watched, after the like manner, by inſpectors.

DIAMOND *Mine of Soumelpour, or River Goual*. When the ſand of the river, have been well examined, the miners proceed to take up that wherein they judge diamonds likely to be found; which is done after the following manner: they dam the place round with ſtones, earth, and faſcines: and lading out the water, dig about two feet deep: the ſand, thus got, is carried into a place walled round on the bank of the river. The reſt is performed after the ſame manner as at Coulour, and the workmen are watched with equal ſtrictneſs.

DIAMOND *Mine in the Iſland of Borneo, or River of Succudan*. We are but little acquainted with this mine; the prince who reigns in that part of the iſland not allowing ſtrangers to have any commerce in theſe ſtones: though there are very fine ones to be brought at Batavia, brought thither by ſtealth. They were anciently imagined to be ſofter than thoſe of the other mines; but experience ſhews, they are in no reſpect inferior to them.

Diamond mines were diſcovered about the year 1728 in the Braſils belonging to the king of Portugal, who, in the year 1740, let them to a company at Rio Janeiro, for a certain ſtipulated annual rent, which is ſaid to be 130,000 cruſades, on condition that the ſaid company employ no more than ſix hundred ſlaves in working them; ſince which time the value of diamonds is diminiſhed.

The diamond we have already obſerved, is the hardeſt of all precious ſtones. It can only be cut, and ground, by itſelf in its own ſubſtance. To bring it to that perfection which augments its price ſo conſiderably, they begin by rubbing ſeveral againſt each other, while rough, after having firſt glued them to the ends of two wooden blocks, thick enough to be held in the hand; it is the powder thus rubbed off the ſtones, and received in a little box for the purpoſe, that ſerves to grind and poliſh the others.

Diamonds are cut and poliſhed by means of a mill, which turns a wheel of ſoft iron ſprinkled over with diamond duſt mixed with oil of olives: the ſame duſt, well ground, and diluted with water and vinegar, is uſed in the ſawing of diamonds; which is performed with an iron or braſs wire, as fine as a hair: ſometimes, in lieu of ſawing the diamonds, they cleave them, eſpecially if there be any viſible plates in them; but the Europeans are not uſually daring or expert enough, to run the riſque of cleaving, for fear of breaking.

Rough DIAMOND, is that not yet cut, but juſt as it comes out of the mine. It muſt be choſen uniform, of a good ſhape, tranſparent, not quite white, and free from flaws and ſhivers.

Black, rugged, dirty, flawey, veiny ſtones, and all ſuch as are not fit for cutting, they uſe to pound in a ſteel mortar made for that purpoſe; and, when pulveriſed, they ſerve to ſaw, cut, and poliſh the reſt.

Brilliant DIAMOND, is that cut in faces both at the top, and bottom; and whoſe table, or principal face at the top is flat.

To make a compleat ſquare brilliant, if the rough diamond be not found to be of the figure here deſcribed, it muſt be made ſo. And if the work be perfectly executed, the length of the axis will be equal to the ſide of the ſquare baſe of the pyramid. Jewellers then form the table and collet, by dividing the block or length of the axis into eighteen parts.

The parts of the ſmall work which complete the brilliant, or the ſtar and ſkill facets, are of a triangular figure. Both of theſe partake equally of the depth of the upper ſides, from the table of the girdle, and meet in the middle of each ſide of the table and girdle, as alſo at the corners. Thus they produce regular lozenges on the four upper ſides and corners of the ſtone. The triangular facets, on the under ſides, joining to the girdle, muſt be half as deep again as the above facet to anſwer to the collet part.

The ſtone here deſcribed is ſaid to be a full ſubſtanced brilliant. If the ſtone be thicker than in the proportion here mentioned, it is ſaid to be an over-weighed brilliant. If the thickneſs be leſs than in this due proportion, it is called a ſpread brilliant. The beauty of brilliants is diminiſhed by their being either over-weighed or ſpread. The true proportion of the axis or depth of the ſtone to its ſide, is as 2 to 3. Brilliants are diſtinguiſhed iuto ſquare, round, oval, and drops, from the figure of their reſpective girdles.

Roſe DIAMOND, is that quite flat underneath, but its upper part cut in diverſe little faces, uſually triangles, the uppermoſt whereof terminate in a point.

The taſte which now prevails of converting roſe-diamonds into brilliants, is condemned by Mr. Jefferies; unleſs the roſe-diamonds be over-weighed. He thinks, that the diſplay of beauty in roſe-diamonds, is often preferable to that of brilliants. See his Treatiſe on Diamonds, p. 32, 35.

Table DIAMOND, is that which has a large ſquare face at the top, encompaſſed with four leſſer.

Complexions of DIAMONDS. The fineſt diamonds are thoſe of a complexion like that of a drop of the cleareſt rock water: and if ſuch ſtones be of a regular form, and truly made, as alſo free from ſtains, fouls, ſpots, ſpecks, flaws, and croſs veins, they will have the higheſt luſtre of any, and be eſteemed the moſt perfect.

If diamonds be tinctured yellow, blue, green, or red, in a high degree, they are next in eſteem. But if they partake of theſe colours only in a low degree, it greatly ſinks their value.

The firſt water in diamonds means the greateſt purity and perfection of their complexion, which ought to be that of the cleareſt drop of water. When diamonds fall ſhort in this perfection they are ſaid to be of the ſecond or third water, &c. till the ſtone may be properly called a coloured one: for it would be an impropriety to ſpeak of a diamond imperfectly coloured, or having other defects, as a ſtone of a bad water only.

Mugnitude of DIAMONDS. The largeſt oriental diamond in the world belongs to the great Mogul. It weighs 279 carats. According to the computation of M. Tavernier, this diamond is worth 779,244l. ſter. but by the tables of Mr. Jefferies, its value is only 624,962l. That known in France under the name of grand ſancy, by corruption of *cent ſix*, which is one of the crown jewels, weighs 106, carats; governor Pitt's diamond, purchaſed by the late duke of Orleans for Louis the XV. king of France, weighs 136¾ carats, and is ſaid to have been bought for 125,000l. and the diamond of the great duke of Tuſcany, weighs 139½ carats.

According to Mr. Jefferies's rule, that the value of diamonds is in the duplicate ratio of their weights, and that a manufactured diamond of one carat is worth at a medium 8l. the great mogul's diamond muſt be valued at above 624962l. this being the value of a diamond of 279½ carats.

It muſt be obſerved, however, that defects in the water, or ſhape, red or black ſpots, ſhivers, and other failings, frequently found in theſe ſtones, reduce the price by one third, and ſometimes more.

When diamonds are fouled with a yellow or brown colour, it is a common practice among jewellers to put them in a fierce fire; this diveſts them of their colours, without doing them the leaſt ſenſible injury. Du-Fay, in Mem. Acad. Paris, 1735.

As to brilliant diamonds of very ſmall cut, the price is always leſs by one third than that of diamonds of a larger cut, though the weights be the ſame: the reaſon is, that the latter ſhew themſelves a great deal more when ſet in their collets, than the former.

DIAMOND is an inſtrument of conſiderable uſe in the glaſs manufactory, for ſquaring the large plates, or pieces; and among glaziers for cutting their glaſs.

DIAMOND, in heraldry, is uſed to expreſs the black colour in the atchievements of noblemen.

DIAMOND *Powder* is of great uſe for grinding hard ſubſtances. And Mr. Boyle obſerves, that though it be much dearer than emery, yet it makes ſo great diſpatch, and the tools employed laſt ſo much longer, as greatly to over-balance the cheapneſs of the emery.

DIANA, the goddeſs of hunting, in heathen mythology, was the daughter of Jupiter and Latona. She is called Hecate in hell, Diana on earth, and Phœbe in heaven. She was famous for her chaſtity. The moſt known character of this goddeſs is that of her preſiding over woods, and delighting in hunting. Accordingly the *Diana venatrix*, or goddeſs of the chace, is frequently repreſented in ancient ſtatues; and deſcribed by the Roman poets, as running, with her veſt ſhortened and girt about her, and yet flying back with the wind. She often is repreſented with her quiver on her ſhoulder; and ſometimes holds a javelin, but more uſually her bow in her right hand. The ſtatues of Diana were frequent in the woods, where ſhe is preſented as hunting, bathing and reſting herſelf after fatigue. When ſhe is repreſented as the intelligencer that preſides over the moon, ſhe appears in a car, drawn by ſtags, or by dogs, but more commonly by horſes of a perfectly white colour, with a lunar crown or creſcent on her forehead. Spence's Polymetis, p. 100, 102, 104.

DIANDRIA, in botany, the ſecond claſs of plants, which have hermaphrodite flowers, with two ſtamina or male parts in each. The word is formed of the Greek δις, *twice*, and ανηρ, *male*. Of this claſs of plants, which comprehends three orders, viz. the monogynia, digynia, and trigynia, are the jeſſamine, phillyrea, olive, roſemary, &c. See Syſtem of BOTANY, Claſs II. and Plate IV.

DIANTHERA, in botany, a genus of the monogynia order of the diandria claſs of plants. This plant grows naturally in Virginia, and other parts of North America. Linnæus enumerates two ſpecies. See Syſtem of BOTANY, Sect. V. and Plate IV.

DIANTHUS, in botany, a genus of the digynia order belonging to the decandria claſs of plants. There are a great number of ſpecies, but not more than four that have any conſiderable beauty, as garden flowers, each of which furniſhes ſome beautiful varieties. See Syſtem of BOTANY. Sect. V. Plate IV.

DIAPASON, from δια, *by*, and πας, *all*, in muſic, a muſical interval, otherwiſe called *octave*; ſo called, becauſe it contains all the poſſible diverſities of ſound. See Syſtem of MUSIC.

DIAPASON, among muſical inſtrument makers, is a kind of rule, or ſcale; whereby they adjuſt the pipes of their organs, and cut the holes of their flutes, hautboys, &c. in due proportion, for performing the tones, ſemi-tones, and concords, juſtly.

DIAPASON is alſo the name of two ſtops of an organ, viz. the open and ſtopped.

DIAPEDESIS, Διαπηδησις, in medicine, an ouſing of blood through the coats of the veins, or arteries; occaſioned either by the blood's becoming too much diſſolved, or attenuated; or by the pores of the veſſels becoming too patent or open. The word is compounded of δια, *through*, and πηδαω, *I leap*.

DIAPHANEITY, the quality of a tranſparent body; or that which denominates it ſuch. See TRANSPARENCY.

DIAPHANOUS, in philoſophy, a thing tranſparent, or that gives paſſage to the rays of light; as water, air, glaſs, talc, fine porcelain, &c. The word is formed of δια, *through*, and φαινω, *I ſhew*.

DIAPHONICS, from δια, *through*, and φωνη, *ſound*, is ſometimes uſed for the ſcience of refracted ſound, as it paſſes through different mediums.

DIAPHORETIC, in medicine, is applied to remedies that promote the expulſion of humours by inſenſible perſpiration. Diaphoretic is much of the ſame import as ſudorific: except that the latter promotes ſenſible, and the former inſenſible perſpiration. Their only difference, therefore, is in the degree of activity.

DIAPHRAGM, *Diaphragma* in anatomy, a part, popularly called the midriff, and by anatomiſts *ſeptum tranſverſum*. It is a nervous muſcle, ſeparating the breaſt, or thorax, from the abdomen, or lower venter; and ſerving as a partition between the natural and the vital parts as they are called. It was Plato, as Galen informs us, that firſt called it diaphragm, from the verb διαφραττειν, *to ſeparate*, or *be between two*. Till his time it had been called φρενες, *underſtanding*; from a notion that an inflammation of this part produced phrenſy: which is not at all warranted by experience, no more than that other tradition, that a tranſverſe ſection of the diaphragm with a ſword, cauſes the patient to die laughing. See Syſtem of ANATOMY, Plate V. *Fig.* 3, Letter N, alſo Plate IV. *Fig.* 3.

DIAPHRAGMATIC, is applied to the arteries, veins, and nerves, diſtributed through the diaphragm. They are alſo called phrenic, or phrenetic.

DIAPHTHORA, from διαφθειρειν, *to corrupt*, is uſed by Galen and Boerhaave, to denote the corruption of the aliments in the ſtomach, and by Hippocrates for the corruption of the fœtus in the womb, and abortion.

DIAPORESIS, Διαπορησις, in rhetoric, is uſed to expreſs the heſitation, or uncertainty of the ſpeaker. We have an example in Homer, where Ulyſſes going to relate his ſufferings to Alcinous, begins thus:

> Τι πρωτον, τι δ' επειτα, τι δ' υσατιον καταλεξω?
> *Quid primum, quid deinde, quid poſtremo alloquar?*

This figure is moſt naturally placed in the exordium or introduction to a diſcourſe.

DIAPRE', or DIAPERED, in heraldry, a dividing of a field into planes, or compartments, in the manner of fretwork; and filling it with variety of figures. This chiefly obtains on bordures, which are diapered, or fretted over, and the frets charged with things proper to bordures.

DIARRHODON, Διαρροδον, in pharmacy, a name given to divers compoſitions, wherein roſes are a principal ingredient. The word is formed δια, and ροδον, *roſe*.

DIARRHOEA, Διαρροια, in medicine, a looſeneſs, or flux of the belly; or a profuſe evacuation of liquid excrements by ſtool. The word is formed of the Greek δια, *through*, and ρεειν, *to flow*. See Syſtem of MEDICINE.

The word in general is uſed for any kind of flux of the belly:

but properly for that wherein the humour, or excremeut, flows out either pure, or mixed, with or without pain, in a fluid ſtate.

DIARTHROSIS, in anatomy, a kind of articulation, or juncture of the bones, which being pretty lax, affords room for a manifeſt motion. The word comes from δια, and αρθρον, *juncture, aſſemblage*. It is oppoſite to ſynarthroſis, wherein the articulation is ſo cloſe, that there is no ſenſible motion at all.

DIARY, a term uſed for a journal, or day book, containing an account of every day's proceedings. Thus we ſay diaries of the weather, &c.

DIASENNA, in pharmacy, a ſoft, purgative electuary, thus called ſenna, which is its baſe.

DIASTASIS, from διϛημι, *I ſet apart*, a word uſed by the writers, in medicine, in many different ſenſes. It is frequently uſed as a name for that ſeparation of the bones, when they naturally recede from one another. Sometimes it is uſed as the term for an interſtice, as that between the ulna and radius, or between the tibia and fibula. Sometimes it is put for a diſtention of the muſcles in convulſions; and, when applied to the ſtomach, it is made to ſignify an inclination to vomit.

DIASTOLE, in anatomy, expreſſes that motion of the heart, and arteries, whereby thoſe parts dilate, or diſtend themſelves: the other oppoſite motion being called the ſyſtole of the heart and arteries, wherein they contract themſelves. The word is Greek, formed from the verb διαϛελλειν, *to ſeparate, open, dilate*. See Syſtem of ANATOMY. Part V. Sect. XXI.

DIASTOLE, in grammar, a figure in proſody whereby a ſyllable naturally ſhort is made long. Such is the firſt ſyllable of *Priamides* in the following verſe of Virgil: *Atque hic Priamides! nihil o tibi amice, relictum.*

DIASURMUS, Διασυρμος, from δια, and συρω, *I draw*, in rhetoric, a figure whereby we ſhortly anſwer, or rather evade, a thing which it would be tedious to reply to in form.

E. gr. *What matters it to reply to an argument foreign to the purpoſe?*

DIATHESIS, from διατιθημι, *I diſpoſe*, a term uſed by ſome writers in the ſame ſenſe with conſtitution; and by others for a diſpoſition of the blood to a faulty ſtate.

DIATONIC, from δια, and τονος, *tone*, an epithet given to the common muſic, as it proceeds by tones, or degrees, both aſcending and deſcending. Authors divide the genera or kinds of muſic into *diatonic*, *chromatic*, and *enharmonic*. The *diatonic* genus was by the ancients divided into two ſpecies; the *molle*, and the *intenſum*. The laſt is in daily practice. It is commonly ſaid to conſiſt of two tones and a ſemi-tone: but, to ſpeak exactly, it conſiſts of a ſemi-tone major, a tone minor, and a tone major.

DIATRÆTA, a word uſed by Pliny, and others of the ancient Romans, to expreſs a ſort of cups and vaſes which were of great value, and only ſeen at the tables of the great. They were pellucid and colourleſs, and cut into various forms, and were often engraven upon with figures expreſſive of the deeds of honour of the family who poſſeſſed them.

DIATRAGACANTH, in pharmacy, is a name applied to certain powders, whereof gum tragacanth is the chief ingredient. There are two kinds, cold and hot.

DIAUGOPHRAGMIA, in natural hiſtory, a genus of foſſils of the order of ſeptariæ, whoſe partitions, or ſepta, conſiſt of ſpar with an admixture of cryſtal. Of this genus there are three ſpecies. 1. A red kind, with browniſh yellow partitions. 2. A browniſh yellow kind, with whitiſh partitions. 3. A bluiſh white kind, with ſtraw coloured partitions. Vide Hill, Hiſt. Foſſ. p. 522.

DICE, among gameſters, certain cubical pieces of bone or ivory, marked with dots on each of their faces, from one to ſix, according to the number of their ſides.

Sharpers have ſeveral ways of falſifying dice: 1. by ſticking a hog's briſtle into them, ſo as to make them run high or low as they pleaſe; 2. by drilling and loading them with quick-ſilver; which trick is diſcovered by holding them gently between two diagonal corners; when, if falſe, the heavy ſide will turn always downwards: 3. by filing and rounding them. But all theſe methods fall far ſhort of the arts of the dice makers, ſome of whom are ſo dextrous, that ſharping gameſters will have any money for ſuch dice. Dice pay a large ſtamp duty and are prohibited to be imported.

DICHOTOMY, *Biſection*, a term uſed by aſtronomers for that phaſis, or appearance of the moon, wherein ſhe is biſected, or ſhews juſt half her diſk, or circle; or when ſhe is in the beginning of her firſt and laſt quarter. The word is Greek, formed of διχοτομεω, *I beſect* or *cut into two*; of δις, *twice*, and τεμνω, *I cut*.

The time of the moon's dichotomy is of conſiderable uſe in fixing the ſun's diſtance from the earth. But it is very difficult to fix the preciſe moment when the moon is biſected, or in her true dichotomy.

DICHOTOMY, in botany, a term uſed to expreſs that diviſion of the branches which we ſee in miſletoe, and in the greater part of the ſea fucuſes, in which each branch is divided into two.

DICTAMNUS, white dittany, or fraxinella; a genus of the monogynia order, belonging to the decandria claſs of plants. There is only one ſpecies. It hath thick, penetrating, perennial roots, collected into a head at top, ſending up erect ſtalks annually, two or three feet high, garniſhed with pinnated alternate leaves, of three or four pair of oblong ſtiff lobes, terminated by an odd one; and the ſtalks crowned by long, pyramidal, looſe ſpikes of flowers, of white, red, and purple colours. They are very ornamental plants, and ſucceed in any of the common borders. See Syſtem of BOTANY, Sect. V. and Plate IV.

DICTATE, *Dictamen*, a ſuggeſtion, motion, or ſentiment of a man's conſcience. A good action becomes evil, if done contrary to the dictates of one's own conſcience.

DICTATE, *Dictata*, is likewiſe uſed in the ſchools for a leſſon, or exerciſe, wherein the maſter reading or ſpeaking ſomething the ſcholars take it down in writing after him. Here the act of the maſter is likewiſe called dictating.

DICTATOR, a Roman magiſtrate, created by the ſenate, or people, on ſome extraordinary and eminent occaſion, to command, with ſovereign authority, for a certain time, ordinarily limited to ſix months, though the office was ſometimes continued to twelve. Recourſe was never had to ſuch an officer but in dangerous and difficult times; as ſudden wars, popular factions, &c. He had abſolute and monarchic power while his dictature laſted: he was arbiter of peace and war, and had command of life and death, without any appeals lying to the people. Twenty four axes were borne before him, whereas only twelve before the conſuls. The origin of this office was unknown even in Livy's time: though ſome ancient authors ſpeak of T. Largius Flavius as the firſt dictator, who was appointed in the year of Rome 259. *Sed nec anno, nec quibus conſulibus—nec quis primum dictator creatus ſit, ſatis conſtat: apud veterrimos tamen auctores. T. Lartium dictatorem primum, Sp. Caſſium magiſtrum equitum creatos invenio. Conſulares legere.* Liv. lib. ii. Sylla was the firſt perpetual dictator, and Cæſar the next. After Cæſar, there were no more dictators. The firſt dictator choſen from among the people was Marcus Rutilius, in 399. Dioniſius Halicarnaſſius derives the word *ab edicendo*, becauſe they ordained or appointed what they pleaſed. But Varro will have the word taken hence, that the conſul named him, which the Latins call *dicere*, lib. iv. De Lingua Latina. Dictator *quod a conſule dicebatur cujus dicta audientes omnes eſſent.*

DICTION, the phraſe, elocution, or ſtyle of a writer, or ſpeaker. The diction or language of an orator ſhould be pure, proper to the ſubject, rich without affectation, ſtrong and cloſe without dryneſs, and ſuitable to the perſon, time, place, and audience. The diction of tragedy is accounted the fourth of the eſſential parts thereof: it is of the leaſt importance of any; yet muſt peculiar care be taken herein to make every paſſion ſpeak its proper language.

DICTIONARY, in its original acceptation, is the arranging all the words of a language according to the order of the alphabet, and annexing a definition or explanation to each word. When arts and ſciences began to be improved and extended, the multiplicity of technical terms rendered it neceſſary to compile dictionaries either of ſcience in general, or of particular ſciences, according to the views of the compiler.

Dictionaries of arts and ſciences were formerly conſidered uſeful only as works to refer to: but ſince the improved plan has been adopted of introducing complete Syſtems of the reſpective Sciences and diſtinct Treatiſes on all the principal arts; they have been eſteemed not only works of conſiderable uſe, but of great entertainment; becauſe they convey knowledge in a connected chain of deſcription, and thereby facilitate improvement, and contribute to amuſement, much more than can be done by treating on ſubjects in a detached and abſtracted manner.

Nor does the advantage reſt ſolely on this point, but extends in a greater degree beyond works on the old plan; as by referring for deſcription of technical words to the reſpective Syſtems and Treatiſes, a better idea muſt be formed in many inſtances of their ſignifications, applications and connections, than could be given of them in alphabetical order.

Another advantage reſulting from this new plan, is, that many authors may be employed at one and the ſame time in forming the various Syſtems and Treatiſes in their reſpective profeſſions, independent of the compiler, which cannot be the caſe on the old plan, where every article is ſubmitted to the arrangement and definition of an individual. By this means we have been and ſhall be enabled, during the courſe of this work, to call in the aſſiſtance of many literary characters, and by their joint efforts to give more accurate deſcriptions of Arts and Sciences than any work publiſhed in this kingdom.

Others have claimed the merit of purſuing the plan, which has raiſed the reputation of this work; that of retaining men of Science to form the ſeveral Syſtems and Treatiſes; but their pretences, independent of the compiler, are evidently groundleſs, as their reſpective productions have been anonymous; the only inference that can poſſibly be drawn from which is, that the Syſtems and Treatiſes are either the compilations of an individual, or that the parties concerned have been aſhamed to affix their ſignatures: whereas all our editors have avowed their productions, and may be referred to at their places of abode for the ſolution of any queſtion in the various Arts and Sciences they have undertaken to define.

The importance and utility of a Scientific Dictionary are evident from conſiderations of the higheſt moment, and particularly the following. It ſupplies in ſome degree the want of a large library, by furniſhing the curious and inquiſitive with Syſtems of Science that are diſperſed in many volumes, which cannot be procured without difficulty and conſiderable expence. It records and tranſmits to future ages many inventions and improvements which might otherwiſe ſink into oblivion. It forms a compendious hiſtory of Science, furniſhes the outlines of its gradual progreſs and advancement, and by preſerving a ſummary of what has been already done and diſcovered, lays a foundation for further diſcoveries and improvements.

A Dictionary of Science from this brief account of its deſign and uſe, muſt therefore be acknowledged a work of great conſequence; and its importance in every country will be eſtimated by the degree in which knowledge is purſued and promoted.

The labours and endeavours of men of curioſity, in all ages, have been chiefly confined to what are called, the Arts and Sciences. Their bounds have been enlarged from time to time, and new acquiſitions made from the adjoining waſte; but ſtill the ſpace of ground they poſſeſs is but narrow; and there is room either to extend them conſiderably, or to lay out new ones.

Art and Science are words of familiar uſe, and great ſignificance; yet, to aſcertain their meaning, requires ſome inveſtigation. To Science, ſeem to belong ſuch things as men may diſcover by the uſe of ſenſe and reaſoning; whatever the mind deſcries in virtue of that faculty whereby we perceive things, and their relations, is matter of ſcience: ſuch are the laws of nature, the affections of bodies, the rules and criterions of right and wrong, truth and error, the properties of lines and numbers, &c. Science, in effect, is the reſult of reaſon and ſenſe, in their general or natural ſtate, as imparted to all men, and not modified, or circumſtantiated, by any thing peculiar in the turn of a man's mind, the objects he has been converſant among, or the ideas preſented to him. In fine, ſcience is a ſeries of deductions, or concluſions, which every perſon, endued with thoſe faculties, may, with a proper degree of attention, ſee, and draw: and a ſcience, i. e. a formed ſcience, is no more than a ſyſtem of ſuch concluſions, relating to ſome one ſubject, orderly and artfully laid down in words.

To Art belong ſuch things as mere reaſon would not have attained to; things which lie out of the direct path of deduction, and which require a peculiar caſt, or turn of mind, to ſee, or arrive at. A man might call theſe the reſults of particular or perſonal reaſon, in oppoſition to the former; but that ſuch a denomination would be thought unphiloſophical. The difference between the two may be illuſtrated by that between wit and humour; the former whereof is a general faculty of exciting agreeable and ſurpriſing pictures in the imagination; and the latter a particular one: the former is pure and abſolute in its kind; the latter tinged with ſomething foreign and complexional.

An art and a ſcience, therefore, only ſeem to differ as leſs and more pure: a ſcience is a ſyſtem of deductions made by reaſon alone, undetermined by any thing foreign, or extrinſic to itſelf: an art, on the contrary, requires a number of data, and poſtulata, to be furniſhed from without; and never goes any length, without, at every turn, needing new ones. It is, in one ſenſe, the knowledge and perception of theſe data that conſtitutes the art: the reſt, that is, the doctrinal part, is of the nature of ſcience; which attentive reaſon alone will deſcry.

An art, in this light, appears to be a portion of ſcience, or general knowledge, conſidered, not in itſelf, as ſcience, but with relation to its circumſtances, or appendages. In a ſcience, the mind looks directly backwards and forwards to the premiſes and concluſions: in an art we alſo look laterally to the concomitant circumſtances. A ſcience, in effect, is that to an art, which a ſtream running in a direct channel, with regard to any thing but its own progreſs, is to the ſame ſtream turned out of its proper courſe, and diſpoſed into caſcades, jets, ciſterns, ponds, &c. In which caſe the progreſs of the ſtream is not conſidered with regard to itſelf, but only as it concerns the works; every one of which modifies the courſe of the ſtream, and leads it out of its way. It is eaſy to trace the progreſs of the former, from its riſe to its iſſue; becauſe its flows conſequentially: but a man ever ſo well acquainted with this, will not be able to diſcover that of the latter, becauſe it depends on the genius, humour, and caprice, of the engineer who laid the deſign.

The ultimate view of a Dictionary of Arts and Sciences ſhould be, the forming of a ſound mind, i. e. acquiring a ſyſtem of perceptions and notions agreeing to the ſyſtem of things, or in the relations thereto intended by its author. The end of learning and ſtudy, is not the filling of our heads with other men's ideas; that is an enrichment which may prove for the worſe: richneſs is only a matter of ſecondary conſideration; ſoundneſs is the firſt. There are many manures which the huſbandman dare not uſe, by reaſon they would corrupt the land, at the ſame time they enriched it, and lay the foundation of a diſeaſe, which would in the end impoveriſh, and make it ſpend itſelf in unprofitable weeds. But it muſt be owned, men's heads are not ſo eaſily filled; the memory is not ſo tenacious as we may imagine; ideas are tranſient things, and ſeldom ſtay long enough with us to do either much good, or harm: what we read to-day may be moſtly forgotten to-morrow. And what chiefly makes new ideas of any ſignificancy, is their extending and enlarging the mind, and making it more capacious, and ſuſceptible. But neither is this enlargement the laſt aim; but is chiefly of uſe, as it contributes to the increaſing our ſenſibility, to the making our faculties more ſubtile and adequate, and giving us a more exquiſite perception of things that occur; and thus enabling us to judge clearly, pronounce boldly, conclude readily, diſtinguiſh accurately, and apprehend the manner and reaſons of our deciſions.

DICTIONARY *of the Engliſh Language.* The only attempt which has hitherto been made towards forming a regular dictionary of the Engliſh language, is that of the learned Dr. Samuel Johnſon. But although it is executed in a maſterly manner, yet as it cannot be expected that an undertaking of this nature could be brought to perfection by one man, we ſhall venture to ſuggeſt a few circumſtances which, if duly attended to, may perhaps be of ſome utility.

The deſign of every dictionary of language, is to explain, in the moſt accurate manner, the meaning of every word; and to ſhow the various ways in which it can be combined with others, in as far as this tends to alter its meaning. The dictionary which does this in the moſt accurate manner, is the moſt complete. Therefore the principal ſtudy of a lexicographer ought to be, to diſcover a method which will be beſt adapted for that purpoſe. Dr. Johnſon, with great labour, has collected the various meanings of every word, and quoted the authorities: but, would it not have been an improvement if he had given an accurate definition of the preciſe meaning of every word; pointed out the way in which it ought to be employed with the greateſt propriety; ſhowed the various deviations from that original meaning, which cuſtom had ſo far eſtabliſhed as to render allowable; and fixed the preciſe limits beyond which it could not be employed without becoming a vicious expreſſion? With this view, it would have been neceſſary to exhibit the nice diſtinctions that take place between words which are nearly ſynonimous. Without this, many words can only be defined in ſuch a manner, as that they muſt be conſidered as exactly ſynonimous. We omit giving any quotations from Johnſon, to point out theſe defects; and ſhall content ourſelves with giving a few examples, to ſhow how, according to our idea, a dictionary of the Engliſh language ought to be compiled.

IMMEDIATELY, *adv. of time.*

1. Inſtantly, without delay. Always employed to denote future time, and never paſt. Thus, we may ſay, *I will come immediately*; but not, *I am immediately come from ſuch a place.* See PRESENTLY.

2. Without the intervention of any cauſe or event; as oppoſed to *mediately.*

PRESENTLY, *adv. of time.*

1. Inſtantly, without delay. Exactly ſynonimous with immediately; being never with propriety employed to denote any thing but future time.

2. Formerly it was employed to expreſs preſent time. Thus, *The houſe preſently poſſeſſed by ſuch a one,* was often uſed: but this is now become a vicious expreſſion; and we ought to ſay, *The houſe poſſeſſed at preſent.* It differs from *immediately* in this, that even in the moſt corrupt phraſes it never can denote paſt time.

FORM, *ſubſt.* The external appearance of any object, when conſidered only with reſpect to ſhape or figure. This term therefore, in the literal ſenſe, can only be applied to the objects of the ſight and touch; and is nearly ſynonimous with *figure*: but they differ in ſome reſpects. Form may be employed to denote more rude and unfiniſhed ſhapes; *figure*, thoſe which are more perfect and regular. Form can never be employed without denoting matter; whereas *figure* may be employed in the abſtract: thus, we ſay a ſquare or a triangle *figure*; but not a ſquare or triangular *form.* And in the ſame manner we ſay, the *figure* of a houſe; but we muſt denote the ſubſtance which forms that figure, if we uſe the word *form*; as, *a cloud of the form of a houſe,* &c. See FIGURE.

2. In contraſt to irregularity, or confuſion. As beauty cannot exiſt without order, it is, by a figure of ſpeech employed to denote beauty, order, &c.

3. As *form* reſpects only the external appearance of bodies, without regard to their internal qualities, it is, by a figure of ſpeech, employed in contraſt to theſe qualities, to denote empty ſhow, without eſſential qualities. In this ſenſe it is often taken when applied to religious ceremonies, &c.

4. As *form* is employed to denote the external appearance of bodies; ſo, in a figurative ſenſe, it is applied to reaſoning, denoting the particular mode or manner in which this is conducted; as, *the form of a ſyllogiſm,* &c.

5. In the ſame manner it is employed to denote the particular mode of procedure eſtabliſhed in courts of law; as, *the forms of law, religion,* &c.

6. *Form* is ſometimes, although improperly, uſed to denote the different circumſtances of the ſame body; as, *water in a fluid or a ſolid form.* But as this phraſe regards the internal qualities rather than the external figure, it is improper; and ought to be, *water in a fluid or a ſolid ſtate.*

7. But when bodies of different kinds are compared with one another, this term may be employed to denote other circumſtances than ſhape or figure: for we may ſay, *a juice exſuding from a tree in the form of wax or reſin*; although, in this caſe, the conſiſtence, colour, &c. and not the external arrangement of parts, conſtitutes the reſemblance.

8. From the regular appearance of a number of perſons arranged in one long ſeat, ſuch perſons ſo arranged are ſometimes called a *form*, as, *a form of ſtudents*, &c. And,

9. By an eaſy tranſition, the ſeat itſelf has alſo acquired that name.

GREAT, *adj.* A relative word, denoting largeneſs of quantity, number, &c. ſerving to augment the value of thoſe terms with which it is combined, and oppoſed to *ſmall* or *little*. The principal circumſtances in which this word can be employed, are the following:

1. When merely *inanimate* objects are conſidered with regard to quantity, *great* is with propriety employed, to denote that the quantity is conſiderable; as, *a great mountain*, *a great houſe*, &c. and it is here contraſted with *ſmall*. When *great* is thus employed, we have no other word that is exactly ſynonimous.

2. When *inanimate* objects are conſidered with regard to their extent, this term is ſometimes employed, although with leſs propriety; as, *a great plain*, *a great field*, &c. And in this ſenſe it is nearly ſynonimous with *large*; and they are often uſed indiſcriminately, but with ſome difference of meaning: for, as *large* is a term chiefly employed to denote extent of ſuperficies, and as *great* more particularly regards the quantity of matter; therefore, when *large* is applied to any object which is not merely ſuperficial, it denotes that it is the extent of ſurface that is there meant to be conſidered, without regard to the other dimenſions; whereas when the term *great* is employed, it has a reference to the whole contents. If, therefore, we ſay, *a large houſe* or *a large river*, we expreſs that the houſe, the river, have a ſurface of great extent, without having any neceſſary connection with the ſize in other reſpects. But if we ſay, *a great houſe*, or *a great river*, it at once denotes that they have not only a large ſurface, but are alſo of great ſize in every reſpect.

3. *Great*, when applied to the human ſpecies, never denotes the ſize or largeneſs of body, but is applied ſolely to the qualities of the mind. Thus, when we ſay, that *Socrates was a great man*, we do not mean that he was a man of great ſize, but that he was a man who excelled in the endowments of the mind. The terms which denote largeneſs of ſize in the human body are, *big*, *bulky*, *huge*, &c.

4. *Great* is ſometimes applied to the human ſpecies, as denoting high rank. In this caſe it is oftener uſed in the plural number than otherwiſe. Thus we ſay ſimply, *the great*, meaning the whole body of men in high ſtation, as oppoſed to *mean*. It ſhould ſeldom be employed in this ſenſe, as it tends to confound dignity of rank with elevation of mind.

5. As this is a general term of augmentation, it may be joined with all nouns which denote *quantity*, *quality*, *number*, *excellence*, or *defects*; or ſuch as imply *praiſe*, *blame*, *anger*, *contempt*, or any other affection of the mind.

6. It is employed to denote every ſtep of aſcending or deſcending conſanguinity; as, *great grandfather*, *great grandſon*, &c.

Theſe examples may ſerve to give ſome idea of the plan of an Engliſh Dictionary compoſed upon philoſophical principles: But, beſides the circumſtances above enumerated, there are many others which would require particular attention in the execution of a work of this kind. In the Engliſh language, a great variety of terms occur, which denote matter under certain general forms or circumſtances, without regarding the minute diverſities that may take place; as the word *cloth*, which denotes matter as manufactured into a particular form, including under it all the variety of ſtuffs manufactured in that particular way, of whatever materials, colours, texture, or fineneſs, they may be. The ſame may be ſaid of *wood*, *iron*, *yarn*, and a great variety of terms of the ſame nature, ſome of which cannot aſſume any plural; while others admit of it in all caſes, and others admit or refuſe it according to the different circumſtances in which they are conſidered. In a dictionary, therefore, all this variety of caſes ought to be clearly and diſtinctly pointed out under each particular article; this is the more neceſſary, as ſome of theſe words have others formed from them, which might be readily miſtaken for their plurals, although they have a very different ſignification: as *cloaths*, which does not denote any number of pieces or different kinds of *cloth*, but *wearing apparel*. The following example will illuſtrate this head.

WOOD, *ſub.* A ſolid ſubſtance, of which the trunks and branches of trees conſiſt.

1. The term is employed to denote the ſolid parts of vegetables of all kinds, in whatever form or circumſtances they are found. Nor does this term admit of plural with propriety, unleſs in the circumſtances after-mentioned: for we ſay, *many different kinds of wood*, in preference to *many kinds of woods*; or, as we ſay, *oak*, *aſh*, or *elm wood*, not *woods*.

2. But where we want to contraſt *wood* of one quality or country with that of another, it admits of a plural: for we ſay, *white woods are in general ſofter than red*; or *Weſt-Indian woods are in general of greater ſpecific gravity than the European woods*: But unleſs where the colour, or ſome quality which diſtinguiſhes it from growing wood, is mentioned, this plural ought as much as poſſible to be avoided, as it always ſuggeſts an idea of growing wood.

3. *Wood* likewiſe denotes a number of trees growing near one another: being nearly ſynonimous with *foreſt*: See Forest. In this ſenſe it always admits of a plural; as, *Ye woods, and wilds, whoſe ſolitary gloom*, &c.

As the Engliſh language is ſo exceedingly irregular in the pronunciation, the ſame letter in the ſame ſituation often aſſuming ſounds totally different in different words, it is impoſſible to eſtabliſh any general rules on this ſubject, which do not admit of many exceptions; therefore, a dictionary is the beſt means of aſcertaining and pointing out the proper pronunciation of words. For, if the writer firſt pointed out all the different ſounds that the ſame letter could ever be made to expreſs, and aſſigned to every particular ſound which each letter could be made to aſſume, a particular mark, which was appropriated to denote that particular ſound of the letter whenever it occurred; by placing theſe particular marks above the letters in the dictionary, the ſound of each letter would be pointed out in all caſes with the utmoſt certainty. It would be impoſſible for us to illuſtrate this by examples, without firſt aſcertaining all the ſounds of each letter; which would lead us into a diſcuſſion too long for this place; and this is at preſent the more unneceſſary, as the public have been long in expectation of a dictionary, by a very able hand, in which this particular will be attended to.

We ſhall only further obſerve, that, beſides having the accented ſyllable of every word *properly* diſtinguiſhed in a dictionary to aſſiſt in the pronunciation, the Engliſh language requires another eſſential improvement, *viz.* the uſe of accents to diſtinguiſh the meaning of *words* and *phraſes*; which, although it is not ſo properly confined to a lexicographer, yet it is not quite without his ſphere. Thus the word *as* admits of two very different ſounds, as well as different ſignifications: as in this example, "Cicero was nearly *as* eloquent *as* Demoſthenes:" in which the firſt *as* is pronounced *aſs*, and the laſt is pronounced *az*. Now, it often happens, that, in reading, the particular way in which it ought to be underſtood is not pointed out by the context, till after the word itſelf is pronounced, which has an equal chance at leaſt of being pronounced wrong; whereas, if it were always accented when employed in the one ſenſe, and not in the other, it would free the reader from this perplexity. There are other caſes in which the uſe of proper accents in writing would be of great conſequence; as at the beginning of a ſentence, when it was put as a queſtion, or uſed ironically, &c. the want of which every one muſt have obſerved. But as this does not ſo properly belong to the lexicographer as the grammarian, we ſhall here take no further notice of it.

The above examples, we hope, will be ſufficient to give the reader ſome idea of the plan that we would propoſe; and enable him to determine, whether or not a dictionary, executed upon this plan, would convey to his mind a more perfect knowledge of the Engliſh language, than thoſe dictionaries that have been hitherto publiſhed. Theſe examples were given rather with a view to ſhow the manner in which a work of this kind might be conducted, than as perfect and unexceptionable explanations of the ſeveral articles there enumerated; and therefore we did not think it neceſſary to produce any authorities, although we are ſenſible that they would be requiſite in a work of this kind.

DIDACTIC, ſignifies the manner of ſpeaking, or writing, adapted to teach or explain the nature of things. The word is formed from the Greek διδασκω, *doceo*, *I teach*. There are many words that are only uſed in the *didactic*, and dogmatic way: and there are many works, ancient and modern, both in proſe and verſe, written after this method; ſuch are the Georgics of Virgil, Lucretius's poem De Rerum Natura, and Pope's Eſſays on Criticiſm, and on Man, &c.

DIDELPHIS, or Oppossum, in tetrapodology; a genus of quadrupeds belonging to the order of feræ, the characters of which are theſe: they have ten fore-teeth in the upper jaw, and eight in the under one. The dog-teeth are long; the tongue is ſomewhat ciliated; and they have a pocket formed by a duplicature of the ſkin of the belly, in which the dugs are included. The tail of this animal has a diſagreeable appearance, looking like the body of a ſnake, and has the ſame prehenſile quality with that of ſome monkeys; the body is round and pretty thick, the legs ſhort: on the lower part of the belly of the female is a large pouch, in which the teats are lodged, and where the young ſhelter as ſoon as they are born. The length of the body is 16 or 17 inches; that of the tail 14. This creature inhabits many parts of America and the Eaſt Indies. It is very deſtructive to poultry, and ſucks the blood without eating the fleſh; it feeds alſo on roots and wild fruits, and is very active in climbing trees. It hunts eagerly after birds and their neſts; and will hang ſuſpended from the branches of a tree by its tail; then, by ſwinging its body, it will fling itſelf among the trees that grow in the neighbourhood. It walks very ſlow; and when purſued and overtaken, will feign itſelf dead. It is not eaſily killed, being as tenacious of life as a cat. When the female is about to bring forth, ſhe makes a thick neſt of dry graſs in ſome cloſe buſh at the foot of a tree: and brings four, five, or ſix, young at a time. As ſoon as the young are brought forth, they take ſhelter in the pouch or falſe belly; and faſten ſo cloſely to the teats, that they cannot be ſeparated without difficulty. They are blind, naked, and very ſmall, when new-born, and reſemble fetuſes: it is therefore neceſſary that they ſhould continue in that falſe-belly, till they attain proper ſtrength and ſight; and are prepared to undergo what may be called a *ſecond birth*. After this they run into the pouch as into an aſylum in time of danger; and the parent carries them about with her. During the time of this ſecond geſtation, the female ſhews an exceſſive attachment to her young, and will ſuffer any torture rather than allow this receptacle to be opened; for ſhe has the power of opening or cloſing it by the aſſiſtance of ſome very ſtrong muſcles. The fleſh of the old animal is very good, like that of a ſucking pig: the hair is dyed by the Indian women, and wove into garters and girdles; the ſkin is very fetid.

2. The Murina. 3. The Maxican Opoſſum. 4. The ſhort tailed Opoſſum. 5. The Opoſſum of Surinam. 6. The Dorſigera or Merian Opoſſum.

DIDYNAMIA, in botany, the fourteenth claſs of plants, whoſe flowers have two of their male parts or ſtamina of greater efficacy in the action of impregnation of the ſeeds than the other two: they are known by the efficacious ſtamina being always much longer than the others. The word is formed of the Greek δις, *twice*, and δυναμις, *power* or *efficacy*. Of this claſs of plants are baum, thyme, lavender, baſil. See Syſtem of BOTANY, Sect. V. and Plate V.

DIESIS, from διεμι, *I divide*, in muſic, a diviſion of a tone, leſſer than a ſemitone; or an interval conſiſting of a leſſer, or imperfect ſemitone.

DIESPITER, in antiquity, a name given to Jupiter.

DIET, in medicine, according to ſome, comprehends the whole regimen, or rule of life, with regard to the ſix non-naturals; air, meats, and drinks, ſleep, and watching, motion and reſt, paſſions of the mind, retentions and excretions. Others reſtrain the term of diet, to what regards eating and drinking, or ſolid aliments and drinks. The word is formed from the Greek διαιτα, which ſignifies *regimen*, or *rule of life*, preſcribed by phyſicians. See Syſtem of MEDICINE.

DIET *Drinks*, a form of phyſic, including all the medicated wines, wheys, and ales, uſed in chronic caſes. They require a courſe or continuance to anſwer any intention of moment. In acute caſes they are of no uſe; but where the diſorder of a conſtitution is gradually to be gained upon, much help may be had from them.

DIET, or DYET, an aſſembly of the ſtates or circles of the empire of Poland, to deliberate and concert meaſures for the public good. The general diet of the empire is ordinarily held at Ratiſbon. It conſiſts of the emperor in perſon, or by his repreſentative or commiſſary; the nine electors, three of whom are eccleſiaſtics, and the other ſix ſecular, forming the electoral college: the eccleſiaſtical princes, viz. archbiſhops, biſhops, abbots, and abbeſſes, and the ſecular princes, forming the ſecond college; and the repreſentatives of the imperial cities, who conſtitute the third college, and are divided into two benches, viz. that of Suabia and of the Rhine. This diet has been uſually ſummoned by the emperor, but there are ſome caſes in which the electors have ſummoned it without his conſent, or requeſted him to ſummon it. In the abſence of the emperor, the right of convocation belongs to the king of the Romans. The diet makes laws, raiſes taxes, determines differences between the ſeveral princes and ſtates, and relieves the ſubjects from the oppreſſions of their ſovereigns. The diets of the empire were originally the ſame with the aſſemblies of March and May, held by the kings of France: they met at leaſt once a year; and every freeman had a right to be preſent. Theſe were aſſemblies, in which the monarch deliberated with his ſubjects, concerning their common intereſt: but when the princes, dignified eccleſiaſtics, and barons, acquired territorial and independent juriſdiction, the diet became an aſſembly of the ſeparate ſtates, which formed an union, of which the emperor was the head. Robertſon's Hiſt. Charles V. vol. i. p. 462.

The term diet is alſo applied to the aſſembly of electors for the choice of an emperor or king of the Romans: this is uſually held at Frankfort on the Main. The general diet of Poland is by the laws only to be held every two years; but preſſing occaſions convene them every year.

There are likewiſe diets held at Switzerland; diets of the proteſtant cantons; diets of the catholic cantons; and general diets. The firſt aſſemble at Araw, and are convoked by the canton of Zurich; the ſecond at Lucern, convoked by the canton of that name; the third, compoſed of the deputies of all the cantons, both proteſtant and catholic, is held twice a year, at the end of June, and the beginning of December, and meets at Baden. It is the canton of Zurich which has the right of convening it.

DIEU *et mon droit*, q. d. *God and my right*, the motto of the arms of England, firſt given by king Richard I. to intimate, that he held not his empire in vaſſalage of any mortal. It was afterwards taken up by Edward III. when he firſt claimed the crown of France; and it was continued, without interruption, to the time of king William III. who uſed the motio *Je maintiendray*; though he commanded the former to be retained on the great ſeal. The ſame is to be underſtood of the late queen Anne, who uſed the motto, *Semper eadem*; which had been before uſed by queen Elizabeth. But ever ſince queen Anne, *Dieu et mon droit* continues to be the royal motto.

DIEXAHÆDRIA, in natural hiſtory, the name of a genus of ſpars. The word is derived from the Greek δις, *twice*, εξ, *ſix*, and εδρα, *ſide*. The bodies of this genus are ſpars, compoſed of twice ſix planes, being formed of two hexædral pyramids, joined baſe to baſe, without any intermediate column. Of this genus there are only two known ſpecies: 1. One with long, narrow, and ſharp pointed pyramids, found in Lamb's cave, on Mendip hills: and, 2. One with long, broad, and obtuſe pyramids: this is found in the mine of Goſſelar in Saxony, and in many of the mines of the Hartz Foreſt. Hill's Hiſt. of Foſſils, p. 213.

DIFFERENCE, in logic, an eſſential attribute belonging to ſome ſpecies, and not found in the genus; being the idea that defines the ſpecies.

Thus, body and ſpirit are the two ſpecies of ſubſtance, which in their ideas include ſomething more than is included in the idea of ſubſtance. In body, for inſtance, is found impenetrability, and extenſion; in ſpirit, a power of thinking, and reaſoning: ſo that the difference of body is impenetrable extenſion, and the difference of ſpirit is cogitation.

DIFFERENCE, in mathematics, the exceſs of one quantity above another. When a leſs quantity is ſubtracted from a greater, what remains is called the difference.

DIFFERENCES, in heraldry, certain additaments to coat-armour; whereby ſomething is altered, or added, to diſtinguiſh the younger families from the elder, or to ſhew how far they are removed from the principal houſe. They are called in Latin, *diminutiones*, and *diſcernicula armorum*; and by the French, *briſures*.

DIFFERENTIAL, *Differentiale*, in the higher geometry, an infinitely ſmall quantity, or a particle of quantity ſo ſmall as to be leſs than any aſſignable one. It is called a differential, or differential quantity, becauſe frequently conſidered as the difference of two quantities; and, as ſuch, it is the foundation of the differential calculus. Sir Iſaac Newton, and the Engliſh, call it a moment, as being conſidered, as the momentary increaſe of quantity. See FLUXIONS.

DIFFERENTIAL *Method*, in mathematics, an appellation given to a method of deſcribing a curve of the parabolic kind through any given number of points. See Syſtem of GEOMETRY.

DIFFRACTION, in optics, a term firſt uſed by Grimaldi the jeſuit, to denote that property of the rays of light, which others have called inflection; the diſcovery of which ſome attribute to Grimaldi, and others to Dr. Hooke.

DIFFUSE, an epithet applied to ſuch writings as are wrote in a prolix manner. Among hiſtorians, Salluſt is reckoned ſententious, and Livy diffuſe. Thus alſo among the orators, Demoſthenes is cloſe and conciſe; Cicero, on the other hand, is diffuſe.

DIFFUSION, from *diffundo*, *I pour out*, *I dilate*, the act whereby a body is ſpread, or ſtretched out, ſo as to take up more ſpace. The learned make three kinds of diffuſion: the firſt, that whereby a pure quality is diffuſed; as cold, force, &c. This they diſtinguiſh into equal, whereby equal portions, or degrees, of the quality are diſtributed upon equal parts of the medium; thus, when a direct motion is impreſſed on a moveable, all the parts of the moveable receive an equal impetus; and unequal, when unequal degrees of the quality, are diſtributed on different parts of the ſubject: thus it is, that force is impreſſed on a lever, and cold propagated through a medium. The ſecond kind of diffuſion is that performed by the motion of bodies; ſuch is the diffuſion of light, ſound, ſmell, magnetic, electric virtues, &c. The third is performed partly by the motion of corpuſcles, and partly by the diffuſion of a quality; and thus they hold fire to be diffuſed.

But the modern philoſophers reject the notion of qualities, and their diffuſion. According to them, there is no other diffuſion, but that of corporeal ſubſtance, emitted in minute effluvia, or particles, into a kind of atmoſphere all around the body; which diffuſion of corpuſcles ſome call atmoſpherical, as being ſuppoſed to be terminated by a circle, whereof the diffuſing body is the centre. Every body, it is now proved, has its ſphere of activity, or diffuſion, within which the particles, or corpuſcles, torn from it, and flying away, have a ſenſible effect; as we ſee in odorous, ſonorous, &c. bodies. See QUALITY, where the phyſical law of the diffuſion of qualities is laid down.

DIGASTRICUS, in anatomy, a muſcle of the lower jaw, thus called, as having a double belly. See Syſtem of ANATOMY, Part III. Sect. II.

DIGEST, methodical diſtribution or arrangement of any literary, a ſcientific ſubject.

DIGEST, *Digeſtum*, a collection of the Roman laws, ranged and digeſted under proper titles, by order of the emperor Juſtinian. That prince gave his chancellor Tribonianus a commiſſion for this purpoſe; who, in conſequence thereof, choſe ſixteen juriſconſulti, or lawyers, to work upon the ſame. Theſe, accordingly, took out the beſt and fineſt deciſions from the two thouſand volumes of the ancient juriſconſulti, and reduced them all into one body; which was publiſhed in the year 533, under the name of the digeſt. To this the emperor gave the force of a law, by a letter at the head of the work, which ſerves it as a preface. The digeſt makes the firſt part of the Roman law, and the firſt volume of the corpus, or body of the civil law, contained in fifty books. It was tranſlated into Greek under the ſame emperor, and called Pandecta.

Cujas ſays, that digeſt is a common name for all books diſpoſed in a good order and œconomy; and hence it is, that Tertullian calls the goſpel of St. Luke, a digeſt. Hence alſo abridgments of the common law are denominated digeſts of the numerous caſes, arguments, readings, pleadings, &c. diſperſed in the year-books, and other reports of the books of the law, reduced under proper heads, or common places. The firſt was that of Statham, which comes as low as Henry VI. That of Fitzherbert was publiſhed in 1516; Brook's in 1573, or which Hughes's, publiſhed in 1663, in a ſequel. Rolls, Danvers, and Nelſon, have alſo publiſhed digeſts or abridgments of this kind, including the caſes of later days; to which may be added the New Abridgement, and Viner's Abridgement.

DIGESTION, in medicine, that change of the food, taken in at the mouth, which it undergoes in the ſtomach, in order to afford fit matter to compoſe, or increaſe, an animal, till it arrives at its deſtined bulk; and to repair the loſs of thoſe particles which the body, in its natural ſtate, neceſſarily undergoes. The operation of digeſtion ſucceeds to maſtication, and deglutition. It includes chylification, and is ſucceeded by ſanguification, and nutrition.

Mr. John Hunter who has made ſeveral experiments on the digeſtion of the ſtomach after death; having obſerved that animals, or parts of animals, poſſeſſed of the living principle, when taken into the ſtomach, are not in the leaſt affected by the powers of that viſcus, whilſt the living principle remains; he ſhews, that the ſtomach when deprived of the living principle, is itſelf capable of being digeſted either by the digeſtive powers of other ſtomachs, or by the remains of that power which it had of digeſting other things. And hence it happens, that the ſtomachs of dead bodies are found diſſolved at their greater extremity, from their own natural digeſtive powers, and not in conſequence of any diſeaſe; appearances of this kind being moſt frequent in thoſe that have died violent deaths. This digeſtive power of the ſtomach was farther evinced in fiſh, which ſwallow their food whole, and ſwallow fiſh much larger than the digeſting part of the ſtomach can contain: the part lodged in the ſtomach was found more or leſs diſſolved, whilſt the part left in the œſophagus remained perfectly ſound; and the digeſting part of the ſtomach was itſelf, in many caſes, actually diſſolved.

From ſeveral facts of this kind, Mr. Hunter inferred, that the ſtomach, being dead, was no longer capable of reſiſting the power of that menſtruum, which itſelf had formed for the digeſtion of its contents; and that digeſtion is performed not by any mechanical power, nor contractions of the ſtomach or heart, but by ſomething ſecreted in the coats of the ſtomach, which is thrown into its cavity, and here animalizes the food, or aſſimilates it to the nature of the blood. Mr. Hunter has found in the ſtomachs of all animals, to which his obſervations or experiments have extended, an acid, but not a ſtrong one, in the juices contained in that viſcus in a natural ſtate. Phil. Tranſ. vol. lxii. art. 32. p. 447, &c. For a further account of this ſubject, ſee Syſtem of Anatomy, Sect. XIII.

Digestion, in chymiſtry, is a preparation of plants, minerals, metals, or other bodies, by putting them, with ſome proper fluid, in a veſſel, and heating them gradually over a gentle fire, like the heat of an animal body. Digeſtion is ordinarily confounded with maceration: but the two things differ, in that there is heat required to digeſtion; whereas maceration is done in the cold. Digeſtion is uſually performed with the addition of ſome menſtruum ſuitable to the matter: thus roſes and poppies heads are put to digeſt in oil, or water, to make unguents, and ſyrups; calcined lead, and ceruſs, are digeſted in diſtilled vinegar, to make the magiſtery thereof, or the ſal ſaturni. Hence Dr. Friend defines digeſtion to be the ſolution of bodies, made by menſtruums with the aſſiſtance of fire. The uſe of digeſtion in pharmacy, is to extract the more volatile particles, and mix them intimately with the menſtruum. Another great uſe of digeſtion is the duly preparing of the eſſence of mineral ſulphurs; the ſtony ſea-plants, which greatly reſemble the nature of foſſils, are alſo better treated by this proceſs than by any other. Tartariſed ſpirits of wine, receives a very high tincture from red coral, after a long digeſtion, in any diſtilled vegetable oil, though it will not in the common way be all at coloured by it. Phil. Tranſ. N° 87.

Digestion, in ſurgery, expreſſes a diſpoſition in abſceſſes to ripen and come to ſuppuration. Tumors, ariſing on the parotides of children, are of eaſy digeſtion: they ripen in a little time.

DIGESTIVE is alſo uſed, in medicine, for ſuch remedies as ſtrengthen and increaſe the tone of the ſtomach, and aſſiſt in the digeſtion of foods. To this claſs belong all ſtomachics and ſtrengtheners, or corroborants.

Digestive, in ſurgery, denotes a ſort of unguent, plaſter, or the like, that ripens and prepares the matter of wounds, &c. for ſuppuration. The common digeſtive is compoſed of turpentine, yolk of eggs, oil of St. John's wort, unguentum buſilicum, and tincture of aloes.

DIGGING, in mineralogy, a term appropriated by the miners to expreſs that penetrating into the earth, where they have the ore, before them, and every ſtroke of the tools turns to account. They appropriated the word to this ſenſe, expreſſing the random openings, which they make in ſearch of mines, by the word *hatching*, or *eſſay-hatching*.

DIGIT, in aſtronomy, is the meaſure whereby we eſtimate eclipſes: amounting to the twelfth part of the diameter of the luminary eclipſed. The diameter of the body, or diſk, of the ſun or moon, is divided into twelve parts, called *digits*; and an eclipſe is ſaid to be of ten *digits*, when ten of thoſe parts are hid.

Digit, in arithmetic, ſignifies an integer, or number, under ten; as 1, 2, 3, 4, 5, 6, 7, 8, 9.

Digit is alſo a meaſure taken from the breadth of the finger. A digit is properly three-fourths of an inch, and equivalent to four grains of barley, laid breadth-wiſe, ſo as to touch each other.

DIGITALIS, fox glove, a genus of the angioſpermia order, belonging to the didynamia claſs of plants. There are ſix ſpecies, five of which are hardy, herbaceous, biennial and perennial plants, and the ſixth a tender, ſhrubby exotic. See Syſtem of Botany, Plate V.

DIGITATED *Leaf*, among botaniſts. See Syſtem of Botany, Sect. IV. Plate I. *Fig.* 66.

DIGLYPH, from δις, *twice*, and γλυφω, *I engrave*, a kind of imperfect triglyph, conſole, or the like, with only two channels, or engravings, inſtead of three. See Triglyph.

DIGNITARY, in the canon law, a perſon who holds a dignity, that is a benefice which gives him ſome pre-eminence, above mere prieſts and canons. Such is a biſhop, dean, archdeacon, prebendary, &c.

DIGNITY, in its moſt uſual acceptation, ſignifies honour and authority, reputation, &c. and dignity may be divided into ſuperior and inferior; as the titles of duke, earl, baron, &c. are the higheſt names of dignity; and thoſe of baronet, knight, ſerjeant at law, &c. the loweſt. Nobility only can give ſo high a name of dignity, as to ſupply the want of a ſurname in legal proceedings; and as the omiſſion of a name of dignity may be pleaded in abatement of a writ, &c. ſo it may be where a peer who has more than one name of dignity, is not named by the moſt noble. 2 Hawk. P. C. 185, 230. No temporal dignity of any foreign nation can give a man a higher title than that of eſquire. 2 Inſt. 667.

Dignity, in the human character, the oppoſite of meanneſs. Man is endued with a ſenſe of the worth and excellence of his nature: he deems it more perfect than that of the other beings around him; and he perceives that the perfection of his nature conſiſts in the virtues of univerſal benevolence. To expreſs that ſenſe, the term dignity is appropriated. Further, to behave with dignity, and to refrain from all mean actions, is felt to be, not a virtue only, but a duty: it is a duty every man owes to himſelf. By acting in that manner, he attracts love and eſteem: by acting meanly, or below himſelf, he is diſapproved and contemned. This ſenſe of the dignity of human nature, reaches even our pleaſures and amuſements. If they enlarge the mind by raiſing grand or elevated emotions, or if they humanize the mind by exerciſing our ſympathy, they are approved as ſuited to the dignity of our nature: if they contract the mind by fixing it on trivial objects, they are contemned as not ſuited to the dignity of our nature.

This leads us to examine more directly emotions and paſſions with reſpect to the preſent ſubject: and it will not be difficult to form a ſcale of them, beginning with the meaneſt, and aſcending gradually to thoſe of the higheſt rank and dignity. Pleaſure felt as at the organ of ſenſe, named corporeal pleaſure, is perceived to be low; and when indulged to exceſs, is perceived alſo to be mean: for that reaſon, perſons of any delicacy diſſemble the pleaſure they take in eating and drinking. The pleaſures of the eye and ear, having no organic feeling, and being free from any ſenſe of meanneſs, are indulged without any ſhame: they even riſe to a certain degree of dignity when their objects are grand or elevated. Sympathetic diſtreſs is never mean: on the contrary, it is agreeable to the nature of a ſocial being, and has general approbation. The rank that love poſſeſſes in the ſcale, depends in a great meaſure on its object; it poſſeſſes a low place when founded on external properties merely; and is mean when beſtowed on a perſon of inferior rank without any extraordinary qualification: but when founded on the more elevated internal properties, it aſſumes a conſiderable degree of dignity. The ſame is the caſe of friendſhip. When gratitude is warm, it animates the mind; but it ſcarce riſes to dignity. Joy beſtows dignity when it proceeds from an elevated cauſe.

Revenge, though it enflame and ſwell the mind, is not accompanied with dignity, not even with elevation: it is not however felt as mean or groveling, unleſs when it takes indirect meaſures for gratification. Shame and remorſe, though they ſink the ſpirits, are not mean. Pride, a diſagreeable paſſion, beſtows no dignity in the eye of a ſpectator. Vanity always appears mean; and extremely ſo where founded, as commonly happens, on trivial qualifications.

We proceed to the pleaſures of the underſtanding, which poſſeſs a high rank in point of dignity. Of this every one will be ſenſible, when he conſiders the important truths that have been laid open by ſcience; ſuch as general theorems, and the general laws that govern the material and moral worlds. The pleaſures of the underſtanding are ſuited to man as a rational and contemplative being, and they tend not a little to ennoble his nature; even to the Deity he ſtretcheth his contemplations, which in the diſcovery of infinite power, wiſdom, and benevolence, afford delight of the moſt exalted kind. Hence it appears, that the fine arts, ſtudied as a rational ſcience, afford entertainment of great dignity; ſuperior far to what they afford as a ſubject of taſte merely.

But contemplation, however in itſelf valuable, is chiefly reſpected as ſubſervient to action; for man is intended to be more an active than a contemplative being. He accordingly ſhows more dignity in action than in contemplation: generoſity, magnanimity, heroiſm, raiſe his character to the higheſt pitch: theſe beſt expreſs the dignity of his nature, and advance him nearer to divinity than any other of his attributes.

Having endeavoured to aſſign the efficient cauſe of dignity and meanneſs, by unfolding the principle on which they are founded, we proceed to explain the final cauſe of dignity or meanneſs beſtowed upon the ſeveral particulars above-mentioned, beginning with corporeal pleaſures. Theſe, as far as uſeful, are, like juſtice, fenced with ſufficient ſanctions to prevent their being neglected: hunger and thirſt are painful ſenſations; and we are incited to animal love by a vigorous propenſity: were corporeal pleaſures dignified over and above with a place in a high claſs, they would infallibly overturn the balance of the mind, by outweighing the ſocial affections.

The more refined pleaſures of external ſenſe, conveyed by the eye and the ear from natural objects and from the fine arts, deſerve a high place in our eſteem, becauſe of their ſingular and extenſive utility: in ſome caſes they riſe to a conſiderable dignity: and the very loweſt pleaſures of the kind are never eſteemed mean or groveling. Pleaſures ariſing from wit, humour, ridicule, or from what is ſimply ludicrous, is uſeful, by relaxing the mind after the fatigue of more manly occupation: but the mind, when it ſurrenders itſelf to pleaſure of that kind, loſes its vigour, and ſinks gradually into ſloth. As all valuable improvements proceed from the exerciſe of our rational faculties, the author of our nature, in order to excite us to a due uſe of theſe faculties, hath aſſigned a high rank to the pleaſures of the underſtanding: their utility, with reſpect to this life as well as a future, intitles them to that rank.

But as action is the aim of all our improvements, virtuous actions juſtly poſſeſs the higheſt of all the ranks. Theſe, we find, are by nature diſtributed into different claſſes, and the firſt in point of dignity aſſigned to actions that appear not the firſt in point of uſe: generoſity, for example, in the ſenſe of mankind is more reſpected than juſtice, though the latter is undoubtedly more eſſential to ſociety; and magnanimity, heroiſm, undaunted courage, riſe ſtill higher in our eſteem.

Dignity, in oratory, is one of the three parts of general elocution, and conſiſts in the right uſe of tropes and figures.

DIGRESSION, in oratory, is defined by Quintilian, agreeably to the etymology of the word, to be a going off from the ſubject we are upon to ſome different thing, which, however, may be of ſervice to it. Inſt. Or. lib. iv. cap. 3.

Digreſſion is not a neceſſary part of a diſcourſe, though it may ſometimes be convenient on ſeveral accounts; as were a ſubject is of itſelf flat and dry, and requires cloſe attention; in this caſe it is of uſe to relieve the mind by ſomething agreeable and entertaining. But as it ſhould never be introduced without ſufficient reaſon, it ſhould never be too frequent, nor too long. Ward's Or. vol. i. p. 283. &c.

DIGYNIA, in the Linnæan ſyſtem of botany, the ſecond order of the 8th claſs of plants, called oxtandria. The term is derived from δις, *double*, and γυνη, *wife*. See Syſtem of Botany. Sect. V. Plate IV.

DIJAMBUS, in poetry, the foot of a Latin verſe of four ſyllables; it is compounded of two iambics, as *ſĕvērĭtās*.

DIKE, a ditch, or drain, made for the paſſage of waters. The word ſeems formed from the verb, *to dig*; though others chooſe to derive it from the Dutch, *diik*, a *dam*, *ſea bank*, or *wall*.

Dike, or **Dyke**, alſo denotes a work of ſtone, timber, or faſcines, raiſed to oppoſe the entrance, or paſſage of the waters of the ſea, a river, lake, or the like. The word comes from the Flemiſh *dyk*, or *diik*, a heap of earth to bound or ſtem the water. Junius and Menage, take the Flemiſh to have borrowed their word from the Greek τειχος, *wall*. Guichard derives it from the Hebrew *daghah*. Theſe dikes are uſually elevations of earth, with hurdles or ſtakes, ſtones, and other matters. The dike of Rochelle is made with veſſels faſtened to the bottom. The dikes of Holland are frequently broke through, and large tracts of land are then drowned.

DILAPIDATION, a waſteful deſtroying, or letting buildings run to ruin and decay, for want of neceſſary reparation. An action lies for dilapidations, either in the ſpiritual court by the canon law, or in the courts of common law; and it may be brought by the ſucceſſor againſt the predeceſſor, if living, or, if dead, againſt his executors. The money recovered for dilapidation, by 14 Eliz. 11, muſt be employed in the repair of the ſame houſes, within two years, on penalty of forfeiting double the value to the crown.

DILATATION, in phyſics, a motion of the parts of a body, whereby it expands or opens itſelf ſo as to occupy a greater ſpace. The generality of authors confound dilatation with rarefaction; but the more accurate, diſtinguiſh between them; defining dilatation to be the expanſion of a body, into a greater bulk, by its own elaſtic power; and rarefaction, the like expanſion produced by means of heat.

Dilatation, in ſurgery, denotes the laying open any orifice, or the lips of a wound, wider; or the extenſion of any veſſel, or the like. This is done by an inſtrument called a dilatatorium.

DILATATOR *Poſticus Urethræ*, in anatomy, a name given by Heiſter, and ſome others, to what is ſuppoſed to be a peculiar muſcle by many, and called alſo *levator ſextus ani*, and by ſome other names, though it is really only a proceſs of the ſphincter ani running into the perinæum.

DILATATORES *Alæ Naſi*, called alſo *Rinæi Naſales*, in anatomy, a pair of muſcles common to the *alæ naſi*, and upper lip. They ariſe thin, broad, and fleſhy, from the cheek bones under the orbits of the eyes, and deſcend obliquely with a two fold order of fleſhy fibres in each muſcle; which partly terminate in the upper lip, and partly in the *alæ naſi*. They draw the *alæ* from each other, and widen the external openings of the noſtrils. See Syſtem of Anatomy, Sect. IX.

DILATORY *Pleas*, in law, are ſuch as are put in merely for delay; and there may be a demurrer to a dilatory plea, or the defendant ſhall be ordered to plead better, &c. 6 Mod. The truth of dilatory pleas is to be made out by affidavit of the fact, &c. by ſtat. 4 and 5 Anne.

DILEMMA, Διλεμμα, in logic, an argument conſiſting of two, or more propoſitions, ſo diſpoſed, that grant which you will of them, you will be preſſed by the concluſion. The word is from the Greek δις, *bis*, *twice*, and λεμμα, *ſumptio*.

DILL, anethum, in botany, a genus of the digynia order, belonging to the petandria claſs of plants. See Anethum.

DILUTE. To dilute a body, is to render it liquid; or, if it were liquid before, to render it more ſo, by the addition of a thinner thereto. Thoſe things thus added, are called *diluents* or *dilutors*.

DIMENSION, the extenſion of a body, conſidered as meaſurable. Hence as we conceive a body extended, and meaſurable in length, breadth, and depth, we conceive a *trine dimenſion*, viz. length, breadth, and thickneſs. The firſt called a *line*, the ſecond a *ſurface*, the third a *ſolid*.

Dimension is particularly uſed with regard to the powers of the roots, or values of the unknown quantities of equations, which are called the dimenſions of thoſe roots. See Syſtem of Algebra, Sect. V.

DIMINUTION, in architecture, a contraction of the upper part of a column, whereby its diameter is made leſs than that of the lower part. To attain thoſe two important points in architecture, ſtrength and the appearance of ſtrength, all architects have made their columns leſſer above than below, which is called their diminution. See Syſtem of Architecture, on the order of Architecture in general.

Diminution, in rhetoric, the augmenting and exaggerating what you have to ſay, by an expreſſion that ſeems to weaken and diminiſh it. As for inſtance, when a man ſays, with a certain tone, this woman is not ugly; meaning, ſhe is very handſome. Some authors take diminution in a ſtricter ſenſe, viz. for ſaying leſs than a man really means; as You are not, indeed, to be commended; where a greater reproach is ſecretly meant.

DIMINUTIVE, in grammar, a word formed from ſome other, to ſoften or diminiſh the force and effect thereof; or to ſignify a thing that is little in its kind. Thus cellule is a diminutive of cell, globule, of globe; hillock, of hill, &c.

DIMISSORY *Letters*, *Literæ Dimiſſoriæ*, in the canon law, a letter given by a biſhop to a candidate for holy orders, having a title in his dioceſe, directed to ſome other biſhop, and giving leave for the bearer to be ordained by him. When a perſon produces letters of ordination, or tonſure, conferred by any other than his own dioceſan, he muſt at the ſame time produce the letters dimiſſory, given by his own biſhop, on pain of nullity. Letters dimiſſory cannot be given by the chapter, *ſede vacante*; this being deemed an act of voluntary juriſdiction, which ought to be reſerved to the ſucceſſor.

DINNER, the great meal, or that taken about the middle of the day. The word is formed from the French *diſner*, which Du Cange derives from the barbarous Latin *diſnare*. Henry Stephens derives it from the Greek δειπνειν; and will have it wrote *dipner*. Menage deduces it from the Italian *deſinare*, *to dine*; and that from the Latin *deſinere*, *to leave off work*. The grand Tartar, emperor of China, after he has dined, makes publication by his heralds, that he gives leave for all the other kings and potentates of the earth, to go to dinner; as if they waited for his leave. In the general, it is agreed to be the moſt ſalutary to make a ſpare ſupper, and to eat the more plentifully at dinner, eſpecially for tender, valetudinary people. This is the ſentiment of the Schola Salernitana.

Ex magna cœna ſtomocho fit maxima pœna;
Ut ſis nocte levis, ſit tibi cœna brevis.

The Romans, we are aſſured, never minded dinner; but deferred their good cheer to the evening, which they made their grand meal.

DIOCESE, or **Diocess**, the circuit or extent of the juriſdiction of a biſhop. See **Bishop**.

The word is formed from the Greek διοκησις, *government, adminiſtration*, formed of διοικεω, which the ancient gloſſaries render *adminiſtro, moderor, ordino*: hence διοικησις της πολεως, the *adminiſtration* or *government of a city*.

Diocese is alſo uſed, in ancient authors, &c. for the province of a metropolitan.

Diocæſis, Διοικεσις, was originally a civil government, or prefecture, compoſed of divers provinces. The firſt diviſion of the empire into dioceſes is aſcribed to Conſtantine, who diſtributed the whole Roman ſtate into four, viz. the dioceſe of Italy, the dioceſe of Illyria, that of the Eaſt, and that of Africa. And yet, long time before Conſtantine, Strabo, who wrote under Tiberius, take noticee, lib. xiii. p. 432, that the Romans had divided Aſia into dioceſes, and complains of the confuſion ſuch a diviſion occaſioned in geography; Aſia being no longer divided by people, but by dioceſes, each whereof had a tribunal, or court, where juſtice was adminiſtered. Conſtantine, then, was only the inſtitutor of thoſe large dioceſes, which comprehended ſeveral metropoles and governments; the former dioceſes only comprehending one juriſdiction, or diſtrict, or the country that had reſort to one judge, as appears from this paſſage in Strabo, and, before Strabo, from Cicero himſelf, lib. iii. Epiſt. ad Famil. Ep. 9. and lib. xiii. Ep. 67. Thus, at firſt, a province included divers dioceſes, and afterwards a dioceſe came to compriſe divers provinces. In after-times the Roman empire became divided into thirteen dioceſes, or prefectures; though, including Rome, and the ſub-urbicary regions, there were fourteen. Theſe fourteen dioceſes comprehended a hundred and twenty provinces; each province had a pro-conſul, who reſided in the capital, or metropolis; and each dioceſe of the empire had a conſul, who reſided in the principal city of the diſtrict. On this civil conſtitution the eccleſiaſtical one was afterwards regulated; each dioceſe had an eccleſiaſtical vicar, or primate, who judged finally of all the concerns of the church within his territory. At preſent there is ſome farther alteration; for dioceſe does not now ſignify an aſſemblage of divers provinces, but is limited to a ſingle province, under a metropolitan, or even to the ſingle juriſdiction of a biſhop.

England, with regard to its eccleſiaſtical ſtate, is divided into two provinces, viz. Canterbury and York; the former province contains twenty-one dioceſes, and the latter three, beſides the biſhopric of the iſle of Man, which was annexed to the province of York by Henry VIII. Every dioceſe is divided into archdeaconries; and each archdeaconry into rural deanries; and every deanry into pariſhes.

DIODIA, in botany, the name of a genus of the monogynia order of the tetrandia claſs of plants. There is but one ſpecies, See Plate IV. in the Syſtem of **Botany**.

DIODON, or **Sun Fish**, in ichthyology, a genus belonging to the order of amphibia nantes. There are three ſpecies, 1. The oblong ſun fiſh grows to a great bulk: one examined by Sylvianus was above 100 pound in weight; and Dr. Borlaſe mentions another taken at Plymouth in 1734, that weighed 500. In form it reſembles a bream or ſome deep fiſh.

When boiled, it has been obſerved to turn into a glutinous jelly, reſembling boiled ſtarch when cold, and ſerved the purpoſes of glue on being tried on paper and leather. The meat of this fiſh is uncommonly rank: it feeds on ſhell fiſh.

2. The mola or ſhort ſun fiſh, differs from the former, in being much ſhorter and deeper. The back and the anal fins are higher, and the aperture to the gills not ſemilunar, but oval. The ſituation of the fins are the ſame in both. Both kinds are taken on the weſtern coaſts of this kingdom, but in much greater numbers in the warmer parts of Europe.

3. The levigatus, or globe, is common to Europe and South Carolina. As yet only a ſingle ſpecimen has been diſcovered in our ſeas; taken at Penzance, in Cornwall.

DIOECIA, (from δις, *twice*, and οικια, a *houſe* or *habitation*) two houſes. The name of the 22d claſs in Linnæus's ſexual method, conſiſting of plants, which having no hermaphrodite flowers, produce male and female flowers on ſeparate roots. See Syſtem of **Botany**, Sect. V. Plate VI.

DIOMEDIA, in ornithology, a genus belonging to the order of anſeres. The bill is ſtrait; the ſuperior mandible is crooked at the point, and the lower one is truncated; the noſtrils are oval, open, a little prominent, and placed on the ſides. There are two ſpecies, viz. 1. The exulans, has pennated wings, and three toes an each foot. It is the albatros of Edwards; and is found in the ocean betwixt the tropics, and at the Cape of Good Hope. It flies pretty high, feeds upon flying fiſh, and is about the ſize of a pelican. 2. The demerſa, has no quill feathers on the wings; and the feet have four toes, connected together by a membrane. It is the black penguin of Edwards, about the ſize of a gooſe, and is found at the Cape of Good Hope. See Synoptical table in Syſtem of **Ornithology**.

DIONÆA Muscipula, or *Venus's Fly Trap*, in botany, a newly diſcovered ſenſitive plant.

Every one ſkilled in natural hiſtory knows, that the minoſæ, or ſenſitive plants, cloſe their leaves, and bend their joints, upon the leaſt touch: and this has aſtoniſhed us; but no end or deſign of nature has yet appeared to us from theſe ſurpriſing motions: they ſoon recover themſelves again, and their leaves are expanded as before. But the plant we are now going to deſcribe, ſhews that nature may have ſome view towards its nouriſhment, in forming the upper joint of its leaf like a machine to catch food: upon the middle of this, lies the bait for the unhappy inſect that becomes its prey. Many minute red glands that cover its inner ſurface, and which perhaps diſcharge ſome ſweet liquor, tempt the poor animal to taſte them; and the inſtant theſe tender parts are irritated by its feet, the two lobes riſe up, graſp it faſt, lock the two rows of ſpines together, and ſqueeze it to death. And further, leſt the ſtrong efforts for life, in the creatures thus taken, ſhould ſerve to diſengage it, three ſmall erect ſpines are fixed near the middle of each lobe among the glands, that effectually put an end to all its ſtruggles. Nor do the lobes ever open again, while the dead animal continues there. But it is nevertheleſs certain, that the plant cannot diſtinguiſh an animal from a mineral ſubſtance; for, if we introduce a ſtraw or a pin between the lobes, it will graſp it full as faſt as if it was an inſect. The plant is one of the monogynia order, belonging to the decandria claſs. It grows in America, about 35 deg. N. Lat. in wet ſhady places, and flowers in July and Auguſt. See Syſtem of **Botany**, Plate IV.

The ſoil in which it grows, as appears from what comes about the roots of the plants when they are brought over, is a black, light, mould, intermixed with white ſand, ſuch as is uſually found in our mooriſh heaths. Its ſenſitive quality will be found in proportion to the heat of the weather as well as the vigour of the plant. In order to try further experiments on its ſenſitive power, ſome of the plants might be placed in pots of light mooriſh earth and placed in pans of water, in an airy ſtove in ſummer; where the heat of ſuch a ſituation being like that of its native country will make it ſurpriſingly active.

DIOPTRICS, the doctrine of refracted viſion, called alſo anaclaſtics. The word is originally Greek, formed of δια, *per, through*, and οπτομαι, *I ſee*. Dioptrics is properly the third branch of optics, its office being to conſider and to explain the effects of light refracted by paſſing through different mediums, as air, water, glaſs, &c. and eſpecially lenſes. For a full deſcription of this branch of Optics, ſee the Syſtem.

DIORTHOSIS, διορθωσις, in ſurgery, an operation, by which crooked or diſtorted members are made even, and reſtored to their primitive and regular ſhape.

DIOSCOREA, in botany, a genus of the hexandria order, belonging to the diœcia claſs of plants, for which there is no Engliſh name. There are eight ſpecies, of which the only remarkable one is the bulbifera or yam; for the claſs and order, ſee Syſtem of **Botany**, Sect. V. Plate VI.

DIOSPYROS, the Indian date plum, a genus of the diœcia order belonging to the polygamia claſs of plants. There are two ſpecies. For the claſs and order, ſee Syſtem of **Botany**, Plate VI.

DIPHTHONG, διφθογγος, in grammar, a double vowel, or the union, or mixture, of two vowels pronounced together, ſo as only to make one ſyllable; as (1) the Latin *ae*, or *æ*; *oe*, or *œ*; (2) the Greek *αι*, *ει*; (3) the Engliſh *ai*, *au*; &c. The word is Greek, and is compounded of δις, *twice*, and φθογγος, *ſound*. See **Grammar**.

DIPLOE, from διπλοος, *double*, in anatomy, a ſpongy, medullary ſubſtance, ſeparating the two tables of the cranium, and together with them conſtituting the ſkull.

DIPLOMA, from διπλοος, *double*, an inſtrument given by colleges and ſocieties, on taking a degree, on paſſing examination, as a proof or qualification for any advancement to title, or pre-eminence, or introduction to the exerciſe of a profeſſion.

DIPPING, in mineralogy, a term uſed to expreſs the deviation of the veins of ore, from that regular and ſtraight line in which they uſually run.

Dipping *Needle*, *or Inclinatory Needle*, a magnetical needle, ſo hung, as that, inſtead of playing horizontally, and pointing out north and ſouth, one end dips, or inclines to the horizon, and the other points to a certain degree of elevation above it; ſee **Needle**.

DIPSACUS, teazel; a genus of the monogynia order, belonging to the tetrandia claſs of plants. There are four ſpecies, the moſt remarkable of which is the carduus fullonum, which grows wild in many parts of England. It is of ſingular uſe in raiſing the knap upon woollen cloth. For this purpoſe, the heads are fixed round the circumference of a large broad wheel, which is made to turn round, and the cloth is held againſt them. In the weſt of England, great quantities of the plant are cultivated for the uſe juſt now mentioned. It is propagated by ſowing the ſeeds in March, upon a ſoil that is well prepared. See Syſtem of **Botany**, Sect. V. Plate IV.

DIPSAS, a ſort of ſerpent, the biting whereof produces ſuch a thirſt as proves mortal; whence it is called *dipſas*; which in Greek ſignifies *thirſty*. In Latin it is called *ſitula*, a *pail*. Moſes ſpeaks of it in Deut. viii. 15.

The Hebrew word *tzimaon* anſwers very well to the Greek *dipſas*, and expreſſes the thirſt occaſioned by the biting of this ſerpent. Some by the Hebrew *tzimaon* underſtand a deſart, or dry place.

DIPTERA, from δις, and πτερον, *wing*, in entomology, an order of inſects, which have only two wings, and under each wing a ſtyle or oblong body, terminated by a protuberance or head, and called a balancer.

DIPTOTES, from δις, and πτωτος, of πιπτω, *cado*, in grammar, a kind of irregular nouns, having only two caſes; as *fors*, *forte*.

DIRECT, in arithmetic. The *Rule of Three* Direct is that oppoſite to the inverſe.

Direct, in aſtronomy. We conſider the planets in three ſtates; viz. direct, ſtationary, and retrograde. They are ſaid to be direct, when they appear to move forward, according to the ſucceſſion of the ſigns; and retrograde, when they go the contrary way.

Direct, in matters of genealogy, is underſtood of the principal line, or the line of aſcendants and deſcendants: in contradiſtinction to the collateral lines. Thus the houſe of Bourbon is ſaid to deſcend in a direct line from St. Louis. The heirs in a direct line always precede thoſe in the collateral line.

A very good hiſtorian uſes the phraſe Direct *Speech*, or *Harangue*, when he introduces any one ſpeaking, or haranguing of himſelf: when the hiſtorian ſpeaks, and only rehearſes the chief points of what was delivered by the ſpeaker, it is called an *indirect ſpeech*.

Direct $\left\{\begin{matrix}\textit{Erect}\\ \textit{Eaſt}\\ \textit{Weſt}\end{matrix}\right\}$ *Dials*, are thoſe whoſe planes lie directly open to the eaſt or weſt points of the heavens, or parallel to the meridian of the place.

Direct *South* or *North* $\left\{\begin{matrix}\textit{Inclining}\\ \textit{Reclining}\end{matrix}\right\}$ *Dials*. See Treatiſe on Dialling, Sections VI. and VII.

Direct, in muſic, is a mark ſet at the end of a ſtaff, eſpecially at the foot of a page upon that line or ſpace where the firſt notes of the next ſtaff is ſet.

Direct, in optics. Direct viſion is that performed by direct rays; in contradiſtinction to viſion by refracted or reflected rays. Direct viſion is the ſubject of optics, which preſcribes the laws and rules thereof.

Direct *Rays* are thoſe which paſs in right lines from the luminary to the eye, without being turned out of their rectilinear direction by any intermediate body, either opaque or pellucid. See Syſtem of Optics.

Direct *Sphere*. See Right *Sphere*.

DIRECTION, in aſtronomy, the motion, and other phenomina, of a planet, when direct.

Direction, or *Line of* Direction, in mechanics, is particularly uſed for a line paſſing from the centre of the earth through the centre of gravity of a body, and the ſupport or fulcrum that bears it. A man muſt neceſſarily fall down as ſoon as the centre of his gravity is out of the *line of direction*.

Line of Direction, in mechanics, alſo denotes that wherein a body moves, or endeavours to proceed.

Angle of Direction, in mechanics, is that comprehended between the lines of direction of two conſpiring powers.

Quantity of Direction, in mechanics, is uſed for the product of the velocity of the common centre of gravity in a ſyſtem of bodies, by the ſum of their maſſes. In the colliſion of bodies, the quantity of direction is the ſame before, and after the impulſe. Bernouilli, Diſcours ſur le Movement. Oper. tom. iii. p. 32, and 56.

Direction *of the Load Stone*, that property whereby the magnet, or a needle touched by it, always preſents one of its ends towards one of the poles of the world, and the oppoſite end to the other pole. The attractive property of the magnet was known long before its directive; and the directive long before the inclinatory.

Magnetical Direction, is alſo uſed in the general for the tendency, or turning of our earth, and all magnetical bodies, to certain points. The direction of a load ſtone denotes its polarity.

DIRECTLY. In geometry, we ſay, two lines lie directly againſt each other, when they are parts of the ſame right line. In mechanics, a body is ſaid to ſtrike, or impinge directly againſt another, if it ſtrike in a right line perpendicular to the point of contact. A ſphere, particularly, ſtrikes directly againſt another when the line of direction paſſes through both their centres.

DIRECTOR, in commercial polity, a perſon who has the management of the affairs of a trading company: thus we ſay, the directors of the India Company, South-ſea Company, &c.

Director, in ſurgery, a grooved probe, to direct the edge of the knife or ſciſſars in opening ſinuſes or fiſtulas, that, by this means, the ſubjacent veſſels, nerves, and tendons, may remain unhurt.

DIS, an inſeparable particle prefixed to divers words; the effect whereof is, either to give them a ſignification contrary to what the ſimple words had: as in *diſgrace*, *diſparity*, *diſproportion*, &c. or to intimate a ſeparation, detachment, diſtribution, &c. as in *diſcerning*, *diſcourſing*, *diſtracting*, *diſpoſing*, &c.

DISABILITY, in law, is when a man is made incapable to inherit lands, or take any benefit, which otherwiſe he might do; which may happen four ways; viz. by the act of the anceſtor; by the act of the party; by the act of law; and by the act of God.

Disability *by the Act of the Anceſtor*, is where the man is attainted of treaſon, or felony; by which attainder his blood is corrupted, and thereby himſelf and his children are diſabled to inherit.

Disability *by the Act of the Party himſelf*, is where a man binds himſelf by obligation, that upon a ſurrender of a leaſe, he will grant a new eſtate to the leſſee; and afterwards he grants the reverſion to another, which puts it out of his power to perform it.

Disability *by the Act of the Law*, is when a man, by the ſole act of law, without any thing by him done, is rendered incapable of the benefit of the law: as, an alien born; ſo that if a man born out of the king's liegeance, will ſue an action, the tenant, or defendant, may ſay, he was born in ſuch a country out of the king's liegeance, and demand judgment, if he ſhall be anſwered; for the law is our birth-right, to which an alien is a ſtranger, and therefore diſabled from taking any benefit thereby.

Disability *by the Act of God*, is when the party is *non compos mentis*, or *non ſanæ memoriæ*, which ſo diſables him, that in all caſes, where he gives, or paſſes any thing, or eſtate from him, after his death it may be annulled, and avoided. There are alſo other diſabilities by the common law, as of idiocy, infancy, and coverture, for making of grants, &c. and by ſtatute, as papiſts are diſabled for making any preſentation to a church, &c. and officers not taking the oaths for holding offices.

DISABLED, in ſea language, is applied to a ſhip, when by the loſs of her maſts, yards, or rigging, or other damage, ſhe is rendered incapable of proſecuting her voyage, without great difficulty and danger.

DISARMING, the act of depriving a perſon of the uſe or poſſeſſion of arms. On the concluſion of a peace, it is uſual for both ſides to diſarm. We have divers laws for diſarming papiſts, and all recuſants. Under king George I. a law was made for diſarming the highlanders; none of whom, except peers, or gentlemen of 400l. per annum, are to wear any arms in the field, on the road, or at market. 1 Geo. I. ſtat. 2. cap. 54. The game law has, in effect, diſarmed all the common people of England, having under 100l. a year in landed eſtate, except the ſervants of lords of manors. Yet, by the ancient policy of England, the whole nation was obliged to bear arms.

DISC, or Disk, in aſtronomy, the body and face of the ſun and moon, ſuch as it appears to us on the earth; or the body and face of the earth, ſuch as it appears to a ſpectator in the moon. See Syſtem of Astronomy, Sect. VIII.

Disc, in optics, is the width of the aperture of teleſcopic glaſſes, whatever their form be, whether plain, convex, concave, &c. See account of Teleſcopes, in Syſtem of Optics.

DISCERNING, an act of the mind, whereby it diſtinguiſhes between ideas. See Metaphysics.

DISCHARGE, in military language, is the diſmiſſion of a ſoldier from the troop or company to which he belonged, either by his own requeſt, or when after long and faithful ſervice, he is entitled to his majeſty's bounty.

To Discharge, in ſea language, ſignifies to unload a ſhip, or take out her ſtores, ammunition, artillery, &c. When applied to the crew, it implies to diſband them from immediate ſervice.

DISCHARGER, or Discharging *Rod*, in electricity. See Syſtem of Electricity, Plate II. *Fig*. 25.

DISCIPLE, from *diſco*, *I learn*, one who learns any thing from another. Thus the followers of any teacher, philoſopher, &c. are called diſciples. In the Chriſtian ſenſe, they were the followers of Jeſus Chriſt, in general; but in a more reſtrained ſenſe, the diſciples denote thoſe alone who were the immediate followers and attendants on his perſon; of which there were 70 or 72. The names diſciple and apoſtle are often ſynonymouſly uſed in the goſpel hiſtory; but ſometimes the apoſtles are diſtinguiſhed from diſciples, as perſons ſelected from them to be the principal miniſters of his religion; of theſe there were only twelve. The Latins keep the feſtival of the ſeventy, or ſeventy-two diſciples, on July 15; and the Greeks on January 4.

DISCIPLINE, in a general ſenſe, denotes inſtruction and government, as military diſcipline, eccleſiaſtical diſcipline, &c.

Eccleſiaſtical diſcipline conſiſts in putting thoſe laws in execution by which the church is governed, and inflicting the penalties enjoined by them againſt the ſeveral ſorts of offenders that profeſs the religion of Jeſus. Diſcipline, in a more peculiar ſenſe, is uſed for the chaſtiſements or bodily puniſhments inflicted on a religious of the Romiſh church who has been found a delinquent; or even for that which the religious voluntarily undergo or inflict on themſelves, by way of mortification.

DISCLAIMER, in law, a plea, containing an expreſs denial, renouncing, or diſclaiming, of a thing alleged.

In chancery, if a defendant by his anſwer renounces having any intereſt in the thing in queſtion, this is a diſclaimer: to which may be added, a diſclaimer by renouncing an executorſhip of a will, or the right to an adminiſtration.

DISCONTINUANCE, an interruption, intermiſſion, or ceſſation, of the courſe of a thing: as diſcontinuance of poſſeſſion, of a plea, proceſs, &c.

DISCORD, in general, ſignifies diſagreement, or oppoſition between different perſons or things.

Discord, in muſic, every ſound which, joined with another, forms an aſſemblage diſagreeable to the ear; or rather, every interval whoſe extremes do not coaleſce. Now, as there are no other concords or conſonances, except thoſe which form amongſt themſelves, and with their fundamental ſound, perfect chords, it follows, that every other interval muſt be a real diſſonance or diſcord: even the third and ſixth were reckoned ſuch among the ancients, who excluded them from the number of conſonant chords. See Syſtem of Music.

DISCOVERY, in a general ſenſe, the act of finding out any thing hidden; ſhewing any thing concealed or covered; or revealing any thing ſecret.

Discovery, in law, the act of revealing or diſcloſing any matter by the defendant, in his anſwer to a bill filed againſt him in a court of equity.

Discovery *of Accomplices* is provided for in the caſes of robbery, burglary, houſe breaking, and larceny, to the value of five ſhillings, from ſhops, ware houſes, ſtables, and coach houſes, by 4 and 5 W. and M. cap. 8. 10 and 11 W. III. cap. 23. and 5 Anne, cap. 31. which enact, that if any ſuch felon, being out of priſon, ſhall diſcover two or more perſons who have committed the like felonies, ſo that they may be convicted, he ſhall in moſt caſes receive a reward of 40*l.* and in general be entitled to a pardon of all capital offences, excepting only murder and treaſon. And if any ſuch perſon having feloniouſly ſtolen any lead, iron, or other metals, ſhall diſcover and convict two offenders of having illegally bought or received the ſame, he ſhall by ſtat. 29 Geo. II. cap. 30. be pardoned for all ſuch felonies committed before ſuch diſcovery.

Discovery, in dramatic poetry, a manner of unravelling a plot or fable, very frequent in tragedies and comedies, wherein, by ſome unforeſeen accident, a diſcovery is made of the name, fortune, quality, and other circumſtances, of a principal perſon, which were before unknown.

DISCOUNT, in commerce, a term among traders, merchants, and bankers. It is uſed by the two former on occaſion of their buying commodities on the uſual time of credit, with a condition that the ſeller ſhall allow the buyer a certain diſcount at the rate of ſo much per cent. per annum, for the time for which the credit is generally given, upon condition that the buyer pays ready money for ſuch commodities, inſtead of taking the time of credit. Traders and merchants alſo frequently taking promiſſory notes for monies due payable to them or order at a certain time, and ſometimes having occaſion for money before the time is elapſed, procures theſe notes to be diſcounted by bankers before the time of payment. Bills of exchange are alſo diſcounted by bankers; and in this conſiſts one article of the profits of banking.

DISCOURSE, in logic, from *diſcurro, I run over*, an operation of the human mind, whereby it paſſes or proceeds from one thing to another, that is, from a known thing to an unknown.

Discourse, in a general ſenſe, denotes converſation, wherein perſons mutually convey their ideas or ſentiments to each other; a treatiſe or diſſertation written or uttered.

DISCRETION, in law, the faculty of diſcerning between right and wrong; and therefore whoever hath power to act at diſcretion, is bound by the rule of reaſon and law. 2 Inſt. 56. 298. Infants, &c. under the age of diſcretion, are not puniſhable for crimes: and want of diſcretion is a good exception againſt a witneſs. 2 Hauk. 434.

DISCRETIVE *Propoſitions*, are thoſe where various judgments are made, and denoted, by the particles *but*, *notwithſtanding*, or by words of the like nature, either expreſſed or underſtood. Thus, fortune may deprive me of my wealth, *but* not of my virtue; they, who croſs the ſeas, change their climate, *but* not their diſpoſition; are called *diſcretive propoſitions*.

DISCUSSION, in matters of literature, ſignifies a clear treating or handling of any point, or problem. The word imports a ſhaking off, or diſpelling the difficulties and obſcurities with which a thing was embarraſſed. We ſay, ſuch a point was well diſcuſſed, when it was well treated of, and cleared up.

Discussion is alſo uſed in a medicinal ſenſe, for a diſperſing the matter of any tumor, or ſwelling, through the pores of the body; or an evacuation of ſome thin matter gathered in any part, by inſenſible perſpiration.

DISCUTIENTS, in medicine, either repellers or remedies proper to open the pores, and evacuate the redundant or peccant humours of the body by inſenſible perſpiration or otherwiſe. Diſcutients are in this laſt ſenſe the ſame with what we otherwiſe call diaphoretics.

DISEASE, in medicine, that ſtate of a living body, wherein it is prevented the exerciſe of any of its functions, whether vital, natural, or animal. Or, is a depravity and diſorderly ſtate of the ſolid and fluid parts; whereby all, or ſome of the functions either of the body, or mind, or both, are either aboliſhed, or impaired.

Of all animals, man is ſubject to the moſt diſeaſes; and of men, the ſtudious and ſpeculative are moſt expoſed thereto. Other animals have their diſeaſes; but they are in ſmall number: nor are plants without them. Some diſeaſes only impair the uſe of the part immediately affected; as the ophthalmia, gout, &c. Others deſtroy it entirely; as the gutta ſerena, palſy, &c. Some affect the whole body; as the fever, apoplexy, epilepſy, &c. Others only impair a part; as the aſthma, colic, dropſy, &c. Some only affect the body; as the gout: others diſturb the mind, as melancholy, delirium, &c. Laſtly, others affect both the body and mind; as the mania, phrenſy, &c.

The colder the country, in general, the fewer and the leſs violent are the diſeaſes. Scheffer tells us, that the Laplanders know no ſuch thing as the plague or fevers of the burning kind; nor are ſubject to half the diſtempers we are. They are robuſt and ſtrong, and live to eighty, ninety, and many of them to more than a hundred years: and at this great age, they are not feeble and decrepid, as with us, but a man of ninety is able to work, or travel, as well as a man of ſixty with us. They are ſubject, however, to ſome diſeaſes more than other nations: thus they have often diſtempers of the eyes, which is owing to their living in ſmoak, or being blinded by the ſnow. Pleuriſies and inflammations of the lungs are alſo very frequent among them; and the ſmall pox often rages with great violence.

The credulity of the public was never more evident, than in the impoſition practiſed by the late exhibitor of thoſe beings called *Monſtrous Craws*, as ſubjects rare and ſingular; whereas the cauſes which excited their curioſity, are common to all the natives of the Alps, as well as ſeveral other parts of Italy.

It has been always obſerved, that people of particular places were peculiarly ſubject to particular diſeaſes which are owing to their manner of living, or to the air, and effluvia of the earth and waters. Hoffman has made ſome curious obſervations on diſeaſes of this kind. He obſerves, that ſwellings of the throat have always been common to the inhabitants of mountainous countries; and the old Roman authors ſay, who wonders at a ſwelled throat in the Alps? The people of Swiſſerland, Carynthia, Styria, the Hartz foreſt, Tranſylvania, and the inhabitants of Cronſtadt, he obſerves, are all ſubject to this diſeaſe from the ſame cauſe. See Bronchocele.

The French are peculiarly troubled with fevers, with worms, and with hydroceles and ſarcoceles; and all theſe diſorders ſeem to be owing originally to their eating very large quantities of cheſnuts. The people of our own nation are peculiarly afflicted with hoarſeneſſes, catarrhs, coughs, dyſenteries, conſumptions, and the ſcurvy: and the women with the *fluor albus*, or whites, and children, with a diſeaſe ſcarce known elſewhere, which we call the rickets. In different parts of Italy, different diſeaſes reign. At Naples, the venereal diſeaſe is more common than in any other part of the world. At Venice, people are peculiarly ſubject to the bleeding piles. At Rome, tertain agues, and lethargic diſtempers are moſt common. In Tuſcany, the epilepſy, or falling ſickneſs. And in Apulia they are moſt ſubject to burning fevers, and pleuriſies.

In Spain, apoplexies are common, as alſo melancholy, hypochondriacal complaints, and bleeding piles. The Dutch are peculiarly ſubject to the ſcurvy, and to the ſtone in the kidneys. Denmark, Norway, Sweden, Pomerania, and Livonia, are all terribly afflicted with the ſcurvy: and it is remarkable, that in Denmark, Sweden, and Norway, fevers are very common; but in Iceland, Lapland, and Finland, there is ſcarce ever ſuch a diſeaſe met with; though peripneumonies are very common in theſe places, as alſo diſeaſes of the eyes and violent pains of the head. The Ruſſians and Tartars are afflicted with ulcers, made by the cold, of the nature of what we call chilblains, but greatly worſe; and in Poland and Lithuania there reigns a peculiar diſeaſe, called the *plica polonica*, ſo terribly painful and offenſive, that ſcarce any thing can be thought of worſe. The people of Hungary are very ſubject to the gout and rheumatiſm: they are alſo more infeſted with lice and fleas than any other people in the world, and they have a peculiar diſeaſe which they call cremor.

The Germans, in different parts of the empire, are ſubject to different reigning diſeaſes. In Weſtphalia, they are peculiarly troubled with peripneumonies and the itch. In Sileſia, Franconia, Auſtria, and other places thereabout, they are very liable to fevers of the burning kind, to bleedings at the noſe, and other hæmorrhages; and to the gout, inflammations, and conſumptions. In Miſnia, they have purple fevers; and the children are peculiarly infeſted with worms. In Greece, Macedonia, and Thrace, there are very few diſeaſes; but what they have, are principally burning fevers and phrenſies. At Conſtantinople the plague always rages; and in the Weſt Indian iſlands, malignant fevers, and the moſt terrible colics. Theſe diſeaſes are called *endemic*.

As the actions, or conditions of the body, ſo alſo the diſeaſes, or defects thereof, may be reduced to three general heads; viz.

1. Diſeaſes of the ſolid parts. 2. Thoſe of the fluid parts. And, 3. Diſeaſes compounded of both.

Diseases *Feigned*. The cheat of feigning diſeaſes, for idleneſs, or profit ſake, or for other occaſional purpoſes, has been too common in all ages, and is too difficult to be diſcovered in all caſes; though, in many, there are ways of coming at the truth. We have had a very late inſtance of a young lady, who puzzled ſeveral of our beſt phyſicians, to account for the nature of a diſeaſe, which ſhowed itſelf in a ſingular kind of excoriations; and the ſecret perhaps had never been diſcovered, had not a bottle of aqua fortis been accidentally found in her chamber; the touching the arms, &c. with which, had occaſioned all the appearances, which ſome ſtrange fault in the juices had been before accuſed of.

Diſſimulation in regard to diſeaſes, may be reduced to three kinds. In the firſt, the ſickneſs is pretended by words only, and really is not: of this nature are the pretended head-ach, colic, and the like; which, as the patient can only know, the phyſician may be always deceived. In the ſecond, there are not only words for teſtimonies of the ſickneſs, but there appear ſigns and marks of it on the body, which yet are only counterfeited to ſerve certain purpoſes. Scabbineſs, leproſy, even the exulceration of the lungs, may be thus counterfeited; the laſt by a pretended ſpitting of blood. Gravidation is often pretended alſo. Our beggars often contrive the means of theſe to excite compaſſion. In the third kind of diſſimulation of diſeaſes, we are to include the concealing a diſeaſe; which really exiſts, inſtead of the owning of one which does not.

In the diſcovery of theſe deceits, on which the credit of the phyſician often depends, it is not mere medical knowledge that will ſucceed, but there muſt be added to it a ſagacity in exploring all circumſtances and outward accidents, and eſpecially thoſe things which relate to the genius, temper, and ſtate of the perſon ſuſpected.

The impoſitions practiſed by feigning diſeaſes have lately been more prevalent than ever, eſpecially amongſt thoſe abetted from venal conſiderations, by pretenders to animal magnetiſm. This ſpecies of fraud originated in France, where through the ſubtelty of the practitioner Doctor Meſmer, and the gallantries it was deſigned to conceal, it gained general credit, and proved a moſt lucrative employ, till the faculty inveſtigated it by order of the king, and exploded the doctrine as palpably deluſive.

An adventurer from France however, relying on the credulity of our nation, undertook to introduce it here, and by means of the affected emotions of paupers ſuborned for the purpoſe of colluſion, brought it into a degree of eſtimation, and continues to practiſe with ſome emolument. Others, inſtigated by the reputation it acquired, have adopted the ſame plan of deluſion, amongſt theſe are a Pſeudo or horſe doctor, and vender of quack medicines, whoſe notoriety need no further explanation; and a well known character, lately reſident at Hammerſmith, whoſe deſign we are candidly induced to think was rather to raiſe his name, than improve his fortune. We paſs theſe current remarks to teſtify our averſion to pretenders and impoſtors.

Diseases *of Plants*. 1. The too great abundance of the nutritious juice. 2. The defect, or want of this juice. 3. Some ill qualities it acquires. 4. Its unequal diſtribution in different parts of the plant. And, 5. External accidents. 1. The diſeaſes principally obſerved by our gardeners, are, 1. Barrenneſs, when the tree, though ſeeming freſh and healthy, bears no bloſſoms: or, if it does, they ſoon fall; or, if they ſet, the fruit drops before it comes to maturity. 2. Blaſting of the buds, occaſioned by a froſt happening when the leaves and bloſſoms are wet; by this means the pores are ſhut, and the vital juices ſuffocated: when if the ſun break out on a ſudden, they turn yellow, with round fiery ſpecks growing on them; whence frequently proceed tumors, like warts, which, rotting, grow full of maggots. Mr. Mortimer adds, that the want of rain in bloſſoming time, often occaſions the dropping off of the bloſſoms, for want of ſap; he, therefore, recommends the watering of them. 3. Conſumption, proceeding from a want of ſuſtenance, through the failure of the nouriſhing juices, or from obſtructions of the veins and roots; or ill digeſtion, and ſecretion of humours, &c. See Blight and Mildew.

DISFRANCHISING, among civilians, ſignifies the depriving a perſon of the rights and privileges of a free citizen or ſubject.

DISGUISE, a counterfeit habit. Perſons doing unlawful acts in diſguiſe are by our ſtatutes ſometimes ſubjected to great penalties, and even declared felons. Thus by an act, commonly called the black act, perſons appearing diſguiſed and armed in a foreſt or grounds incloſed, or hunting deer, or robbing a warren or a fiſhpond, are declared felons.

DISJUNCTIVE, ſomething that ſeparates, or disjoins. Thus, *or*, *neither*, &c. are called disjunctive conjunctions; which, in connecting a diſcourſe, do yet ſeparate the parts thereof. E. gr. *Aut Cæſar, aut nullus*; *either Cæſar, or nothing*. He *neither* advanced, *nor* gave back. Disjunctive conjunctions may alſo be called *partitive*, *diſtributive*, and *alternative*.

Disjunctive *Propoſitions*, in logic, are compound propoſitions, conſiſting of two members, or parts, connected by a disjunctive conjunction.

DISLOCATION, the putting a bone out of joint, by ſome violence, uſually called by the faculty, luxation. We have an inſtrument of Mr. Freke's invention for the reduction of diſlocated ſhoulders, deſcribed in the Philoſophical Tranſactions, Nº 470.

DISMASTED, in ſea language, denotes the ſtate of a ſhip, when ſhe has loſt her maſts by engagement, or bad weather.

DISMEMBERED, in heraldry, is applied to birds that have neither feet nor legs; as alſo to lions and other animals, whoſe members are ſeparated.

DISMISSION *of a Bill*, in chancery. If the plaintiff does not attend on the day fixed for the hearing, his bill is diſmiſſed with coſts. It may be alſo diſmiſſed for want of proſecution, which is in the nature of a non-ſuit at law, if he ſuffers three terms to elapſe without moving forward in the cauſe.

DISMOUNTING, in the military art, the act of unhorſing. Thus, to diſmount the cavalry, the dragoons, or the like, is to make them alight. *Diſmount the Canon*, is to break their carriages, wheels, and axle trees, ſo as to render them unfit for ſervice. Horſes are alſo diſmounted when they are rendered unfit for ſervice.

DISPARAGEMENT, in law, is uſed for the matching an heir, &c. in marriage, below his or her degree or condition; or againſt the rules of decency. The word is a compound of the privative particle *dis*, and *par*, *equal*.

DISPART, in gunnery, is uſed for ſetting a mark on the muzzle ring of a piece of ordnance; ſo that a ſight line taken upon the top of the baſe ring againſt the touch-hole, by the mark ſet on or near the muzzle, may be parallel to the axis of the concave cylinder.

DISPATCH, a letter on ſome affair of ſtate, or other buſineſs of importance, ſent with care and expedition, by a courier expreſs. The buſineſs of diſpatches lies on the ſecretaries of ſtate, and their clerks. The king gives directions to his miniſters abroad by diſpatches. The word is alſo uſed for the packet, or mail, containing ſuch letters.

DISPENSARY, or Dispensatory, a name given to divers collections of recipes for compound medicines, wherein are ſpecified the ingredients, propoſitions, and circumſtances, of the preparation and mixture; the ſame with what we otherwiſe call a *pharmacopœia*, or *antidotary*. Such are the diſpenſaries of the college of phyſicians at London and Edinburgh, Quincy, &c. The apothecaries, in and about London, are obliged to make up their compound medicines according to the formulas preſcribed in the College Diſpenſary, and are enjoined to keep always ready in their ſhops, all the medicines therein enumerated.

Dispensary is likewiſe uſed for a magazine or office of medicines, kept ready to be diſpenſed at the prime coſt of the ingredients, for the benefit of the ſick poor. There are at this time ſeveral ſupported by voluntary contribution, where the poor have both advice and medicines gratis.

DISPENSATION, in law, &c. a permiſſion to do ſomething contrary to the ſtanding laws; or a relaxation, or ſuſpenſion of a law, on ſome juſt occaſion. Some confound diſpenſation with equity; but they are very different things; for equity is only the correction, or modification, of a law which is too general; but a diſpenſation ſuſpends the obligation of the law itſelf, and can, therefore, be only given by the legiſlative power.

The king of France grants diſpenſations of age to ſome officers, to be admitted before the legal age: but the greateſt dealer in diſpenſations is the pope, who claims the office, *jure divino*, and extends it to every thing: indeed, the more ſober of the Romaniſts themſelves deny that he can give a diſpenſation for a thing contrary either to the divine law, or the law of nature.

Dispensation *of the King*, makes a thing prohibited lawful to be done by the perſon that has it, though a thing evil in itſelf will not admit of a diſpenſation. When an offence wrongs none but the king, or if the ſuit is only the kings for the breach of a penal law, that is not to the damage of a third perſon, the king may diſpenſe: but in caſe the ſuit is the king's, for the benefit of another, he cannot. It was formerly held, that the king might in many caſes diſpenſe with penal ſtatutes, and the exerciſe of this diſpenſing power was one of the moſt ignominious badges of ſlavery and engines of tyranny, which ever diſgraced and harraſſed this country; but by 1 W. and M. ſtat. 2. c. 2. it is declared, that the ſuſpending or diſpenſing with laws by regal authority, without the conſent of parliament, is illegal: it is alſo a maxim in law, that it requires the ſame ſtrength to diſſolve as to create an obligation. See Blackſt. Com. vol. i. p. 142. 185. 342. and vol. ii. p. 429, 432.

Dispensation, in pharmacy, the diſpoſition and arrangement of ſeveral medicines, either ſimple or compound, all weighed in their proper doſes, or quantities; in order to be employed in the making of a compoſition.

DISPERSION, in dioptrics. *Point of diſperſion*, is a point from which refracted rays begin to diverge, when their refraction renders them divergent. It is called *point of diſperſion*, in oppoſition to the point of concourſe, which is the point wherein converging rays concur after refraction. But the latter is more uſually called *focus*, and the former, *virtual focus*.

Diſperſion *of Mankind*, in the hiſtory of the world, was occaſioned by the confuſion of tongues, and took place in conſequence of the overthrow of Babel at the birth of Peleg; whence he derived his name: and it appears by the account given of his anceſtors, Gen. chap. xi. 10—16. to have happened in the 101ſt year after the flood, according to the Hebrew chronology, and by the Samaritan computation in the 401ſt. However, various difficulties have been ſuggeſted by chronologers concerning the true æra of this event.

Sir John Marſham and others, in order to reconcile the Hebrew and Egyptian chronologies, maintain a diſperſion of mankind before the birth of Peleg: others, unable to find numbers ſufficient for the plantation of colonies in the ſpace of 101 years, according to the Hebrew computation, fix the diſperſion towards the end of Peleg's life, thus following the computation of the Jews: Petavius aſſigns the 153d year after the flood; Cumberland, the 180th: and Uſher, though he generally refers it to the time of Peleg's birth, in one place aſſigns the 131ſt after the flood for this event. Mr. Shuckford ſuppoſes the diſperſion to have been gradual, and to have commenced with the ſeparation of ſome companies at the birth of Peleg, and to have been completed thirty one years after. According to the calculation of Petavius, the number of inhabitants on the earth at the birth of Peleg amounted to 32,768; Cumberland makes them 30,000; Mr. Mede ſtates them at 7000 men, beſides women and children; and Mr. Whiſton, who ſuppoſes that mankind now double themſelves in four hundred years, and that they doubled themſelves between the deluge and the time of David in ſixty years at a medium, when their lives were ſix or ſeven times as long as they have been ſince, by his computation, produces about 2389, a number much too inconſiderable for the purpoſes of ſeparating and forming diſtinct nations. This difficulty induced Mr. Whiſton to reject the Hebrew, and to adopt the Samaritan chronology; as many others have done; which, by allowing an interval of 401 years between the flood and the birth of Peleg, furniſhes, by the laſt mentioned mode of computation, more than 240,000 perſons. Marſh. Can. Chron. ſec. 1. Petav. Doctrin. Temp. lib. ix. c. 14. Cumb. Orig. Gent. Antiq. p. 142—154. Uſher ad A. M. 1777 and 1787. Whiſton's View Chron. O. T.

Dr. Bryant has advanced a new hypotheſis on this ſubject, and ſupported it with his uſual acuteneſs and learning: he maintains, that the diſperſion as well as the confuſion of tongues was local, and limited to the inhabitants of the province of Babel; that the ſeparation and diſtribution recorded to have taken place in the days of Peleg, Gen. x. 25, 31, 32. which was the reſult of divine appointment, occaſioned a general migration; and that all the families among the ſons of men were concerned in it: the houſe of Shem, from which the Meſſiah was to ſpring, was particularly regarded in this diſtribution; the portion of his children was near the place of ſeparation; they in general had Aſia to their lot; as Japhet had Europe, and Ham the large continent of Africa. But the ſons of Chus would not ſubmit to the divine diſpenſation; they went off under the conduct of Nimrod, and ſeem to have been for a long time in a roving ſtate: however, at laſt they arrived at the plains of Shinar, and having ejected Aſhur and his ſons, who were placed there by divine appointment, ſeized his dominions, and laid there the foundation of a great monarchy. But afterwards fearing leſt they ſhould be divided and ſcattered abroad, they built the tower of Babel, as a land mark, to which they might repair, and probably to anſwer the purpoſes of an idolatrous temple, or high altar, dedicated to the hoſt of heaven, from which they were never long to be abſent. They only, viz. the ſons of Chus or the Cuthites, and their aſſociates from other families, who had been guilty of rebellion againſt divine authority, and of wicked ambition and tyranny, were puniſhed with the judgment of confounded ſpeech through a failure in labial utterance, and of the diſperſion recorded in Gen. x. 8, 9: in conſequence of which they ſcattered abroad from this city and tower, without any certain place of deſtination. The Cuthites invaded Egypt or the land of Mizraim, in its infant ſtate, ſeized the whole country, and held it for ſome ages in ſubjection: and they extended likewiſe to the Indies and Ganges, and ſtill farther into China and Japan. From them the province of Cuſhan or Goſhen in Egypt derived its name: here they obtained the appellation of royal ſhepherds; and when they were by force driven out of the country, after having been in poſſeſſion of it for two hundred and ſixty, or two hundred and eighty years, the land which they had been obliged to quit was given to the Iſraelites, who were alſo denominated ſhepherds, but ſhould not be confounded with the former or the antecedent inhabitants of Goſhen. Bryant's Analyſis of Ancient Mythol. vol. iii. p. 16, &c.

DISPLANTING, among gardeners, is the plucking up a tree or plant out of the ground.

DISPLAYED, in heraldry, is underſtood of the poſition of an eagle, or other bird, when it is erect, with its wings expanded, or ſpread forth.

DISPOSITION, in human nature. In every man there is ſomething original, that ſerves to diſtinguiſh him from others, that tends to form a character, and to make him meek or fiery, candid or deceitful, reſolute or timorous, cheerful or moroſe. This original bent, termed diſpoſition, muſt be diſtinguiſhed from a principle: the latter, ſignifying a law of human nature, makes part of the common nature of man; the former makes part of the nature of this or that man. Propenſity is a name common to both; for it ſignifies a principle, as well as a diſpoſition.

Diſpoſition, from *dis*, and *pono*, *I place*, in architecture, is the juſt placing of all the ſeveral parts of an edifice, according to their proper nature and office.

Diſpoſition, in logic, is that operation of the mind, whereby we put the ideas, propoſitions, and arguments which we have formed concerning one ſubject, into ſuch an order as is fitteſt to gain the cleareſt knowledge of it, to retain it longeſt, and to explain it to others in the beſt manner: the effect of this is called method. Watt's Logic.

Diſpoſition, in a military ſenſe, is the arrangement of an army, or body of men upon the moſt advantageous ground, and in the beſt ſituation for a vigorous attack or defence.

Diſpoſition, in rhetoric, is defined, by Cicero, the act of diſtributing the things, or arguments, invented or found out, into a proper order; or a due placing, or ranging, the ſeveral parts of ſpeech, or diſcourſe. The diſpoſition makes one of the great branches, or diviſions, of rhetoric.

Iſocrates was the firſt among the Greeks that made them ſenſible of the beauty of diſpoſition; and Cicero among the Romans. The diſpoſition is of the ſame neceſſity in oratory, as the marſhalling of an army in order to a battle; or a beautiful compoſition in architecture, painting, &c. Horace enjoins it expreſsly in poetry: *Singula quæque locum teneant ſortita decenter.* The diſpoſition, then, is the order, or arrangement, of the parts of an oration; which parts are uſually reckoned four, viz. the *exordium*, or *beginning*; the *narration*; the *confirmation*; and the *peroration*, or *concluſion*. Though ſome make them ſix, viz. the *exordium*, *diviſion*, *narration*, *confirmation*, *confutation*, and *peroration*; as indicated in that popular verſe:

Exorſus, narro, ſeco, firmo, refuto, peroro.

But the diviſion is moſt naturally referred to the exordium; and the confutation to the confirmation. The diſpoſition is either natural or artificial. Natural, is the order the parts are above rehearſed in. Artificial, is when, for ſome particular reaſon, we recede from the order of nature.

DISPROPORTION, a term of relation, implying a want of proportion; or ſymmetry.

DISPUTE, or **Diſputation**, from *dis*, and *puto*, *I think*, in the ſchools, &c. a conteſt, or combat, either by word or writing, on ſome point of learning or religion, for a degree, prize, exerciſe, or even for the mere ſake of a truth, or advantage of a party, or the honour of a triumph.

The Port Royaliſts take occaſion to obſerve, that nothing gives ſo many different lights and openings, for diſcovering the truth, as diſputation. The movements of a mind, employed ſingly in the examination of any ſubject, are uſually too cool and languid; the mind needs a certain degree of heat to awaken its ideas. Now, by the oppoſitions in a diſpute, we come to find wherein the difficulty lies, and the vigour the mind has acquired enables us to ſurmount it.

DISQUISITION, from *dis*, and *quæro*, *I enquire*, an enquiry into the nature, kinds, and circumſtances of any problem, queſtion, or topic; in order to gain a right notion of it, and to diſcourſe clearly about it.

DISSECTION, from *dis*, and *ſeco*, *I cut*, in anatomy, the operation of cutting and dividing the parts of an animal body, with a knife, ſciſſars, &c. in order to ſee and conſider each of them apart. The ancients made diſſections of living men; as we read of Herophilus and Eraſiſtratus; and, in our own times, of Carpus and Veſalius. Yet, Le Gendre obſerves, that the diſſection of a human body, even dead, was held a ſacrilege till the time of Francis I. And the ſame author aſſures us, he has ſeen a conſultation held by the divines of Salamanca, at the requeſt of Charles V. to ſettle the queſtion, whether or no it were lawful, in point of conſcience, to diſſect a human body, in order to learn its ſtructure.

DISSEISIN, in law, an unlawful diſpoſſeſſing a man of his land, tenement, or other immoveable and incorporeal right.

DISSEISOR, he who diſſeiſeth or puts another out of his land: as diſſeiſee is he who is put out. If a diſſeiſor, after he has expelled the right owner, gains peaceable poſſeſſion of the lands five years without claim, and continues in poſſeſſion, ſo as to die ſeiſed, and the land deſcends to his heirs, they will have a right to the poſſeſſion till the owner recovers at law; and the owner ſhall loſe his eſtate for ever, if he doth not proſecute his ſuit within the time limited by the ſtatute of limitations.

DISSENTERS, a general denomination of equal import with non-conformiſts. It expreſſes certain ſects, or parties, who, in matters of religion, church-diſcipline, and ceremonies, diſſent from, or diſagree with the church of England, and have a toleration by law for the ſame. Such, particularly, are the preſbyterians, independents, anabaptiſts, and quakers.

At the Revolution, a law was enacted, that the ſtatutes of queen Elizabeth, and king James I. concerning the diſcipline of the church, ſhould not extend to proteſtant diſſenters: but the perſons

diſſent

diſſenting are to ſubſcribe the declaration of 30 Car. II. c. 1. and take the oaths, or the declaration of fidelity, &c. And they muſt not hold their meetings until their place of worſhip is certified to the biſhop, &c. or to the juſtices at their quarter ſeſſions, and regiſtered there; alſo they are not to keep the doors of their meeting-houſes locked, &c. If any perſon diſturbs them at their worſhip, on conviction at the ſeſſions, he ſhall forfeit 20l. And there are many ſtatutes relating to diſſenters beſides the toleration act.

DISSEPIMENTUM, among botaniſts, the thin ſeptum ſeparating the cells of the fruit of plants.

DISSIDENTS, a denomination applied in Poland to thoſe of the Lutheran, Calviniſtic, and Greek profeſſion. The king of Poland engages by the *pacta conventa* to tolerate them in the free exerciſe of their religion, but they have often had reaſon to complain of the violation of theſe promiſes.

DISSIMILAR *Leaves*, denote the two firſt leaves of any plant at its firſt ſhooting out of the ground. They are thus called, becauſe they uſually are of a different form from the common leaves of a grown plant.

Dissimilar, in anatomy. Authors divide the parts of the body into ſimilar, and diſſimilar. Diſſimilar parts, by ſome called alſo compound, and organical parts, are ſuch as may be divided into various parts, of different ſtructure, &c. Thus the hand is diviſible into veins, muſcles, bones, &c. whoſe ſubdiviſions are neither of the ſame nature nor denomination.

DISSIMILITUDE, in rhetoric, &c. an argument, wherein, from diſſimilar, or unlike things, other diſſimilars are deduced.

Thus Cicero, *Si barbarorum eſt in diem vivere; noſtra conſilia ſempiternum tempus ſpectare debent.* Catullus furniſhes a very beautiful argument from diſſimilitude.

> *Soles occidere & redire poſſunt,*
> *Nobis cum ſemel occidit brevis lux,*
> *Nox eſt perpetua una dormienda.*

DISSIMULATION, in morals, the act of diſſembling, by fallacious appearances, or falſe pretenſions. Good princes regard diſſimulation as a neceſſary vice; but tyrants conſider it as a virtue. It is apparent that ſecrecy is often neceſſary, to oppoſe thoſe who may be willing to circumvent our lawful intentions.

> " Your face, my Thane, is a book where men
> " May read ſtrange matters. To beguile the time,
> " Look like the time; bear welcome in your eye,
> " Your hand your tongue; look like th' innocent flow'r
> " And be the ſerpent under't."
>
> " Shakespear."

DISSIPATION, in phyſics, an inſenſible loſs, or conſumption, of the minute parts of a body: or, more properly, that flux whereby they fly off, and are loſt.

We do not ſay diſſipation, but loſs of blood, in ſpeaking of the blood diſcharged at a wound, or in any other ſenſible manner: on the contrary, we ſay diſſipation, or expence of ſpirits; this is more copious than that of the ſolid parts: and conſequently, the reparation ought to be more copious.

Circle of Dissipation, or *Aberration*, in optics, denotes, that circular ſpace upon the retina of the eye, which is occupied by the rays of each pencil in indiſtinct viſion. See Aberration, and Syſtem of Optics.

DISSOLVENT, ſomething that diſſolves, i. e. divides, and reduces a body into its ſmalleſt parts. Thus, aqua regia is the diſſolvent of gold; aqua fortis of ſilver, and other metals; water, of ſalts and gums; ſpirits of wine, of raiſins; ſpirit of vinegar, of pearls, corals, &c. Sea ſalt is found the proper diſſolvent of gold. This, in almoſt any form, whether as a fluid, or a ſolid, or a ſpirit, does the buſineſs: accordingly, this is a baſis, or fundamental ingredient, of aqua regia. So nitre is the proper diſſolvent of ſilver, and has that effect, in whatever form it is applied: and, accordingly, it is the baſis of aqua fortis.

DISSOLUTION, in chymiſtry, pharmacy, and phyſics, a diſcontinuation, or analyſis, of the ſtructure of a mixed body; whereby, what was one, and contiguous, is divided into little parts, either homogeneous, or heterogeneous. See Analysis.

Diſſolution, then, is a general name for all reductions of concrete bodies into their ſmalleſt parts, without any regard either to ſolidity or fluidity: though, in the uſual acceptation of the word among authors, it is reſtrained to the reduction of ſolid bodies into a ſtate of fluidity, by the action of ſome fluid menſtruum or diſſolvent; in which caſe an union is formed between the integrant parts of one body, and thoſe of another of a different nature; ſo that it is nothing elſe than an act of combination: this is more properly expreſſed by ſolution, as a branch of diſſolution.

Dissolution *of Metals, &c.* by fire, is particularly called *fuſion.* See Syſtem of Chymistry, Sect. II. Part II.

Dissolution *of the Blood*, is an affection of that humour, directly oppoſite to coagulation. The diſſolution is ſuch a comminution of the fibrous parts of the blood, as indiſpoſes it for that ſeparation of the craſſamentum from the ſerous part, which always enſues in healthy blood, on its cooling out of the body. This diſſolution is frequently the conſequence of malignant and peſtilential fevers, and ſhews itſelf in petechiæ, or purple ſpots; alſo of certain poiſons, particularly the bites of venemous beaſts, &c.

Dissolution *of Parliament*. See Parliament.

DISSONANCE, or Discord, in muſic, a falſe conſonance, or concord. A diſſonance is properly the reſult of a mixture, or meeting of two ſounds, which are diſagreeable to the ear.

DISSYLLABLE, a word of two ſyllables; as fortune, lament, &c. The ſpondee, trochee, iambus, and pyrrhichius, are diſſyllabic feet.

DISTAFF, an inſtrument about which flax is tied, in order to the ſpinning of it.

DISTANCE, properly denotes the ſhorteſt line between two points, objects, &c. Diſtance, according to an ingenious author, cannot of itſelf and immediately be ſeen. For diſtance being a line directed endwiſe to the eye, it projects only one point in the fund of the eye, which point remains invariably the ſame, whether the diſtance be longer or ſhorter. Dr. Berkeley, Eſſay on Viſion.

The word is alſo uſed figuratively for an interval, not only in reſpect of place, but alſo of time, or quality. Thus, we ſay the diſtance of the creation of the world from the nativity of Jeſus Chriſt, is upwards of four thouſand years: the diſtance between the creator and the creature is infinite.

Distance, in aſtronomy. The diſtance of the ſun, planets, and comets, is found from their parallax. See Syſtem of Astronomy, Sect. VII.

Distance *of the Baſtions*, in fortification, is the ſide of the exterior polygon. See Syſtem of Fortification.

Distances, in geometry, are meaſured by the chain, decempeda, and the like.

Inacceſſible Distances, are found by taking bearings thereto from the two extremes of a line, whoſe length is given.

Distance, in geography, is the arch of a great circle interſected between two places. See Syſtem of Geography.

Apparent Distance, in optics, that diſtance which we judge an object to be from us when ſeen afar off, being commonly very different from the true diſtance: becauſe we are apt to think that all very remote objects, whoſe parts cannot well be diſtinguiſhed, and which have no other object in view near them, to be at the ſame diſtance from us, though perhaps the one is thouſands of miles nearer than the other, as is the caſe with regard to the ſun and moon. See Syſtem of Optics, and the following Works.

Accidens de la Vie, p. 358. Smith's Optics, vol. i. p. 52. and Rem. p. 51. Robins's Tracts, vol. ii. p. 230, 247, 251. Porterfield on the Eye, vol. i. p. 105, vol. ii. p. 387, &c. See Prieſtley's Hiſt. of Viſion, p. 205. and p. 689, &c.

Distance, in navigation, is the number of miles, or leagues, that a ſhip has ſailed from any point.

Line of Distance, in perſpective, is a right line drawn from the eye to the principal point. See Syſtem of Perspective.

Point of Distance, in perſpective, is a point in the horizontal line at ſuch diſtance from the principal point, as is that of the eye from the ſame.

DISTASTE, or Disgust, a loſs of appetite, or an averſion, or repugnance, to foods which are commonly eaten. Diſtaſte is held, by phyſicians, one of the principal diſorders of the ſtomach. It ariſes from a want of ſenſation in the upper orifice of the ventricle, which may be occaſioned various ways: as by a too great abundance of food; thick, heavy humours in the ſtomach: fat viſcid aliment; obſtructions of the lacteals: ſuppreſſions of the uſual evacuations; intermiſſions of the ordinary exerciſes, a defect of the nerves, in having their natural faculty aboliſhed, or ſuſpended as in a lethargy, and apoplexy; and according to Sylvius, by a groſs viſcid ſaliva, or a thick bile, aſcending out of the ſmall guts into the ſtomach.

DISTEMPER, in medicine. See Disease.

Distemper is uſed in painting, for the working up of colours with ſomething elſe beſides bare water, or oil. If the colours be prepared with the former of theſe, that kind of painting is called limning; and if with oil, it is called painting in oil, or ſimply painting. If the colours be mixed with ſize, whites of eggs, or any ſuch proper glutinous, or unctuous ſubſtance, and not with oil, they then ſay, it is done in diſtemper; as thoſe of the admirable cartoons, formerly at Hampton court.

DISTENSION, the act of ſtretching a thing; alſo the ſtate of a thing violently ſtretched, and diſtended.

DISTICH, Διςιχον, a couplet of verſes; or a piece of poetry, the ſenſe whereof is comprehended in two lines. There are excellent morals in Cato's Diſtichs. See Vigneul de Marville on the Diſtichs of Cato, tom. i. p. 54, 55. Hexameter and pentameter verſes, otherwiſe called elegiacs, are diſpoſed in diſtichs.

DISTICHIASIS, in medicine, a diſorder of the eye lids; wherein, inſtead of one, they have two rows of cilia, or hairs. The word is formed of δις, *twice*, and ςιχος, or ςοιχος, *order*, *rank*. In the diſtichiaſis, over the common, and natural hairs, there grows another extraordinary row, which frequently eradicates, and tears up the former; and, pricking the membrane immediately inveſting the eye, occaſions pain, and draws defluxions upon it. It is cured by plucking up the ſecond rows of hairs with nippers, and cauteriſing the pores out of which they iſſued.

TREATISE ON DISTILLATION.

DISTILLATION: the objects of diſtillation, conſidered as a trade diſtinct from the other branches of chymiſtry, are chiefly ſpirituous liquors, and thoſe waters impregnated with the eſſential oils of plants, commonly called *ſimple diſtilled* waters. The diſtilling compound ſpirits and waters is reckoned a different branch of buſineſs, and they who deal in that way are commonly called *rectifiers*. This difference, however, though it exiſts among commercial people, is not at all founded in the nature of the thing; compound ſpirits being made, and ſimple ſpirits being rectified, by the very ſame operations by which they are at firſt diſtilled, or at leaſt with very trifling alterations.

Spirit perfectly flavourleſs, how obtained.

The great object with every diſtiller ought to be to procure a ſpirit perfectly flavourleſs, or at leaſt as well freed from any particular flavour as may be; and in this country the procuring of ſuch a ſpirit is no eaſy matter. The only materials for diſtillation that have been uſed in large quantity, are malt and molaſſes or treacle. Both of theſe, eſpecially the firſt, abound with an oily matter, which riſing along with the ſpirit, communicates a diſagreeable flavour to it, and from which it can ſcarce be freed afterwards by any means whatever. Some experiments have been made upon carrots, as a ſubject for the diſtillers: but theſe are not as yet ſufficiently deciſive; nor is it probable, that a ſpirit drawn from carrots would be at all devoid of flavour, more than one drawn from malt. To diſſipate the eſſential oil which gives the diſagreeable flavour to malt ſpirits, it has been propoſed to inſpiſſate the wort into a rob, or thin extract like a ſyrup; afterwards to thin it with water, and ferment it in the uſual manner. This certainly promiſes great ſueceſs; there is no ſubject we know of that is poſſeſſed of any kind of eſſential oil, but what will part with it by diſtillation, or by long boiling. The inſpiſſating of the wort, however, does not ſeem to be either neceſſary, or ſafe to to be attempted; for, in this caſe, there is great danger of its contracting an empyreuma, which never could be remedied. The quantity loſt by evaporation, therefore, might be occaſionally added, with an equal certainty of diſſipating the obnoxious oil. Whether the yield of ſpirit would be as great in this caſe as in the other, is a queſtion that can by no means be diſcuſſed without further experiments.

Eſſential Oil by ſome thought convertible into Spirit.

According to the theory adopted by ſome diſtillers, namely, that eſſential oils are convertible into ardent ſpirits; and that the more oily any ſubject is, the greater quantity of ſpirit is obtainable from it; the practice of diſſipating the oil before fermentation muſt certainly be a loſs. But we are too little acquainted with the compoſition of vinous ſpirits, to have any juſt foundation for adopting ſuch theories. Beſides, it is certain, that the quantity of ardent ſpirit producible from any ſubſtance, malt for inſtance, very greatly exceeds the quantity of eſſential oil which can by any means be obtained from the ſame; nor do we find that thoſe ſubſtances, which abound moſt in eſſential oil, yield the greateſt quantity of ſpirits. So far from this, fine ſugar, which contains little or no eſſential oil, yields a great deal of ardent ſpirit.

Directions concerning Fermentation.

Previous to the operation of diſtilling, thoſe of brewing and fermentation are neceſſary; but as theſe are fully treated of under the article BREWING, we ſhall here only obſerve, that unleſs the boiling of the wort, before fermentation, is found to diſſipate the eſſential oil, ſo as to take away the flavour of the malt, there is no neceſſity for being at the trouble of that operation. The wort may be immediately cooled and fermented. The fermentation ought always to be carried on as ſlowly as poſſible, and performed in veſſels cloſely ſtopped; only having at the bung a valve preſſed down by a ſpring, which will yield with leſs force than is ſufficient to burſt the veſſel. It ſhould even be ſuffered to remain till it has become perfectly fine and tranſparent; as by this means the ſpirit will not only be ſuperior in quantity, but alſo in fragrance, pungency, and vinoſity, to that commonly produced.

For Diſtillation.

With regard to performing the operation of diſtilling, there is only one general rule that can be given; namely, to let the heat, in all caſes, be as gentle as poſſible. Accidents will be effectually prevented by having the worm of a proper wideneſs, and by rectifying the ſpirits in a water bath; which, if ſufficiently large, will perform the operation with all the diſpatch requiſite for the moſt extenſive buſineſs. The veſſel in which the rectification is performed, ought to be covered with water up to the neck, and to be loaded with lead at the bottom, ſo that it may ſink in the water. Thus the operation will go on as quickly as if it was on an open fire, and without the leaſt danger of a miſcarriage; nor will it ever be neceſſary to make the water in the bath come to a boilling heat.

Combinatory Diſtillation, is a term introduced into uſe by Dr. Shaw, in his eſſay on diſtillation, to expreſs that ſort of rectification of diſtilled ſpirits which is done with additions, and which he otherwiſe calls improper rectification by way of diſtinction from that proper rectification, which is the only method of reducing a ſpirit to its utmoſt degree of purity and perfection.

In the combinatory diſtillation, many ingredients are added in order to rectify the ſpirit, as the diſtillers expreſs it; and ſome part of theſe actually come over and mix themſelves along with the ſpirit ſo intimately, as not to be ſeparable again without great difficulty. This is done with a deſign to alter, improve, or aboliſh the natural flavour of the ſpirit; but inſtead of rectifying it, they only obſcure and pervert its true qualities. In the buſineſs of rectification, properly ſo called, of the malt ſpirit, all that is neceſſary is the re-diſtilling of the low wines procured from the waſh; the again diſtilling over of the ſpirit thus obtained, and called proof ſpirit, into a totally inflammable liquor called alcohol. This is done by the common proceſſes, only taking care not to increaſe the fire by ſudden ſpurts, ſo as to raiſe the oil with the ſpirit, which if once mixed, will not be eaſily ſeparated again, and ſcarce ever perfectly, whatever care is uſed.

For Rectification.

As the end of rectification is to make the ſpirit clean as well as ſtrong, or to deprive it of the eſſential oil as well as the aqueous part, it will be proper to have regard to this even in the firſt diſtillation. For this purpoſe, the ſpirit, as it firſt comes over, ſhould be received into a quantity of cold water; as by this means the connection betwixt it and the oily matter will be conſiderably leſſened. For the ſame reaſon, after it has been once rectified in the water bath, it ſhould be again mixed with an equal quantity of water, and diſtilled a ſecond time. Thus the ſpirit will be freed from moſt of the oily matter, even though it hath been very much impregnated with it at firſt. It is neceſſary to obſerve, however, that by uſing ſuch a quantity of water, a conſiderable part of the ſpirit will be left in the reſiduum of each rectification. All theſe reſiduums, therefore, muſt be mixed together, and diſtilled on an open fire, with a briſk heat, that the remainder of the ſpirit may be got out.

After the ſpirit has been diſtilled once or twice in this manner from water, it may be diſtilled in a water bath without any addition; and this laſt rectification will free it from moſt of the water it contains. But if it is required to be highly dephlegmated, a quantity of pure and dry ſalt of tartar muſt be added. The attraction betwixt this ſalt and water is greater than that betwixt water and ſpirit of wine: The ſalt therefore imbibes the water contained in the ſpirit, and ſinks with it to the bottom. The ſpirit, by a ſingle diſtillation, may then be rendered perfectly free from water; but there is great danger of ſome of the alkaline ſalt riſing along with it, and impregnating it with what is called an urinous flavour. When this once happens, it is impoſſible to be remedied; and the only way to prevent it, is to make the heat with which the ſpirit is diſtilled as gentle as poſſible. It hath been propoſed, indeed, to prevent the riſing of any thing alkaline, by the admixture of ſome calcined vitriol, ſal catharticus amarus, or other imperfect neutral ſalt; but this can ſcarce be ſuppoſed to anſwer any good purpoſe, as the alkali unites itſelf with the oily matter of the ſpirit, and forms a kind of ſaponaceous compound, which is not ſo eaſily affected by the acid of vitriol or other ſalt, eſpecially as theſe ſalts will not diſſolve in the ſpirit itſelf.

The Methods of Combinatory Rectification are very numerous, every diſtiller having his peculiar noſtrum. Malt ſpirit is the general ſubject of this proceſs, and the means uſed to rectify it on this plan may be reduced to three heads. 1. That by fixed alkaline ſalt alone. 2. That by fixed alkaline ſalts and acid ſpirits. And 3. That by ſaline bodies and flavouring additions.

The general method is that by fixed alkaline ſalts alone; but it is ſurpriſing to ſee in how careleſs and ſlovenly a manner this is done by the generality of our diſtillers, though we are allowed to excel all other nations in it. The effect of this operation, when carefully performed, is to attenuate and thin the ſpirit, and to keep back a part of its groſs and fœtid oil, and ſo far to alter the part of the oil which comes over, as ſcarce to leave the ſpirit diſtinguiſhable for a malt ſpirit. This end is greatly promoted by a prudent and ſteady management of the fire, and by leaving out the faints; but this is a thing our diſtillers never attend to: they hurry over the operation, working the ſtill in its full force, and by this means raiſe and carry over the oil; though the whole buſineſs of the proceſs is to keep it back; and they even ſuffer the fulſome bitter oil, made into a kind of liquid ſoap with the ſalt in this proceſs, to run among the ſpirit with the faints; by this the whole intent of the proceſs is fruſtrated, and the ſpirit rendered much harder to clean than it was before.

This operation is uſually performed upon proof-ſpirit, and the quantity allowed is from eight to fourteen pounds of ſalt of tartar, fixed nitre, pot-aſh, or more commonly calcined tartar, to the piece. The tartar being only roaſted to a blackneſs in this laſt proceſs, is ſold under the abſurd notion of a vinous ſalt; and the dealers will often praiſe the vinoſity of their ſpirit, becauſe diſtilled from this ſalt: but the truth is, that this ſalt never fails to give, inſtead of a vinoſity, a ſaponaceous, urinous, or lixivial taſte and ſmell. This is the great misfortune that attends the method of rectifying by means of fixed ſalt, for they all of them become volatile in part during the operation; and this volatile portion paſſes over the helm with the ſpirit, and impregnates it, uniting itſelf alſo with that portion of oil yet retained in the ſpirit, and much more firmly combining it and the ſpirit together than they were before; ſo that in reality the ſpirit thus rectified is no other than an alkaline or tartariſed ſpirit, as the chymiſts call it, a thing extremely different from a true vinous ſpirit.

This method, therefore, though it were practiſed to the utmoſt perfection, would never do what was intended by it, but would alter, inſtead of rectifying the ſpirit. Hence there appears the neceſſity of ſome acid to deaden the force of the alkali thus uſed in the rectification. The neceſſity of this, gave occaſion to the method of mixing acids and alkalis together for theſe purpoſes. The acids uſed by our diſtillers on this occaſion, are thoſe of the mineral kingdom, becauſe of their cheapneſs; and the moſt common in uſe among them are oil of vitriol, ſpirit of nitre, oil of ſulphur, and the like. The moſt celebrated rectifiers in the malt way have got their reputation by the uſe of theſe acids. There is ſome choice, however, to be made of the ſpirits according to the greater or leſſer foulneſs and need of rectification, and they muſt not only be well proportioned, but carefully introduced, and regularly mixed; and indeed without ſome ſkill and judgment in the management of theſe corroſives, no diſtiller ought to attempt to meddle with them.

Theſe ſtrong and violent acids at beſt are not ſo well adapted to the work as the milder ones, particularly the ſulphureous ſpirit of vitriol, which comes over in the rectification of the oil; to this may be added the common *ſpiritus nitri dulcis*, and Mr. Boyle's acid ſpirit of wine well prepared.

Some of our rectifiers, inſtead of this ſalt, uſe quick-lime, which cleanſes and dephlegmates conſiderably: but this method requires the aſſiſtance of acids alſo afterwards, to take off not only the alkaline diſpoſition, but alſo the ſtinking flavour it leaves behind it. Some alſo uſe chalk, virgin earth calcined, and burnt animals bones. Theſe are of conſiderable uſe in the rectifying of brandy without rendering the ſpirit any more unfit for the purpoſe of the compounders than before, or requiring much acid afterwards.

The ultimate perfection aimed at in all the proceſſes of combinatory diſtillation, is the depurating of the Engliſh malt ſpirit at one operation, ſo as to render it taſteleſs and inordorous, and yet vinous; or elſe to make it reſemble the French brandy, arrack, or ſome other low flavoured vinous ſpirits.

This is certainly practicable, though not uſually practiſed to the perfection that it might be: the principal thing to be endeavoured after, is the obtaining of a taſteleſs ſpirit, capable of receiving any impreſſion, and then the buſineſs of flavouring is eaſy. The method of rectifying, by fixed alkaline ſalts, is capable of great improvement, as by ſteeping the ſpirit firſt brought near to the ſtate of alcohol, upon a well dried ſalt of tartar, or any other cheaper, but pure fixed alkali; by this means it will be almoſt totally freed of its oil without volatiliſing much of the ſalt, as it does in the way of diſtillation; by this means a weak tincture of ſalt of tartar may be procured, and an acid added to this, to take off the effects of the alkali in the ſpirit; the whole is then to be diſtilled, and the fire being well managed, a very clean ſpirit will be thus procured at one operation, ſuch as can no way elſe be obtained at once.

Of Imitating Foreign Spirits.

One very great deſideratum among the diſtillers of this country, is a method of imitating the foreign ſpirits, brandy, rum, gin, &c. to a tolerable degree of perfection; and notwithſtanding the many attempts that are daily made for this purpoſe, the ſucceſs in general hath been but very indifferent. One of the lateſt, Mr. Cooper hath the following obſervations, in his "Complete Syſtem of Diſtillation;" which, as they are applicable to all other ſpirits a well as brandy, we ſhall here tranſcribe.

Method of making Brandies in France.

" The general method of diſtilling brandies in France need not be formally deſcribed, as it differs in nothing from that practiſed here in working from malt waſh, or molaſſes; nor are they in the leaſt more cleanly or exact in the operation. They only obſerve more particularly to throw in a little of the natural ley into the ſtill along with the wine, as finding this gives their ſpirit the flavour for which it is generally admired abroad. But, though brandy is extracted from wine, experience tells us that there is a great difference in the grapes from which the wine is made. Every ſoil, every climate, every kind of grapes, varies with regard to the quantity and quality of the ſpirits extracted from them. There are ſome grapes which are only fit for eating; others for drying, as thoſe of Damaſcus, Corinth, Provence, and Avignon, but not fit to make wine. Some wines are very proper for diſtillation, and others much leſs ſo. The wines of Languedoc and Provence afford a great deal of brandy by diſtillation, when the operation is performed on them in their full ſtrength. The Orlean wines, and thoſe of Blois, afford yet more: but the beſt are thoſe of the territories of Cogniac and Andaye; which are, however, in the number of thoſe the leaſt drank in France. Whereas thoſe of Burgundy and Champagne, though of a very fine flavour, are improper, becauſe they yield but very little in diſtillation.

" It muſt alſo be farther obſerved, that all the wines for diſtillation, as thoſe of Spain, the Canaries, of Alicant, of Cyprus, of St. Peres, of Toquet, of Grave, of Hungary, and others of the ſame kind, yield very little brandy by diſtillation; and conſequently would coſt the diſtiller conſiderably more than he could ſell it for. What is drawn from them is indeed very good, always retaining the ſaccharine quality and rich flavour of the wine from whence it is drawn; but as it grows old, this flavour often becomes aromatic, and is not agreeable to all palates.

" Hence we ſee that brandies always differ according as they are extracted from different ſpecies of grapes. Nor would there be ſo great a ſimilarity as there is between the different kinds of French brandies, were the ſtrongeſt wines uſed for this purpoſe: but this is rarely the caſe: the weakeſt and loweſt flavoured wines only are diſtilled for their ſpirit, or ſuch as prove abſolutely unfit for any other uſe.

" A large quantity of brandy is diſtilled in France during the time of the vintage; for all thoſe poor grapes that prove unfit for wine, are uſually firſt gathered, preſſed, their juice fermented, and directly diſtilled. This rids their hands of their poor wines at once, and leaves their caſks empty for the reception of better. It is a general rule with them not to diſtil wine that will fetch any price as wine; for, in this ſtate, the profits upon them are vaſtly greater than when reduced to brandies. This large ſtock of ſmall wines, with which they are almoſt over-run in France, ſufficiently accounts for their making ſuch vaſt quantities of brandy in that country, more than in others which lie in warmer climates and are much better adapted to the production of grapes. Nor is this the only fund of their brandies; for all the wine that turns eager, is alſo condemned to the ſtill; and, in ſhort, all that they can neither export nor conſume at home, which amounts to a large quantity: ſince much of the wine laid in for their family proviſion is ſo poor as not to keep during the time of ſpending.

How Brandy may be imitated in this Country.

" Hence many of our Engliſh ſpirits, with proper management, are convertible into brandies that ſhall hardly be diſtinguiſhed from the foreign in many reſpects, provided the operation be neatly performed.

" The common method of rectifying ſpirits from alkaline ſalts, deſtroys their vinoſity, and in its ſtead introduces an urinous or lixivious taſte. But as it is abſolutely neceſſary to reſtore, or at leaſt to ſubſtitute in its room, ſome degree of vinoſity, ſeveral methods have been propoſed, and a multitude of experiments performed, in order to diſcover this great deſideratum. But none has ſucceeded equal to the ſpirit of nitre; and accordingly this ſpirit, either ſtrong or dulcified, has been uſed by moſt diſtillers to give an agreeable vinoſity to their ſpirits. Several difficulties, however, occur in the method of uſing it; the principal of which is, its being apt to quit the liquor in a ſhort time, and conſequently depriving the liquor of that vinoſity it was intended to give. In order to remove this difficulty, and prevent the vinoſity from quitting the goods, the dulcified ſpirit of nitre, which is much better than the ſtrong ſpirit, ſhould be prepared by a previous digeſtion, continued for ſome time, with alkohol; the longer the digeſtion is continued, the more intimately will they be blended, and the compound rendered the milder and ſofter.

" After a proper digeſtion, the dulcified ſpirit ſhould be mixed with the brandy, by which the vinoſity will be intimately blended with the goods, and not diſpoſed to fly off for a very conſiderable time. No general rule can be given for the quantity of this mineral acid requiſite to be employed; becauſe different proportions of it are neceſſary in different ſpirits. It ſhould, however, be carefully attended to, that though a ſmall quantity of it will undoubtedly give an agreeable vinoſity reſembling that naturally found in the fine ſubtile ſpirit drawn from wines, yet an over large doſe of it will not only cauſe a diſagreeable flavour, but alſo render the whole deſign abortive, by diſcovering the impoſition. Thoſe, therefore, who endeavour to cover a foul taſte in goods by large doſes of dulcified ſpirit of nitre, will find themſelves deceived.

" But the beſt, and indeed the only method of imitating French brandies to perfection, is by an eſſential oil of wine; this being the very thing that gives the French brandies their flavour. It muſt, however, be remembered, that in order to uſe even this ingredient to advantage, a pure taſteleſs ſpirit muſt firſt be procured; for it is ridiculous to expect that this eſſential oil ſhould be able to give the agreeable flavour of French brandies to our fulſome malt ſpirit, already loaded with its own nauſeous oil, or ſtrongly impregnated with a lixivious taſte from the alkaline ſalts uſed in rectification. How a pure inſipid ſpirit may be obtained, has already been conſidered; it only therefore remains to ſhew the method of procuring this eſſential oil of wine, which is this:

" Take ſome cakes of dry wine lees, ſuch as are uſed by our hatters, diſſolve them in ſix or eight times their weight of water, diſtil the liquor with a ſlow fire, and ſeparate the oil with a ſeparating glaſs; reſerving for the niceſt uſes only that which comes over firſt, the ſucceeding oil being coarſer and more reſinous. Having procured this fine oil of wine, it may be mixed into a quinteſſence with pure alcohol; by which means it may be preſerved a long time fully poſſeſſed of all its flavour and virtues; but, without ſuch management it will ſoon grow reſinous and rancid.

" When a fine eſſential oil of wine is thus procured, and alſo a pure and inſipid ſpirit, French brandies may be imitated to perfection,

fection, with regard to the flavour. It muſt however be remembered, and carefully adverted to, that the eſſential oil be drawn from the ſame kind of lees as the brandy to be imitated was procured from; we mean, in order to imitate Coniac brandy, it will be neceſſary to diſtil the eſſential oil from Coniac lees; and the ſame for any other kind of brandy. For, as different brandies have different flavours, and as theſe flavours are entirely owing to the eſſential oil of the grape, it would be prepoſterous to endeavour to imitate the flavour of Coniac brandy with an eſſential oil procured from the lees of Bourdeaux wine. When the flavour of the brandy is well imitated by a proper doſe of the eſſential oil, and the whole reduced into one ſimple and homogeneous fluid, other difficulties are ſtill behind: the flavour, though the eſſential part, is not, however, the only one; the colour, the proof, and the ſoftneſs, muſt alſo be regarded, before a ſpirit that perfectly reſembles brandy can be procured. With regard to the proof, it may be eaſily hit, by uſing a ſpirit rectified above proof; which, after being intimately mixed with the eſſential oil of wine, may be let down to a proper ſtandard with fair water. And the ſoftneſs may, in a great meaſure, be obtained by diſtilling and rectifying the ſpirit with a gentle fire; and what is wanting of this criterion in the liquor when firſt made, will be ſupplied by time: for it muſt be remembered, that it is time alone that gives this property to French brandies; they being at firſt acrid, foul, and fiery. But, with regard to the colour, a particular method is required to imitate it to perfection.

Spirits how coloured.

“ The art of colouring ſpirits owes its riſe to obſervations on foreign brandies. A piece of French brandy that has acquired by age a great deal of ſoftneſs and ripeneſs, is obſerved, at the ſame time, to have acquired a yellowiſh brown colour; and hence our diſtillers have endeavoured to imitate this colour in ſuch ſpirits as are intended to paſs for French brandy. And in order to this, a great variety of experiments have been made on different ſubſtances. But in order to know a direct and ſure method of imitating this colour to perfection, it is neceſſary we ſhould be informed whence the French brandies themſelves acquire their colour. This diſcovery is very eaſily made. The common experiment of trying whether brandy will turn blackiſh with a ſolution of iron, ſhews that the colour is owing to ſome of the reſinous matter of the oak caſk diſſolved in the ſpirit. There can be no difficulty, therefore, in imitating this colour to perfection. A ſmall quantity of the extract of oak, or the ſhavings of that wood, properly digeſted, will furniſh us with a tincture capable of giving the ſpirit any degree of colour required. But it muſt be remembered, that as the tincture is extracted from the caſk by brandy, that is, alcohol and water, it is neceſſary to uſe both in extracting the tincture; for each of theſe diſſolves different parts of the wood. Let, therefore, a ſufficient quantity of oak ſhavings be digeſted in ſtrong ſpirit of wine, and alſo at the ſame time other oak ſhavings be digeſted in water; and when the liquors have acquired a ſtrong tincture from the oak, let both be poured off from the ſhavings into different veſſels, and both placed over a gentle fire till reduced to the conſiſtence of treacle. In this condition let the two extracts be intimately mixed together; which may be effectually done by adding a ſmall quantity of loaf ſugar, in fine powder, and rubbing the whole well together. By this means a liquid eſſential extract of oak will be procured, and always ready to be uſed as occaſion ſhall require.

“ There are other methods in uſe for colouring brandies; but the beſt, beſides the extract of oak above mentioned, are treacle and burnt ſugar. The treacle gives the ſpirits a fine colour, nearly reſembling that of French brandy; but as its colour is but dilute, a large quantity muſt be uſed: this is not, however, attended with any bad conſequences; for notwithſtanding the ſpirit is really weakened by this addition, yet the bubble proof, the general criterion of ſpirits, is greatly mended by the tenacity imparted to the liquor by the treacle. The ſpirit alſo acquires from the mixture a ſweetiſh or luſcious taſte, and a fullneſs in the mouth; both which properties render it very agreeable to the palates of the common people, who are, in fact, the principal conſumers of theſe ſpirits. A much ſmaller quantity of burnt ſugar than of treacle will be ſufficient for colouring the ſame quantity of ſpirits: the taſte is alſo very different; for inſtead of the ſweetneſs imparted by the treacle, the ſpirit acquires from the burnt ſugar an agreeable bitterneſs, and by that means recommends itſelf to nicer palates, which are offended with a luſcious ſpirit. The burnt ſugar is prepared by diſſolving a proper quantity of ſugar in a little water, and ſcorching it over the fire till it acquires a black colour. Either treacle or burnt ſugar will nearly imitate the genuine colour of old French brandy; but neither of them will ſucceed when put to the teſt of the vitriolic ſolution.

“ The ſpirit diſtilled from molaſſes or treacle is very clean or pure. It is made from common treacle diſſolved in water, and fermented in the ſame manner as the waſh for the common malt ſpirit. But if ſome particular art is not uſed in diſtilling this ſpirit, it will not prove ſo vinous as malt ſpirit, but more flat and leſs pungent and acid, though otherwiſe much cleaner taſted, as its eſſential oil is of a much leſs offenſive flavour. Therefore, if good freſh wine lees, abounding in tartar, be added and duly fermented with the molaſſes, the ſpirit will acquire a much greater vinoſity and briſkneſs, and approach much nearer to the nature of foreign ſpirits. Where the molaſſes ſpirit is brought to the common proof ſtrength, if it is found not to have a ſufficient vinoſity, it will be very proper to add ſome good dulcified ſpirit of nitre; and if the ſpirit be clean worked, it may, by this addition only, be made to paſs on ordinary judges for French brandy. Great quantities of this ſpirit are uſed in adulterating foreign brandy, rum, and arrack. Much of it is alſo uſed alone in making cherry brandy, and other drams by infuſion; in all which many, and perhaps with juſtice, prefer it to foreign brandies. Molaſſes, like all other ſpirits, is entirely colourleſs when firſt extracted; but diſtillers always give it as nearly as poſſible the colour of foreign ſpirits.”

Rum how imitated.

If theſe principles hold good, the imitation of foreign ſpirits of all kinds muſt be an eaſy matter. It will only coſt the procuring of ſome of thoſe ſubſtances from which the ſpirit is drawn; and diſtilling this with water, the eſſential oil will always give the flavour deſired. Thus, to imitate Jamaica rum, it will only be neceſſary to procure ſome of the tops, or other uſeleſs parts, of the ſugar-canes; from which an eſſential oil being drawn, and mixed with clean molaſſes ſpirit, will give it the true flavour. The principal difficulty muſt lie in procuring a ſpirit totally, or nearly, free of all flavour of its own. The ſpirit drawn from the refuſe of a ſugar-houſe is by our author commended as ſuperior to that drawn from molaſſes; though even this is not entirely devoid of ſome kind of flavour of its own; nor indeed is that drawn from the beſt refined ſugar entirely flavourleſs. It is very probable, therefore, that to procure an abſolutely flavourleſs ſpirit is impoſſible. The only method, therefore, of imitating foreign ſpirits, is by chooſing ſuch materials as will yield a ſpirit flavoured as much like them as poſſible. The materials moſt recommended by our author in this caſe, and probably the beſt that can be uſed are raiſins. Concerning theſe he gives the following directions.

“ In order to extract this ſpirit, the raiſins muſt be infuſed in a proper quantity of water, and fermented in the manner already directed. When the fermentation is completed, the whole is to be thrown into the ſtill, and the ſpirit extracted by a ſtrong fire. The reaſon why we here direct a ſtrong fire is, becauſe by that means a greater quantity of the eſſential oil will come over the helm with the ſpirit, which will render it fitter for the diſtiller's purpoſe; for this ſpirit is commonly uſed to mix with common malt goods; and it is ſurpriſing how far it will go in this reſpect, ten gallons of it being often ſufficient to give a determining flavour and agreeable vinoſity to a whole piece of malt ſpirits.

“ It is therefore well worth the diſtiller's while to endeavour at improving the common method of extracting ſpirits from raiſins; and perhaps the following hint may merit attention When the fermentation is completed, and the ſtill charged with fermented liquor as above directed, let the whole be drawn off with as briſk a fire as poſſible; but, inſtead of the caſk or can generally uſed by diſtillers for a receiver, let a large glaſs, called by chymiſts a ſeparating glaſs, be placed under the noſe of the worm, and a common receiver applied to the ſpout of the ſeparating glaſs: by this means the eſſential oil will ſwim upon the top of the ſpirit, or rather low wine, in the ſeparating glaſs, and may be eaſily preſerved at the end of the operation. The uſe of this limpid eſſential oil is well known to diſtillers; for in this reſides the whole flavour, and conſequently may be uſed to the greateſt advantage in giving that diſtinguiſhing taſte and true vinoſity to the common malt ſpirits. After the oil is ſeparated from the low-wine, the liquor may be rectified in balneo mariæ into a pure and almoſt taſteleſs ſpirit, and therefore well adapted to make the fineſt compound cordials, or to imitate or mix with the fineſt French brandies, arracks, &c. In the ſame manner a ſpirit may be obtained from cyder. But as its particular flavour is not ſo deſirable as that obtained from raiſins, it ſhould be diſtilled in a more gentle manner, and carefully rectified according to the directions we have already given.”

Directions for diſtilling Compound Spirits.

Theſe directions may ſuffice for the diſtillation of any kind of ſimple ſpirits. The diſtillation of compound ones depends on the obſervation of the following general rules, which are very eaſy to be learned and practiſed.

1. The artiſt muſt always be careful to uſe a well cleanſed ſpirit, or one freed from its own eſſential oil. For, as a compound water is nothing more than a ſpirit impregnated with the eſſential oil of the ingredients, it is neceſſary that the ſpirit ſhould have depoſited its own.

2. Let the time of previous digeſtion be proportioned to the tenacity of the ingredients, or the ponderoſity of their oil.

3. Let the ſtrength of the fire alſo be proportioned to the ponderoſity of the oil intended to be raiſed with the ſpirit.

4. Let only a due proportion of the fineſt parts of the eſſential oil be united with the ſpirit: the groſſer and leſs fragrant parts of the oil not giving the ſpirit ſo agreeable a flavour, and at the ſame time rendering it unſightly. This may in a great meaſure be effected by leaving out the faints, and making up to proof with fine ſoft water in their ſtead.

A careful obſervation of theſe four rules will render this part of diſtillation much more perfect than it is at preſent. Nor will there be any occaſion for the uſe of burnt alum, white of eggs, iſinglaſs, &c. to fine down cordial waters; for they will preſently be fine, ſweet and pleaſant taſted, without any further trouble. We ſhall now ſubjoin particular receipts for making ſome of thoſe compound waters, or ſpirits, that are moſt commonly to be met with, and are in the moſt general eſtimation.

Receipts for a Number of Compound Spirits.

Strong Cinnamon Water. Take eight pounds of fine cinnamon bruiſed, 17 gallons of clean rectified ſpirit, and two gallons of water. Put them into your ſtill, and digeſt them 24 hours with a gentle heat; after which draw off 16 gallons with a pretty ſtrong heat. A cheaper ſpirit, but of an inferior quality, may be obtained, by uſing caſſia lignea inſtead of cinnamon. If you would dulcify your cinnamon water, take double-refined ſugar in what quantity you pleaſe; the general proportion is about two pounds to a gallon; and diſſolve it in the ſpirit, after you have made it up proof with clean water. One general caution is here neceſſary to be added; namely, that near the end of the operation, you carefully watch the ſpirit as it runs into the receiver, in order to prevent the faints from mixing with the goods. This you may diſcover by often catching ſome of it as it runs from the worm in a glaſs, and obſerving whether it is fine and tranſparent; for as ſoon as ever the faints begin to riſe, the ſpirit will have an azure or bluiſh caſt. As ſoon as this alteration in colour is perceived, the receiver muſt be immediately changed; for if the faints are ſuffered to mix themſelves with the reſt, the value of the goods will be greatly leſſened. Here we may obſerve, that the diſtillers call ſuch goods as are made up proof, double goods; and thoſe below proof, ſingle.

Clove Water. Take of cloves bruiſed, four pounds; pimento, or all-ſpice, half a pound; proof ſpirit, 16 gallons. Digeſt the mixture 12 hours in a gentle heat, and then draw off 15 gallons with a pretty briſk fire. The water may be coloured red, either by a ſtrong tincture of cochineal, alkanet, or corn-poppy flowers. It may be dulcified at pleaſure with double-refined ſugar.

Lemon Water. Take of dried lemon peel, four pounds; clean proof ſpirit 10 gallons and a half, and one gallon of water. Draw off 10 gallons by a gentle fire, and dulcify with fine ſugar.

Citron Water. Take of dry yellow rhinds of citrons, three pounds; of orange-peel, two pounds; nutmegs bruiſed, three quarters of a pound; clean proof-ſpirit, ten gallons and a half; water, one gallon: digeſt with a gentle heat; then draw off ten gallons in balneo mariæ, and dulcify with fine ſugar.

Aniſeed Water. Take of aniſeed bruiſed, two pounds; proof-ſpirit, twelve gallons and a half; water, one gallon: draw off ten gallons with a moderate fire. This water ſhould never be reduced below proof; becauſe the large quantity of oil with which it is impregnated, will render the goods milky and foul when brought down below proof. But if there is a neceſſity for doing this, their tranſparency may be reſtored by filtration.

Orange Water. Take of the yellow part of freſh orange-peels, five pounds; clean proof ſpirit, ten gallons and a half; water, two gallons: draw off ten gallons with a gentle fire.

Cedrat Water. The cedrat is a ſpecies of citron, and very highly eſteemed in Italy where it grows naturally. The fruit is difficult to be procured in this country; but as the eſſential oil is often imported from Italy, it may be made with it according to the following receipt. Take of the fineſt loaf-ſugar reduced to powder, a quarter of a pound; put it into a glaſs mortar, with 120 drops of the eſſence of cedrat; rub them together with a glaſs peſtle; and put them into a glaſs alembic, with a gallon of fine proof-ſpirits and a quart of water. Place the alembic in balneo mariæ, and draw off one gallon, or till the faints begin to riſe; and dulcify with fine ſugar. This is reckoned the fineſt cordial yet known; it will therefore be neceſſary to be particularly careful that the ſpirit is perfectly clean, and, as much as poſſible, freed from any flavour of its own.

Ros Solis. Take of the herb called ros ſolis, picked clean, four pounds; cinnamon, cloves, and nutmegs, of each three ounces and a half; marigold-flowers, one pound; caraway-ſeeds, ten ounces; proof-ſpirit, ten gallons; water, three gallons. Diſtill with a pretty ſtrong fire, till the faints begin to riſe. Then take of liquorice root ſliced, half a pound; raiſins ſtoned, two pounds; red ſaunders, half a pound: digeſt theſe three days in two quarts of water; then ſtrain out the clear liquor, in which diſſolve three pounds of fine ſugar, and mix it with the ſpirit drawn by diſtillation.

Uſquebaugh. Take of nutmegs, cloves, and cinnamon, of each two ounces; of the ſeeds of aniſe, caraway, and coriander, of each four ounces; liquorice-root ſliced, half a pound. Bruiſe the ſeeds and ſpices; and put them, together with the liquorice, into the ſtill with 11 gallons of proof ſpirits, and two gallons of water. Diſtill with a pretty briſk fire till the faints begin to riſe. But, as ſoon as the ſtill begins to work, faſten to the noſe of the worm two ounces of Engliſh ſaffron tied up in a cloth, that the liquor may run through it, and extract all its tincture; and in order to this, you ſhould frequently preſs the ſaffron with your fingers. When the operation is finiſhed, dulcify your goods with fine ſugar.

Ratafia. Is a liquor prepared from different kinds of fruits, and is of different colours according to the fruits made uſe of. Of red ratafia there are three kinds, the fine, the dry or ſharp, and the common. The fruits moſt proper for making red ratafia, are the black heart cherry, the common red cherry, the black cherry, the mery or honey cherry, the ſtrawberry, the raſberry, the red gooſeberry, and the mulberry. Theſe fruits ſhould be gathered when in their greateſt perfection, and the largeſt and moſt beautiful of them choſen for the purpoſe. The following is a receipt for making red ratafia, fine and ſoft. Take of the black heart cherries 24 pounds; black cherries, four pounds; raſberries and ſtrawberries, of each three pounds. Pick the fruits from their ſtalks, and bruiſe them; in which ſtate let them continue 12 hours: preſs out the juice; and to every pint of it add a quarter of a pound of ſugar. When the ſugar is diſſolved, run the whole through the filtrating bag, and add to it three quarts of clean proof ſpirits. Then take of cinnamon, four ounces; of mace, an ounce; and of cloves, two drams. Bruiſe theſe ſpices; put them into an alembic with a gallon of clean proof ſpirits and two quarts of water, and draw off a gallon with a briſk fire. Add as much of this ſpicy ſpirit to your ratafia as will render it agreeable to your palate; about one fourth is the uſual proportion.

Ratafia made according to the above receipt will be of a very rich flavour and elegant colour. It may be rendered more or leſs of a ſpicy flavour, by adding or diminiſhing the quantity of ſpirit diſtilled from the ſpices. Some, in making ratafia, ſuffer the expreſſed juices of their fruits to ferment ſeveral days: by this means the vinoſity of the ratafia is increaſed; but, at the ſame time, the elegant flavour of the fruits is greatly diminiſhed. Therefore, if the ratafia is deſired ſtronger or more vinous, it may be done by adding more ſpirits to the expreſſed juice; by which means the flavour of the fruits may be preſerved, as well as the ratafia rendered ſtronger. It is alſo a method with ſome to tie the ſpices in a linen bag, and ſuſpend them in the ratafia. But if this method is taken, it will be neceſſary to augment the quantity of ſpirit firſt added to the expreſſed juice. There is no great difference in the two methods of adding the ſpices, except that by ſuſpending them in the ratafia the liquor is rendered leſs tranſparent.

Dry or Sharp Ratafia. Take cherries and gooſeberries, of each 30 pounds; mulberries, ſeven pounds; raſberries, ten pounds. Pick all theſe fruits clean from their ſtalks, &c. bruiſe them, and let them ſtand 12 hours; but do not ſuffer them to ferment. Preſs out the juice, and to every pint add three ounces of ſugar. When the ſugar is diſſolved, run it through the filtrating bag, and to every five pints of liquor, add four pints of clean proof ſpirit; together with the ſame proportion of ſpirit drawn from the ſpices in the foregoing compoſition.

Common Ratafia. Take of nutmegs, eight ounces; bitter almonds, ten pounds; Liſbon ſugar, eight pounds; ambergreaſe, ten grains: infuſe theſe ingredients three days in ten gallons of clean proof ſpirit, and filter through a flannel bag for uſe. The nutmegs and bitter almonds muſt be bruiſed, and the ambergreaſe rubbed with Liſbon ſugar in a marble mortar, before they are infuſed in the ſpirit.

Gold Cordial. Take of the roots of angelica, four pounds; raiſins ſtoned, two pounds; coriander-ſeeds, half a pound; caraway-ſeeds and cinnamon, of each half a pound; cloves, two ounces: figs and liquorice-root, of each one pound; proof ſpirit eleven gallons; water, two gallons. The angelica, liquorice, and figs, muſt be ſliced before they are added. Digeſt two days; and draw off by a gentle heat till the faints begin to riſe; hanging in a piece of linen, faſtened to the mouth of the worm, an ounce of Engliſh ſaffron. Then diſſolve eight pounds of ſugar in three quarts of roſe-water, and add to it the diſtilled liquor.

Geneva. There was formerly ſold in the apothecaries ſhops a diſtilled ſpirituous water of juniper: but the vulgar being fond of it as a dram, the diſtillers ſupplanted the apothecaries, and ſold it under the name of geneva. The common kind, however, is not made from juniper-berries, but from oil of turpentine; and indeed it is ſurpriſing, that people ſhould accuſtom themſelves to drink ſuch liquors for pleaſure. The receipt for making this kind of ſpirit, ſold in the gin-ſhops at London, is as follows. Take of the ordinary malt ſpirits, ten gallons; oil of turpentine, two ounces; bay-ſalt, three handfuls: draw off by a gentle fire till the faints begin to riſe; and make up your goods to the ſtrength required with clear water.

The beſt kind is made by the following recipe. Take of juniper-berries, three pounds; proof ſpirit, ten gallons; water, four gallons: draw off by a gentle fire till the faints begin to riſe, and make up your goods to the ſtrength required with clean water.

There is a ſort of this liquor called Hollands Geneva, from its being imported from Holland, which is greatly eſteemed. The ingredients uſed by the Dutch, are the ſame with thoſe given in the laſt recipe; only, inſtead of malt-ſpirits, they uſe French brandy. But from what has been already obſerved concerning the nature of theſe kinds of ſpirits, it is eaſy to ſee, that by the help of a well rectified ſpirit, geneva may be made in this country at leaſt nearly equal to the Dutch, provided it is kept to a proper age; for all ſpirituous liquors contract a ſoftneſs and mellowneſs by age, impoſſible to be imitated any other way.

Brewing for Distillation. See Brewing.

Distillation *of Salt Water*, in order to obtain freſh. See *Salt* Water.

DISTILLER, a perſon who diſtills ſpirits for ſale. Such a perſon is liable to the ſurvey and duties; and is not allowed to have any ſtill or number of ſtills, which ſingly or together contain leſs than a hundred gallons under the penalty of 100l. and the waſh-ſtill ſhall contain at leaſt four hundred gallons, excluſive of the head, under the ſame penalty. 2 Geo. III. c. 5. and 14 Geo. III. c. 73.

DISTINCT *Notion*, or *Idea*, is, when we can enumerate marks and characters enough whereby to recollect a thing. Such, e. gr. is this; that a circle is a figure bounded with a curve line that returns into itſelf; all the points whereof are equally diſtant from one middle part.

DISTINCTION, a diverſity in things, or conceptions. Logicians define diſtinction, an aſſemblage of two, or more words, whereby diſparate things, or their conceptions, are denoted.

DISTORTION, in medicine, is when any part of the human body remarkably deviates from its natural ſhape or poſition. Diſtortions of different parts may ariſe either from a convulſion or palſy; though ſometimes a terrible diſtortion in the ſhape of the whole body hath ariſen merely from careleſſneſs and ill habits. Mr. Winſlow, in the Memoirs of the Academy of Sciences at Paris, gives a very remarkable account of a lady of quality, whom he had known to be perfectly ſtraight for ſeveral years; but who taking afterwards to a ſedentary courſe of life, got a cuſtom of dreſſing herſelf very careleſsly, and of leaning as ſhe ſat, either forwards, or to a ſide. It was not many months before ſhe found it painful and troubleſome to ſtand or ſit upright: and ſoon afterwards ſhe found an inequality in the lower part of the back-bone. Alarmed at this, ſhe conſulted the gentleman who gave the account. To prevent the increaſe of the malady, he ordered her to wear a particular ſort of jumps inſtead of ſtays, and had a pad of a proper ſize applied: but this was ſoon neglected; and the conſequence was, that in a little time the back-bone became more and more crooked, and at length bent itſelf ſidewiſe in two contrary directions, ſo as to repreſent the figure of the Roman S; and the lady, ſtill refuſing to take the proper meaſures, loſt a fourth part of her height: and continued for the remainder of her life, not only crooked from right to left, and from left to right, but ſo oddly folded together, that the firſt of the falſe ribs on one ſide, approached very near the creſt of the os ilium on that ſide, and the viſcera of the lower belly became ſtrangely puſhed out of their regular places to the oppoſite ſide: and the ſtomach itſelf was ſo ſtrongly compreſſed, that whatever ſhe ſwallowed ſeemed to her to fall into two ſeparate cavities.

DISTORTOR *Oris*, in anatomy, a muſcle of the mouth, called alſo zygomaticus. See Syſtem of Anatomy, Sect. IX.

DISTRAIN, in law. To diſtrain, is to attach, or ſeize on one's goods, for the ſatisfaction of a debt.

DISTRESS, in law, the ſeizing or diſtraining any thing for rent in arrear, or other duty unperformed.

The effect of this diſtreſs is to compel the party either to replevy the things diſtrained, and conteſt the taking, in an action of treſpaſs againſt the diſtrainer; or rather to oblige him to compound and pay the debt or duty for which he was ſo diſtrained.

There are likewiſe compulſory diſtreſſes in actions, to cauſe a perſon to appear in court; of which kind there is a diſtreſs perſonal of one's moveable goods, and the profits of his lands, for contempt in not appearing after ſummons: there is likewiſe diſtreſs real, of a perſon's immoveable goods. In theſe caſes none ſhall be diſtrained to anſwer for any thing touching their freeholds, but by the king's writ.

Diſtreſs may be either finite or infinite. Finite diſtreſs is that which is limited by law, in regard to the number of times it ſhall be made, in order to bring the party to a trial of the action. Infinite diſtreſs is that which is without any limitation, being made till the perſon appears: it is farther applied to jurors that do not appear; as, upon a certificate of aſſiſe, the proceſs is *venire facias, habeas corpora*, and diſtreſs infinite.

It is alſo divided into grand diſtreſs, and ordinary diſtreſs: of theſe the former extends to all the goods and chattels that the party has within the county. A perſon, of common right, may diſtrain for rents and all manner of ſervices; and where a rent is reſerved on a gift in tail, leaſe for life, or years, &c. though there be no clauſe of diſtreſs in the grant or leaſe, ſo as that he has the reverſion: but on a feoffment made in fee, a diſtreſs may not be taken, unleſs it be expreſsly reſerved in the deed.

DISTRIBUTION, in a general ſenſe, the act of dividing a thing into ſeveral parts, in order to the diſpoſing each in its proper place.

Distribution, in law, the ſurplus of an eſtate, or *pour autre vie*, is diſtributable by adminiſtrators.

Distribution, in logic, is a kind of diviſion which diſtinguiſhes an univerſal whole into its ſeveral kinds or ſpecies. The rules of a good diſtribution are much the ſame as thoſe of diviſion.

Distribution, in painting, denotes the diſpoſition of the objects and lights in a picture. See Clair-Obscure.

Distribution, in printing, the taking a form aſunder, ſeparating the letters, and diſpoſing them in the caſes again, each in its proper cell.

Distribution, in rhetoric, is a kind of deſcription; or a figure whereby an orderly diviſion and enumeration is made of the principal qualities of a ſubject.

DISTRICT, the territory, or extent of juriſdiction of a judge. judge or officer, cannot act out of his own diſtrict.

District, in law, properly denotes the place wherein a man has the power of diſtraining; or, the circuit, or territory, wherein one may be compelled to appear. Where we ſay, *hors de ſon fee*; others ſay, *extra diſtrictum ſuum*.

DISTRINGAS, a writ directed to the ſheriff, or other officer commanding him to diſtrain one for a debt to the king; or for his appearance at a certain day.

Distringas *Juratores*, a writ directed to the ſheriff, whereby he is commanded to diſtrain upon a jury to appear, and to return iſſues on their lands, &c. for non-appearance. This writ iſſues for the ſheriff to have their bodies in court, &c. at the return of the writ.

DISVELOPED, in heraldry, is uſed much in the ſame ſenſe with diſplayed. Thus colours, ſaid in an army to be flying, are, in heraldry, ſaid to be diſveloped.

DITCH, in agriculture. In marſhes, and other wet land, where there are no hedges, the common fence and incloſure for land is a ditch. They allow theſe ditches ſix feet wide againſt highways that are broad, and againſt commons five feet. But the common ditches about incloſures, dug at the bottom of the bank, on which the quick is raiſed, are three feet wide at the top, one at the bottom, and two feet deep; by this means each ſide has a ſlope, which is of great advantage; for where they neglect this, and dig them perpendicular, they are always waſhing down: beſide, in a narrow bottomed ditch, if cattle get down into it, they cannot ſtand to turn themſelves to crop the quick; but where the ditch is four feet wide, it ſhould be two and a half deep; and where it is five wide, it ſhould be three deep; and ſo in proportion.

Ditch, in fortification, called alſo foſs and moat, a trench dug round the rampart, or wall of a fortified place, between the ſcarp and counterſcarp. See Syſtem of Fortification.

Ditch *Water*. See Water.

DITHYRAMBUS, Διθυραμβος, in the ancient poetry, a hymn in honour to Bacchus, full of tranſport and poetical rage. This poetry owes its birth to Greece, and to the tranſports of wine; and yet art is not quite exploded, but delicately applied to guide and reſtrain the dithyrambic impetuoſity, which is indulged only in pleaſing flights. Horace and Ariſtotle tell us, that the ancients gave the name of dithyrambus to thoſe verſes wherein none of the common rules or meaſures were obſerved. As we have now no remains of the dithyrambus of the ancients, we cannot ſay exactly what their meaſure was.

DITONE, Ditonum, in muſic, an interval comprehending two tones, a greater and a leſs. The word is formed of δις, *twice*, and τονος, *tone*.

DITTO, in books of accounts, written contractedly D°. ſignifies the ſame, viz. as the preceding article.

The word is corrupted from the Italian *detto*, *the ſaid*; as in our law phraſe "the ſaid premiſes," meaning the ſame as were aforementioned.

DIVAN, a council-chamber, or court, wherein juſtice is adminiſtered, in the eaſtern nations, particularly among the Turks. Divan is an Arabic word, ſignifying the ſame with *ſopha* in the Turkiſh dialect. There are two ſorts of divans, that of the grand ſignior, called the council of ſtate, which conſiſts of ſeven of the principal officers of the empire; and that of the grand vizir, compoſed of ſix other vizirs, or counſellors of ſtate, the chancellor and ſecretaries of ſtate, for the diſtribution of juſtice. The word is alſo uſed for a hall, in the private houſes of the orientals. The cuſtom of China does not allow the receiving of viſits in the inner parts of the houſe, but only at the entry, in a divan contrived on purpoſe for ceremonies. Travellers relate wonders of the ſilence and expedition of the divans of the Eaſt.

Divan-*Beghi*, the appellation of one of the miniſters of ſtate in Perſia. The divan-beghi is the ſuperintendant of juſtice; his place is the laſt of the ſix miniſters of the ſecond rank, who are all under the athemadaulet, or firſt miniſter. In the tribunal of the divan-beghi appeals lie from ſentences paſſed by the governors. He has a fixed ſtipend, or appointment, of 50,000 crowns, that he may render juſtice gratis. All the ſerjeants, uſhers, &c. of the court, are in the ſervice of the divan-beghi. He takes cognizance of the criminal cauſes of the chams, governors, and other great lords of Perſia, when accuſed of any fault, and receives appeals from the daruga. There are divan-beghis not only at court, and in the capital, but alſo in the provinces, and other cities of the empire. This officer is not confined by any other law or rule, in the adminiſtration of juſtice, but the Alcoran, which alſo he interprets at pleaſure. He takes no cognizance of civil cauſes.

DIVER, in ornithology, the Engliſh name of the colymbus, a genus of water birds, belonging to order 9 of the 2d diviſion.

DIVERGENT, or Diverging *Lines*, in geometry, are ſuch whoſe diſtance is continually increaſing. Lines which converge one way, diverge the oppoſite way.

Divergent, or *Diverging*, in optics, is particularly applied to rays, which, iſſuing from a radiant point, or having in their paſſage undergone a refraction, or reflection, do continually recede farther from each other. In which ſenſe the word is oppoſed to convergent, which implies the rays to approach each other; or to tend to a centre, where, being arrived, they interſect; and, if continued farther, become diverging. Concave glaſſes render the rays diverging; and convex ones, converging. Concave mirrors make the rays converge; and convex ones, diverge. See Syſtem of Optics.

DIVERSIFYING, in rhetoric, is of infinite ſervice to the orator; it is an accompliſhment eſſential to his character, and may fitly be called the ſubject of all his tropes and figures. Voſſius lays down ſix ways of diverſifying a ſubject. 1. By enlarging on what was briefly mentioned before. 2. By a conciſe enumeration of what had been inſiſted on at length. 3. By adding ſomething new to what is repeated. 4. By repeating only the principal heads of what had been ſaid. 5. By tranſpoſing the words and periods. 6. By imitating them. Voſſ. Rhet. lib. v. p. 281, ſeq.

DIVERSION, in medicine, the turning of the courſe or flux of humours from one part to another, by proper applications.

Diversion, in war, the act of attacking an enemy in one place, where he is weak, and unprovided, with deſign to make him call his forces from another place, where he was going to make an irruption, or is to be attacked with greater force. The Romans had no way to drive Hannibal out of Italy, but to make a diverſion, by attacking Carthage.

DIVERSITY. This differs from diſtinction in this, that the latter is the work of the mind; but the former is in things themſelves, antecedent to the operation of the mind. For things that are ſeveral, are different; even though I do not conceive them. The diverſity, or difference of things, therefore, ariſes from their eſſential attributes.

DIVERSITY, in painting, conſiſts in giving every part or figure in a picture its proper air and attitude. The ſkilful painter has the penetration to diſcern the characters of nature, which vary in all men; whence the countenances and geſtures of the perſons he paints continually vary.

DIVESTING, properly ſignifies undreſſing, or ſtripping off one's garment, in contradiſtinction from inveſting. In law, it is uſed for the act of ſurrendering, or relinquiſhing one's effects. By a contract of donation, or ſale, the donor, or ſeller, is ſaid to be diſſeiſed and diveſted of their property in ſuch a commodity, and the donee, or purchaſer, becomes inveſted therewith. A demiſe is a general diveſtiture, which the fathers and mothers make of all their effects, in favour of their children.

DIVIDEND, in arithmetic, the number given to be divided: or that whereof the diviſion is made. The dividend muſt always be greater than the diviſor. The dividend contains the diviſor as many times as the quotient contains units. See Syſtem of Arithmetic, Article V.

Dividend *of a Bankrupt's Eſtate*, is that part which is diſtributed to every creditor in proportion to his debt.

Dividend *of Stocks*, is a ſhare or proportion of the intereſt of ſtocks erected on public funds, as the South Sea, India, Bank, &c. divided among and payable half-yearly to the ſtock-holders; and the orders they have for receiving theſe dividends, are called dividend-warrants. Stealing any dividend-warrants of the Bank, South Sea Company, Eaſt India Company, or of any other corporation, is made felony, with or without benefit of clergy, in the ſame manner as if the offender had ſtolen, or taken by robbery, goods to the value of the money due on ſuch dividend warrants. Stat. 2 Geo. II. c. 25.

DIVIDIVI, the name of a drug brought from the Caraccas into Spain in 1769; and which, by experiments that have been made upon it at Madrid, is found to be preferable to galls in dying black.

DIVIDUAL, in arithmetic, is uſed for that part of the dividend diſtinguiſhed by a point, in working by the rule of diviſion.

DIVINATION, the knowledge of things obſcure, or future, which cannot be attained by any natural means. It was a received opinion among the heathens, that the gods were wont to converſe familiarly with ſome men, whom they endowed with extraordinary powers, and admitted to the knowledge of their councils and deſigns. Plato, Ariſtotle, Plutarch, Cicero, and others, divide divination into two ſorts or ſpecies, viz. natural and artificial.

Divination of all kinds was neceſſarily made an occult ſcience, which naturally remained in the hands of the prieſts and prieſteſſes, the magi, the ſoothſayers, the augurs, the viſionaries, the prieſts of the oracles, the falſe prophets, and other like profeſſors, till the time of the coming of Jeſus Chriſt. The light of the goſpel, it is true, has diſſipated much of this darkneſs; but it is more difficult, than is commonly conceived, to eradicate from the human mind a deep-rooted ſuperſtition, even though the truth be ſet in the ſtrongeſt light, eſpecially when the error has been believed almoſt from the origin of the world; ſo we ſtill find exiſting among us the remains of this pagan ſuperſtition, in the following chimeras, which enthuſiaſtic and deſigning men have formed into arts and ſciences; though it muſt be owned, to the honour of the 18th century, that the pure doctrines of Chriſtianity, and the ſpirit of philoſophy, which become every day more diffuſed, equally concur in baniſhing theſe viſionaries opinions. The vogue for theſe pretended ſciences and arts, moreover, is paſt, and they can no longer be named without exciting ridicule in all ſenſible people. By relating them here, therefore, and drawing them from their obſcurity, we only mean to ſhow their futility, and to mark thoſe rocks againſt which the human mind, without the aſſiſtance of a pilot, might eaſily run.

For the attaining of theſe ſupernatural qualifications, there are ſtill exiſting in the world the remains of,

1. Aſtrology; a conjectural ſcience which teaches to judge of the effects and influences of the ſtars; and to predict future events by the ſituation of the planets and their different aſpects. It is divided into natural aſtrology, or meteorology; which is confined to the foretelling of natural effects, as the winds, rain, hail, and ſnow, froſts and tempeſts. In this conſiſts one branch of the art of almanack-makers; and by merely confronting theſe predictions in the calendar, which the weather each day produces, every man of ſenſe will ſee what regard is to be paid to this part of aſtrology. The other part, which is called judicial aſtrology, is ſtill far more illuſive and raſh than the former: and having been at firſt the wonderful art of viſionaries, it afterwards became that of impoſtors; a very common fate with all thoſe chimerical ſciences, of which we ſhall here ſpeak. This art pretends to teach the method of predicting all ſorts of events that ſhall happen upon the earth, as well ſuch as relate to the public, as to private perſons; and that by the ſame inſpection of the ſtars and planets, and their different conſtellations. The cabala ſignifies, in like manner, the knowledge of things that are above the moon, as the celeſtial bodies and their influences; and in this ſenſe it is the ſame with judicial aſtrology, or makes a part of it.

2. Horoſcopy, which may alſo be conſidered as a part of aſtrology, is the art by which they draw a figure, or celeſtial ſcheme, containing the 12 hours, wherein they mark the diſpoſition of the heavens at a certain moment; for example, that at which a man is born, in order to foretel his fortune, or the incidents of his life. In a word, it is the diſpoſition of the ſtars and planets at the moment of any perſon's birth. But as there cannot be any probable or poſſible relation between the conſtellations and the human race, all the principles they lay down, and the prophecies they draw from them, are chimerical, falſe, abſurd, and a criminal impoſition on mankind.

3. Hydromancy is the ſuppoſed art of divining by water. The Perſians, according to Varro, invented it; Pythagoras and Numa Pompilius made uſe of it; and we ſtill admire the like wonderful prognoſticators.

4. Geomancy was a divination made by obſerving of cracks or clefts in the earth. It was alſo performed by points made on paper, or any other ſubſtance, at a venture; and they judged of future events from the figures that reſulted from thence. This was certainly very ridiculous; but it is nothing leſs ſo to pretend to predict future events by the inſpection of the grounds of a diſh of tea or coffee, or by cards, and many other like matters. Thus have deſigning men made uſe of the four elements to deceive their credulous brethren.

5. Chiromancy is the art which teaches to know, by inſpecting the hand, not only the inclinations of a man, but his future deſtiny alſo. The fools or impoſtors who practiſe this art pretend, that the different parts or the lines of the hand have a relation to the internal parts of the body, as ſome to the heart, others to the liver, ſpleen, &c. On this falſe ſuppoſition, and on many others equally extravagant, the principles of chiromancy are founded: and on which, however, ſeveral authors, as Robert Flud an Engliſhman, Artemidorus, M. de la Chambre, John of Indagina, and many others, have written large treatiſes.

6. Phyſiognomy, or phyſiognomancy, is a ſcience that pretends to teach the nature, the temperament, the underſtanding, and the inclinations of men, by the inſpection of their countenances, and is therefore equally frivolous with their chiromancy; though Ariſtotle, and a number of learned men after him, have wrote expreſs treatiſes concerning it.

DIVINE, ſomething that comes from or relates to God. The word is alſo uſed figuratively, for any thing that is excellent, extraordinary, and that ſeems to go beyond the power of nature, and the capacity of mankind. In which ſenſe, the compaſs, teleſcope, clocks, &c. are ſaid to be divine inventions: Plato is called the *divine author*, the *divine Plato*; and the ſame appellation is given to Seneca: Hippocrates is called the *divine old man, divinus ſenex*, &c.

DIVING, the art or act of deſcending under water, to conſiderable depths, and abiding there a competent time. The uſes of diving are very conſiderable, particularly in the fiſhing for pearls, corals, ſponges, &c. See Pearl *Fiſhing*.

There have been divers methods propoſed, and engines contrived, to render the buſineſs of diving more ſafe and eaſy. The great point in all theſe is to furniſh the diver with freſh air, with-but which he muſt either make but a ſhort ſtay, or periſh. Thoſe who dive for ſpongies in the Mediterranean, help themſelves by carrying down ſponges dipt in oil in their mouths. But conſidering the ſmall quantity of air that can be contained in the pores of a ſponge, and how much that little will be contracted by the preſſure of the incumbent water, ſuch a ſupply cannot long ſubſiſt the diver. For it is found by experiment, that a gallon of air included in a bladder, and by a pipe reciprocally inſpired and expired by the lungs, becomes unfit for reſpiration in little more than one minute of time. For though its elaſticity be but little altered paſſing the lungs, yet it looſes its vivifying ſpirit, and is rendered effete.

In effect, a naked diver, Dr. Halley aſſures us, without a ſponge, cannot remain above two minutes encloſed in water; nor much longer with one, without ſuffocating; nor without long practice, near ſo long; ordinarily perſons beginning to be ſuffocated in about half a minute. Beſides, if the depth be conſiderable, the preſſure of the water in the veſſels makes the eyes bloodſhotten, and frequently occaſions a ſpitting of blood.

Hence, where there has been occaſion to continue long at the bottom, ſome have contrived double flexible pipes, to circulate air down into a cavity encloſing the diver, as with armour, both to furniſh air, bear off the preſſure of the water, and permit his breaſt to dilate upon inſpiration; the freſh air being forced down one of the pipes with bellows, and returning by the other of them, not unlike to an artery and vein.

But this method is impracticable when the depth ſurpaſſes three fathoms; the water embracing the bare limbs ſo cloſely, as to obſtruct a circulation of the blood in them; and withal preſſing ſo ſtrongly on all the junctures where the armour is made tight with leather, that if there be the leaſt defect in any of them, the water ruſhes in, and inſtantly fills the whole engine, to the great danger of the divers life.

It is certain, however, that people, by being accuſtomed to the water from their infancy, will at length be enabled, not only to ſtay much longer under water than the time above-mentioned, but put on a kind of amphibious nature, ſo that they ſeem to have the uſe of all their faculties as well when their bodies are immerſed in water, as when they are on dry land. Moſt ſavage nations are remarkable for this. According to the accounts of our late voyagers, the inhabitants of the South-ſea iſlands are ſuch expert divers, that when a nail or any piece of iron was thrown overboard, they would inſtantly jump into the ſea after it, and never failed to recover it notwithſtanding the quick deſcent of the metal. Even among civilized nations, many perſons have been found capable of continuing an incredible length of time below water.

Diving *Bell*, is a machine contrived to remedy all theſe inconveniences. In this the diver is ſafely conveyed to any reaſonable depth, and may ſtay more or leſs time under the water, as the bell is greater or leſs. For a deſcription of this machine and other curious matters, See Syſtem of Hydrostatics.

Diving *Bladder*, a machine invented by Borelli, and by him preferred, though without any good reaſon, to the Diving Bell. It is a globular veſſel of braſs or copper, about two feet in diameter, which contains the divers head. It is fixed to a goat's ſkin habit exactly fitted to his perſon. Within the veſſel are pipes, by means of which a circulation of air is contrived; and the perſon carries an air-pump by his ſide, by which he can make himſelf heavier or lighter as fiſhes do, by contracting or dilating their air-bladder. By this means he thought all the objections to which other diving machines were liable, were entirely obviated and particularly that for want of air: the air which had been breathed, being, as he imagined, deprived of its noxious qualities, by circulating through the pipes. Theſe advantages, however, it is evident, are only imaginary. The diver's limbs, being defended from the preſſure of the water only by a goats ſkin, would infallibly be cruſhed if he deſcended to any conſiderable depth; and from the diſcoveries now made by Dr. Prieſtley and others, it is abundantly evident, that air, which is once rendered foul by breathing, cannot in any degree be reſtored by circulation through pipes. Concerning the uſe of copper machines in general: Mr. Spalding has favoured us with the following curious obſervation, namely, that when a perſon has breathed in them a few minutes, he feels in his mouth a diſagreeable braſſy taſte, which continues all the time he remains in the veſſel, ſo that, on this account, copper ſeems by no means an eligible material, this taſte moſt probably ariſes from the action of the alkaleſcent effluvia of the body upon the copper, for volatile alkali is a ſtrong diſſolvent of this metal: but how theſe effluvia volatiliſe the copper in ſuch a manner as to make the taſte of it ſenſible in the mouth is not eaſy to ſay.

DIVINITY, the quality, nature, and eſſence of God. It is falſly, that the atheiſts hold the nature of divinity to be a political invention of the ancient legiſlators, to ſecure and enforce the obſervation of their laws; on the contrary, it is certain, the legiſlators made uſe of that opinion, which they found already impreſſed on the minds of the people. The heathen divinities may be reduced to three claſſes: the firſt theological, repreſenting the divine nature under divers attributes: thus Jupiter denotes the abſolute power of God, Juno his juſtice, &c. The ſecond claſs of divinities are phyſical: thus Æolus is that power in nature, whereby vapours and exhalations are collected to form winds, &c. The laſt are moral divinities. Thus the furies are only the ſecret reproaches and ſtings of conſcience.

Divinity is alſo uſed in the ſame ſenſe with theology.

DIVISIBILITY, a paſſive power, or property in quantity, whereby it becomes ſeparable into parts; either actually or at leaſt mentally.

This the Peripatetics and Carteſians univerſally hold an affection, or property of all matter, or body: the Carteſians, as holding the eſſence of matter to conſiſt in extenſion: for every part, or corpuſcle of the body being extended, has parts including other parts, and conſequently is diviſible.

The Epicureans, again, hold diviſibility to agree to every phyſical continuum, as, without parts adjacent to parts, there can be no continuity; and wherever there are parts ſo adjacent, there muſt be diviſibility. But they deny, that this affection agrees to all bodies: for the primary corpuſcles, or atoms, they hold perfectly inſecable, and indiviſible.

The chief objections againſt this doctrine are, that an infinite cannot be contained by a finite; and that it follows from a *diviſibility in infinitum*, either that all bodies are equal, or that one infinite is greater than another. To which it is anſwered, that to an infinite may be attributed the properties of a finite and determined quantity; and who has ever proved, that there could not be an infinite number of parts infinitely ſmall in a finite quantity; or that all infinites are equal? The contrary is demonſtrated by mathematicians in innumerable inſtances. We are not here contending for the poſſibility of an actual diviſion *in infinitum*: we only aſſert, that however ſmall a body is, it may be ſtill farther divided; which we imagne may be called a diviſion *in infinitum*, becauſe what has no limits, is called *infinite*.

It is true, that there are no ſuch things as parts infinitely ſmall: yet the ſubtility of the particles of ſeveral bodies is ſuch, that they very much ſurpaſs our conception; and there are innumerable inſtances in nature of ſuch parts actually ſeparated from one another.

Mr. Boyle gives us ſeveral inſtances of this. He ſpeaks of a ſilken thread 300 yards long, that weighed but two grains and a half. He meaſured leaf gold, and found by weighing it, that fifty ſquare inches weighed but one grain: if the length of an inch be divided into 200 parts, the eye may diſtinguiſh them all; therefore there are in one ſquare inch 40000 viſible parts; and in one grain of it there are 2000000 of ſuch parts: which viſible parts no one will deny to be farther diviſible.

Again, a whole ounce of ſilver may be gilt with eight grains of gold, which may be afterwards drawn into a wire thirteen thouſand feet long.

In odoriferous bodies we can ſtill perceive a greater ſubtility of parts, and even ſuch as are actually ſeparated from one another; ſeveral bodies ſcarce loſe any ſenſible part of their weight in a long time, and yet continually fill a very large ſpace with odoriferous particles. The particles of light, if light conſiſts of real particles, furniſh another ſurpriſing inſtance of the minuteneſs of ſome parts of matter. A lighted candle placed on a plane will be viſible two miles, and conſequently fill a ſphere, whoſe diameter is four miles, with luminous particles, before it has loſt any ſenſible part of its weight. And as the force of any body is directly in proportion to its quantity of matter multiplied by its velocity; and ſince the velocity of the particles of light is demonſtrated to be at leaſt a million of times greater than the velocity of a canon ball, it is plain, that if a million of theſe particles were round, and as big as a ſmall grain of ſand, we durſt no more open our eyes to the light, than expoſe them to ſand ſhot point blank from a cannon.

By help of microſcopes, ſuch objects as would otherwiſe eſcape our ſight, appear very large: there are ſome ſmall animals ſcarce viſible with the beſt microſcopes; and yet theſe have all the parts neceſſary for life, as blood, and other liquors. How wonderful muſt the ſubtility of the parts be, which make up ſuch fluids! Whence is deducible the following theorem:

Any particle of matter, how ſmall ſoever, and any finite ſpace, how large ſoever, being given; it is poſſible for that ſmall ſand, or particle of matter, to be diffuſed through all that great ſpace, and to fill it in ſuch a manner, as that there ſhall be no pore in it, whoſe diameter ſhall exceed any given line; as is demonſtrated by Dr. Keil. Introduct. ad Ver. Phyſ.

DIVISION, in general, the act of ſeparating a whole into the parts it contains. If the whole be compoſed of parts really diſtinct, called integral parts, the diviſion made thereof is properly called partition; as when a houſe is divided into its apartments If the whole be compoſed of parts, called ſubjective; that is, if the whole be only one common term, the ſubjects compriſed in the extent whereof are the parts, the diviſion thereof is what we properly call diviſion: ſuch is the diviſion of a genus into its ſpecies, &c.

Division, in algebra, or ſpecies, is performed by reducing the dividend and diviſor into the form of a fraction; this fraction being the quotient. See Syſtem of Algebra, Sect. III.

Division, in arithmetic, is the laſt of the four fundamental rules, being that whereby we find how often a leſs quantity is contained in a greater; and the overplus. Diviſion, in reality, is only a compendious method of ſubtraction; its effect being to take a leſs number from another greater as often as poſſible; that is, as oft as it is contained therein. There are three numbers concerned in diviſion: 1. That given to be divided, called the dividend. 2. That whereby the dividend is to be divided, called the diviſor. 3. That which expreſſes how often the diviſor is contained in the dividend; or the number reſulting from the diviſion of the dividend by the diviſor, called the quotient. See Syſtem of ARITHMETIC, Article V.

DIVISION, in decimal fractions. See Syſtem of ARITHMETIC, Article XII.

DIVISION, in geometry, or geometrical diviſion. See Syſtem of GEOMETRY.

DIVISION *of a Word*, in grammar, is a diſcourſe explaining the latitude, or comprehenſion of a word: the latitude, when the word is univerſal; as when the genus is divided into ſpecies, and differenees; the comprehenſion, when the word is ambiguous, as *taurus*, *bull*; which ſometimes denotes a conſtellation, ſometimes a beaſt, and ſometimes a mountain.

DIVISION, in logic, is the ſeparating any thing into diverſe parts, or ideas.

DIVISION *of a Mode*, divides a quality into its degrees. Philoſophers, after the phyſicians, ſuppoſe eight degrees of every quality: hence when a quality is ſaid to be in the eighth degree, it marks, that it can be no farther intended, or heightened.

DIVISION, in muſic, imports the dividing of the interval of an octave into a number of leſſer intervals. The 4th and 5th, each of them, divide or meaſure the octave perfectly, though differently. When the 5th is below, and ſerves as a baſs to the 4th, the diviſion is called harmonical; when the 4th is below, the diviſion is called authentic.

DIVISION, in vulgar fractions. See Syſtem of ARITHMETIC, Article XI.

DIVISIONS *of an Army*, in the military art, the ſeveral brigades and ſquadrons into which it is cantoned.

DIVISIONS *of a Battalion*, the ſeveral platoons into which it is divided in marching or firing, each of which is commanded by an officer. See BATTALION.

DIVISION, in the ſea language, the third part of a naval army, or fleet; or one of the ſquadrons thereof, diſtinguiſhed by a particular flag or pendant, under the command of ſome flag officer. The white flag denotes the firſt ſquadron of France, the white and blue the ſecond, and the third is characterized by the blue. In England, the firſt admiral, or the admiral of the fleet, diſplays the union flag at the main-top-maſt-head; next follows the white flag with St. George's croſs; and afterwards the blue. The private ſhips carry pendants of the ſame colour with their reſpective ſquadrons at the maſts of their particular diviſions; ſo that the laſt ſhip in the diviſion of the blue ſquadron carries a blue pendant at her mizen-top-maſt-head. Naval battles are uſually ranged in three lines, according to their three diviſions.

DIVORCE, from *diverto*, *I turn away*, a breach or diſſolution of the bond of marriage. In our law, divorce is of two kinds; the one total, *a vinculo matrimonii*; which alone is properly *divorce*; the other partial, *a menſa & thoro*; a ſeparation from bed and board. The woman divorced, *a vinculo matrimonii*, receives all again that ſhe brought with her: the other has a ſuitable, ſeparate maintenance allowed her out of her huſband's effects. The firſt only happens through ſome eſſential impediment, as conſanguinity or affinity within the degrees forbidden, precontract, impotency, adultery, &c. of which impediments the canon law allows fourteen, comprehended in theſe verſes:

Error, conditio, votum, cognatio, crimen,
Cultus, diſparitas, vis, ordo, ligamen, honeſtas,
Si ſis affinis, ſi forte coire nequibis,
Si parochi & duplicis deſit præſentia teſtis,
Raptave ſit mulier, nec parti reddita tutæ.

In this kind of divorce, the marriage is declared null, as having been abſolutely unlawful, *ab initio*, and the parties are ſeparated *pro ſalute animarum*, and allowed to marry again; the iſſue of ſuch marriage as is thus entirely diſſolved, are baſtards. *Divorce a menſa & thoro*, diſſolveth not the marriage, becauſe it was juſt and lawful *ab initio*; but for ſome ſupervenient cauſe, it becomes improper or impoſſible for the parties to live together; as in the caſe of intolerable ill temper, or adultery, in either of the parties. However, *divorces a vinculo matrimonii*, for adultery, have of late years been frequently granted in England, by act of parliament.

Divorce is a ſpiritual judgment, and therefore is paſſed in the ſpiritual court. Under the old law, the woman divorced was to have of her huſband a writing, as St. Jerom and Joſephus teſtify, to this effect: *I promiſe, that hereafter I will lay no claim to thee*, which was called a *bill of divorce*.

Among the Jews, beſides incontinence and adultery, uglineſs, old age, or ill humour in a wife, were ſufficient reaſons for giving her a bill of divorce. Nay, even the man's own pleaſure, or his repenting of his match, were admitted as good reaſons. Selden de Uxore Heb. lib. iii. cap. 17.

It is generally held that Jeſus Chriſt allowed of divorce in the caſe of adultery. But ſome take this for a miſtake; and maintain, that divorce is no where permitted in the New Teſtament for adultery; but only a ſeparation. See Matt. xix. 9. Mark x. 11. Paul 1 Cor. vii. 27. See alſo the council of Florence, at the end, after the queſtions propoſed to the Greeks. Tertull. de Monogam. cap. 9. & 10. Auguſtin. de Bono Conjugio, & de Adult. Conjug.

In England divorce can only be had by conſent of parliament. Milton has an expreſs treatiſe of the doctrine and diſcipline of divorce, were he maintains, that divorce ought to be permitted for a mere incompatibility of humours.

DIURESIS, Διερησις, that ſeparation which is made of the urine by the kidneys. The word is formed from *δια*, *through*, and *ȣρεω*, *I make water*.

DIURETICS, in medicine, are ſuch remedies as provoke or promote the diſcharge of urine. Such is water drank plentifully, white wine drank in a morning; alkali ſalts of all kinds; ſea-ſalt, ſal gemmæ, nitre, borax, alum, tartar, ſal ammoniac, whey, ſour milk, lemon juice, &c. Aqueous liquors are generally diuretic, eſpecially if mixed with ſalt, and drank cold. Fermented liquors are the leaſt diuretic of all; and the leſs ſo, as they are the fatter. Sharp, thin, ſour wines, rheniſh, &c. as alſo acid ſpirits of vinegar, ſalt, ſulphur, alum, vitriol, &c. aſparagus, bitter almonds, ſmallage, eryngium, eupatorium, ſaſſafras, &c. are all diuretics.

DIURNAL, from *dies*, *day*, in aſtronomy, ſomething relating to the day; in oppoſition to nocturnal, which regards the night.

DIURNAL *Motion of a Planet*, is ſo many degrees and minutes, &c. as any planet moves in twenty-four hours. See Syſtem of ASTRONOMY, Sec. II.

The **DIURNAL** *Motion of the Earth*, is its rotation round its axis, the ſpace whereof conſtitutes the natural day. The reality of the diurnal motion of the earth is now paſt all diſpute. See Syſtem of ASTRONOMY, Sect. II.

DIURNAL is alſo uſed in ſpeaking of what belongs to the nycthemeron, or natural day of twenty-four hours. In which ſenſe it ſtands oppoſed to annual, menſtrual, &c.

DIVUS, **DIVA**, in antiquity, appellations given to men and women who had been deified, or placed in the number of the gods. Hence it is, that on medals ſtruck for the conſecration of an emperor or empreſs, they gave them the title of *Divus*, or *Diva*. For example: DIVUS JULIUS. DIVO ANTONINO PIO. DIVO PIO. DIVO CLAUDIO. DIVA FAUSTINA AUG. &c.

DIZZINESS, in medicine. See VERTIGO.

DOB-CHICK, or **DIDAPPER**, in ornithology, the common Engliſh name of a ſmall water fowl, the leaſt of all the diver kind, and known among authors by the name of colymbus minor; and called by Linnæus colymbus auritus. It ſeldom exceeds ſix ounces in weight, and has a ſhort beak, not more than a finger's breadth long, large at the baſe, but taperiog to a point at the end; its eyes are large, and it is covered with a very thick downy plumage: it is of a very deep blackiſh hrown on the back, and very white on the belly; its wings are very ſmall, and it has no tail.

DOCK, in botany, *Rumex*. See RUMEX.

DOCK, from δοχιον, *receptaculum*, of δεχομαι, *I receive*, in maritime affairs, a pit, pond, or creek, by the ſide of a harbour, made convenient to work in, in order to build or repair ſhips. This is of two ſorts: a dry dock, where the water is kept out by great flood-gates, till the ſhip is built, or repaired; but afterwards can be eaſily let into it again to float, and launch her. A wet dock is any place where a ſhip may be haled in, and ſo dock herſelf, or ſink herſelf a place to lie in; and where ſhe can be cleaned only during the receſs of the tide.

DOCK *Yards*, are magazines of all ſorts of naval ſtore, and timber for ſhip building; the royal dock yards in England, are thoſe at Chatham, Portſmouth, Plymouth, Woolwich, Deptford, and Sheerneſs. In time of peace, ſhips of war are laid up in theſe docks, thoſe of the firſt rates moſtly at Chatham, where, and at other yards, they receive, from time to time, ſuch repairs as are neceſſary. Theſe yards are generally ſupplied from the northern crowns, with hemp, pitch, tar, roſin, canvaſs, oak-plank, and ſeveral other ſpecies. But as for maſts, particularly thoſe of the largeſt ſize, they have been uſually brought from New England. The principal dock yards are governed by a commiſſioner, reſident at the port, who ſuperintends all the muſters of the officers, artificers, and labourers, employed in the dock yard and ordinary. He alſo controuls their payments; examines the accounts; contracts and draws bills on the navy-office to ſupply the deficiency of ſtores, and regulates whatever belongs to the yard, maintaining due order in the reſpective offices.

DOCKET, or **DOGGET**, in law, is a brief in writing, on a ſmall piece of paper, or parchment, containing the purport and effect of a larger writing. The rolls of judgment are docketted, when they are brought into the court of common-pleas, and entered on the docket of that term; ſo that by ſearching theſe dockets, any judgment may be found, if the attorney's name is known. Decrees in chancery are alſo docketted.

DOCTOR, a perſon who has paſſed all the degrees of a faculty, and is empowered to teach or practiſe the ſame. The title of doctor was firſt created towards the middle of the twelfth century; to ſucceed to that of maſter, which was become too common and familiar. It was ſoon transferred from the faculty of law to that of theology; the firſt inſtance whereof was given in the univerſity of Paris, where Peter Lombard, and Gilbert de la Potree, the two chief divines of thoſe days, were created doctors in theology, *ſacræ theologiæ doctores*. Others declare Bede to have been the firſt doctor at Cambridge, and John de Beverley at Oxford, which latter died in the year 721. But Spelman will not allow doctor to have been the name of any title or degree in England till the reign of king John, about the year 1207.

Doctor *of the Law*, was a title of honour or dignity among the Jews. The Jews it is certain, had doctors long before Jeſus Chriſt. The inveſtiture, if we may ſo ſay, of this order, was performed by putting a key, and a table book in their hands; which is what ſome authors imagine our Saviour had in view, Luke xi. 52, where, ſpeaking of the doctors of the law, he ſays, *Woe unto you, doctors of the law*; *for you have taken away the key of knowledge*; *you entered not in yourſelves, and them that were entering, you hindered*. The Greek text of St. Luke calls them *νομικοι*; and the Vulgate, *legiſperiti*; agreeably to which, our English tranſlators call them lawyers. But the French verſion of *docteurs de la loi*, ſeems the moſt adequate. In effect, the words *lawyer*, *legiſperitus*, is only found in St. Luke, and St. Paul, Titus iii. 13. And *νομικος*, in St. Matthew, xxii. 35, is rendered by the Vulgate, *legis doctor*; though the Engliſh verſion ſtill retains the word lawyer. Theſe Jewiſh doctors are the ſame whom they otherwiſe call Rabbins.

Doctor *of the Church*, a title given to certain of the fathers whoſe doctrines and opinions have been the moſt generally followed and authorized. We uſually reckon four doctors of the Greek church, and three of the Latin. The firſt are St. Athanaſius, St. Baſil, St. Gregory Nazianzen, and St. Chryſoſtom. The latter are St. Jerom, St. Auguſtine, and Gregory the Great.

Doctor is alſo an appellation adjoined to ſeveral ſpecific epithets, expreſſing wherein the merit of ſuch as the ſchools owned for their maſters, conſiſted.

Doctors *Commons*. See College *of Civilians*.

DOCTRINE, from *doceo*, *I teach*, denotes in general any thing that is taught, as a matter either of faith or practice; and the term has accordingly been applied to a variety of opinions, that have been adopted and inculcated in philoſophy, religion, &c. There are certain doctrines reſpecting the political conſtitution of Great Britain, the aſſerting and publiſhing of which are made illegal by ſtatute. Thus, if any perſon maliciouſly or adviſedly affirm, that both or either of the houſes of parliament have any legiſlative authority without the king, ſuch perſon ſhall incur all the penalties of a præmunire. 13 Car. II. cap. 1. Alſo if a perſon affirm and maintain, by writing or printing, that the king and parliament have no right to direct the ſucceſſion of the crown, he is guilty of high treaſon; and if he maintains the ſame doctrine by teaching, or adviſed ſpeaking, he incurs a præmunire. 13 Eliz. cap. 1. 6 Anne, cap. 7. There are alſo other doctrines of a religious nature, which it is unlawful publicly to maintain and preach.

DOCUMENT, in law, ſome written monument produced in proof of any fact aſſerted, eſpecially an ancient one.

DODDER, in botany. See Cuscuta.

DODECAGON, from *δοδεκα*, *twelve*, and *γωνια*, *angle*, a regular polygon, or figure, with twelve equal ſides and angles. Dials are ſometimes drawn on all the ſides of a dodecagon. In fortification, a place ſurrounded with twelve baſtions is called a dodecagon; ſuch is Palma Nova in Friuli, &c.

DODECAHEDRON, from *δωδεκα*, *twelve*, and *εδρα*, *ſeat*, in geometry, one of the regular bodies comprehended under twelve equal ſides, each whereof is a pentagon.

DODECANDRIA, (from *δωδεκα*, *twelve*, and *ανηρ*, *a man*); the name of the eleventh claſs in Linnæus's ſexual ſyſtem, conſiſting of plants with hermaphrodite flowers, that, according to the title, have twelve ſtamina or male organs. This claſs, however, is not limited with reſpect to the number of ſtamina. Many genera have ſixteen, eighteen, and even nineteen ſtamina; the eſſential character ſeems to be, that, in the claſs in queſtion, the ſtamina, however numerous, are inſerted into the receptacle; whereas, in the next claſs, Icoſandria, which is as little determined in point of number as the preſent, they are attached to the inſide of the calix or flower-cup.

The orders in this claſs, which are ſix, are founded upon the number of the ſtyles, or female organs. Aſarabacca, mangoſton, ſtorax, purple looſe-ſtrife, wild Syrian rue, and purſlane, have only one ſtyle; agrimony and heliocarpus have two; burning thorny plant, and baſtard rocket, three; *glinus*, five; *illicium*, eight; and houſe-leek, twelve. See Plate V.

DODO, Didus, in ornithology, a genus belonging to the 6th order and the firſt diviſion.

DODONÆUS, Dodonian, in antiquity, an epithet given to Jupiter, as adored, or worſhipped, in the temple of Dodona, in a foreſt of the ſame name. Dodona, whence the appellation ariſes, is an ancient city of Epirus, celebrated on divers accounts, as the foreſt of Dodona, the oracle of Dodona, and the fountain of Dodona.

DOE, the female of the buck.

DOG, *Canis*, in tetrapodology, an animal remarkable for its natural docility, fidelity, and affection for its maſter: which qualities mankind are careful to improve for their own advantage. Theſe uſeful creatures guard our houſes, gardens, and cattle, with ſpirit and vigilance. By their help we are enabled to take not only beaſts, but birds; and to purſue game both over land and through the waters. In ſome northern countries, they ſerve to draw ſleds, and are alſo employed to carry burdens. In ſeveral parts of Africa, China, and by the Weſt Indian negroes, dogs are eaten, and accounted excellent food. Nay, we have the teſtimony of Mr. Forſter, that dogs fleſh, in taſte, exactly reſembles mutton. They were alſo uſed as food by the Romans, and long before them by the Greeks, as we learn from ſeveral treatiſes of Hippocrates. In the preſent times, their ſkins, dreſſed with the hair on, are uſed in muffs, made into a kind of buſkins for perſons in the gout, and for other purpoſes. Prepared in another way, they are uſed for ladies gloves, and the linings of maſks, being thought to make the ſkin peculiarly white and ſmooth. The French import many of theſe ſkins from Scotland, under a ſmall duty. Here, when tanned, they ſerve for upper leathers for neat pumps.

With regard to the qualities of dogs, thoſe bred in the iſland of Britain are juſtly reckoned ſuperior to the dogs bred in any other country. The ſwiftneſs of the greyhound is amazing: as are alſo the ſteadineſs and perſeverance of other hounds and beagles; the boldneſs of terriers in unearthing foxes, &c.; the ſagacity of pointers and ſetting dogs, who are taught a language by ſigns as intelligible to ſportſmen as ſpeech; and the invincible ſpirit of a bull-dog, which can be quelled only by death. All the nations in Europe not only do juſtice to the ſuperior qualities of the Britiſh dogs, but adopt our terms and names, and thankfully receive the creatures as preſents. It is remarkable, however, that almoſt every kind of Britiſh dogs degenerate in foreign countries; nor is it poſſible to prevent this degeneracy by any art whatever.

Chuſing of Dogs. In order to chuſe a dog and bitch for good whelps, take care that the bitch come of a generous kind, be well proportioned, having large ribs and flanks; and likewiſe that the dog be of a good breed and young, for a young dog and an old bitch breed excellent whelps.

As to the training up a dog for ſporting, the maſter of him cannot begin when he is too young, the principal thing to be taught being obedience, and that being beſt taught while the creature is young. As ſoon as he can lap, he ſhould be taught to couch and lie cloſe at command, and not to dare to ſtir from that poſture till he is ordered: he will ſoon be brought to this, by beating when he diſobeys, and encouraging him when he does right. He ſhould always be taught before the times of his eating, and never have his food given him but when he has done ſomething to deſerve it. This will teach him always to do well, for the ſake of expected victuals. No perſon ſhould ever interfere in the teaching; for two maſters breed a confuſion, and the creature never will learn well from them.

The teacher muſt be careful always to uſe the ſame words in his leſſons; thoſe words are to be choſen which are the moſt plain in their ſounds, and the moſt diſtinct from one another; and when theſe are once fixed upon, they muſt never be altered; for the dog, being guided wholly by the ſound, and not at all by the ſenſe, any alteration of them, though the change be into words of the ſame ſenſe, quite confounds the creature. The word *down* is ſhort and expreſſive, and no other need be uſed when he is ordered to couch: but this being once given him is never to be varied afterwards. The next ſound he ſhould be taught after this, is the word of correction; for no leſſon can be given but faults will be committed, and no fault ſhould paſs without correction or blame; in this caſe, the word *ſirrah*, ſpoke angrily, will always be underſtood. This, at firſt, ſhould be uſed with a laſh or a blow, and after a time he will know it as a word of diſpleaſure, and it will do for ſmall faults without the blow. Certain words of cheriſhing and encouragement muſt alſo be taught him the ſame time, as *good boy*, or the like, uſing always with them actions and looks of chearfulneſs and pleaſure, as clapping him on the back, and the like. After theſe, he muſt be taught the meaning of ſome words of advice, to put him in mind of his buſineſs, when he is out upon the ſport, ſuch as take heed, or the like. Theſe will not only ſet him upon the watch, and make him diligent; but he will alſo be careful and cunning, and at the ſame time chearful and pleaſed in himſelf, as knowing that he is doing his maſter a pleaſure. The water ſpaniel ſhould be taught, to fetch and carry any thing he is commanded; this muſt be taught him by way of ſport, as a diverſion, by ſhaking a glove at his head, and teaching him to ſnatch it, and afterwards to catch it when thrown from the hand, and bring it back again; this he is to be encouraged in with cheriſhing words, and all other means.

When he has been perfected in all theſe leſſons, he muſt be taught his buſineſs of hunting: he is to be firſt taught with tame fowl, which his maſter is to aſſiſt him in taking, and reward and encourage him when he has done. After this he is to be ſent in without aſſiſtance to take the fowl alone; and if he ſucceeds, he is to be encouraged and rewarded, and corrected if he fails. By this practice he will ſoon become maſter of his game; but great care is to be taken in teaching him, when he has caught it, to bring it back to the ſhore, without biting or hurting it.

Many of theſe dogs are ſo expert, that they will have their eye upon the game as ſoon as their maſter; and the moment the gun is gone off, they will, without bidding, go and fetch it; but this is being too forward; and if he is uſed afterwards with nets or lime-twigs, he will do great miſchief, by ruſhing on the birds as ſoon as they are taken, and tearing the nets, or ſpoiling the twigs. Obedience is the beſt quality in this ſort of dog; and it is better he ſhould wait for command, than know his buſineſs without it. The ſportſmen, who know the time of birds moulting, make a very good uſe of this ſort of dog; taking him with them without gun, net, or any other aſſiſtance. The common moulting time of water fowl is from June to Auguſt; in this time they are not able to fly well; and in ſome part of it, when their old wing feathers are off, and the new ones are ſcarce grown, the dog is then to be taken to the ſides of rivers and other waters, and ſet to hunt about the cloſe places, among which they hide themſelves at this time: the dog being ſet to hunt, will eaſily find them in theſe retreats, and will take them either by leaping ſuddenly upon them, or fairly purſuing ſuch of them as have not the uſe of their wings. There is alſo another great uſe of the dog in driving them without catching them. This is practiſed only in mooriſh and fenny countries, where they are very numerous. In theſe countries a proper place is to be ſought for, where the birds retire to, and theſe are planted with nets; then the dog is ſent into the waters and places of covert, where they are ſuppoſed to be, and this at the moulting time, when they cannot fly away from him. The alarm he puts them into on the firſt attack, ſoon brings many others together, and there is a large body of them formed which the dog drives before him like a flock of ſheep; and being directed by the ſportſmen, frightens directly into the places of their retreat, where the nets are placed before hand to receive them.

As pointers and ſpaniels, when good of their kinds, and well broken, are very valuable to a ſportſman, it is worth while to take ſome care to preſerve them in health. This very much depends on their diet and lodging: frequent cleaning their kennels, and giving them freſh ſtraw to lie on, is very neceſſary; or, in ſummer time, deal ſhavings, or ſand, inſtead of ſtraw, will check the breeding of fleas. If you rub your dog with chalk, and bruſh him once or twice a week, he will thrive much the better; the chalk will clear his ſkin from all greaſineſs, and he will be the leſs liable to be mangy. A dog is of a very hot nature: he ſhould therefore never be without clean water by him, that he may drink when he is thirſty. In regard to their food, carion is by no means proper for them: it muſt hurt their ſenſe of ſmelling, on which the excellence of theſe dogs greatly depends. Barley meal, the droſs of wheat flour, or both mixed together, with broth or ſkimmed milk, is very proper food. For change, a ſmall quantity of greaves from which the tallow is preſſed by the chandlers, mixed with their flour, or ſheep's feet well baked or boiled, are a very good diet; and when you indulge them with fleſh, it ſhould always be boiled. In the ſeaſon of hunting your dogs, it is proper to feed them in the evening before, and give them nothing in the morning you intend to take them out except a little milk. If you ſtop for your own refreſhment in the day, you ſhould alſo refreſh your dogs with a little bread and milk. It has been already obſerved that dogs are of a hot conſtitution; the greateſt relief to them in the ſummer, is twitch-graſs, or dog-graſs, which is the ſame thing. You ſhould therefore plant ſome of it in a place where you can turn them into every morning: they will feed freely on it to be cured of the ſickneſs they are ſubject to, and cured of any extraordinary heat of blood: but unleſs the graſs be of this ſort, it will have no effect.

Dogs are ſubject to the mange from being fed too high, and allowed no exerciſe or an opportunity of refreſhing themſelves with dog graſs; or by being ſtarved at home, which will cauſe them to eat the vileſt ſtuff abroad, ſuch as carrion, or even human excrement; or by want of water, and ſometimes by not being kept clean in their kennel, or by foundering and melting in their greaſe. Either of theſe will heat the blood to a great degree, which will have a tendency to make them mangy. The cure may be effected by giving ſtone brimſtone powdered fine, either in milk or mixed up with butter, and rubbing them well every day for a week with an ointment made of ſome of the brimſtone and pork-lard, to which add a ſmall quantity of oil of turpentine. Or, boil four ounces of quickſilver in two quarts of water to half the quantity; bathe them every day with this water, and let them have ſome of it to lick till the cure is perfected. Or, a ſmall quantity of trooper's ointment rubbed on the parts on its firſt appearance will cure it. It will alſo free louſy puppies from their lice. Or, take two ounces of euphorbium; flour of ſulphur, Flanders oil of bays, and ſoft ſoap, each four ounces. Anoint and rub your dog with it every other day; give him warm milk, and no water. The cure will be performed in about a week.

If you ſuſpect your dog to be poiſoned with nux vomica (the poiſon uſually employed by the warreners, which cauſes convulſive fits and ſoon kills); the moſt effectual remedy, if immediately applied, is to give him a good deal of common ſalt; to adminiſter which, you may open his mouth, and put a ſtick acroſs to prevent his ſhutting it, whilſt you cram his throat full of ſalt, at the ſame time holding his mouth upwards; and it will diſſolve ſo that a ſufficient quantity will be ſwallowed to purge and vomit him. When his ſtomach is ſufficiently cleared by a free paſſage obtained by ſtool, give him ſome warm broth frequently, to prevent his expiring from faintneſs; and he will recover.

A pointer ought not to be hunted oftener than two or three days in a week: and unleſs you take care of his feet, and give him good lodging as well as proper food, he will not be able to perform that through the ſeaſon. You ſhould therefore, after a hard day's hunting, waſh his feet with warm water and ſalt; and when dry, waſh them with warm broth, or beer and butter, which will heal their ſoreneſs, and prevent a ſettled ſtiffneſs from fixing. If your dog has received any little wounds by forcing through hedges, or gets any lameneſs from a blow or ſtrain; bathe the wound or grieved part with ſalt and cold vinegar (for warming it only evaporates the fine ſpirit); and when dry, if a wound, you may pour in it a little friar's balſam, which will perform the cure ſooner than any method hitherto experienced.

The ſymptoms of madneſs are many and eaſily diſcerned. When any dog ſeparates himſelf contrary to his former uſe, becomes melancholy or droops his head, forbears eating, and as he runs ſnatches at every thing; if he often looks upwards, and his ſtern at his ſetting on be a little erect, and the reſt hanging down; if his eyes be red, his breath ſtrong, his voice hoarſe, and he drivels and foams at the mouth; you may be aſſured he has this diſtemper.

Of the ſeven ſorts of madneſs, two are incurable; the hot burning madneſs, and the running madneſs. The animals labouring under theſe are peculiarly dangerous: for all things they bite and draw blood from, will have the ſame diſtemper; and they generally ſeize on all they meet with, but chiefly on dogs: their pain is ſo great, it ſoon kills them.

When a dog happens to be bit by a mad one, there is nothing better than their licking the place with their own tongues, if they can reach it; if not, then let it be waſhed with butter and vinegar made luke warm, and let it afterwards be anointed with Venice turpentine; it is alſo good to piſs often on the wound; but, above all, take the juice of the ſtalks of ſtrong tobacco boiled in water, and bathe the place therewith; alſo waſh him in ſea water, or water artificially made ſalt: give him likewiſe a little mithridate inwardly in two or three ſpoonfuls of ſack, and ſo keep him apart; and if you find him after ſome time ſtill to droop, the beſt way is to hang him.

Dog, in aſtronomy, a name common to two conſtellations called the *Great* and *Little Dog*; but among the aſtronomers, more uſually, *Canis major*, and *minor*. See Canis *major & minor*.

Dog *Draw*, in the foreſt law, a manifeſt deprehenſion of an offender againſt veniſon in a foreſt; when he is found drawing after a deer by the ſcent of a hound led in his hand. There are four offences in the foreſt, viz. ſtable ſtand, dog-draw, back-bear or back-berond, and bloody hand.

Dog's *Bane*, in botany, apocynum. See Apocynum.

Dog-*Days*, Canicular, properly denote a certain number of days preceding and enſuing the heliacal riſing of the Canicula, or the dog ſtar, in the morning. Almanack makers uſually mark the beginning of the dog days from about the end of July, and end them about their firſt week in September.

Dog *Fly*, cynomyia, in entomology, the name of a ſpecies of fly common in woods and among buſhes, and particularly troubleſome to dogs. It uſually ſeizes upon the ears, and it is in vain to beat it off; for it returns in a moment, and cannot be prevented but by being killed. It ſtings very ſeverely, and always raiſes a bliſter in the part. It ſomewhat reſembles the flat black fly, ſo troubleſome to cattle. It has no trunk, but has two teeth, much reſembling thoſe of the waſp. Its wings are always placed ſo cloſe upon its body, that they are not ſeen. There are two kinds of it, one larger, and found in woods, and the other common in hedges.

Dog *Wood-tree*. See Piscidid.

DOGE, the chief magiſtrate in the republics of Venice and Genoa. The word properly ſignifies *duke*, being formed from the Latin *dux*; as *dogate* and *dogado*, from *ducatus*, *duchy*.

The dogate, or office and dignity of doge is elective: at Venice, the doge is elected for life; at Genoa, only for two years; he is addreſſed under the title of Serenity, which among the Venetians is ſuperior to that of highneſs.

The doge is the chief of the council, and the mouth of the republic: yet the Venetians do not go into mourning at his death, as not being their ſovereign, but only their firſt miniſter. In effect, the doge of Venice is no more than the phantom or ſhadow of the majeſty of a prince, all the authority being reſerved to the republic. He only lends his name to the ſenate; the power is diffuſed throughout the whole body, though the anſwers be all made in the name of the doge. If he gives any anſwers on his own account, they muſt be very cautiouſly expreſſed, and in general terms, otherwiſe he is ſure to meet with a reprimand. So that it is abſolutely neceſſary he be of an eaſy and pliable diſpoſition.

Anciently, the doges were ſovereigns; but things are much altered; and at preſent, all the prerogatives reſerved to the quality of doge, are thoſe which follow: he gives audience to ambaſſadors; but does not give them any anſwer from himſelf, in matters of any importance; only he is allowed to anſwer according to his own pleaſure to the compliments they make to the ſignory; ſuch anſwers being of no conſequence. The doge, as being firſt magiſtrate, is head of all the councils; and the credentials which the ſenate furniſhes its miniſters in foreign courts, are written in his name; and yet he does not ſign them; but a ſecretary of ſtate ſigns them, and ſeals them with the arms of the republic. The ambaſſadors direct their diſpatches to the doge; and yet he may not open them, but in preſence of the counſellors. The money is ſtruck in the doge's name, but not with his ſtamp or arms. All the magiſtrates riſe, and ſalute the doge, when he comes into council; and the doge riſes to none but foreign ambaſſadors.

The doge nominates to all the benefices in the church of St. Mark; he is protector of the monaſtery delle Virgine; and beſtows certain petty offices of uſhers of the houſhold, called *commanders of the palace*. His family is not under the juriſdiction of the maſter of the ceremonies; and his children may have ſtaff-officers, and gondoliers in livery.

His grandeur, at the ſame time, is tempered with a variety of circumſtances which render it burthenſome. He may not go out of Venice, without leave of the council; and if he does go out, he is liable to receive affronts, without being intitled to demand ſatisfaction; and, if any diſorder ſhould happen where he was, it belongs not to him, but to the podeſta, as being inveſted with the public authority, to compoſe it.

The children and brothers of the doge are excluded from all the chief offices of ſtate. They may not receive any benefice from the court of Rome; but are allowed to accept of the cardinalate, as being no benefice, nor including any juriſdiction. The doge may not diveſt himſelf of his dignity, for his eaſe; and after his death, his conduct is examined by three inquiſitors, and five correctors, who ſift it with great ſeverity.

DOGGS, machines of iron for burning wood on; alſo hooks fixed in large timbers, for drawing them with horſes.

DOGGER, a ſmall ſhip, built after the Dutch faſhion, with a narrow ſtern, and two maſts; viz. a main maſt, and a mizen maſt, principally uſed in fiſhing on the Doggers bank. See Plate II. *Fig.* 4. NAVAL ARCHITECTURE.

DOGGERS, in the Engliſh alum works, a name given by the workmen to a ſort of ſtone found in the ſame mines with the true alum rock, and containing ſome alum, though not nearly ſo much as the right kind. The county of York, which abounds greatly with the true alum rock, affords alſo a very conſiderable quantity of theſe doggers; and in ſome places they approach ſo nearly to the nature of the true rock, that they are wrought to advantage.

DOGMA, Δογμα, a maxim, tenet, ſettled propoſition, or principle; particularly in matters of religion, or philoſophy.

DOGMATICAL, ſomething relating to a doctrine, or opinion. Dogmatical philoſopher is one who aſſerts every thing poſitively; in oppoſition to a ſceptic, who doubts of every thing.

DOGMATICI, DOGMATISTS, a ſect of ancient phyſicians of which Hippocrates was the firſt author, called alſo, *logici, logicians*, from their uſing the rules of logic and reaſon, in ſubjects of their profeſſion. They laid down definitions, and diviſions, reducing diſeaſes to certain genera, thoſe genera to ſpecies, and furniſhing remedies for them all; ſuppoſing principles, drawing conſequences, and applying thoſe principles and conſequences to the particular diſeaſes under conſideration. In which ſenſe the dogmatiſts ſtand contradiſtinguiſhed to empirics, and methodiſts. They brought phyſic into a form and arrangement, like thoſe of other ſpeculative ſciences; defining, dividing, laying down principles, and drawing concluſions; and hence they had alſo the appellation of *logici*; q. d. *reaſoners*. They alſo applied themſelves to ſeek the cauſes of diſeaſes, the nature of remedies, &c.

DOLICHOS, kidney bean; a genus of the decandria order, belonging to the diadelphia claſs of plants. There are 25 ſpecies, the moſt uſeful of which are the following:

1. The lablab with a winding ſtalk, a native of warm climates, where it is frequently cultivated for the table. Mr. Haſſelquiſt informs us, that it is cultivated in the Egyptian gardens, but is not a native of that country. The Egyptians make pleaſant arbours with it in their houſes and gardens, by ſupporting the ſtem and leading it where they think proper. They not only ſupport it with ſticks and wood, but tie it with cords: by which means the leaves form an excellent covering, and an agreeable ſhade.

2. The urens, or cow-itch, alſo a native of warm climates, is generally eradicated from all cultivated grounds; becauſe the hairs from the pods fly with the winds, and torment every animal they touch. If it was not for this miſchievous quality, the beauty of its flowers would entitle it to a place in the beſt gardens. It flowers in the cool months, from September to March, according to the ſituation.

This plant has lately acquired a conſiderable reputation as an anthelmintic. As ſuch it is mentioned by Dr. Macbride, in his "Introduction to the theory and practice of phyſic," and by ſome other authors. From the teſtimonies of Mr. Cochrane ſurgeon at Nevis, and Mr. Bancroft author of a "Natural hiſtory of Guiana," we are aſſured that it is uſed in theſe countries with the greateſt ſafety and efficacy. Mr. Bancroft, after mentioning the frequency of diſorders ariſing from worms, in that part of the world, and aſſigning ſome reaſons for them, proceeds as follows: "But from whatever cauſe theſe worms are produced, their number is ſo great, that the uſual remedies are very inſufficient for their deſtruction: for which reaſon the planters in general have recourſe to the cow-itch for that purpoſe. From whence its uſe was firſt ſuggeſted, I am uncertain; but its efficacy is indiſputable. The part uſed is the ſetaceous hairy ſubſtance growing on the outſide of the pod, which is ſcraped off, and mixed with common ſyrup or molaſſes, to the conſiſtence of a thin electuary; of which a tea-ſpoonful to a child of two or three years old, and double the quantity to an adult, is given in the morning faſting, and repeated the two ſucceeding mornings; after which a doſe of rhubarb is uſually ſubjoined. This is the empirical practice of the planters, who uſually once in three or four months exhibit the cow-itch in this manner to their ſlaves in general, but eſpecially to all their children without diſtinction; and in this manner I have ſeen it given to hundreds, from one year old and upwards, with the moſt happy ſucceſs. The patients, after the ſecond doſe, uſually diſcharged an incredible number of worms, even to the amount of more than 20 at a time; ſo that the ſtools conſiſted of little elſe than theſe animals. But though theſe were indiſputable proofs of its efficacy, I was far from being convinced of its ſafety. I obſerved that the ſubſtance given conſiſted of an aſſemblage of ſpiculæ exquiſitely fine, and ſo acutely pointed, that, when applied to the ſkin, they excited an intolerable itching, and even inflammation; from whence I apprehended dangerous conſequences from their contact with the coats of the ſtomach and inteſtines. Indeed, when mixed with an electuary in the manner in which they are given, their elaſticity is ſo impaired, that they do not produce the ſame ſenſible irritation: but yet I could conceive no other quality on which their efficacy depended; eſpecially after I had prepared both a tincture and decoction from the cow-itch, and given them to worm patients without any ſenſible advantage. Influenced by theſe ſuggeſtions, I particuliarly examined the ſtate and condition of all ſuch patients as I knew had taken the cow-itch; and yet can with the greateſt truth declare, that, though prejudiced to its advantage, I was never able, either by my own obſervation or a diligent inquiry, to diſcover a ſingle inſtance of any ill conſequence reſulting from its uſe: which has been ſo extenſive, that ſeveral thouſands muſt have taken it, and as no ill effects have been obſerved, I think not only its efficacy, but ſafety, are ſufficiently evinced, to entitle it to general uſe, eſpecially when we reflect on the uncertainty, and even danger, which attends other vermifuges. It is to be obſerved, that this remedy is particularly deſigned againſt the long round worm. Whether it is equally deleterious to the aſcarides, or whether it has ever been uſed againſt them, is uncertain."

DOLLAR, a ſilver coin, nearly of the value of the Spaniſh piece of eight, or French crown. Dollars are coined in divers parts of Germany and Holland; and have their diminutions, as rix dollars, ſemi dollars, quarter dollars, &c. They are not all of the ſame fineneſs, nor weight. The Dutch dollars are the moſt frequent. In the Levant they are called *oſtaini*, from the impreſſion of a lion thereon.

DOLPHIN. See DELPHINUS.

DOLPHINS *of a Cannon*, in gunnery, are the two handles placed on the ſecond reinforce rings of braſs guns, reſembling the fiſh of that name. They ſerve for mounting and diſmounting the guns.

DOLPHIN *of the Maſt*, in ſea language, is a peculiar kind of wreath, formed of platted cordage, to be faſtened occaſionally round the maſt, as a ſupport to the puddening, whoſe uſe is to ſuſtain the weight of the fore and main-yards, in caſe the rigging or chains, by which thoſe yards are ſuſpended, ſhould be ſhot away in the time of battle.

DOM, or DON, a title of honour originally Spaniſh, though uſed occaſionally in other countries. It is equivalent to *maſter, ſir*; or *lord, monſieur, ſieur, mynheer, &c.*. In Portugal, nobody is allowed to aſſume the title of *dom*, which is a badge or token of nobility, without the king's leave. Dom is likewiſe uſed in France among ſome orders of religious. The word is formed from the Latin *domnus* or *dominus*; of which it is an abbreviature.

DOMAIN, the inheritance, eſtate, or poſſeſſion, of any one.

DOME, or DOOM, ſignifies, judgment, ſentence, or decree. The homagers oath, in the Black Book of Hereford, ends thus: ſo help me God at his holy *dome*, and by my trowthe.

DOME, in architecture, a ſpherical roof; or a work of a ſpherical form raiſed over the middle of a building, as a church, hall, pavilion, veſtibule, ſtair-caſe, &c. by way of crowning. They are uſually made round; though we have inſtances of ſquare ones; as thoſe of the Louvre; and others that are polygons, as that of the Jeſuits church in the Rue St. Antoine at Paris. They have uſually columns ranged around their outſides, both by way of ornament, and to ſupport the vault.

DOMES-DAY, or Dooms-Day *Book, Liber judiciarius vel cenſualis Agliæ*, the judicial book, or book of the ſurvey of England: a moſt ancient record made in the time of William the Conqueror; upon a ſurvey, or inquiſition, of the ſeveral counties, hundreds, tithings, &c. Its name is formed from the Saxon *dom*, *doom*, *judgment*, *ſentence*, and *day*, which has the ſame force; ſo that *dome day* is no more than a reduplicative, importing *judgment judgment*.

Doomſday ſignifies the lord's or king's proclamation, or advertiſement, to the tenants who hold under him; and agrees well with great part of the contents of this famous ſurvey. Obſervations on the Statutes, p. 190.

The deſign of the book is to ſerve as a regiſter, by which ſentence may be given in the tenures of eſtates; and from which that noted queſtion, whether lands be ancient demeſne, or not, is ſtill decided.

This book is ſtill remaining, fair and legible; conſiſting of two volumes, a greater and a leſs; the greater comprehending all the counties of England, except Northumberland, Cumberland, Weſtmoreland, Durham, and part of Lancaſhire, which were never ſurveyed; and except Eſſex, Suffolk, and Norfolk, which are comprehended in the leſſer volume, which concludes with theſe words, *Anno milleſſimo octageſimo ſexto ab incarnatione Domini, vigeſimo vero regis Wiſhelmi, facta eſt iſta deſcriptio non ſolum per hos tres comitatus, ſed etiam ulios.*

It is called *Liber judicialis*, becauſe a juſt and accurate deſcription of the whole kingdom is contained therein; with the value of the ſeveral inheritances, &c.

It was begun by five juſtices, aſſigned for that purpoſe in each county, in the year 1081, and finiſhed in 1086. Camden calls it *Gulielmi Librum cenſualem*, king William's tax-book.

This book was formerly kept under three locks and keys; one in the cuſtody of the treaſurer, and the others of the two chamberlains of the exchequer. It is now depoſited in the chapter-houſe at Weſtminſter, where it may be conſulted, on paying to the proper officers a fee of 6*s*. 8*d*. for a ſearch, and 4*d*. per line for a tranſcript.

DOMESTIC, from *domus*, houſe, a term of ſomewhat more extent than that of ſervant; the latter only ſignifying ſuch as ſerve for wages, as footman, lacquies, porters, &c. whereas domeſtic comprehends all who act under a man, compoſe his family, and live with him. Such are ſecretaries, chaplains, &c. Sometimes domeſtic goes farther, being applied to the wife and children.

DOMINICAL *Letter*, properly called Sunday letter, one of the ſeven letters of the alphabet ABCDEFG, uſed in almanacs, ephemerides, &c. to denote the Sundays throughout the year. The word is formed from *Dominica*, or *Dominicus dies*, Lord's day, Sunday. The dominical letters were introduced into the calendar by the primitive Chriſtians, in lieu of the nundinal letters in the Roman calendar. Theſe letters, we have obſerved, are ſeven: and that in a common year, the ſame letter ſhould mark all the Sundays will eaſily appear; inaſmuch as all the Sundays are ſeven days apart, and the ſame letter only returns in every ſeventh place. But in biſſextile, or leap year, the caſe is otherwiſe: for by means of the intercalary day, either the letters muſt be thruſt out of their places for the whole year afterwards, ſo, e. gr. as that the letter which anſwers to the firſt of March, ſhall otherwiſe anſwer to the ſecond, &c. or elſe the intercalary day muſt be denoted by the ſame letter as the preceding one. This latter expedient has been judged the better, and accordingly the Sundays after the intercalary day have another dominical letter.

DOMINICANS, an order of religious, called in ſome places Jacobins, and in others Predicants, or Preaching Friars, in England black friars. The Dominicans take their name from the founder Dominic de Guzman, a Spaniſh gentleman, born in 1170, at Calaroga, in Old Caſtile. He was firſt canon and archdeacon of Oſma; and afterwards preached with great zeal and vehemence againſt the Albigenſes in Languedoc, where he laid the firſt foundation of his order. It was approved of in 1215, by Innocent III. and confirmed in 1216, by a bull of Honorius III. under the title of St. Auguſtin; to which Dominic added ſeveral auſtere precepts and obſervances, obliging the brethren to take a vow of abſolute poverty, and to abandon entirely all their revenues and poſſeſſions; and alſo the title of preaching friars, becauſe public inſtruction was the main end of their inſtitution. The firſt convent was founded at Tholouſe by the biſhop thereof, and Simon de Montfort. Two years afterwards they had another at Paris, near the biſhop's houſe; and ſome time after, a third in the rue St. Jaques, St. James's ſtreet, whence the denomination of Jacobins. Juſt before his death, Dominic ſent Gilbert de Freſney, with twelve of the brethren, into England, where they founded their firſt monaſtery at Oxford, in the year 1221, and ſoon after another at London. In the year 1276, the mayor and aldermen of the city of London gave them two whole ſtreets by the river Thames, where they erected a very commodious convent, whence that place is ſtill called Black Friars, from the name by which the Dominicans were called in England.

DOMINIUM, Dominion, in the civil law, denotes the abſolute power, or property, of a thing, to uſe or diſpoſe of it how we pleaſe.

DONATION, Donatio, an act, or contract, whereby a man transfers to another, either the property, or the uſe, of the whole, or a part of his effects, as a free gift. A donation to be valid and complete, ſuppoſes a capacity both in the donor, and the donee; and requires conſent, acceptance and delivery; and by the French law regiſtry alſo.

DONATIVE, Donativum, a preſent made to any perſon; called alſo gratuity. The Romans made large donatives to their ſoldiers. Julia Pia, wife of the emperor Severus, is called, on certain medals, Mater Caſtrorum, becauſe of the care ſhe took of the ſoldiery, by interpoſing for the augmentation of their donatives, &c. Donative was properly a gift made to the ſoldiery; as Congiarius was that made to the people.

All biſhopricks in ancient time were donative by the king. Again, where the biſhop has a gift of the benefice, it is properly called a donative, becauſe he cannot preſent to himſelf.

DONAX, in conchology, the ninth genus belonging to the order of vermes teſtacea. The ſhell has two valves, with a very obtuſe margin in the fore-part. See the Syſtem and Synoptical Table, Genus 9.

DONOR, in law, he who gives lands or tenements, to another, in tail. As donee, is he to whom the ſame are given.

DOOR, in architecture, an aperture in a wall, to give entrance, and exit, in and out of the building, or ſome apartment thereof. Moſt of the obſervations that are applicable to windows may be applied to doors. See Syſtem of Architecture, on the Principles of the Art.

DOR, the Engliſh name for the common black beetle. Some alſo apply it to the duſty beetle, that flies about hedges in the evening.

DOREE, or *John* Doree, in ichthyology, a name given by us to a fiſh, called by authors the faber and gallus marinus. We have borrowed the name doree from the French; and, as to the word John, by ſome writers perfixed to it, it ſeems only a corruption of the French word *jaune*, *yellow*; expreſſing the colour of the ſides of this fiſh, which is a gold-yellow, by the phraſe *jaune dorée*; this has given us the words *John Dorée*, or by thoſe who ſpell yet worſe, *John Dory*, as we ſee it in ſome authors. See Zeus.

The fleſh is well taſted, and by many preferred to that of the turbot. It is caught in the Mediterranean and other ſeas, and is not uncommon on the Cornwall coaſt, and other of the Engliſh ſhores.

DORIC, in architecture, is the ſecond of the five orders; being that between the Tuſcan and Ionic. It is uſually placed upon the Attic baſe, though originally it had no baſe. The Doric order ſeems the moſt natural, and beſt proportioned, of all the orders; all its parts being founded on the natural poſition of ſolid bodies. Accordingly, the Doric is the firſt, and moſt ancient, of the orders of architecture, and is what gave the firſt idea of regular building. See Orders of Architecture, in the Syſtem, Plate II.

Doric, in grammar. The *Doric dialect* is one of the five dialects, or manners of ſpeaking, which obtained among the Greeks. See Dialect.

DORING, or Daring, among the ſportſmen, a term uſed to expreſs a method of taking larks, by means of a clap-net, and a looking glaſs. The looking glaſs is to be prepared in the following manner. Take a piece of wood, about an inch and a half thick, and cut it in form of a bow, ſo that there may be about nine inches ſpace between the two ends; and let it have its full thickneſs at the bottom, that it may receive into it a falſe piece; in the five corners of which, there are to be let in five pieces of looking glaſs. Theſe are to be fixed, that they may part their light upwards, and the whole machine is to be ſupported on a moveable pin, with the end of a long line fixed to it; and made in the manner of the children's play-thing of an apple and a plum-ſtone; ſo that the other end of the cord being carried through a hedge, the barely pulling it may ſet the whole machine of the glaſſes a-turning. This and the other contrivances are to be placed in the middle between the two nets. The larks fixed to the place, and termed calls, and the glittering of the looking glaſſes, as they twirl round in the ſun, invite the other larks down; and the cord that communicates with the nets, and goes through the hedge, gives the perſon behind an opportunity of pulling up the nets, ſo as to meet over the whole, and take every thing that is between them. The places where this ſort of ſporting ſucceeds beſt are open fields remote from any trees or hedges, except one by way of a ſhelter for the ſportſman, and the wind ſhould always be either in the front or back; for if it blows ſideways, it prevents the playing of the nets.

DORIS, a genus of worms, belonging to the ſixth claſs and the third order called vermes teſtacea. The body is oblong, flat beneath; creeping: mouth placed below; vent behind, ſurrounded with a fringe: two feelers, retractile. There are ſeveral ſpecies. The argo, or lemon doris, has an oval body, convex, marked with numerous punctures, of a lemon colour, the vent beſet with elegant ramifications. It inhabits different parts of our ſeas, called about Brighthelmſtone the ſea lemon. See Syſtem of Vermeology.

DORMANT, from *dormio*, *I ſleep*, is the herald's term for the poſture of a lion, or other beaſt, borne as ſleeping in a coat of arms. See Syſtem of Heraldry, Plate V.

DORMOUSE, in tetrapodology, the name of a ſpecies of wild mice, called alſo the ſleeper, claſſed under the genus of mouſe, in the order of glires, in the Linnæan ſyſtem. It has two cutting teeth in each jaw; four toes before, and five behind, and naked ears. There are two kinds of this creature, a larger and a ſmaller. See Mus.

DORONICUM, in botany, leopard's bane, a genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants. For claſs and order ſee Syſtem of Botany, Sect. V. Plate V.

DORSAL, from *dorſum*, *back*, any thing that belongs to the back; as dorſal glands, dorſal nerves, dorſal muſcles.

Dorsi *Longiſſimus*, a muſcle common to the loins, and the back. It riſes from the upper part of the os ſacrum, ilium, and firſt vertebra of the loins; and in its beginning is confounded, if not the ſame, with the ſacrolumbaris. It runs upwards along the whole tract of the back, and is connected to every tranſverſe proceſs in its way; ending ſometimes in the firſt vertebra of the back, and ſometimes in the firſt of the neck. See Syſtem of Anatomy, Sect. XII.

DORSIFEROUS, or Dorsiparous *Plants*, from *dorſum*, and *fero*, *I bear*, are thoſe of the capillary kind; which are without ſtem, and bear their ſeeds on the backſide of their leaves.

DORSTENIA, contrayerva, in botany, a genus of the monogynia order, belonging to the tetandria claſs of plants. For claſs and order, ſee Syſtem of Botany, Sect. V. Plate IV.

DORSUM, in anatomy, is the hind part of the thorax; commonly tranſlated the back. The dorſum includes alſo the loins.

Dorsum *Manus*, and *Pedis*, is the outſide of the hand and foot; or that part oppoſite to the palm and ſole.

Dorsum *Naſi* is the ridge of the noſe, which runs the whole length of that part. In thoſe we call Roman noſes, the dorſum is higher, and more prominent, about the middle, than in the reſt; which part is called the ſpina, or ſpine.

DORT, *Synod of*, in eccleſiaſtical hiſtory, a national ſynod, ſummoned by authority of the ſtates-general, the provinces of Holland, Utrecht, and Overyſſel, excepted, and held at Dort in 1618. The moſt eminent divines of the United Provinces, and deputies from the churches of England, Scotland, Switzerland, Bremen, Heſſia, and the Palatinate, aſſembled on this occaſion, in order to decide the controverſy between the Gomariſts, or Calviniſts, and Arminians; the latter of whom were declared corrupters of the true religion.

But the authority of this ſynod was far from being univerſally acknowledged either in Holland or in England. The provinces of Frieſland, Zealand, Utrecht, Guelderland, and Groningen, could not be perſuaded to adopt their deciſions; and they were oppoſed by the authority of archbiſhop Laud, and king James I. in England. The reformed churches in France, though at firſt diſpoſed to give a favourable reception to the deciſions of this famous ſynod, in proceſs of time eſpouſed doctrines very different from thoſe of the Gomariſts; and the churches of Brandenburgh and Bremen would not ſuffer their doctors to be tied down to the opinions and tenets of the Dutch divines. The liberty of private judgment, with reſpect to the doctrines of predeſtination and grace, which the ſpirit that prevailed among the divines of Dort ſeemed ſo much adapted to diſcourage and ſuppreſs, acquired new vigour, in conſequence of the arbitrary proceedings of this aſſembly. Moſh. Eccl. Hiſt. vol. iv. p. 498.

DOSE, in pharmacy, &c. the quantity of a medicine to be taken at one time. The word is formed from the Greek δοσις, which ſignifies gift, or a thing given; from διδομι, *do*, *I give*.

A ſecret in phyſic is nothing, unleſs the doſe be known. In authors, and diſpenſatories, that deſcribe the ſame remedy, frequently the doſe is different; which occaſions a great difference in its effect. Dr. Cockburn has given us an eſſay towards determining the doſes of purgative medicines, on mechanical principles. Several attempts have been made to aſcertain the proportional doſes for the different ages and conſtitutions of patients; but, after all than can be ſaid on this ſubject, much muſt be left to the judgment of the perſon who adminiſters the medicine. The following general proportions may be obſerved, though by no means intended for exact rules. A patient between 20 and 14 may take two-thirds of the doſe ordered for an adult; from 14 to 9. one half; from 9 to 6, one third; from 6 to 4, one fourth; from 4 to 2, one ſixth; from 2 to 1, a tenth; and under 1, a twelfth. Buchan's Dom. Med. App. p. 595.

DOSITHEANS, in church hiſtory, a ſect among the Hebrews, being one of the branches of the Samaritans. They abſtained from eating any creature that had life; and were ſo ſuperſtitious in keeping the ſabbath, that they remained in the ſame place and poſture wherein that day ſurpriſed them, without ſtirring till the next day. They married but once, and a great number never married. Doſitheus, their founder, being diſſatisfied among the Jews, retired to the Samaritans, who were reputed heretics, and invented another ſect; and to make it more authentic, he went into a cave, where, by too long abſtinence, he killed himſelf. The name of Doſitheans was alſo given to ſome of the diſciples of Simon Magus.

DOTE *Aſſignando*, in law, a writ that lay for a widow, where it was found by office, that the king's tenant was ſeiſed of tenements in fee, or fee tail, at the day of his death; and that he held of the king in chief, &c. in which caſe, the widow came into the chancery, and there made oath, that ſhe would not marry without the king's leave. Anno 16 Edw. III. c. 4. And hereupon ſhe had this writ to the eſcheator; for which ſee Reg. of Writs, fol. 297. and Fitz. Nat. Br. fol. 263. Theſe widows are called the king's widows.

Dote *unde nihil habet*, in law, a writ of dower that lies for the widow againſt the tenant, who bought land of her huſband in his life time, whereof he was ſolely ſeiſed in fee-ſimple or fee-tail, in ſuch ſort, as the iſſue of them both might have inherited.

DOTTEREL, charadrius, in ornithology, ſee Charadrius.

DOUBLE; two of a ſort, one correſponding to the other.

Double *Banked*, in ſea language, denotes the ſituation of the oars of a boat, when two oppoſite ones are managed by rowers ſeated on the ſame bench, or thwart. The oars are alſo ſaid to be double banked when two men row upon every ſingle one.

Double *Children*, Double *Cats*, Double *Pears*, &c. inſtances oft are frequent in the Philoſophical Tranſactions, and elſewhere. See Monster.

Sir John Floyer, in the ſame tranſactions, giving an account of a double turkey, furniſhes ſome reflections on the production of double animals in general. Two turkeys, he relates, were taken out of an egg of the common ſize, when the reſt were all hatched, which grew together by the fleſh of the breaſt bone: but, in all other parts, were diſtinct. They ſeemed leſs than the ordinary ſize, as wanting bulk, nutriment, and room for their growth, which latter, too, was apparently the occaſion of their coheſion. For, having too diſtinct cavities in their bodies, and two hearts, they muſt have ariſen from two cicatriculas; and conſequently, the egg had two yolks, which is no uncommon accident. He had a dried double chicken: he aſſures us, that though it had four legs, four wings, &c. it had but one cavity in the body, one heart, and one head; and that this, conſequently, was produced from one cicatricula. So, Paræus mentions a double infant with only one heart: in which caſe, the original, or ſtamen of the infant, was one, and the veſſels regular: only the nerves and arteries towards the extremities, dividing into more branches than ordinary, produced thoſe double parts. The ſame is the caſe in the double flowers of plants, occaſioned by the richneſs of the ſoil. So it is in the eggs of quadrupeds, &c. There are, therefore, two reaſons of duplicity in embryos: 1. The conjoining, or connection of two perfect animals; and, 2. An extraordinary diviſion, and ramification of the original veſſels, nerves, arteries, &c.

Double *Horizontal Dial*, one with a double gnomon, whereof one points out the hour on the outward circle, and the other ſhews the hour on the ſtereodraphic projection drawn upon it. This dial finds the meridian, hour, the ſun's place, riſing, ſetting, &c. and many other propoſitions of the globe. See Treatiſe on Dialling, Sect. V.

Double *Fichê*, or Double *Fichy*, in heraldry. A croſs is denominated *double fichê*, when the extremities are pointed at each angle; that is, when each extremity has two points: in contradiſtinction to *fichê*, where the extremity is ſharpened away to one point. Gibbon expreſſes it by an octagonal croſs, the two points whereof at each extremity are parted inwards by a ſmall ſpace of a line; by which it is diſtinguiſhed from the croſs of Malta, the two points whereof proceed from a third point, or acute angle between them.

Double *Letter*, in grammar, a letter, which has the force and effect of two: as the Hebrew *Tſade*, which is equivalent to *T* and *S*; or the Greek ξ, or Latin *x*, &c. Theſe letters are evidently equal to two: when we pronounce the Latin *axis*, or the Engliſh *axillary*, we give the *x* the ſame ſound, as if it were written with two *cc*, *accis*, *accillary*; or a *c* and *s*, *acſis*, *acſillary*. The Greeks have three, Ζ, Ξ, Ψ; the Latins only two, X and Z; and moſt of the modern languages have the ſame.

Double *Point*, in the higher geometry. When all the right lines tending the ſame way with the infinite leg of any curve, do cut it only in one point (as happens in the ordinates of the Carteſian, and the cubical parabola) and in the right lines which are parallel to the abſciſſes of hyperbolas, and parabolas, then you are to conceive, that thoſe right lines paſs through two other points of the curve, placed, as it may be ſaid, at an infinite diſtance. Which coincident interſection, whether it be a finite, or an infinite diſtance, ſir Iſaac Newton calls the double point.

Double *Veſſel*, in chymiſtry, is when the neck of one bolthead, or mattraſs, is put, and well luted, into the neck of another. Of theſe there are divers kinds and forms, uſed in the circulation of ſpirits, in order to their being exalted, and refined, as high as can be.

DOUBLETS, among lapidaries, denote cryſtals wrought into ſuch a form, and ſo coloured, that the ſurfaces of two pieces thus coloured being laid together, might produce the ſame effect as if the whole ſubſtance of the cryſtal had been tinged. For this purpoſe, two plates of cryſtal muſt be cut in the manner of a brilliant, and fitted ſo exactly, that no diviſion can appear when they are laid together. The upper part muſt be poliſhed ready for ſetting, and then the colours may be put between them by the following proceſs: take of Venice, or Cyprus turpentine, two ſcruples, and add to it one ſcruple of the grains of pure maſtic powdered. Melt them together in a ſilver or braſs ſpoon, ladle, or other veſſel, and mix with them any of the coloured ſubſtance propoſed, well powdered. Warm the doublets to the ſame degree of heat with the mixture, and paint the upper ſurface of the lower part, and put the upper one inſtantly upon it, preſſing them evenly together. When the cement is quite cold, ſcrape the edges, and let the doublets be ſkilfully ſet, by carrying the mounting over the joint, ſo that the two pieces may be well ſecured from ſeparating. The colour of the ruby may be imitated, by mixing a fourth part of carmine with fine crimſon lake; the ſapphire and amethyſt may be counterfeited by mixing very bright Pruſſian blue with a ſmall quantity of crimſon lake; the emerald may be imitated by diſtilled verdigriſe, with a little powdered aloes; the garnet may be counterfeited by dragon's blood, the brightneſs of which may be improved by the addition of a ſmall quantity of carmine; the yellow topazes may be imitated by mixing the powdered aloes with a little dragon's blood. Glaſs may be alſo prepared in the ſame manner. Doublets may be eaſily diſtinguiſhed, by holding them betwixt the eye and the light, in ſuch poſition, that the light may paſs through the upper part and corner of the ſtone; which will then ſhew ſuch parts to be white, and that there is no colour in the body of the ſtone. Handmaid to the Arts, vol. ii. p. 328, &c.

Doubling, in a military ſenſe, is the putting of two ranks, or files of ſoldiers, into one. When the word of command is, double your ranks, the ſecond, fourth, and ſixth ranks are to march up into the firſt, third, and fifth; ſo that of ſix ranks they make but three, leaving double the interval there was between them before. But it is not ſo when they double the half-files, becauſe then three ranks ſtand together, and the three others come up to double them; that is, the firſt, ſecond, and third, are doubled by the fourth, fifth, and ſixth; or on the contrary. Double your files, directs each to march to that next to it on the right or left, according to the word of command; in which caſe the ſix ranks are turned into twelve, the men ſtanding twelve deep; the diſtance between the files being now double of what it was before.

Doubling *a Cape*, or *Point*, in navigation, ſignifies the coming up with it, paſſing by it, and leaving it behind the ſhip.

The Portugueſe pretend to be the firſt that ever doubled the Cape of Good Hope, under their admiral Vaſquez de Cama; but we have accounts in hiſtory, particularly in Herodotus, of the Egyptians, Carthaginians, &c. having done the ſame long before them.

Doubling *Upon*, in a naval engagement, is the art of encloſing any part of a hoſtile fleet between two fires, or of cannonading it on both ſides. It is uſually performed by the van or rear of that fleet which is ſuperior in number taking the advantage of the wind; or of its ſituation, and tacking, or veering round the van or rear of the enemy, who are thereby expoſed to great danger, and can ſcarcely avoid being thrown into a general confuſion.

DOUBLINGS, in heraldry, the lining of mantles over the arms in an atchievement.

DOUBLON, **Dubloon**, a Spaniſh and Portugueſe coin, being the double of a piſtole. There are alſo double dubloon, formerly current among us for three pounds twelve ſhillings.

DOUBTING, the act of with-holding a full aſſent from any propoſition; on ſuſpicion, that we are not thoroughly appriſed of the merits thereof; or from our not being able peremptorily to decide between the reaſons for, and againſt it. The ſceptics and academics doubt of every thing; the character of their philoſophy is, not to allow any thing for truth; but to with-hold the aſſent, and keep the mind free, and in ſuſpenſe. The Epicureans truſt their ſenſes, and doubt of their reaſon: their leading principle is, that our ſenſes always tell truth; that they are the firſt and only criterions of truth; and that if you go ever ſo little from them, you come within the proper province of doubting. The Carteſians, on the contrary, of all things bid us doubt our ſenſes; they are perpetually inculcating the deceitfulneſs of our ſenſes; and tell us, that we are to doubt of every one of their reports, till they have been examined, and confirmed by reaſon.

DOUCINE, in architecture, a moulding, or ornament, on the higheſt part of the corniche, in form of a wave, half convex, and half concave.

DOVE, the Engliſh name of a bird of the pigeon kind, belonging to the order Columbine. It ſeldom flies ſingle, but in large flocks, and builds on trees; its food is ivy berries, and other vegetable matter. They begin to cooe in March, when they pair, and leave off in the beginning of winter. See Plate III.

Dove *Tail*, in carpentry, the ſtrongeſt of all the kinds of jointings; wherein the tenon, or piece of wood that enters the other, goes widening to the extreme, and ſo cannot be drawn out again, becauſe the tip, or extreme, is bigger than the whole. It has its denomination from the reſemblance the tenon bears to a dove's tail. The French call it *queue d'aronde*, *ſwallow's tail*; which name the Engliſh themſelves alſo retain in fortification.

DOVELLA, in ichthyology, a name given by the Maſſilians to the fiſh called the donzellina by the Italians: it is the julia, or julis, of authors; and, according to the Artedian ſyſtem, it is a ſpecies of the labrus. That author diſtinguiſhes it by the name of the labrus of variegated colours, with two large teeth in the upper jaw. See **Labrus**.

To **DOUSE**, in ſea language, is to lower ſuddenly, or ſlacken; and it is applied to a ſail in a ſquall of wind, an extended hawſer, &c.

DOWAGER, **Dotissa** (q. d. a widow endowed, or that has a jointure), a title or addition, applied to the widows of princes, dukes, earls, and perſons of high rank only.

Dowager, *Queen*. See **Queen**.

DOWER, **Dotarium**, **Doarium**, or **Dos**, a portion of lands, or tenements, which a widow enjoys for term of life, from her huſband, in caſe ſhe ſurvives him; and which, at her death, deſcends to their children. But ſhe muſt have been the wife of the party at the time of his deceaſe; or not divorced *a vinculo Matrimonii*; nor, if ſhe has eloped from her huſband, and lives with an adulterer, ſhall ſhe be entitled to dower, unleſs her huſband be voluntarily reconciled to her. The widows of traitors are alſo barred of their dower by 5 and 6 Ed. VI. cap. 11. but not the widows of felons. An alien cannot be endowed, unleſs ſhe be queen conſort, and if a woman levies a fine with her huſband, or if a common recovery be had with the huſband and wife of the huſband's lands, ſhe is barred of her dower. A widow clear of theſe impediments, is by law entitled to be endowed of all lands and tenements, of which her huſband was ſeiſed in fee ſimple or fee tail, at any time during the coverture; and of which any iſſue ſhe might have had, might by poſſibility have been heir. Our law books diſtinguiſh five kinds of dower; viz. *dower per legem communem*; *per conſuetudinem*; *ex aſſenſu patris*; *ad oſtium eccleſiæ*; and *de la plus belle*. But the two firſt are now only in uſe.

Dower *by the common Law*, is a third part of ſuch lands as the huſband was ſole ſeiſed of in fee during the marriage; which the wife is to enjoy during her life, and for which there lies a writ of error.

Dower *by Cuſtom* gives the wife, in ſome places, half her huſband's lands, ſo long as ſhe lives ſingle, as in gavel-kind. And as cuſtom may enlarge, ſo that the widow may have the whole during life, which is called her *free bench*, ſo may it abridge dower, and reſtrain it to a fourth part.

In **Dower** *ex aſſenſu Patris*, and *ad oſtium Eccleſiæ*; the wife may have ſo much dower as ſhall be aſſigned, or agreed upon; but it ought not to exceed the third part of the huſband's lands. If this be done before marriage, it is called a jointure.

DOWN, in natural hiſtory, denotes the firſt feathers of geeſe, with which beds and pillows are ſtuffed. The cottony ſubſtance on the tops of thiſtles, &c. is alſo thus called.

DOWNS, a bank, or elevation, of ſand, which the ſea gathers and forms along its ſhores; and which ſerves it as a barrier.

Downs, a famous road for ſhips, along the eaſtern coaſt of the county of Kent; from Dover to the North Foreland. This road has excellent anchorage, and is well defended by the caſtles of Sandwich, Deal, and Dover.

DOWNY, ſomething partaking of the nature of down. Thus ſome leaves and fruit, &c. are ſaid to be covered with a downy matter.

DOWRY, **Dos**, is properly the money, or fortune, which the wife brings her huſband in marriage, to have the uſe of it, during her marriage, towards ſupporting the charge thereof.

It is otherwiſe called *maritagium*, *marriage goods*; by the Romans *dos*; and it differs from *dower*. See **Dower**. Among the Germans, it was anciently cuſtomary for the huſband to bring a dowry to his wife.

Dowry is alſo uſed, in a monaſtic ſenſe, for a ſum of money given along with a maid, upon entering her in ſome religious order. In France, the dowry of perſons entering a monaſtery, to make profeſſion of a religious life, is limited by law. That, e. gr. given upon entering a monaſtery of Carmelites, Urſulines, and others, not regularly founded, but eſtabliſhed ſince the year 1600, by letters patent, muſt not exceed the ſum of 8000 livres, in towns where parliaments are held; nor 6000, in other places.

DOXOLOGY, an appellation given by the Greeks to the fourteenth verſe of the ſecond chapter of St. Luke, *Glory be to God in the higheſt*, &c. becauſe beginning with the Greek word *δοξα*, *glory*. This they diſtinguiſh by the name of *great doxology*; and the *Gloria Patria*, *Glory be to the Father*, they call the *leſs doxology*, as beginning with the ſame word *δοξα*. Philoſtorgius, lib. iii. n. 13. gives three formulas of the *leſſer doxology*. The firſt is, *Glory be to the Father, and to the Son, and to the Holy Ghoſt*; the ſecond, *Glory be to the Father, by the Son, in the Holy Ghoſt*; and the third, *Glory be to the Father, in the Son, and the Holy Ghoſt*. Sozomen, and Nicephorus, give a fourth: viz. *Glory be to the Father, and the Son, in the Holy Ghoſt.*

The firſt of theſe doxologies is that in common uſe throughout the weſtern church. It was firſt inſtituted about the year 350, by the Catholics of Antioch, then called Euſtathians. The three others were compoſed by the Arians; the ſecond was that of Eunomius, and Eudoxus, and which was approved by Philoſtorgius. The three were all made about the year 341, in the council of Antioch, when they firſt began to diſagree among themſelves. Philoſtorgius aſſures us, that Flavian, afterward patriarch of Antioch, was the author of the firſt, or catholic doxology; but Sozomen, and Theodoret, ſay nothing of it; and Philoſtorgius's ſingle authority is hardly ſufficient.

There were anciently very great diſputes, and principally at

Antioch, as to the form of doxology; that moſtly uſed among the orthodox was, the ſame as ſtill obtains; the reſt were affected by the Arians, and other Antitrinitarians; yet St. Baſil, in his book on the Holy Spirit, defends the ſecond as orthodox, and legitimate; and it is certainly more agreeable to Scripture authority; to which we muſt ultimately appeal, as the only infallible rule of our devotion, as well as of our conduct: and it has been urged, that no inſtance of the former doxology occurs in the New Teſtament.

Some authors write hymnology as ſynonymous with doxology; but there is a difference: hymnology is applied to pſalms, or the recitation of pſalms; and doxology only to the little verſe. *Glory be to the Father*, &c. repeated at the end of each pſalm.

DRABA, in botany, a genus of the ſiliculoſa order, belonging to the tetradynamia claſs of plants. For the Claſs and Order, ſee Syſtem of BOTANY, Sect. V. Plate V.

DRABS, in the Engliſh ſalt-works, a name given to a ſort of wooden caſes in which the ſalt is put, as ſoon as it is taken out of the boiling pan. Theſe are partitions like ſtalls made for horſes; they are lined on three ſides and at the bottom with boards, and at the front have a ſliding board to put in or take out occaſionally. Their bottoms are made ſhelving, being higheſt at the backſide, and gradually inclining forwards; by which means the ſaline liquor that remains mixed with the ſalt eaſily drains out from it, and the ſalt in three or four days becomes ſufficiently dry, and is then taken out and laid up in large heaps for ſale. In ſome places they uſe cribs inſtead of the drabs.

DRACHM, or DRAM, is a weight uſed by our phyſicians, containing juſt ſixty grains, or three ſcruples, or the eighth part of an ounce troy, and the ſixteenth of an ounce avoirdupois.

DRACO, dragon, in aſtronomy, a conſtellation of the northern hemiſphere; whoſe ſtars, according to Ptolemy, are 31; according to Tycho, 32; according to Hevelius, 40; according to Bayer, 33; and according to Mr. Flamſtead, 80. See Syſtem of ASTRONOMY, Sect. VIII.

DRACO, the dragon, a genus belonging to the order of amphibia reptilia. The characters of which are theſe: it has four legs; a cylindrical tail, and two membranaceous wings, radiated like the fins of a fiſh, by which he is enabled to fly, but not to any great diſtance at a time. There are two ſpecies, 1. The volans, or flying dragon, with the wings entirely diſtinct from the fore legs; it is found in Africa and the Eaſt Indies. 2. The præpos, with the wings fixed to the fore legs; it is a native of America. They are both harmleſs creatures, and feed upon flies, ants, and ſmall inſects.

DRACO *Volans*, in meteorology, a fiery exhalation, frequent in marſhy and cold countries. It is moſt common in ſummer; and though principally ſeen playing near the banks of rivers, or in boggy places, yet ſometimes mounts up to a conſiderable height in the air, to the no ſmall terror of the amazed beholders; its appearance being that of an oblong, ſometimes roundiſh, fiery body, with a long tail. It is entirely harmleſs, frequently ſticking to the hands and cloaths of people, without injuring them in the leaſt.

DRACONTIUM, a genus of the polyandria order, belonging to the gynandria claſs of plants. See Syſtem of BOTANY, Sect. V. Plate V.

DRACUNCULI, in medicine, a ſort of long and ſlender worms, which breed in the muſcular fleſh of the arms, legs, &c. and from their being more frequent in ſome parts of Guinea than elſewhere, are called by many Guinea-worms.

The microſcope has put it paſt doubt, that they are real living animals, of an aſh colour, having two long horns, two large round eyes, and a long tail, terminated with a tuft of hair. The common way of getting out theſe worms is by the point of a needle; to prevent their forming again the uſual way is to waſh the parts with wine or vinegar, allum, nitre, or common ſalt, or with a ſtrong lixivium of oak aſhes, and afterwards anointing them with an ointment of the common kind uſed for ſcorbutic eruptions, with a ſmall mixture of quickſilver.

DRAGON, in aſtronomy. See DRACO.

DRAGON *Beams*, in architecture, are two ſtrong braces or ſtruts, which ſtand under a breaſt-ſummer, and meet in an angle on the ſhoulder of the king-piece.

DRAGON'S *Blood*, *ſanguis draconis*, in medicine, a reſinous ſubſtance brought from the Eaſt, in oval drops, wrapped up in flag leaves, of conſiderable uſe, as an agglutinant and deſiccative, againſt fluxes, both alvine and uterine, and ulcerations internal and external, &c. It derives its name dragon's blood from the redneſs of the colour, and gives its name dragon to the tree that yields it. The genuine dragon's blood is the juice, or reſin, of a large tree, called *draco arbor*, the *dragon tree*, reſembling the palm, growing in Africa, and America, as well as in China. It is a good aſtringent; and is uſed in hæmorrhages and dyſenteries; as alſo to faſten the teeth, and ſtrengthen the gums. A ſolution of dragon's blood in ſpirit of wine is uſed for ſtaining marble, to which it gives a red tinge, which penetrates more or leſs deeply, according to the heat of the marble during application. But for fine deſigns, the marble ſhould be cold, becauſe it ſpreads while it ſinks. Mr. Du Fay ſays, that by adding pitch to this ſolution, the colour may be rendered deeper. There is alſo a counterfeit dragon's blood, made of the gum of the cherry, or almond tree, diſſolved, and boiled in a tincture of Brazil wood; but this is of no uſe, except for external diſeaſes of horſes. Theſe adulterated reſins are diſtinguiſhed from the true by their diſſolving in water, and crackling in the fire without burning.

DRAGON *Fly*, in entomology, the Engliſh name of a very large genus of four winged flies, called by us adder-flies, and dragon-flies. They belong to the order of neuroptera in the Linnæan ſyſtem; they are characteriſed by having jaws, by antennæ ſhorter than the thorax, by extended wings, and by the male's tail being terminated by a hooked kind of forceps. See LIBELLA.

Theſe flies have all two very large and reticulated eyes, covering the whole ſurface of the head, which are a beautiful object for the microſcope. They fly very ſwiftly, and prey upon the wing, being of great uſe to mankind, and clearing the air of innumerable little flies. They are produced of ſeveral ſpecies of ſix-legged worms living in the waters, and figured by ſeveral other authors, under the name of *pulices*, and *locuſtæ aquaticæ*.

Moſt of theſe ſpecies are found in Auguſt and September, in our fields and gardens, eſpecially near places where there are waters, as they have their origin for worms living in that element. The great ones uſually live all their time about waters, but the ſmaller are common among hedges, and the ſmalleſt of all are moſt frequent in gardens. The ſmaller kinds often ſettle upon buſhes or upon the ground; but the large ones are almoſt always upon the wing, ſo that it is very difficult to take them. The manner of this inſect's coupling with the female is a thing that has attracted the obſervation and admiration of multitudes, as they are frequently ſeen, in the hotter months, in that ſtate, flying together about the edges of waters.

Mr. Homberg, of the Academy of Paris, has taken great pains to inform the world of the whole ſecret of this ſtrange coitus, and of ſeveral other remarkable particulars in regard to the creature. The part to which the wings are fixed is called the breaſt in animals of this kind; but in this creature the lungs are not ſituated there, but in the middle of the belly, which is ſeen continually riſing and falling at inſpiration and expiration. The laſt joint of the body of the male is a ring containing the anus, and this is furniſhed with two pair of hooks; the one pair outward and larger, the other inward and ſmaller: theſe the creature is able to open and ſhut as lobſters do their claws. The extremity of the belly of the female ſeems to conſiſt of two tubes, or pipes, one placed upon the other; the upper one is the anus, at which it voids its excrements; the under one is the female part of generation, and the entrance of the womb of the animal. When the male of this ſpecies finds the female ſitting upon a leaf, or ſtick, he ſeizes her as ſhe flies, taking faſt hold of her with the hooks at the anus by the neck, or that part which joins the head to the breaſt, and immediately flies away with her, holding her fixed by the neck to the end of his tail.

The male does not carry his bride far before he ſettles himſelf upon ſome plant, and raiſes his tail ſo, that the female may be brought to ſit eaſily under him upon the ſame plant. As ſoon as the female is thus ſeated, ſhe turns up her tail, and brings it between the legs of the male, then places it to a certain part of the breaſt of the male, in which are the organs of generation in that ſex. All this while the male keeps his hold of her neck with his forceps, or hooks. They uſually remain in this poſture about three minutes; and after that the male gently raiſing up his breaſt, they become ſeparated, and leaving the hold he had on her neck, at the ſame time, he flies away as he pleaſes. The female uſually remains on the place for half a quarter of an hour, and then ſhe flies away alſo. Mr. Homberg having obſerved the coupling of theſe animals thus far, was determined to examine the organs uſed in it by diſſection. To this purpoſe he caught ſeveral of them, and on the whole collected ſeveral curious obſervations, which may be ſeen in Mem. Acad. Par. 1699.

DRAGONNEE, in heraldry. A lion dragonneé, is where the upper half reſembles a lion; the other half going off like the hind part of a dragon.

DRAGOONS, in war, an order of ſoldiery, who march on horſeback, and fight on foot, though ſometimes, too, on horſeback. Dragoons are divided into brigades, as the cavalry, and each regiment into troops; each troop having a captain, lieutenant, cornet, quarter-maſter, two ſerjeants, three corporals, and two drums. Some regiments have hautboys. They are very uſeful on any expedition that requires diſpatch; for they can keep pace with the cavalry, and do the duty of infantry: they encamp generally on the wings of the army, or at the paſſes leading to the camp; and ſometimes they are brought to cover the general's quarters: they march in the front and rear of the army.

DRAGS, in the ſea language, is uſed for whatever hangs over the ſhip in the ſea, as ſhirts, coats, or the like; and boats when towed, or whatever elſe that, after this manner, may hinder the ſhip's way when ſhe ſails.

DRAIN, or DREIN, in the military art, a trench made to draw the water out of a moat, which is afterwards filled with hurdles and earth, or with faſcines, or bundles of ruſhes and planks, to facilitate the paſſage over the mud.

DRAINS, a name given in the fen countries to certain large cuts, or ditches, of twenty, thirty, nay ſometimes forty feet wide, carried through the marſhy ground to ſome river, or other place capable of diſcharging the water they carry out of the fen lands. Moſt of theſe drains are made in our fen countries by a body of men called the undertakers, whoſe reward is one third of the ground they drain. They alſo erect ſluices at a great expence, often not leſs than two thouſand pounds each. Yet theſe, with all the care they employ in erecting them, are ſubject to be blown up by the vaſt weight of water that lies upon them when the lands are overflown. Some of theſe ſluices have two or more pair of doors, of ſix, eight, or ten feet high, which ſhut when the water in the river is higher than in the drains, by the weight and force of it; and ſo *è contra*, throw out a body of eight feet ſquare of water for about ſix or ſeven hours during the ebb. The real uſe of theſe drains is very evident from the preſent ſtate of the land where they are cut, and that of it before. In Camden's time all this was bog, and now it is all firm land. The country about Crowland was in that author's time ſo ſoft, that it was not paſſable by carriages; and thus grew a witticiſm upon it, that all the carts that entered this town were caſed on the wheels with ſilver; but this is now ſo firm ground, that carriages of any kind paſs over it. The duck-ponds uſed to be called the fen corn-fields, and they now are ſuch in reality, their bottoms being dry, and producing oats, and rape-ſeed, or cole-ſeed, with great increaſe. Phil. Tranſ. Nº 223.

Drains are alſo more generally uſed to carry off the ſuperfluous moiſture from wet and marſhy lands. For this purpoſe a deep drain muſt be cut in the loweſt part, ſo as to reach the bed, whether of gravel or ſand, through which the water flows. See Syſtem of AGRICULTURE, Sect. IX.

DRAMA, in poetry, a piece, or poem, compoſed for the ſtage. The word is Greek, δραμα, which literally ſignifies *action*; becauſe in dramas, or dramatic poems, they act, or repreſent actions, as if they really paſſed. A drama, or as we popularly call it, a play, is a compoſition either in proſe or verſe, conſiſting, not in the ſimple recitation, but in the actual repreſentation of an action. Our dramas are, tragedies, comedies, operas, and farces.

DRAMATIC, in poetry, is an epithet given to pieces written for the ſtage.

DRANK, a name given by our farmers to the great wild oats, Theſe are often very troubleſome to the ploughed lands, eſpecially after wet ſeaſons and much froſt. Many to deſtroy this weed ſow the land with black oats, which being ripe much ſooner than the ſeeds of this plant, are cut down before it can ſow itſelf for another year; eſpecially if they are cut a little the earlier, which will do them no harm, if they be ſuffered to lie a while upon the ground afterwards, for the grain to ſwell before they are carried in. But, in general, when ploughed lands begin to run to theſe weeds and thiſtles, it is a token to the farmer that it is time to fallow them, or elſe to ſow them with hay-ſeed, and make paſtures of them. The ſowing beans upon a land ſubject to theſe weeds is alſo a good method, becauſe the farmer may ſend in his ſheep when they are about three inches high, which will eat up the drank, and all the other weeds, and will not hurt the beans. The general method is to put twenty ſheep to an acre; but they muſt be put in only in dry weather, and not left too long.

DRAPERY, in drawing and ſculpture, the repreſentation of the garments, or clothing of human figures. The word is French, *draperie*, formed from *drap*, *cloth*. In the general ſenſe, drapery includes not only the garments, but alſo the tapeſtry, linens, and moſt other things that are not carnations, nor landſcapes. The art of drapery conſiſts chiefly in three points, viz. the ordering of the folds or plaits; the different quality of the ſtuffs; and the variety of their colours. M. de Piles give abundance of good obſervations relating to drapery. Their firſt effect, he obſerves, and that which the painter ought to have principally in view, is, that they expreſs the thing they are ſuppoſed to cover; and they muſt never be made to adhere, and ſtick to the parts of the body; a great lightneſs, and motion of the drapery, are only proper for figures in great agitation, or expoſed to the wind. The nudities of the figures ſhould always be deſigned, before the painter proceeds to the draperies. Titian, Paul Veroneſe, and Vandyke, excelled in draperies. See Treatiſe of DRAWING.

DRASTIC, from δραω, *I act*, a ſtrong and powerful medicine; more particularly, a purgative that works with ſpeed and vigour; as jalap, ſcammony, and the other ſtronger cathartics.

DRAUGHT, in trade, is an allowance made in the weight of commodities.

DRAUGHT is alſo uſed ſometimes for a bill of exchange, and commonly for an order for the payment of any ſum of money due, &c. Then the perſon who gives the order is ſaid to draw upon the other.

DRAUGHT, or, as it is pronounced, draft, in architecture, the figure of an intended building deſcribed on paper: wherein are laid down, by ſcale and compaſs, the ſeveral diviſions and partitions, of the apartments, rooms, doors, paſſages, conveniencies, &c. in their due proportion. It is uſual, and even exceedingly convenient, before a building is begun to be raiſed, to have draughts of the ichnography, or ground-plot of each floor, or ſtory; as alſo of the form and faſhion of each front, with the windows, doors, ornaments, &c. in an orthography, or upright. Sometimes the ſeveral fronts, &c. are taken, and repreſented in the ſame draught, to ſhew the effect of the whole building: this is called a ſcenography, or perſpective.

DRAUGHT-*Compaſſes*, thoſe provided with ſeveral moveable points, to draw fine draughts in architecture, &c.

DRAUGHT-*Hooks*, are large hooks of iron fixed on the cheeks of a cannon-carriage, two on each ſide, one near the trunnion-hole, and the other at the train, and are called the fore and hind draught-hooks.

DRAW. A ſhip is ſaid to draw ſo much water, according to the number of feet ſhe ſinks into it. Thus, if fifteen feet from the bottom of her be under water, or if ſhe ſink into the water fifteen feet perpendicularly, ſhe is ſaid to draw fifteen feet water; and according as ſhe draws more, or leſs, ſhe is ſaid to be of more, or leſs draught; and that this may be more readily known, the feet are marked on the ſtern and ſtern-poſt regularly from the keel upwards. Drawing denotes alſo the ſtate of the ſail, when it is inflated with the wind, ſo as to advance the veſſel in her courſe.

DRAW-*Back*, in commerce, a rebate, or diſcount, upon the price of commodities, purchaſed on certain conditions. Draw-back is more particularly uſed to denote certain duties, either of the cuſtoms or of exciſe, that are allowed upon the exportation of ſome of our own manufactures, or upon certain foreign commodities that have paid a duty at importation. The oaths of the merchants importing or exporting are required, to obtain the draw-back of foreign goods, affirming the truth of the officer's certificate of the entry, and the due payment of the duties; and theſe may be made by the agent or huſband of any corporation or company, or by the known ſervant of any merchant, uſually employed in making his entries, and paying his cuſtoms. 2 and 3 Ann. cap. 9. With reſpect to foreign goods entered outwards, if leſs in quantity or value be fraudulently ſhipped out than is expreſſed in the exporter's certificate, the goods therein mentioned, or their value, are forfeited, and no draw-back is to be allowed for the ſame. Foreign goods exported by certificate, in order to obtain the draw-back, not ſhipped or exported, or re-landed in Great-Britain, unleſs in caſe of diſtreſs, to ſave them from periſhing, which muſt be immediately ſignified to the officers of the cuſtoms, are to loſe the benefit of the draw-back, and are forfeited, or their value, with the veſſels, horſes, carriages, &c. employed in the relanding of them; and the perſons concerned in re-landing them, or by whoſe privity they are re-landed, or into whoſe hands they ſhould knowingly come, are to forfeit double the amount of the draw-back. 13 and 14 Car. II. cap. 11. This is to be paid for within five years after the offence. And the ſeizure of the horſes, &c. may be adjuſted by two or more juſtices of the peace. 6 Geo. I. cap. 21. 8 Geo. I. cap. 18. and 11 Geo. I. cap. 29.

Officers of the cuſtoms conniving at, or aſſiſting in any fraud relative to certificate goods, beſides other penalties, are to forfeit their office, and to ſuffer ſix months impriſonment, without bail or mainprize; as are alſo maſters or perſons belonging to the ſhips employed in this buſineſs. 8 Ann. cap. 13. Bonds given for the exportation of certificate goods to Ireland muſt not be delivered up, nor draw back allowed for any goods, till a certificate under the hands and ſeals of the comptroller, or collector, &c. of the cuſtoms of ſome port in Ireland be produced, teſtifying the landing, which certificate muſt be produced in ſix months from the date of the bond. 8 Ann. cap. 13. 5 Geo. I. cap. 11. 9 Geo. I. cap. 8. 2 Geo. II. cap. 28. See CUSTOMS.

DRAW *Bridge*, a bridge made after the manner of a floor, to be drawn up, or let down, as occaſion ſerves, before the gate of a town or caſtle.

DRAW *Net*, a kind of net for taking the large ſort of wild fowl, which ought to be made of the beſt packthread, with wide meſhes: they ſhould be about two fathoms deep, and ſix long, verged on each ſide with a very ſtrong cord, and ſtretched at each end on long poles. It ſhould be ſpread ſmooth and flat upon the ground, and ſtrewed over with ſedge, graſs, or the like, to hide it from the fowl; and the ſportſman is to place himſelf in ſome ſhelter of graſs, fern, or ſome ſuch thing.

DRAWING *of Gold*, or *Silver*, is the paſſing of it through a number of holes in an iron, each leſs than another, to bring it into a wire. See WIRE *Drawing*.

DRAWING *of a Bill of Exchange*, is the writing, ſigning, and giving it to the perſon, who has already paid the value or content thereof, to receive it in another place.

DRAWING, among hunters, is, when they beat the buſhes after a fox.

DRAWING *Amiſs*, is, when the hounds, or beagles, hit the ſcent of their chace the contrary way, ſo as to purſue it up the wind, when they ſhould have done it down the wind.

DRAWING *on the Slot*, is, when the hounds touch the ſcent, and draw on, till they rouſe, or put up the chace.

DRAWING is the art of repreſenting the appearances of objects by imitation; or expreſſing, by lines and ſhades, the form or appearance of any thing in nature or art: the copying of another draught, or any deſign conceived in the mind; and all this without the aſſiſtance of mathematical rules.

TREATISE ON DRAWING.

INTRODUCTION.

THERE is reaſon to believe that amongſt the firſt eſſays of human ſkill, the art of drawing had a principal place; as it is natural for the hand to form ſome kind of imitation of what the eye beholds, it may be ſuppoſed that the ſame fertile imagination which could invent inſtruments of muſic, was not deſtitute of pictureſque ideas: and that the ſame hardy ingenuity which could form into various utenſils the maſſy ore, might likewiſe poſſeſs talents ſufficient for the application of colours, which required neither toil nor ſtrength to procure, but were preſented by liberal nature upon the ſurface of the earth. If this ſuppoſition is juſt, the arts may claim an origin of remoteſt antiquity; it is certain they were employed by mankind wherever we can trace the progreſs of ſcience, and long before any period to which our reſearches can attain.

This uſeful and extenſive art, recalls to our memory things long ſince paſt, and reſcues from oblivion the deeds of our anceſtors, and revives their image in our minds, by preſerving their features for many generations; in a word, it may be ſaid to be the ſilent, but the moſt expreſſive language of nature, as it is underſtood by all nations, and conveys ideas where words prove deficient. Beſides its being an immediate introduction to painting, ſculpture, engraving, with all the train of graceful ſtudies, it is even neceſſary to form mankind for whatever ſtation deſigned; ſince nothing informs or corrects our ideas ſo effectually as a true knowledge of ſymmetry and proportion. Although this art in its extent be as ſpacious as obſervation can diſcover, or imagination conceive, yet in this Treatiſe we preſume will be found an abſtract containing examples amply ſufficient to direct a genius the leaſt apt or inquiſitive. It would be wrong on a ſudden to expect perfection in this art, yet after a few painful eſſays, a pleaſure ſucceeds in the proſpect, and grows in the practice beyond that of any other acquiſition; and ſure no one would ſpare the means where the end is ſo deſirable.

There ſeem to have been two principal reaſons for the ſuperiority of the ancient artiſts, from the remains of whoſe ſculpture we may believe the wonders recorded of their drawings. They had unqueſtionably the fineſt models, owing to a variety of cauſes; added to this, they ſtudied them with the moſt diligent aſſiduity. It may be obſerved with great propriety, that what is loſt of the beauty of the ancients, by the local and incidental circumſtances of modern manners and education, is to be traced in the remains which have been tranſmitted to us of ancient buſts, gems, and ſtatues.

The Grecian artiſts have univerſally been acknowledged to have ſurpaſſed thoſe of every other nation, but the luxury and effeminacy into which their empire dwindled, proved its deſtruction and put an end to their progreſs. They became ſubjugated to the Roman policy and power; their country was deſolated, their temples ſpoiled of their ornaments, and their capital productions were tranſported to embelliſh the porticos of Rome.

Rome was the ſeat of univerſal empire, the miſtreſs of the world; into Rome flowed all that was curious and coſtly; many generous minds were there, who prided themſelves upon their patronage of the arts, and liberally rewarded the merit of profeſſors. That the Roman artiſts attained conſiderable ſkill is granted, yet notwithſtanding their efforts to rival their maſters, the Grecian manner was always ſuperior, and the Greek productions unequalled.

It is not the lot of an art, or a ſcience, any more than that of a ſtate, or a kingdom, to continue long in glory; with great labour it reaches its zenith, and perhaps maintains a ſplendour during the lives of a few eminent men; when they are gone, it dwindles to mediocrity, and from mediocrity to neglect and oblivion.

If the morals of Greece, were luxurious, and effeminate, under what epithets ſhall we characterize the manners of the Romans? "Earthly! ſenſual! deviliſh!" Rome became the ſink into which ran the vices of every country it had ſubdued. Abandoned to impiety, ſlaves to debauchery, its citizens exulted in what ſhould have aſtoniſhed them with ſhame and horror.

We do not therefore wonder, when reading the hiſtory of thoſe times, that providence commiſſioned the barbarous nations to puniſh the licentious, the profligate Romans; our wonder rather is, that long before that period they were not involved in deſolating ruin. When the numerous herds of the ſurly north had over-run the diſtant provinces, and ravaged Italy, the artiſt hung his head in ſilent ſorrow, or burſt into lamentation at the ſavage ſcene; not ſo much for his own performances, as for the deſtruction of thoſe he had been uſed to ſurvey with wonder and delight; farewel the breathing marble! the animated picture! farewel the productions of APELLES and ZEUXIS! farewel LYSYPPUS! PRAXITELES! PHIDIAS! buried for a long, long night, beneath the ruins of the Capitol; of the Palaces; of Rome.

We have briefly hinted at the progreſs of the arts in ancient times, becauſe it does not ſo immediately concern us as what will follow upon their revival: they have accompanied learning and politeneſs: as theſe have been encouraged, the arts have have flouriſhed; when theſe have been neglected, they have drooped; when liberal ſcience and knowledge were baniſhed, they died.

It is unneceſſary to make any further eulogium on the art of drawing; the degree of eſtimation in which it is held in a country has always been reckoned a criterion by which to judge of the national taſte; and we have almoſt without exception found, that a neglect of it has been ever a mark of degeneracy or barbariſm; as the latter ages of the empire after the incurſions of the Francs and Lombards, and the modern ſtates of moſt of the Mahometan ſovereignties, may ſerve to teſtify.

The protection and cultivation which have been given to theſe purſuits in this country, within theſe few years, and eſpecially in the preſent reign, compared with that barren catalogue of artiſts and patrons, which preceded, may at leaſt evince, that we have rather advanced than receded in the knowledge and culture of thoſe arts which adorn life and poliſh taſte; and which are only to be ſucceſsfully promoted amidſt national opulence and ſplendor.

Few books have hitherto appeared in this country well ſuited to facilitate the attainment of this art; yet we are always invited to attend to ample and learned inſtructions to beginners, where the preliminary diſcourſes often puzzle and confuſe the ideas more than the examples they recommend are ever able to eradicate. But ſince example has made verbal inſtructions expected, we here ſubjoin ſuch directions as ſeem to us neceſſary to aſſiſt the ſtudent.

SECT. I.

USEFUL DIRECTIONS TO THE PRACTITIONER.

THE firſt and greateſt part of the difficulty in learners to draw, will be ſurmounted by placing before them good models for imitation, accurately delineated; the ſame pains are beſtowed on the worſt as on the beſt ſubjects. If they conſidered this, they would be curious in the choice of their examples, that they might have the leſs to unlearn. Bad habits are of all things the greateſt obſtacles to improvement, and ſcarcely to be entirely effaced by the moſt unremitting diligence. It is only by good examples of imitation that the ſtudent can form correct ideas of beauty and nature, which will always ſerve him as a ſtandard. The ſtudent's firſt uſe of them will be to attain by a deliberate ſtudy of their outlines, thoſe fixed ideas of beauty, which may always remain as ſtandards to which he ſhall refer his views of nature; to do this he muſt proceed with patience and care, "what we hope to do with eaſe (ſays an eminent modern) we muſt learn to do with diligence."

A general knowledge of the principles of muſcular anatomy; a habit of delineating the moſt uſeful inflexions of lines and contours, and a tolerable idea of the conſtituent parts of the human ſubject in ordinary nature, ſhould be the ground work for every ſcholar to build upon; nor ſhould an impatience of producing an effect from the concomitant circumſtances of light, and ſhade, divert him from a diligent ſtudy of outlines, the only ſure fundamental baſis of his future excellence. When he begins to attempt compoſition, let him accurately finiſh every part from good models; thus he will at once perfect his ſtudies as a learner, and exerciſe his imagination as an inventor. This was the conſtant practice of the beſt artiſts, and this alone will put thoſe of our days in a capacity to imitate them with ſucceſs. Let the ſcholar uſe every aid to aſſiſt his invention in compoſing, and his execution in finiſhing; the veins of a piece of marble, the accidental combinations of light and ſhadow in clouds, have given occaſion to very excellent works, when artiſts have had ſkill and genius enough to apply them with judgment.

To render landſcape perfect, the knowledge of figures becomes neceſſary; nay, it may be remarked, that the ſtudy of the human figure in its general anatomy, and in the variety of its movements, is of itſelf ſo comprehenſive a ſtudy, as not only lays a ſure ground for a juſt theoretical judgment of the art, but, in fact, includes the leſſer branches of it, as it facilitates the execution to a degree which is not to be conceived by thoſe, who from the inferior branches have applied themſelves afterwards to the higher.

The Materials uſed in Drawing, are, Charcoal, cut in long ſlips. Black lead pencils. Crayons of black, white, and red chalk. A port crayon. Indian ink. Camel's hair pencils. Fitches. Crow quill pens. A ruler and a pair of compaſſes. India rubber.

The firſt object of the ſtudent, ſhould be to ſketch his general proportions ſlightly from the ſubject he is drawing from, which he ſhould carefully ſurvey, and after, by rubbing it gently out with ſtale bread or India rubber, ſlightly and cautiouſly retouching with more correctneſs, ſtill keeping your copy ſo faint that you may with eaſe rub out and amend it. When you can find no farther diſagreement from the original in your ſketch, freſh point your pencil, and keeping a waſte paper under your hand, begin to finiſh your out-line, taking particular care to obſerve and imitate ſuch parts as appear dark, diſtinctly from thoſe which are faint or ſmaller, the ſtrong touches being what give ſpirit to the out-line, and when properly given, always denote a maſter's hand. We therefore ſhall again entreat the ſtudent to direct his greateſt attention and application to a perfect out-line, for in this principally conſiſts the Art of Drawing; this fully attained, the art will be eaſy, and the ſtudy of it become delightful. The out-line compleated,

pleated, light and ſhadow become your next concern, which is a labour ſo pleaſing, that no commendation can be given adequate to the pleaſure a real profeſſor finds in the execution of this art, or rather ſcience ſucceeding art. Beginners are apt to leave the ſtudy of out-lines too ſoon, and ſo commence painters; like thoſe who raiſe a ſtructure ere the foundation be compleated. When you ſhade with Indian ink, go exactly over your out-line with a pen dipped in common ink, with clean ſtale bread or India rubber, rub out all remains of your black lead; then mix your Indian ink, by rubbing it in an earthen ſaucer with water, till it is pretty black: then take another clean ſaucer and dip your pencil in the Indian ink, and with water mix it to the lighteſt ſhade; as it dries deepen it where neceſſary, till you come up to the ſtrength of your original. This method is moſt proper to uſe in drawing from mezzotintos or paintings.

Laſtly of Crayons, beginning with black and white: take blue or purple-colured paper, and having exactly formed your outline, begin on the ſecond degree of your ſhades, and with black chalk darken downwards; then take white French chalk, to be found at all colour-ſhops, and heighten the lighter parts to a perfect white. In this manner all paintings may be copied in their proper colours, by having different Crayons of each colour, from dark to light in due gradations. By practiſing according to the preceding rule, rolling a piece of paper to a point, and dozzeling or rubbing each colour on the paper when finiſhed, it will mellow the tints and prevent them in a great meaſure from rubbing off.

SECT. II. OUTLINES.

Drawing Eyes, Ears, Legs, Arms, Hands, Feet, &c.

As to the drawing of eyes and ears, legs and arms, the learner will have very little more to do than to copy carefully the examples given in Plate I. But the actions and poſtures of the hands are ſo many and various, that no certain rules can be given for drawing them, that will univerſally hold good. Yet as the hands and feet are difficult members to draw, it is very neceſſary, and well worth while, to beſtow ſome time and pains about them; carefully imitating their various poſtures and actions, ſo as not only to avoid all lameneſs and imperfection, but alſo to give them life and ſpirit. To arrive at this, great care, ſtudy, and practice, are requiſite; particularly in imitating the beſt prints or drawings that can be got of hands and feet, ſome good examples of which are given in Plate I. One general rule, however, may be given, which is univerſally to be obſerved in all ſubjects, and that is, not to finiſh perfectly at firſt any ſingle part, but to ſketch out faintly, and with light ſtrokes of the pencil, the ſhape and proportion of the whole hand, with the action and turn of it; and after conſidering carefully whether this firſt ſketch be perfect, and altering it wherever it is amiſs, you may then proceed to the bending of the joints, the knuckles, the veins, and other ſmall particulars, which, when the learner has got the whole ſhape and proportion of the hand or foot, will not only be more eaſily but alſo more perfectly deſigned.

Of Drawing Faces. The head is uſually divided into four equal parts. 1. A, From the crown of the head to the top of the forehead, the top line of which muſt be alloted for the hair. 2. B, From the top of the forehead to the top of the noſe between the eye brows. 3. From the eye brows to the bottom of the noſe. 4. D, From thence to the bottom of the chin. But this proportion is not conſtant; thoſe features in different men being often very different as to length and ſhape. In a well proportioned face, however, they are nearly right. To direct the learner therefore, in forming a perfect face, his firſt buſineſs is to draw a complete oval; in the middle of which, from the top to the bottom, draw a perpendicular line. Through the centre or middle of this line draw a diameter line, directly acroſs from one ſide to the other of your oval. On theſe two lines all the features of your face are to be placed as above directed, and divide your perpendicular line into four equal parts; and your diameter line, or the breadth of the face, is always ſuppoſed to be the length of five eyes; you muſt therefore divide it into five equal parts, and place the eyes upon it ſo as to leave exactly the length of one eye betwixt them. This is to be underſtood only of a full front face; for if it turn to either ſide, then the diſtances are to be leſſened on that ſide which turns from you, leſs or more in proportion to its turning. The top of the ear is to riſe parallel to the eye-brows, at the end of the diameter line; and the bottom of it muſt be equal to the bottom of the noſe. The noſtrils ought not to come out further than the corner of the eye in any face; and the middle of the mouth muſt always be placed upon the perpendicular line, as in Plate I.

We have not been ſo copious on the ſubjects of outlines, ovals, and other ſimple introductiory matters as treatiſes on drawing have generally been; becauſe we wiſh rather to refer our readers to the Plate, which will more forcibly illuſtrate thoſe principles of the art than any verbal deſcription that can poſſibly be given.

SECT. III.

PROPORTIONS AND MEASUREMENTS.

To illuſtrate theſe eſſential principles of the art, we ſhall introduce the accurate meaſurements of Monſieur Audran from the Antiques at Rome; and ſubjoin his account of them.

“ There will be, but little occaſion to enlarge upon the neceſſity of a perfect knowledge of the proportions to every perſon converſant in deſigning; it being very well known, that without obſerving them they can make nothing but monſtrous and extravagant figures.

Every one agrees to this maxim generally conſidered, but every one puts it differently in practice; and here lies the difficulty, to find certain rules for the juſtneſs and nobleneſs of the porportions; which, ſince opinions are divided, may ſtand as an infallible guide, upon whoſe judgment we may rely with certainty.

This appears at firſt very eaſy: for ſince the perfection of art conſiſts in imitating nature well, it ſeems as if we need conſult no other maſter, but only work after the life; nevertheleſs, if we examine the matter farther, we ſhall find, that very few men, or perhaps none, have all their parts in exact proportion without any defect. We muſt therefore chuſe what is beautiful in each, taking only what is called the beautiful nature. But who will ſay that he has himſelf diſcernment enough, not to be miſtaken in ſuch a choice?

Our greateſt maſters find themſelves at a loſs in this matter, and often diſagree; they form to themſelves different ideas of beauty, which they generally regulate according to their country and temper. I ſay according to their country; for ſince all men, in their air and manners, have much in them of the climate where they were born, the painters from their particular guſtos from the objects that are continually before their eyes, with which they ſo fill their imaginations, as to make all their figures conformable to them.

Hence it comes that we give a character of painters by the name of certain countries, ſaying, the piece is of the guſto of ſuch a country; and indeed this guſto is always found, more or leſs, in all the deſigners of thoſe nations.

As to our temper, that acts ſtill more powerfully in us. It is that which makes the moſt eſſential diſtinction between one man and another, and has a part in every thing we do. In this ſenſe we may ſay, that a painter paints himſelf in his works: and if we had penetration enough, we might there find his moſt prevailing inclinations. A ſecret prejudice born with us, the reaſon of which we many times do not know, is generally that which determines our choice, and cauſes us to make our figures agreeable to the air of thoſe perſons we have moſt inclination to.

There are ſome painters, in whoſe works their temper is ſo remarkable, that it is impoſſible to be miſtaken in it. We have had ſome that have been carried by their inclinations only to pleaſant ſubjects, ſuch as Diana bathing, the ſports of nymphs, and the like; others always chooſe diſagreeable ſubjects, as ſorceries, apparitions of ghoſts, and ſuch things as are frightful and terrible.

If we were to take the pains to obſerve them according to this remark, we ſhall find that their ways of living agreed with their works, and that the character of their diſpoſition might be found, not only in the choice of the ſubjects, but yet farther, in each figure in particular.

Let us add, to ſo many prejudices which we have from ourſelves, thoſe which proceed from our maſter, of whoſe manner we almoſt always retain ſomething. Upon which we may obſerve by the by, that what is called a manner, in painting, is generally a fault; it being commonly only ſome particular agreeableneſs with which we are ſo much pleaſed as to load it with exceſs; by doing which, we have paſſed the juſt point of that truth which all the world ſeeks, and to which it is ſo difficult to attain.

What can a deſigner do amidſt all theſe difficulties? I ſee nothing but the antique in which we can place an entire confidence, The ſculptors who have left us thoſe beautiful figures which remain to this day, have happily diſengaged themſelves from this perplexity. Some of theſe difficulties were not ſuch to them, and they have perfectly underſtood how to ſurmount the others.

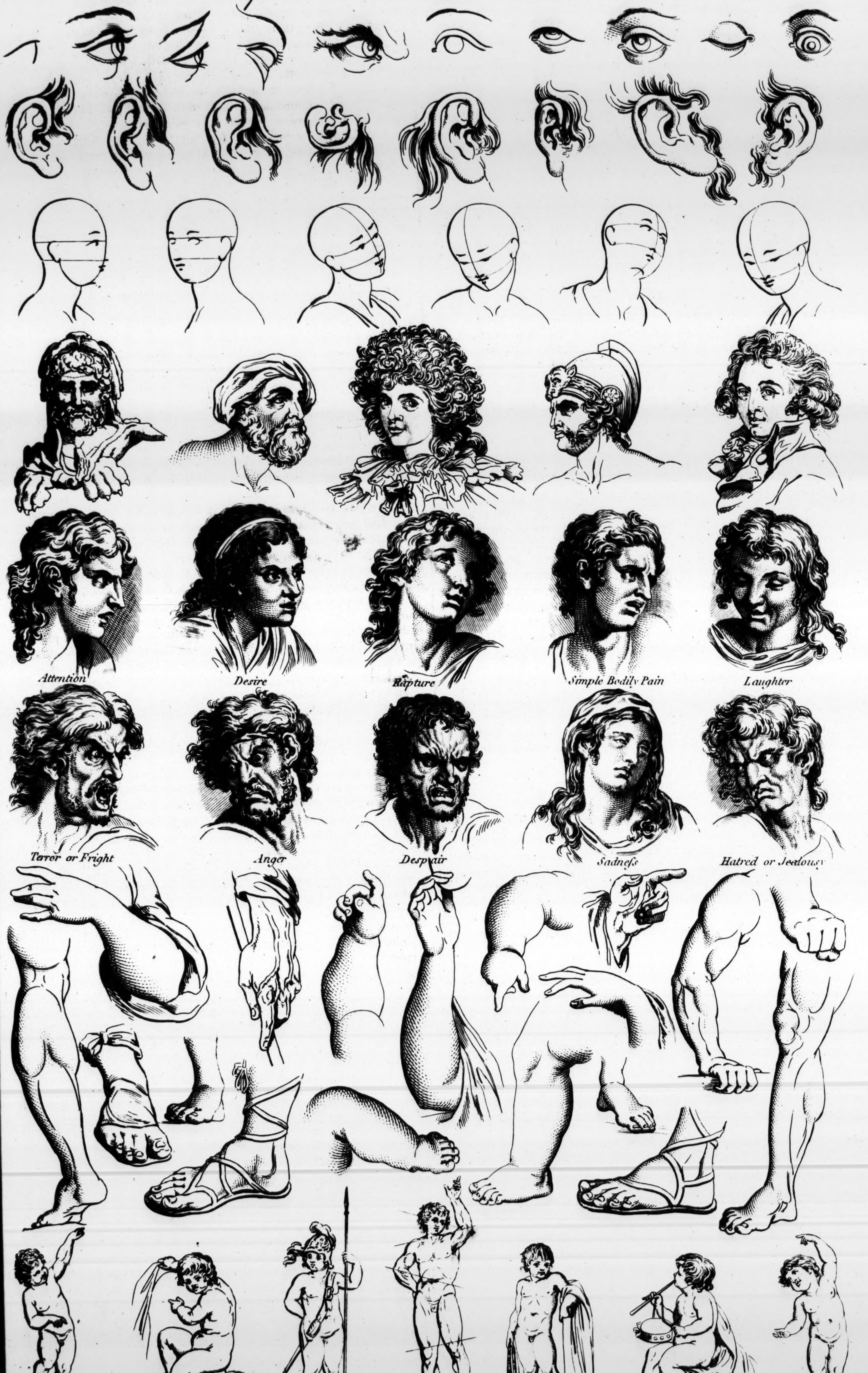
Firſt, as to thoſe which regard the country, they worked in Greece and Italy. We know that the one abounded with beauties; and the other, being the miſtreſs of the world, every thing that was beautiful and curious came there from all parts.

As to their temper and paſſions, without doubt they were ſubject to them as well as we; indeed, a natural inſenſibility would be no very happy diſpoſition for an artiſt; and his works would hardly eſcape having a teint of this extreme coldneſs: but however, theſe great men did not ſuffer themſelves ſo to be drawn aſide by their paſſions, as not to obſerve what was to be avoided and practiſed according to the different characters of their figures; and that with ſo much exactneſs, that no one in ſo many ages has yet been able to attain that high perfection they gave their works.

We may boldly ſay, that they have in ſome ſort excelled nature; for though it be true, that really they have only imitated her; that muſt be underſtood of each part in particular, but not of the whole together; and there never was any man ſo perfect in all his parts as ſome of their figures. They have imitated the arms of one, the legs of another, collecting thus in one figure all the beauties which agreed to the ſubject they repreſented, as we ſee in the Plate, which contains the Hercules, all the ſtrokes that are marks of ſtrength; and in that of the Venus, all the delicacy and graces that can form an accompliſhed beauty. The ſculptor ſpared neither time nor care: there have been ſome that worked their whole lives in view of producing one perfect figure.

Plate 1

Introductory Principles of Drawing with a representation of the Passions, from Le Brun. See the Treatise.

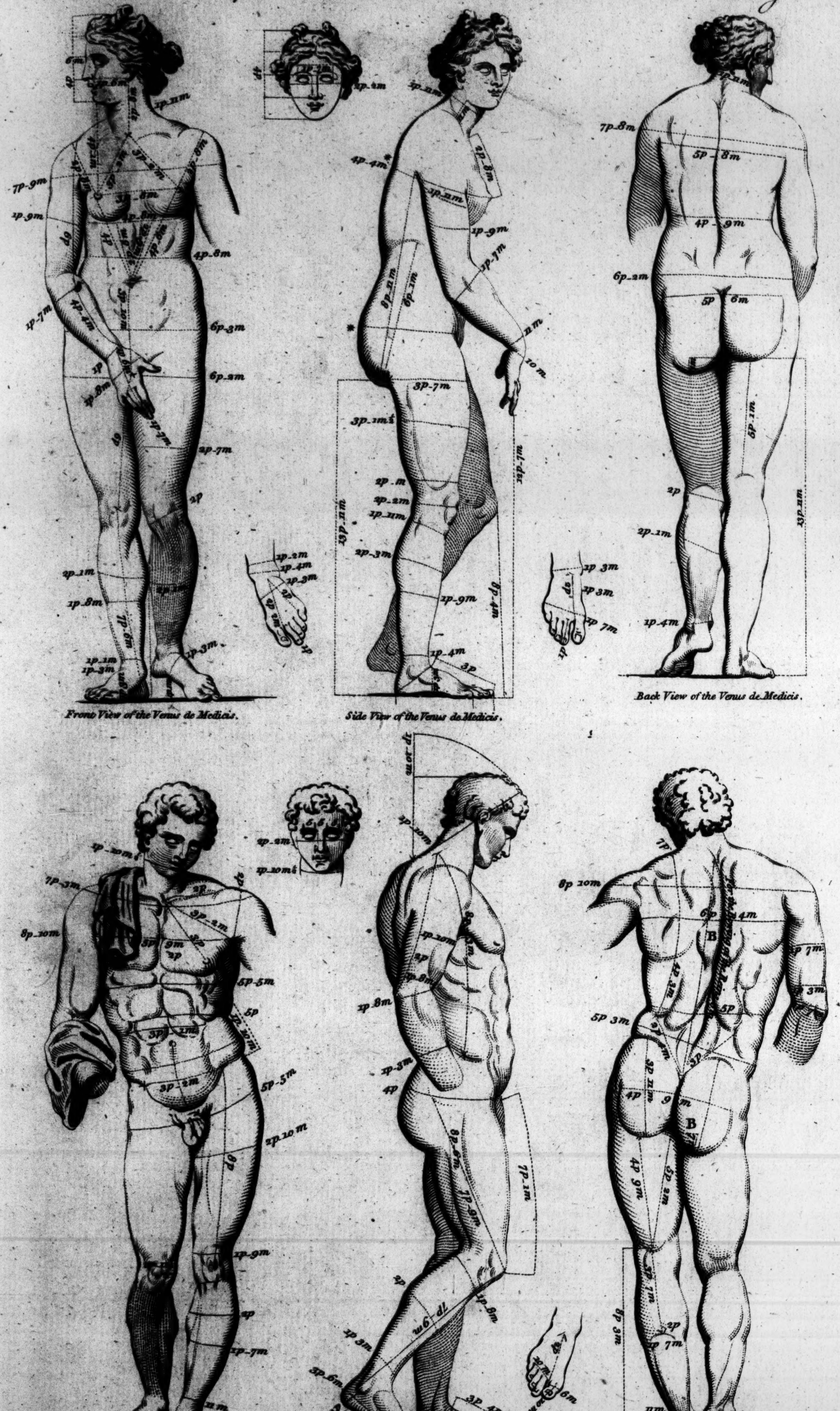

Attention
Desire
Rapture
Simple Bodily Pain
Laughter
Terror or Fright
Anger
Despair
Sadneſs
Hatred or Jealousy

Published as the Act directs, by C. Cooke, N° 17 Paternoster Row June 18.^{d} 1790.

C. Warren del. et sculp^{t}

BRITISH 18 MR 63 MUSEUM

Proportions of the Human Body accurately measured from the most admired Antique Statues at Rome, See the Treatise on Drawing.


7p_9m
2p_9m
4p_8m
1p_7m
6p_3m
6p_2m
2p_7m
2p
2p_1m
1p_8m
7p_6m
1p_3m
2p_3m
2p_2m
4p_4m
2p_11m
3p_8m
2p_9m
3p_7m
3p_1m
2p_m
2p_2m
2p_11m
2p_3m
13p_11m
2p_9m
8p_4m
2p_4m
3p
2p_4m
2p_9m
10 m
15p_7m
7p_8m
5p_8m
4p_9m
6p_2m
5p 6m
6p_1m
2p
2p_1m
1p_4m
13p_11m
2p 3m
3p 3m
2p 7m
2p_10m
7p_3m
8p_10m
9m
5p_5m
5p
5p_5m
2p_10m
3p_2m
2p_9m
2p
2p_7m
11m
2p_3m
2p_4m
2p_10m
2p_10m
2p_8m
2p_3m
4p
8p_6m
7p_9m
7p_2m
2p
3p_8m
2p 3m
3p_6m
3p_4m
8p 10m
6p_4m
B
2p 7m
2p 3m
5p 3m
5P
3P
4P
9m
B
4P 9m
5p 2m
8p 3m
2p
2p 7m
11m
6m

Front View of the Venus de Medicis.

Side View of the Venus de Medicis.

Back View of the Venus de Medicis.

Front View of the Antinous.

Side View of the Antinous.

Back View of the Antinous.

* If the Point of the Compass had been placed in the Cavity of the Loins or of the Buttocks, these Measures would have been less they are marked with two Stars.

Published as the Act directs by C. Cooke No. 27 Paternoster Row Decr. 3. 1789

Grainger sculp.

BRITISH
18 MR 63
MUSEUM

Proportions of the Human Body accurately measured from the most admired Antique Statues at Rome See the Treatise on Drawing.

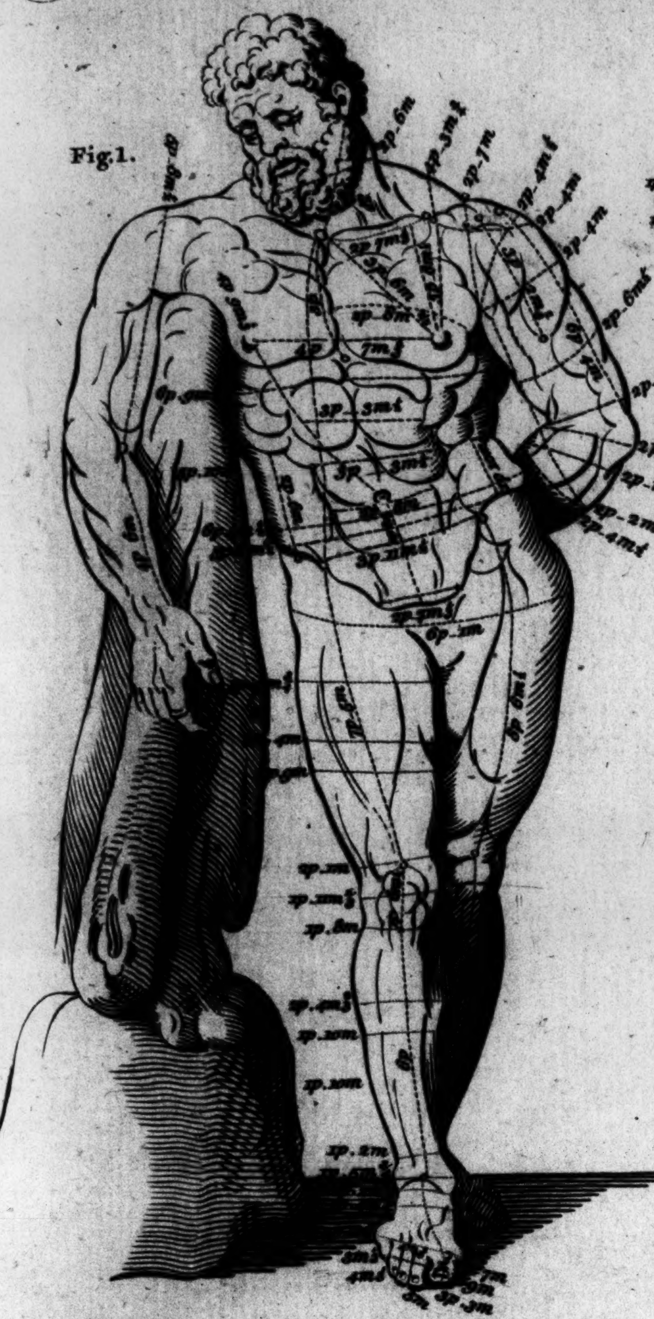
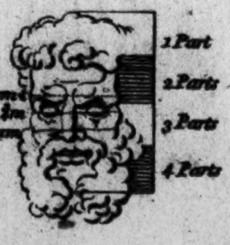


Fig.1.
3p.6m
3p.3m
3p.7m
3p.4m
3p.6m
3p.3m
3p.2m
3p.1m
3p.3m
3p.2m
7m
5m
4m


1 Part
2 Parts
3 Parts
4 Parts

Front View of the Statue of Hercules, which measures 7 Heads, 3 parts and 7 minutes, supposing ye Figure upright.

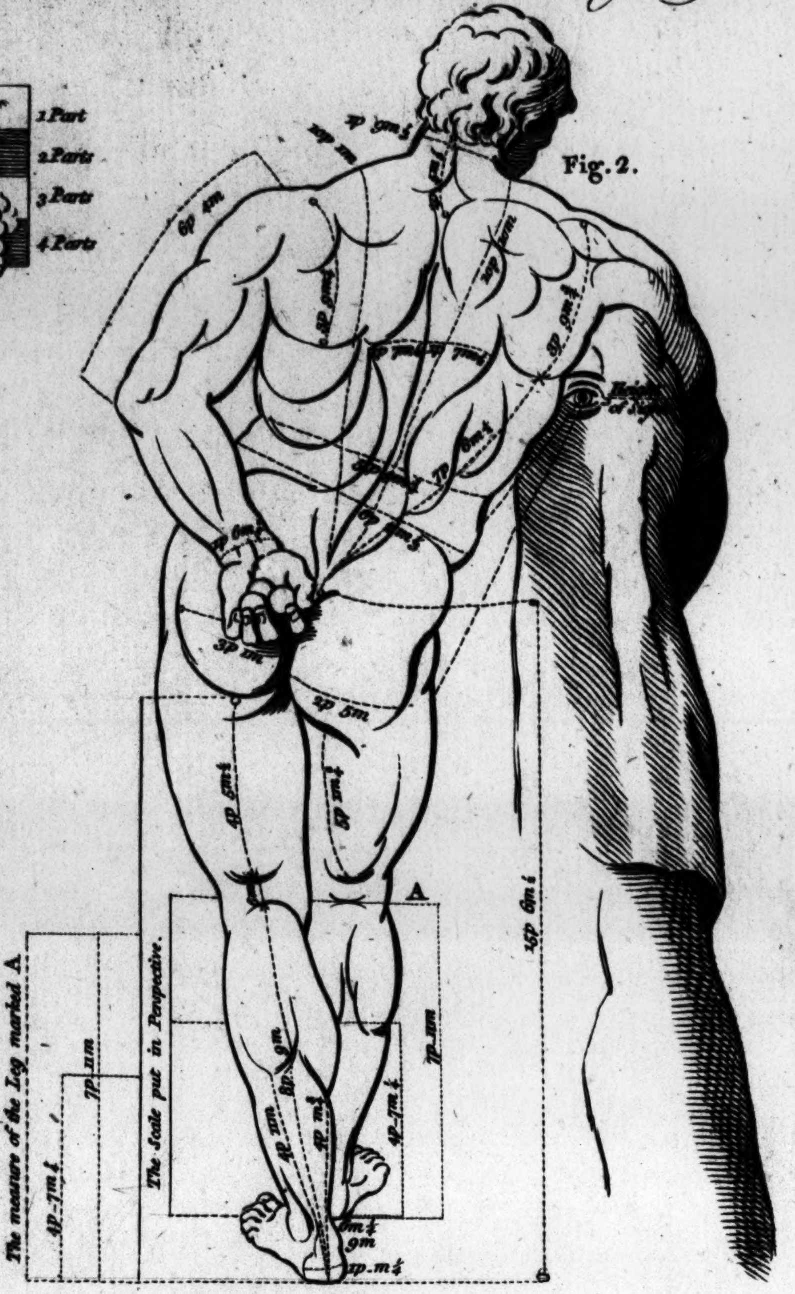


Fig.2.
The measure of the Leg marked A.
The Scale put in Perspective.
A
3p.6m
3p.5m
3p.7m
3p.m
9m

Back View of the Statue of Hercules, which measures 7 Heads, 3 parts & 7 minutes, supposing the Figure upright

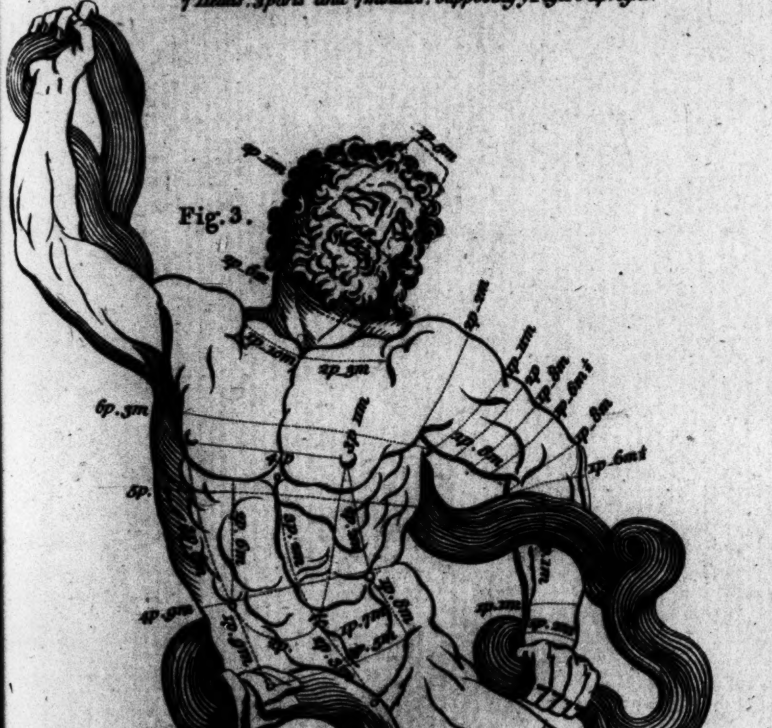


Fig.3.
6p.3m
3p.9m
3p.6m
3p.3m
3p.2m

The Statue of Laocoon, which measures 7 heads, 2parts and 3 minutes.

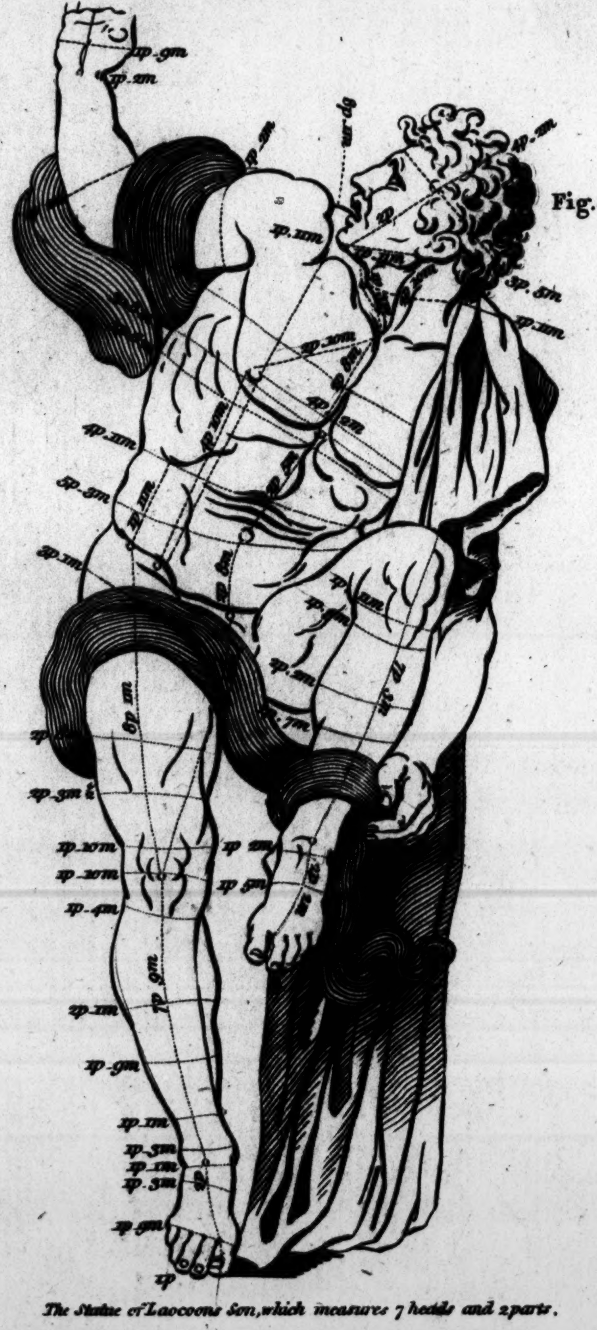


Fig.4.
3p.9m
3p.2m
3p.5m
3p.3m
3p.10m

The Statue of Laocoons Son, which measures 7 heads and 2 parts.

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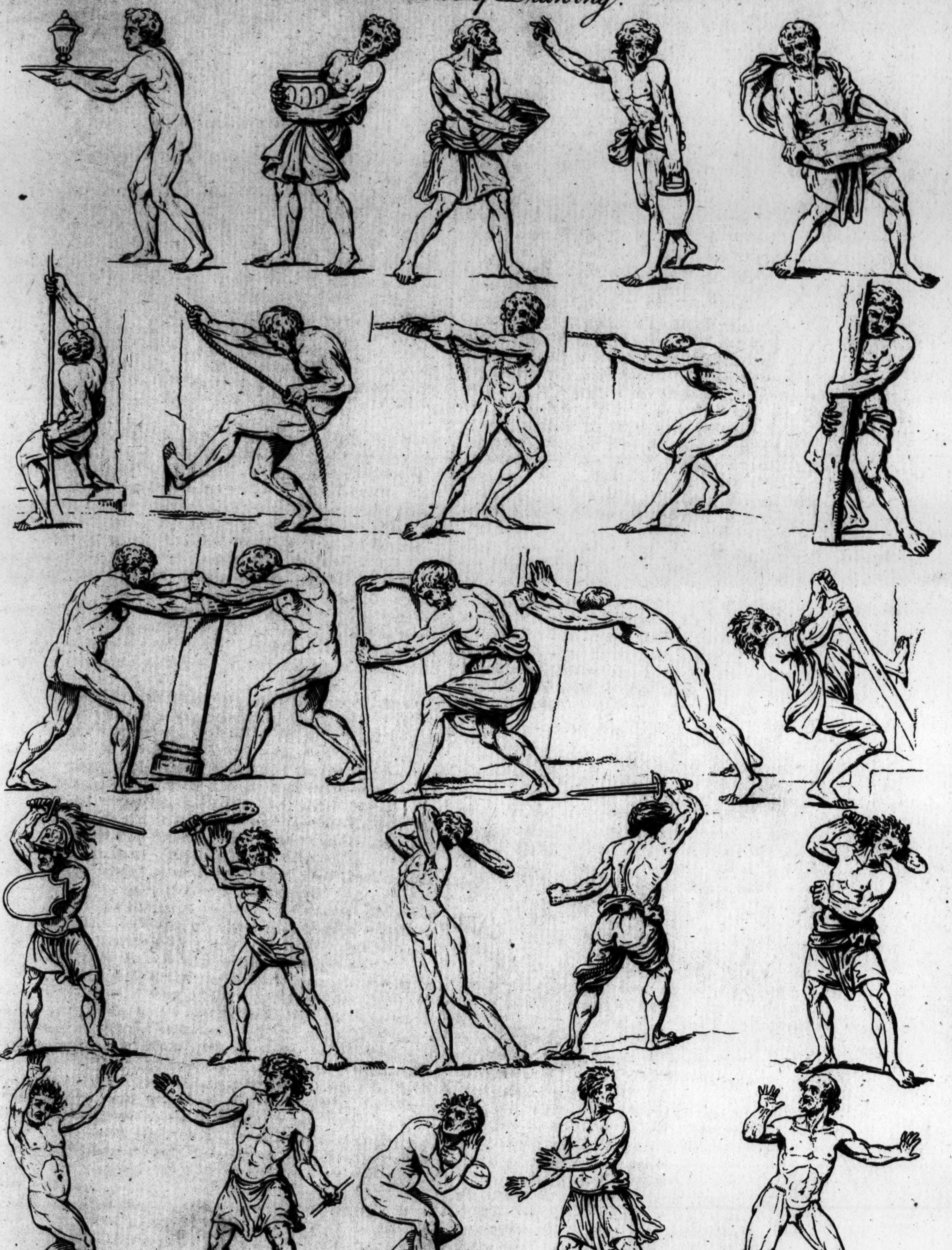
Grainger sc

BRITISH
18 MR 63
MUSEUM

Various Attitudes displaying the Motion of the Members, See the Treatise of Drawing.



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C. Warren del. et Sculp.

BRITISH 18 MR 63 MUSEUM

To animate them, they had three powerful motives, religion, glory, and intereſt. They conſidered it as a kind of religious worſhip to give the figures of their gods ſo much nobleneſs and beauty, as to be able to attract the love and veneration of the people. Their own glory was concerned, particular honours being beſtowed on thoſe that ſucceeded. And as to their fortune, they had no farther care to take, when they were arrived to a certain degree of merit.

Beſide theſe reaſons, which have the moſt contributed to form theſe excellent men, it is certain there are happy ages like thoſe of Alexander and Auguſtus. We live at preſent under a reign like theirs, where we ſee the arts flouriſhing in ſuch a manner, as there is reaſon to hope that they may attain at laſt to the perfection of the Greeks and Romans in their moſt finiſhed works.

However, the high eſteem we have for the ancients, though well grounded, muſt not make us blindly admire all the antique figures; there is reaſon to believe, that as there were maſters, ſo there were ſcholars too, ſome of whoſe works have been brought down to us, though they do not indeed deſerve the care that has been taken to preſerve them. Therefore among the great number there is of them, I have only choſe thoſe that have the moſt univerſal approbation, and which the greateſt deſigners look upon with admiration; and allow to be the moſt certain models to work after.

Your principal ſtudy being to be made upon theſe figures, it may be proper to mention to you, that in the beſt of them we obſerve certain things which would certainly be counted faults if they were in the works of a modern. The left leg of the Laocoon, is four minutes longer than the other; the leg of the Venus, that bends, is almoſt a part and three minutes longer than that which bears the body. The right leg of the greater of Laocoon's children, is near nine minutes longer than the left.

Nevertheleſs, I cannot forbear having a veneration even for theſe ſeeming faults; I believe the ſculptors had their reaſons for them, and that it would be raſhneſs to condemn them; how can we think that theſe great men who have been the authors of works that may be called perfect, ſhould fall into ſuch groſs miſtakes as theſe I have been ſpeaking of, if they had not been done with deſign?

Among ſeveral conſiderations with which we are not acquainted, one of them is likely to be the fore-ſhortening. I take the matter to be thus; theſe figures was made to be ſet in places where they were chiefly to be viewed from certain ſides, with heights and diſtances that might change the appearances of the object; the parts we have taken notice of being fore-ſhortened would have ſeemed defective; and it was that, I ſuppoſe, that obliged them to make them longer: whence we may draw an important conſequence, which is, that where a figure is to be viewed on all ſides, and at a diſtance, that gives us leave to examine it thoroughly, we muſt make the proportions ſuch as we find them in the antique, in thoſe parts that are ſeen without fore-ſhortening: but if the figure be placed where it can be viewed only at ſuch places and diſtances as hide ſome part from the eye; in that caſe, it would have good effect, (if it is not neceſſary) to put in practice thoſe ingenious artifices of which the ancients have made ſuch a happy uſe.

I propoſed to myſelf to make this work larger, by adding the ſame figures ſhadowed with as much guſto and correctneſs as I could, and above all, according to my meaſures; but being preſſed to give it to the public, for the benefit of the ſtudious, I thought I ought not to put it off any longer; the rather becauſe all that is neceſſary is here, and the reſt would only ſerve for entertainment. I muſt only advertiſe you, that theſe figures not being ſhadowed, and the places which would appear round, repreſenting nothing but a flat ſurface, you may chance to think them ſhort; but trouble not yourſelf with that doubt; they are in the moſt elegant proportions; if you doubt of it, draw one of them in the ſame meaſures I have marked, ſhadow it tenderly, and you will have a very light figure.

Different books have been written upon this ſubject; it ſeems to me, that ſeveral of thoſe that have treated of it, have affected to make themſelves heads of a ſect, by giving ſuch meaſures as pleaſed themſelves, without relying on any authority. I believe they are miſtaken, it is your part to judge; compare their proportions with mine, deſign the ſame figure according to the different rules, and you will ſee the effect.

Others having firſt drawn figures very regular and of a good guſto by ſight, after the antique, have afterwards meaſured the ſtatues to find the proportions, which not being done with all the exactneſs neceſſary, their writings did not agree with their figures.

I have endeavoured equally to avoid theſe two faults. I give you nothing of myſelf; every thing is taken from the antique: but I have drawn nothing upon the paper till I had firſt marked all the meaſures with the compaſſes, in order to make the out-lines fall juſt according to the numbers.

I have choſen figures of different characters, and meaſured them on ſeveral ſides, that you may find in one or in the other ſomething that may be uſeful to you. I have diſpoſed my meaſures in ſuch a manner, that you may make uſe of them whatever profeſſion you are of, where there is occaſion for drawing.

If you are a ſculptor, you will eaſily find more than another, ſuch things as may be of moſt ſervice to know; for ſince your art counterfeits nothing, and repreſents the figures with their real dimenſions, you may meaſure with the compaſſes any place about which you have any doubt.

If you are a painter, or graver, you will find likewiſe many uſeful things; becauſe, in whatever view a figure preſents itſelf, there are always many meaſurable parts. I have beſides invented a way of meaſuring different from the common; which will ſerve for the parts that go off; you will find it in the back view of the Hercules.

I confeſs, you would perplex very much the greateſt part of painters, if you were to meaſure their works with the compaſſes in all the places that can be meaſured; ſeveral ſave themſelves by the help of the graces of painting; but let us not flatter ourſelves, neither the livelineſs of the colouring, nor the richneſs of the diſpoſitions, nor the ſtrongeſt expreſſion, will make a beautiful whole, except they are ſuſtained by the correctneſs of the drawing. However, let not that diſcourage you; for though few pictures will bear ſuch an examination, yet we may uſe all the ſeverity of the compaſſes to the works of Raphael, Hannabel Carracci, Pouſſin, and ſome of our moſt famous maſters; we even know ſome at this day with whom we may uſe this way; their modeſty forbids my naming them; their works make them ſufficiently known; examine them well; you will find painters whoſe pictures are juſt in all their proportions by outlines both correct and graceful.

When I give ſuch great commendations to thoſe painters whoſe works may be meaſured, I do not mean to make you ſpend too much time in meaſuring your figures with the compaſſes, which would certainly hinder your progreſs in drawing; but you may uſe the compaſſes and my meaſures, whenever you have any difficulty about the proportions; then having informed your judgment ſeveral times, it will become natural to you, and you will get a habit of obſerving them regularly without the compaſſes.

In the laſt place, do not take it ill that I ſpeak well of my own work, the principal honour is not for me, it is the antique I commend. The antique preſents me admirable works; I make them my principal ſtudy, I am obliged to it for the little I know; I collect the meaſures that I may the better examine the beauties, and now offer them to you, hoping you will find as much benefit by them."

Directions for the Meaſurements.

"IN order to underſtand theſe meaſures and their uſe, it will be neceſſary to know, that it is the manner of good painters and ſculptors, to make their figures a little bending, to give them an appearance of freedom and gracefulneſs; and almoſt all the antique ſtatues are in this manner, more or leſs, as the different ſubjects require. The places where this bending is made, are, the knees, the loins, and the head; which however in ſome figures is but very little, as in the Apollo which is almoſt upright; but in others, as the Antinous, amounts to about one part ten minutes. Therefore when we ſay that a figure has ſo much in height, it is not meant, that the ſtatue meaſured from the crown of the head, to the ſole of the foot, in the attitude it is in, has ſo much height as we give it, but it is to be underſtood, ſuppoſing the figure to ſtand upright, and equally poized on both feet, that then it would have the height we ſet down.

"This being ſuppoſed, I have meaſured theſe figures according to the height they would have if they ſtood upright; I have marked, in ſome places where the parts appear leſs than they are, and have taken my principal meaſures from thoſe parts which appear in their proper bigneſs.

"The meaſures of the whole are regulated by thoſe of the head according to the uſual method. The head is divided into fonr parts, one of which reaches from the lower part of the chin to the lower part of the noſe; another, from the lower to the upper part of the noſe between the eye-brows: a third, from between the eye-brows to the hairs upon the forehead; and a fourth, from thence to the top of the head, which is plainly illuſtrated in the head of Hercules. Each part is divided into twelve minutes, and the minutes into halfs, thirds, and quarters. For example, P. ſignifies a part, M. a minute, M$\frac{1}{2}$, half a minute, M$\frac{1}{3}$, one third of a minute, M$\frac{1}{4}$, a quarter of a minute. It is to he obſerved, that when I mark half a minute it is thus, M$\frac{1}{2}$, and when a minute and half, thus, 1 M$\frac{1}{2}$."

SECT. IV.

THE MOTION OF THE MEMBERS.

We ſhall now proceed to deſcribe that eſſential part of drawing wherein ſo much beauty conſiſts, viz. the motions of the members in the human figure: and further to explain this important particular, we ſhall devote a Plate ſolely to the ſubject, which will ſerve not only to aſſiſt the ſtudent in the earlier ſtages of the art, but be uſeful to ſuch as have made a progreſs in it, in furniſhing them with all the paſſions and attitudes that are neceſſary to form a compoſition to illuſtrate any paſſage of hiſtory. This part of drawing depends chiefly upon properly contraſting or oppoſing the different members of the body, and their reſpective lights and ſhades. This is chiefly effected by a graceful turn or ſway of the whole form, e. gr. when the face is placed in front, the body ſhould turn a little aſide, with the legs ſtill fronting the ſpectator, (See *Fig*. I.) in the Plate illuſtrative of this ſubject; in the ſecond place, there muſt be a contraſt in the inclining of the figure, e. gr. if one ſhoulder riſe, the other ſhould ſink; the hips, knees, and feet, the ſame as in the above figure, where the right ſhoulder riſes, the right hip falls, the right knee or foot riſing again, and falling on the oppoſite ſide of the body.

A third obſervation is, that when the right arm and left leg advance, the left arm and right leg, ſhould fall back. This motion is doubled when the right ſhoulder is ſeen fronting; for then, the head and lower part of the body muſt be the ſame, as *Fig*. I. demonſtrates; and when the breaſt riſes the head ought to ſink, and vice verſa. Care muſt be taken that the hand and arm be not on a line, but that each contraſt the other by the oppoſing turn.

The croſs line of the face is never parallel with that of the body, either fronting or in profile, nor the upper part of the body with the lower. To the proper regulation of theſe attitudes or motions of the body, it owes its beauty with reſpect to form. As for the motions, the three following are the principal. 1. That of the head. 2. That of the hands and feet. Laſtly, that of the body. Thoſe of the head are four, forward, backward, and on each ſide; thoſe of the hands and feet are the ſame. The arms and legs have but one motion; one on the elbow, the other at the knee, the arm bending and the leg drawing back. The motions of the body are three, forwards, backwards, and on one ſide.

Beſides theſe, there are four other ſorts of motions proceeding from the ſame members which we may ſtile the ſimple, the active, the reſtleſs, and the violent. 1. The ſimple is when the members move naturally, as in walking, eating, or drinking. 2. The active conſiſts in carrying, pulling, thruſting, preſſing, climbing, and the like. 3. The reſtleſs ariſes from diſquiets of the mind where the paſſions are ſhown by the geſtures of the body, as in love, hatred, anger, ſorrow, joy, ſpite, ſcorn, and ſuch like; the effect produced is chiefly viſible in the leſſer members, as the eyes, noſe, mouth, and finger. The violent proceeds from the effect produced by fright, fear, deſpair, rage, which occaſion a ſhrinking, a ſtretching, and violent action of the members. A perſon may be ſometimes affrighted by any incident without ſhewing it in the face. We may be in love, and it ſhall not appear in our countenance, but our deſign is to expreſs the paſſions by the motions of the members in the body, as well as thoſe of the face, the latter of which we ſhall illuſtrate in the following part, by giving Mr. Le Brun's ideas on the ſubject. In ſhort, a perfect figure can only be deſigned by a ſtrict attention to the effect produced by the different paſſions, upon the ſeveral members of the body, and contraſting their appearances with judgment.

Motions of the Members, as actuated by the different Paſſions.

It is not always the language that produces the greateſt effect on the party deſigned to be moved; there is often more eloquence in a flood of tears, than in the beſt ſpoken oration, and in a ſilent attitude, than in a tempeſt of words. Indeed it has frequently been ſaid, it was not ſo much the words as the manner of ſpeaking that gave offence, or ſatisfaction; which "manner of ſpeaking" is part of expreſſion. There is a difference between geſticulation and expreſſion, the former being an acquired and conſtant habit, the latter the offspring of mental ſenſibility. All the members of the perſon contribute to expreſſion; an elevation of the head expreſſes haughtineſs, diſdain, contempt; a depreſſion, modeſty, humility, reſpect; when borne evenly, it indicates firmneſs; when ſinking on one ſide, dejection. The hands are very conſiderable agents in this buſineſs: by them we applaud, we requeſt, we refuſe, we command. In requeſt we hold our hands level, the palm upward, as if to receive what we deſire; in refuſing, we turn the palm of the hand downward, thereby rendering it impoſſible the object intended ſhould be put in it; in commanding, we point to what we order to be done, and ſometimes the finger held up is a ſufficient authoritative. The feet as the means of advancing and retreating, chiefly, if not altogether, in thoſe motions contribute to expreſſion. It is ſeldom the feet contradict the motions of the hands, but ſometimes they are ready for eſcape from dangers wherein the hands will venture. We ſhall proceed to notice the paſſions in the following order: ADMIRATION, which produces but little change in the features of the countenance, has ſcarce greater effect on the figure: it may be repreſented by a perſon ſtanding erect, his hands open and lifted up, his arms approaching his body; ſtanding pretty firmly on his feet. In ESTEEM, the body will be rather bent, the ſhoulders rather elevated though but little; the arms folded and cloſe to the body; the hands opened, and not very diſtant from each other; the knees bent. VENERATION encreaſes the flexure of the body, and of the knees; the hands and arms almoſt unite; all parts of the body mark profound reſpect. When connected with objects of faith, VENERATION augments the ſtrength of the foregoing motions; croſſes the hands on the breaſt, lowers the head, and bends the body to proſtration. RAPTURE, or extacy, may be expreſſed by the body thrown backwards, the arms elevated, the hands open; the whole action, joyful, animated, tranſported. The effect of SCORN is to draw back the body, to extend the arms, as repulſing the object of averſion; the legs ſtiff. HORROR excites violent movements; the body greatly withdrawn from the object which cauſes the paſſion, the hands will be quite open, the fingers ſpread, the arm kept tight to the body; the legs endeavouring to eſcape. AFFRIGHT has very vigorous expreſſions, the arms thrown for ward ſeem to ſtiffen; the legs fly with the utmoſt rapidity; and every part of the body recoils from its dreaded adverſary. LOVE creates no great emotion in the figure; the preſence of its object animates the motion, but not very ſtrongly, not after any fixed manner in modeſt affection. DESIRE extends the arms towards its object, and inclines the whole body on that ſide: all the parts appear agitated and reſtleſs. HOPE excites motions contradictory and fluctuating, wavering between doubt and expectation. JOY is a firſt ſtep to rapture; its motions are more or leſs moderate. FEAR has many motions in common with affright, when it ariſes from a dread of loſing ſomewhat we value, or when we expect a calamity to befall us. This paſſion ſhrugs the ſhoulders, keeps tight the arms and hands to the body, the other parts are bent, and as if it were collected together and ſhivering. JEALOUSY has an invincible curioſity to watch its object, the head and upper part of the body will produce themſelves, in hopes of eſcaping notice by means of the feet, which ſtand ready for retreat. The agitations of ANGER are exceſſive and outrageous, the muſcles ſwelled, highly inflated and diſtinct, the veins prominent; and the whole figure in fury. ANGER would generally deſtroy its object if poſſible, and may be repreſented as ſo employed. What ſhall we ſay of DESPAIR? It is a madneſs, a poſſeſſion, an unutterable ſuffering, a principal ingredient of hell: in its motions cloſely allied to anger.

We have attended to each paſſion apart, that we might attain a clearer, and more forcible conception of its motions; it is however very ſeldom that any paſſion is free from ſome mixture with others; their combinations may eaſily be gathered from what we ſhall ſuggeſt on this ſubject in relation to the countenance.

SECT. V. LIGHT AND SHADE.

Lights and ſhades are important objects; for without a tolerable knowledge of them, it is impoſſible to produce a good Drawing; we ſhall therefore make ſome obſervations ou the ſubject.

After the learner has made himſelf in ſome meaſure perfect in drawing human figures, his next endeavour muſt be to ſhade them properly. It is this which gives an appearance of ſubſtance, ſhape, diſtance, and diſtinction, to whatever bodies he endeavours to repreſent, whether animate or inanimate. The beſt rule for doing this is, to conſider from what point, and in what direction, the light falls upon the objects which he is delineating, and to let all his lights and ſhades be placed according to that direction throughout the whole work.

That part of the object, whether in naked figures, drapery, or buildings, that ſtands fartheſt out, muſt be made the lighteſt, becauſe it comes neareſt to the light; and the light looſeth ſo much of its brightneſs, by how much any part of the body bends inward, becauſe thoſe parts that ſtick out hinder the luſtre and full brightneſs of the light from ſtriking on thoſe parts that fall in. Titian uſed to ſay, that he knew no better rule for the diſtribution of lights and ſhadows, than his obſervations drawn from a bunch of grapes. Sattins and ſilks, and all other ſhining ſtuffs, have certain glancing reflections, exceeding bright, where the light falls ſtrongeſt. The like is ſeen in armour, braſs pots, or any other glittering metal, where you ſee a ſudden brightneſs in the middle or centre of the light, which diſcovers the ſhining nature of ſuch things. Obſerve alſo, that a ſtrong light requires a ſtrong ſhade, a fainter light a fainter ſhade; and that an equal balance be preſerved throughout the piece between the lights and ſhades. Thoſe parts which muſt appear round, require but one ſtroke in ſhading, and that ſometimes but very faint; ſuch parts as ſhould appear ſteep or hollow, require two ſtrokes acroſs each other, or ſometimes three, which is ſufficient for the deepeſt ſhade. Care muſt be alſo taken to make the outlines faint and ſmall in ſuch parts as receive the light; but where the ſhades fall, the outline muſt be ſtrong and bold. The learner muſt begin his ſhadings from the top, and proceed downward, and uſe his utmoſt endeavours both by practice and obſervation to learn how to vary the ſhadings properly; for in this conſiſts a great deal of the beauty and elegance of drawing. Another thing to be obſerved is, that as the human ſight is weakened by diſtances, ſo objects muſt ſeem more or leſs confuſed or clear according to the places they hold in the piece: thoſe that are very diſtant; weak, faint, and confuſed: thoſe that are near and on the foremoſt ground; clear, ſtrong and accurately finiſhed.

When you round the parts of an object, it requires the niceſt touch of the pencil to draw the extremities ſo, as that in turning they ſhall looſe themſelves inſenſibly and confuſedly, without too ſudden a tranſition of the light into the ſhadows, or the ſhadows into the light; but let the one paſs into the other as it were reciprocally, and imperceptibly, that is by degrees of light into ſhadow, and ſhadow into light.

It ſhould be farther obſerved in regard to lights and ſhades, that it is not enough that remote objects be coloured in a more faint and languid manner, but the more or leſs diſtant they are, the parts ſhould be more or leſs made out; the eye cannot minutely diſcriminate an object which is at a diſtance from it. We can ſee human figures at a ſtreet's length, but cannot diſcern the features of their faces or the plaits in their cloaths; ſo the innumerable leaves of a diſtant grove appear to the ſight but as one maſs.

In the repreſentation of bodies you muſt always give them ſuch lights as are moſt proper and convenient for their ſuppoſed ſituations. Suppoſe the objects before you to be in fields or open air, and the ſun obſcured with clouds, your buſineſs is to introduce an univerſal light, though not vivid or ſtrong, your ſhades too muſt be faint. But when the ſun appears in all its glory, you lights muſt then be very ſtrong and bold, and the ſhadows exceeding dark.

Though the beauty of a figure conſiſts in a good proportion and diſpoſition of its parts with reſpect to action and paſſion; yet it cannot be ſaid to be abſolutely perfect till further improved by beautiful lights and ſhades; for it is to be obſerved that too faint lights render objects imperfect, and produce diſagreeable effects. This will be the caſe, when through want of attending to the effect of objects, an improper light is introduced as when a violent paſſion is repreſented in a feeble light, the effect muſt certainly be loſt; on the other hand, when tender and pleaſing objects, are repreſented in too ſtrong and broad a light, and the ſhade too ſharp, the beauty, grace and ſtillneſs of the compoſition is materially injured.

Some artiſts injudiciouſly contend, that it is impoſſible for different lights in the ſame piece to look well; and to ſupport this argument they alledge that if the principle were juſtifiable, Raphael, Caracci, Titian, Pouſſin, and other great maſters, would have not rejected, but approved of it. Notwithſtanding we acknowledge the great merit of theſe ancient maſters, we cannot but concur in the opinion and practice of the moſt eminent artiſts of the preſent day, whoſe productions evidently point out the advantage of many lights; and when they are judiciouſly managed, it is demonſtratively evident, that they give the piece a diverſifying elegance. But it ſhould be obſerved, that thoſe who are not fully acquainted with the effects of lights and ſhades, ſhould be cautious how they introduce them; for when they are too profuſe, they exhibit a fond conceit without a baſis.

Objects in a common light have no broad ſharp lights, and their ſhades are uncertain; becauſe the objects being lighted on all ſides, without miſt or fog, appear better relieved than in ſunſhine. The common light alſo has not that force and oppoſition, which the ſun light has; but its harmony is more agreeable, becauſe it has not that ſudden contraſt of light and ſhade, and therefore is better ſuited to portraits, and ſubjects where the landſcape is made ſubordinate to the drawing; but where it is the principal object, a preference is to be given to a ſun light, as it gives ſpirit and nature to the performance.

Hence it becomes highly important, before a compoſition is begun, to conſider alternately the nature and effects of the ſubject. For inſtance, whether it be the murder of Julius Cæſar in full ſenate, or the death of Cato, or the nuptials of Stratonica with Antiochus; or the reception of Queen Sheba, with her train of female attendants by Solomon; becauſe thoſe different ſubjects require the repreſentation of different paſſions. In the former are diſplayed conſternation, fright, and confuſion in the extreme; nay all is in motion. In the latter, nothing is prevalent, but captivating beauty, eaſy carriage, winning modeſty, with all their alluring charms. It cannot ſurely admit of a doubt, that the two former ſubjects ſhould be repreſented in ſtrong and ſharp lights, and the two latter in ſoft and delicate. The effect depends on the nature and qualities of theſe lights; ſome conveying ideas of ſtrength and ſharpneſs, others of ſweetneſs, ſoftneſs, and pleaſure. But the reverſe of a due repreſentation deſtroys the ſubject, for in that caſe, the two former examples might be termed *a graceful confuſion*, and the two latter, a *ſevere amour*. It may be concluded upon the whole, that a figure well proportioned and diſpoſed, having a graceful motion and ſway, and lights and ſhades agreeable to its outline, may be called a perfect figure.

It is a great fault in a certain painter well known amongſt the artiſts, and whoſe ſingularity has often been remarked, in uttering when inſtructing his pupils, the words Broad! Broad! in a tone ſo low that no ſtranger might hear it, as if it were a ſecret unknown to the very art. This brings to recollection an anecdote of Philemon the painter, who was ſo prepoſſeſſed in favour of broad lights, that in all his paintings, he repreſented the objects as if the ſun was ſhining on them at noon-day. This prepoſſeſſion he evinced in exerting his utmoſt ability, to repreſent Jupiter with Alcmena, where, though they both are preparing for repoſe, the ſun ſhines quite bright into the room. Alas! Jupiter what indignity is offered thee! Dares Phœbus, contrary to your expreſs command, peep through the windows, though you charged him to hide for three days and three nights? But what avails that, (ſays the painter) the painting muſt be broad, and the ſun-ſhine muſt be there were it midnight. Had he made a moon-light, it would have fitted that ſeaſon.

SECT. VI. OF DRAPERY.

In the art of cloathing the figures, or caſting the drapery properly and elegantly upon them, many things are to be obſerved. 1. The eye muſt never be in doubt of its object; but the ſhape and proportion of the part or limb, which the drapery is ſuppoſed to cover, muſt appear; at leaſt ſo far as art and probability will permit: and this is ſo material a conſideration, that many artiſts draw firſt the naked figure, and afterwards put the draperies upon it. 2. The drapery muſt not ſit too cloſe to the parts of the body: but let it ſeem to flow round, and as it were to embrace them; yet ſo as that the figure may be eaſy, and have a free motion. 3. The draperies which cover thoſe parts that are expoſed to great light, muſt not be ſo deeply ſhaded as to ſeem to pierce them; nor ſhould thoſe members be croſſed by folds that are too ſtrong, leſt by the too great darkneſs of their ſhades the members look as if they were broken. 4. The great folds muſt be drawn firſt, and then ſtroked into leſſer ones: and great care muſt be taken that they do not croſs one another improperly. 5. Folds in general ſhould be large, and as few as poſſible. However, they muſt be greater or leſs according to the quantity and quality of the ſtuffs of which the drapery is ſuppoſed to be made. The quality of the perſons is alſo to be conſidered in the drapery. If they are magiſtrates, their draperies ought to be large and ample; if country clowns or ſlaves, they ought to be coarſe and ſhort; if ladies or nymphs, light and ſoft. 6. Suit the garments to the body, and make them bend with it, according as it ſtands in or out, ſtrait or crooked; or as it bends one way or another; and the cloſer the garment ſits to the body, the narrower and ſmaller muſt be the folds. 7. Folds well imagined give much ſpirit to any kind of action; becauſe their motion implies a motion in the acting member, which ſeems to draw them forcibly, and makes them more or leſs ſtirring as the action is more or leſs violent. 8. An artful complication of folds in a circular manner greatly helps the effects of fore-ſhortenings. 9. The ſhades in ſilk and fine linen are very thick and ſmall, requiring little folds and a light ſhadow. 10. Obſerve the motion of the air or wind, in order to draw the looſe apparel all flying one way: and draw that part of the garment that adheres cloſeſt to the body, before you draw the looſer part that flies off from it; leſt, by drawing the looſe part of the garment firſt, you ſhould miſtake the poſition of the figure, and place it awry. 11. Rich ornaments, when judiciouſly and ſparingly uſed, may ſometimes contribute to the beauty of draperies. But ſuch ornaments are far below the dignity of angels or heavenly figures; the grandeur of whoſe draperies ought rather to conſiſt in the boldneſs and nobleneſs of the folds, than in the quality of the ſtuff, or the glitter of ornaments. 12. Light and flying draperies are proper only to figures in great motion, or in the wind: but when in a calm place, and free from violent action, their draperies ſhould be large and flowing; that, by their contraſt and the fall of the folds, they may appear with grace and dignity.

SECT. VII. ON THE PASSIONS.

The paſſions, ſays M. Le Brun, are motions of the ſoul, either upon her purſuing what ſhe judges to be for her good, or ſhunning what ſhe thinks hurtful to her; and commonly, whatever cauſes emotion of paſſion in the ſoul, creates alſo ſome action in the body. It is therefore neceſſary for a pupil to know which are the different actions in the body that expreſs the ſeveral paſſions of the ſoul, and how to delineate them.

M. Le Brun has been extremely happy in expreſſing many of the paſſions, the pupil cannot ſtudy any thing better than the examples which he has left us of them. However, as M. De Piles juſtly obſerves, it is abſurd as well as impoſſible to pretend to give ſuch particular demonſtrations of them as to fix their expreſſion to certain ſtrokes, which the artiſt ſhould be obliged to make uſe of as eſſential and invariable rules. This, ſays he, would be depriving the art of that excellent variety of expreſſion which has no other principle than diverſity of imagination, the number of which is infinite. The ſame paſſion may be finely expreſſed ſeveral ways, each yielding more or leſs pleaſure in proportion to the artiſt's underſtanding, and the ſpectator's diſcernment. Tho' every part of the face contributes towards expreſſing the ſentiments of the heart, yet the eye-brow, according to M. Le Brun, is the principal ſeat of expreſſion, and where the paſſions beſt make themſelves known. It is certain, ſays he, that the pupil of the eye, by its fire and motion, very well ſhews the agitation of the ſoul, but then it does not expreſs the kind or nature of ſuch an agitation; whereas the motion of the eye-brow differs according as the paſſions change their nature. To expreſs a ſimple paſſion, the motion is ſimple: to expreſs a mixed paſſion, the motion is compound: if the paſſion be gentle, the motion is gentle; and if it be violent, the motion is ſo too. We may obſerve farther, ſays he, that there are two kinds of elevation in the eye-brows. One, in which the eye-brows riſe up in the middle; this elevation expreſſes agreeable ſenſations, and it is to be obſerved that then the mouth riſes at the corners: another, in which the eye-brows riſe up at the ends, and fall in the middle; this motion denotes bodily pain, and then the mouth falls at the corners. In laughter, all the parts agree, for the eye-brows, which fall toward the middle of the forehead, make the noſe, the mouth, and the eyes, follow the ſame motion. In weeping, the motions are compound and contrary; for the eye-brows fall toward the noſe and over the eyes, and the mouth riſes that way. It is to be obſerved alſo, that the mouth is the part of the face which more particularly expreſſes the emotions of the heart: for when the heart complains, the mouth falls at the corners; when it is at eaſe, the corners of the mouth are elevated: and when it has an averſion, the mouth ſhoots forward, and riſes in the middle.

“ The head, ſays M. De Piles, contributes more to the expreſſion of the paſſions than all the other parts of the body put together. Thoſe ſeparately can only ſhew ſome few paſſions, but the head expreſſes them all. Some, however, are more peculiarly expreſſed by it than others; as humility, by hanging it down; arrogance, by lifting it up; languiſhment, by inclining it on one ſide; and obſtinacy, when with a ſtiff and reſolute air it ſtands upright, fixed, and ſtiff between the two ſhoulders. The head alſo beſt ſhews our ſupplications, threats, mildneſs, pride, love, hatred, joy, and grief. The whole face, and every feature, contributes ſomething, eſpecially the eyes; which, as Cicero ſays, are the *windows of the ſoul*. The paſſions they more particularly diſcover are, pleaſure, languiſhing, ſcorn, ſeverity, mildneſs, admiration, and anger; to which one might add joy and grief, if they did not proceed more particularly from the eye-brows and mouth; but when thoſe two paſſions fall in alſo with the language of the eyes, the harmony will be wonderful. But though the paſſions of the ſoul are moſt viſible in the lines and features of the face, they often require the aſſiſtance alſo of the other parts of the body. Without the hands, for inſtance, all action is weak and imperfect; their motions, which are almoſt infinite, create numberleſs expreſſions: it is by them that we *deſire*, *hope*, *promiſe*, *call*, *ſend back*; they are the inſtruments of *threatening*, *prayer*, *horror*, and *praiſe*; by them we *approve*, *condemn*, *refuſe*, *admit*, *fear*, *aſk*; expreſs our *joy* and *grief*, our *doubts*, *regrets*, *pain*, and *admiration*. In a word, it may be ſaid, as they are the language of the dumb, that they contribute not a little to ſpeak a language common to all nations, which is the language of drawing.

When the heart is dejected, ſo are all parts of the face; but when the heart is enflamed and hardened by ſome paſſion, the parts of the face follow a ſimilar movement, particularly the mouth, which proves that this part exhibits more eſpecially the ſenſations of the heart. For we muſt obſerve, that when the heart ſuffers, the corners of the mouth ſink; when it is ſatisfied, they riſe: when the heart has averſion to any object, the mouth expreſſes that averſion by riſing in the middle and pouting. Thus we ſee that all parts of the face contribute to expreſſion, according to the nature and force of the ſentiment which impels them.

SECT. VIII.

ON DRAWING LANDSCAPES, BUILDINGS, &c.

To be able, on the ſpot, to take the ſketch of a building, of a beautiful proſpect; of any curious production of art, or uncommon appearance in nature; is not only a very deſirable accompliſhment, but a very agreeable amuſement. Rocks, mountains, fields, woods, rivers, cataracts, cities, towns, caſtles, houſes, fortifications, ruins, or whatever elſe may preſent itſelf to view on our journeys or travels in our own or foreign countries, may be thus brought home, and preſerved for our future uſe either in buſineſs or converſation. On this part, therefore, more than ordinary pains ſhould be beſtowed.

All drawings conſiſt in nicely meaſuring the diſtances of each part of the piece by the eye. In order to facilitate this, let the pupil imagine in his own mind, that the piece he copies is divided into ſquares. For example: ſuppoſe or imagine a perpendicular and a horizontal line croſſing each other in the centre of the picture you are drawing from; then ſuppoſe alſo two ſuch lines croſſing your own copy. Obſerve in the original, what parts of the deſign thoſe lines interſect, and let them fall on the ſame parts of the ſuppoſed lines in the copy: we ſay, the ſuppoſed lines; becauſe though engravers, and others who copy with great exactneſs, divide both the copy and original into many ſquares, yet this is a method not to be recommended, as it will be apt to deceive the learner, who will fancy himſelf a tolerable proficient, till he comes to draw after nature, where theſe helps are not to be had, when he will find himſelf miſerably defective, and utterly at a loſs.

If he is to draw a landſcape from nature, let him take his ſtation on a riſing ground, where he will have a large horizon: and mark his tablet into three diviſions, downwards from the top to the bottom; and divide in his own mind the landſcape he is to take, into three diviſions alſo. Then let him turn his face directly oppoſite to the midſt of the horizon, keeping his body fixed, and draw what is directly before his eyes upon the middle diviſion of the tablet; then turn his head, but not his body, to the left hand, and delineate what he views there, joining it properly to what he had done before; and, laſtly, do the ſame by what is to be ſeen upon his right hand, laying down every thing exactly, both with reſpect to diſtance and proportion

In drawing landſcapes, the beſt way is to get upon a riſing ground, make the neareſt objects in the piece the higheſt, and thoſe that are farther off to ſhoot away lower and lower till they come almoſt level with the line of the horizon, leſſening every thing proportionably to its diſtance, and obſerving alſo to make the objects fainter and leſs diſtinct the farther they are removed from the eye. He muſt make all his lights and ſhades fall one way; and let every thing have its proper motion; always remembering, that whatever motions are cauſed by the wind, muſt be made all to move the ſame way.

In drawing of landſcapes, many draftſmen find the leaſage of trees an arduous taſk. Moſt of them copy after the manner of the artiſt, who particularly pleaſes them. By this means their leaſage generally becomes ſet and ſtiff, from the difficulty of copying after nature. This manner may be admitted in ſuch as are commencing the art, but thoſe who have made a proficiency in it ſhould follow nature, as it will inſtruct them better in their growth and ſhape. To gain any eminence in the ſtudy, ſtrict obſervation ſhould be made of the ſeveral ſorts of leaſage ſeen at a diſtance, whether they are cloſe and maſſy, or thin leaved and branched; or whether they hang in cluſters, or uniformly on their boughs: attend nicely to the difference of their colours in their ſeveral kinds, as well while growing, as in perfection and decay.

Finally, it muſt be obſerved, that in order to attain any conſiderable proficiency in drawing, a knowledge of Perspective is abſolutely neceſſary; ſee that article.

CONCLUSIVE REMARKS.

Many who have not attained to a knowledge of the truth of nature in the art we have been deſcribing, impute their deficiency to want of talent and ability, when upon due reflection it will be found to ariſe from an inert diſpoſition, which prevents them from purſuing ſuch means as would render them flouriſhing artiſts. From a falſe perſuaſion of its unſurmountable difficulties, they are induced to abandon the cultivation of the art; though by a ſedulous attention to the ſtudy and practice of it, there is every ground to conclude they would make a proficiency.

It may be alledged by thoſe who have practiſed from their early years, and ſtill continue the purſuit, and call themſelves artiſts, yet have made no conſiderable progreſs, that our obſervations are not founded upon truth; but ſuch an inference is erroneous, and the reſult of an obſtinate adherence to one ſtated mode, inſtead of inveſtigating knowledge and tracing nature up to her nobleſt ſprings.

To further improvement, and acquire proficiency, it ſhould be the fixed reſolution of an artiſt, to ſelect every production of merit, to devote the whole of his leiſure time to attendance on ſales, exhibitions and collections of pictures. He ſhould diligently explore the beauties and mark the defects of the ſeveral pieces, in order to retain and copy their excellencies and reject their imperfections.

By theſe means he will gradually improve in judgment and practice, and every piece he produces will ſurpaſs the foregoing; for a laudable zeal to excel in a purſuit, rarely fails of effecting the deſign; we therefore venture to offer it as our opinion, that to a neglect of the means we have propoſed, may in general be imputed the obſtacles which impede a progreſs in the art.

With reſpect to engravers in particular we are ſorry to remark, that through neglect of the remarks we have made, many of the preſent time, whoſe names we forbear to mention, diſplay in their latter productions, no more traits of merit, than in thoſe they exhibited twenty years paſt. From their want of obſervation, and conſequent inability, their pupils through impulſe of genius have been reduced to a neceſſity of rejecting their falſe principles, and making nature and good originals their models to copy after, rejecting the guidance and inſtruction of their incompetent maſters. To confirm theſe remarks, we need only to advert to the productions of young artiſts, as Heath, Smith, Neagle, Bromley, Grainger, &c. and compare them with thoſe of the engravers, to whom they were pupils. What a difference muſt we diſcover! What infinite ſatisfaction muſt it afford thoſe who are anxious for the advancement of the art in this country, to find ſo many young profeſſors in ſo early a ſtage diſplay ſuch wonderful abilities!

Though we have at this time in the kingdom, ſuch a numerous catalogue of excellent engravers, and a few years ago the names of Grignion, Scotin, Vander-Gucht, and Ravenet, only were regarded, ſuch is the improvement of the public taſte, and ſuch their avidity for capital productions, that if we had double the number, they would meet with ample encouragement.

This may be aſcribed to that accurate judgment of the merits of engravings, that has prevailed amongſt people in general, ſince Woolett's engraving of the death of General Wolfe. The proof impreſſions of that print having been ſold at the enormous price of fifteen or twenty pounds, raiſed the ſurprize and aſtoniſhment of all who knew its eſtimate, but were unacquainted with its merits. Hence they were induced to examine the particulars which conſtituted ſuch exquiſite merit, and from minute inſpection and diligent enquiry, they formed competent ideas which became the ſtandard of their judgment, with reſpect to other productions.

In forming this Treatiſe, I have deviated from the plan generally adopted, in avoiding prolixity on the leſs important points, in order to afford ſcope for ſuch as are eſſential. I do not offer it as a production wholly of my own, having received from the publiſher many hints of a highly important nature, as his long practice, and the proficiency he has made in the art, under the inſtruction of Mr. Green, Drawing Maſter to Chriſt's Hoſpital, has rendered him competent to ſelect many valuable materials for the compoſition. To his judgment it is but juſtice in me to aſcribe the well choſen Subjects and well executed Prints, which embelliſh his works in general. The precepts contained in this Treatiſe are not propoſed as laws but examples, as the reſult of practice and obſervations; and if they tend to the advancement of the ſtudent in the art, I ſhall be highly delighted to think my endeavours have been uſeful.

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DRAY, a kind of cart uſed by brewers, for carrying barrels of beer, or ale; alſo a ſledge drawn without wheels.

DRAY, among ſportſmen, denotes ſquirrel-neſts, built in the tops of trees.

Dissertation upon Dreams.

DREAMS; thoſe fancies or imaginations which occur to the minds of people when aſleep.

The ſubject of dreaming hath been inveſtigated by ſeveral philoſophers, but hitherto with very little ſucceſs. Wolfius ſuppoſes that dreams take their riſe entirely from the ſenſations; and that no dream ariſes in the human mind without a previous ſenſation, though perhaps ſuch a ſlight one that it cannot eaſily be traced. This hypotheſis is expreſsly adopted by Mr. Formey, in an eſſay on dreaming, in the Memoirs of the Academy of Sciences at Berlin. Mr. Baxter, in his treatiſe of the Immateriality of the human Soul, attributes dreams to the action of ſome immaterial beings upon our ſouls. Laſtly, ſome modern phyſiologiſts reckon dreaming to be a ſpecies of delirium. Their account of the matter is as follows. The brain and nervous ſyſtem, which are the only organs of ſenſation, are generally in two ſtates, exeeedingly different from one another, which may be expreſſed by the words excitement and collapſe. The firſt of theſe denotes that ſtate in which the nervous ſyſtem is eaſily made ſenſible of the impreſſions of external objects, and then we are ſaid to be awake. The ſecond is, when external objects do not eaſily make theſe impreſſions: and of this ſtate there are various degrees; drowſineſs, ſleep, fainting, and death. Theſe do not indeed proceed in the order in which we have placed them. Sleep is of a quite different nature from fainting, or from that ſtupor and inſenſibility produced by a compreſſion of the brain. But, whatever be the nature of ſleep, it is certain that this ſtate is attended with what we call a collapſe of the brain; as external objects do not make the ſame impreſſions on the organs of ſenſe when people are aſleep, that they do when awake. Between the two ſtarts of ſleeping and waking, a ſtate of delirium always occurs; and this is moſt probably occaſioned by the excitement of one part of the brain, and the collapſe of another. That one part of the brain is capable of being excited, while the other ſuffers a collapſe, will be evident from conſidering what happens when we are juſt falling aſleep. Every one muſt be ſenſible, that at that time we do not loſe our ſenſes all at once. The hearing will continue after the ſight is loſt; and, even while we are yet conſcious of the place we are in, falſe imaginations of a nature ſimilar to that of dreaming will occur to our minds. But when the brain is perfectly collapſed, ſenſation or imagination of every kind totally vaniſhes, and we are altogether inconſcious of exiſtence.

On a ſubject ſo obſcure, and ſo much out of the reach of inveſtigation, as that of dreaming, it is difficult to advance any thing ſatiſfactory. All the abovementioned hypotheſes, however, ſeem to be exceedingly imperfect. It may be granted by Wolfius and Formey, that dreams will ariſe from certain impreſſions made either on the external or internal parts of the body. But theſe impreſſions by no means produce any thing like the ſenſations we have from ſimilar ones made upon us while we are awake. Thus, if a perſon whoſe digeſtion is not very good, goes ſoon to bed after eating a large ſupper, it is not improbable that he will dream of being oppreſſed with a great weight, by a monſter, being ſuffocated, &c. Theſe dreams undoubtedly ariſe from the uneaſy ſenſations produced in the ſtomach from two great a quantity of food; but if the perſon was awake, ſuch ſenſations would produce only a ſickneſs and uneaſineſs at the ſtomach. If dreams, therefore in all caſes proceed from ſenſations, we muſt alſo ſay, that in ſleep the laws of ſenſation itſelf are altered; that thoſe connections which we look upon to be the moſt conſtant and invariable, are not ſo in reality; and thus we are led into a greater difficulty than before. For example, there is no ſenſation more invariable than that, when a man's ſtomach is oppreſſed, he ſhould feel what we call ſickneſs. This ſenſation happening in the time of ſleep according to Wolfius, produces a dream. Very true, it will do ſo; but why does not the man dream that he his ſick? What connection is there between ſickneſs, the waking ſenſation, and being oppreſſed by a weight, ſuffocated by a monſter, &c. the ſleeping ones? This difficulty ſeems inſurmountable on the hypotheſes of Wolfius and Formey.

Mr. Baxter's ſuppoſition is, in its very nature, incapable of proof. We are by no means aſcertained of the exiſtence of any immaterial beings, created ones at leaſt, that can have acceſs to our ſouls; and though we were, the ridiculous fancies that ſometimes occur in dreams are too abſurd to be ſuppoſed the work of any rational being; much leſs of thoſe who poſſeſs an higher rank in the creation than ourſelves. It muſt alſo be obſerved, that the method which this author takes to prove his hypotheſis can never be concluſive, even though every thing he contends for ſhould be granted. He inſiſts that the phantaſm, or what is properly called the viſion, in dreams, is not the work of the ſoul itſelf, and cannot be the effect of mechanical cauſes; therefore, according to him, it muſt be the effect of immechanical, or immaterial, agents operating upon the ſoul. That it is not the work of the ſoul itſelf, may readily be granted; and likwiſe that it is not the effect of ſuch mechanical cauſes as we are acquainted with: but from thence it will not follow, that it muſt neceſſarily be the effect of immaterial cauſes, unleſs we were perfectly well acquainted with the extent of all mechanical powers whatever. Nay, in many inſtances, ſuch as that before mentioned, we are certain that dreams not only may be, but actually are, the effects of mechanical cauſes, though we ſhould never be able to inveſtigate them.

The third hypotheſis ſeems alſo inadequate to ſolve the phenomena of dreaming. If this depended on a partial excitement of the brain, our ideas ought to be juſt, as that excitement could reach. Thus, ſuppoſing that part of the brain on which ſight depends, to be quite collapſed; and that on which hearing depends, to be in ſome meaſure excited; the perſon, though deprived of ſight, would hear ſounds confuſedly: but ſtill they would only be ſuch ſounds as were actually produced by external objects: and no reaſon can be aſſigned why he ſhould imagine he heard ſounds which never exiſted.

Mr. Locke, though he does not expreſly declare how dreams are excited during ſleep, ſeems to aſcribe the perfection of rational thinking to the body; and traces their origin to previous ſenſations, when he ſays; "The dreams of ſleeping men are all made up of the waking man's ideas, though for the moſt part oddly put together." He urges the incoherence, frivolouſneſs, and abſurdity, of many of our dreams, as well as the ſuppoſed fact that ſome ſleep without dreaming, as objections to the notion that men think always: to which it has been replied, that dreams may be entirely, imperfectly, or not at all remembered, according to the various degrees in which the nerves are impreſſed by the motion given to the animal ſpirits in ſleep. Ariſt. de inſomn. cap. 3. Hobb. Lev. cap. 2. & cap. 45. Locke, Eſſ. book ii. ch. i. § 10, &c. Watt's Eſſ. § 2. p. 120, &c. Dr. Hartley explains all the phenomena of the imagination by his theory of vibrations and aſſociations. Dreams, he ſays, are nothing but the imaginations or reveries of ſleeping men, and they are deducible from three cauſes, viz. the impreſſions and ideas lately received, and particularly thoſe of the preceding day, the ſtate of the body, and particularly of the ſtomach and brain, and aſſociation. Obſ. on Man, vol. i. § 5. p. 383, &c.

Before any thing can be conjectured with probability concerning the phenomena of dreaming, it is neceſſary to inveſtigate in ſome meaſure the nature of ſleep. On this ſubject it may be obſerved, that by whatever means ſleep is produced, whether naturally by fatigue, artificially by compreſſing the brain, &c.; and however different theſe kinds of ſleep may be from one another, one general effect ſtill remains the ſame; namely, that the external ſenſes are aboliſhed, and the perſon becomes totally inconſcious of whatever paſſes around him. From this general effect, which in all caſes is conſtant and invariable, ſleep may be defined, "a ſtate in which all communication is cut off between our ſentient principle and this viſible world." That the ſentient and vital principle hath its reſidence in the brain, is an opinion which in all ages hath been eſteemed very probable. If the compariſon can be allowed, it might here be ſaid, that the brain, with regard to ſenſation, hath the ſame to the nerves, that a pond or reſervoir of water hath to a number of ſmall ſtreams that flow into it and out from it. In the brain there ſeems to be a kind of general repoſitory of ſome part of thoſe ſenſations we have formerly felt; but in what manner this repoſitory is formed, we know not. Certain it is, that there the ideas are treaſured up in ſuch a manner as to be at times, and indeed moſt commonly imperceptible to ourſelves. Thus, there are many things we have done, many people we have been acquainted with, and many places we have been in, of which we are juſt now quite inſenſible, and will remain ſo till ſome circumſtance or other brings them to our remembrance. For example: Suppoſe a man has been intimately acquainted with two others who were companions, and lodged in the ſame houſe; he goes into another country, and being engaged in new purſuits, forgets both, ſo completely, that for a conſiderable time he hath perhaps never thought of them at all. But if he ſhould unexpectedly meet with one of theſe friends in the ſtreet, he will inſtantly remember the other who is at a diſtance; and this very circumſtance will bring a train of thoughts into his mind, which produces the remembrance of many things that otherwiſe perhaps would never have been thought of. Now, if we conſider what paſſes with regard to our own minds and intellectual faculties, we ſhall readily be convinced, that every thing we do remember, occurs only in conſequence of ſome external circumſtance.

The only things we can think of, are the preſent and the paſt. When we think of what is to come, we muſt combine ideas from the preſent to the paſt. If, therefore, our memory depends on a certain combination of external circumſtances immediately preſent to our view, it muſt neceſſarily follow, that the more a perſon is kept in perfect ſolitude, or removed from every thing that can affect his ſenſes, the more he will be inclined to ſleep. And, indeed, as far as this experiment can be tried, it will moſt commonly be found ſucceſsful. For, let a perſon who has ſlept his uſual time through the night be put to bed at noon-day, in a dark room, where there is nothing either to amuſe or diſturb him, and he will almoſt certainly fall aſleep in a ſhort time. Hence it would ſeem, that by whatever means our ſenſations of what is preſent, or our external ſenſes, are ſuſpended; by the ſame, our memory muſt alſo be extinguiſhed, and we become abſolutely inconſcious of exiſtence, or fall aſleep.

The ſenſe of feeling is leſs liable to deception while we are awake than any of the reſt; nevertheleſs there is one caſe which may be referred to that of dreaming, and which has been very often taken notice of. It is an imagination common to people who have loſt a limb, that they ſtill feel a pain in it, though many years after it has been ſeparated from their body. If this imagination occured only in the time of ſleep, we would have no heſitation in calling it a dream; but as it occurs while the perſons are awake, it hath been explained without thinking of any connection between it and the phenomenon of dreaming. It is certain, however, that whatever explains the one, will explain the other alſo. In the caſe of the amputated limb, the ſenſation ariſes from ſome injury offered to the nerve which had formerly gone to that limb. This produces a certain motion in the nervous fluid, that is propagated along the nerves to the brain, upon which the imagination that the limb ſtill remains immediately takes place. In like manner, if, during the time of ſleep, a ſimilar motion ſhall occur, a ſimilar imagination or dream will be the conſequence. It muſt be obſerved, however, that, in dreaming, our ſenſe of feeling is much more obſcure than thoſe of ſeeing and hearing. We dream that we ſee objects and hear ſounds pretty diſtinctly; while we ſcarce feel any thing we imagine ourſelves to touch, or carry in our hands; and as for the ſenſes of taſte and ſmell, they are ſcarce ever exerciſed in dreaming.

Dreams have in all ages been reckoned by the vulgar to have ſomething portentous in them, and to preſage future events. Indeed, there are few things about which the ſuperſtition of mankind hath more exerciſed itſelf than the interpretation of dreams. If the abovementioned ſolution of this phenomenon is allowed, it may readily be granted, that dreams may preſage diſeaſes, or changes of the weather, becauſe the nervous ſyſtem is very apt to be influenced by alterations in our atmoſphere; and no alteration in our health can poſſibly take place without producing ſome change in the nervous ſyſtem. But how they can preſage events entirely unconnected with our bodies, doth not appear; or rather it appears very plain that naturally they cannot; though the ſacred writers give us many inſtances of the knowledge of future events being conveyed to mankind in dreams, by a ſupernatural influence. From the ſolution of this phenomenon we have juſt now given, it appears, that imaginations reſembling dreams may occur as well when we are awake as when we are aſleep; and that they actually do ſo, we have many melancholy inſtances in hypochondriac and mad people.

DREDGERS, a term uſed in the admiralty courts for the fiſhers for oyſters.

DREGS *of Oil*, that coarſe and thick part of it, which ſubſides to the bottom of the veſſels in which great quantities of it are kept. This is not fit for the common uſes of the clear oil at the top, but there are ſeveral purpoſes to which it ſerves very well. Great quantities of the lees or dregs of common oil are uſed by the ſoap-boilers, principally in making the common ſoft ſoap. The leather dreſſers alſo uſe it in conſiderable quantities to ſoften the hides they are employed to prepare for the ſeveral artificers who uſe them. Some of theſe dregs are alſo uſed in the making of flambeaux, which inſtead of being made of yellow wax as pretended, are uſually compoſed of pitch, roſin, and this oil, mixed in ſuch a proportion as to make a maſs of a proper hardneſs and conſiſtence. All ſorts of oil produce more or leſs fæces and dregs, but of all others, the whale oil is obſerved to produce the largeſt quantity, and the nut oil the leaſt.

DRENCH, among farriers, a phyſical draught, or portion, given a horſe, by way of purge.

DRESSING *of Hemp and Flax*. See HEMP and FLAX.

DRESSING *of Hops*. See HOPS.

DRESSING *of Meats*, the preparing of them for food, by means of culinary fire. The deſign of dreſſing is, to looſen the texture of the fleſh, and diſpoſe it for diſſolution and digeſtion in the ſtomach. Fleſh not being a proper food without dreſſing, is alledged as an argument, that man was not intended by nature for a carnivorous, or fleſh eating animal.

The uſual operations are, roaſting, boiling, and ſtewing. In roaſting, it is obſerved, meat will bear a much greater and longer heat than either in boiling, or ſtewing; and in boiling greater and longer than in ſtewing. The reaſon is, that roaſting being performed in the open air, as the parts begin externally to warm, they extend and dilate, and ſo gradually let out part of the rarefied included air, by which means the internal ſuccuſſions, on which the diſſolution depends, are much weakened, and abated. Boiling being performed in water, the preſſure is greater, and conſequently, the ſuccuſſions to lift up the weight are proportionably ſtrong; by which means the coction is haſtened, and even in this way there are great differences; for the greater the weight of water, the ſooner is the buſineſs done.

Boiling, Dr. Cheyne obſerves, draws more of the rank, ſtrong juices from meat, and leaves it leſs nutritive, more diluted, lighter, and eaſier of digeſtion: roaſting, on the other hand, leaves it fuller of the ſtrong, nutritive juices, hard to digeſt, and needing more dilution. Strong, grown, and adult animal food, therefore, ſhould be boiled, and the younger and tenderer roaſted.

DRESSING, in ſurgery, denotes the treatment of a wound or any diſordered part. The apparatus for this purpoſe conſiſts of doſſils, tents, plaſters, compreſſes, bandages, bands, ligatures, &c. See Syſtem of SURGERY.

DRESSING *a Ship*, is the act of ornamenting a ſhip with a variety of colours, as enſigns, flags, pendants, &c. diſplayed from different parts of her maſts and rigging, on a day of feſtivity.

DRIFT *of the Foreſt*, an exact view, or examination of what cattle are in the foreſt; that it may be known whether it be overcharged, or not, and whoſe the beaſts are; and whether they are commonable beaſts, or not.

DRIFT, in navigation, denotes the angle which the line of a ſhip's motion makes with the neareſt meridian, when ſhe drives with her ſide to the wind and waves, and is not governed by the power of the helm; and alſo the diſtance which the ſhip drives on that line, ſo called only in a ſtorm.

DRILL, in mechanics, a ſmall inſtrument for making ſuch holes as punches will not conveniently ſerve for. Drills are of various ſizes, and are chiefly uſed by ſmiths and turners.

DRILL, a name given to an inſtrument uſed in the new method of horſe-hoeing huſbandry for ſowing the land. See Syſtem of AGRICULTURE, Sect. XXX. Plate I.

DRILLING, is a method of ſowing grain or ſeed of any kind, ſo that it may all be at a proper depth in the earth, which is neceſſary to its producing healthful and vigorous plants. For this purpoſe a variety of drill-ploughs have been invented and recommended.

This method, is greatly recommended in the Georgical eſſays, where we have the following obſervations and experiments. "Grain ſown by the hand, and covered by the harrow, is placed at unequal depths; the ſeeds conſequently ſprout at different times, and produce an unequal crop. When barley is ſown late, and a drought ſucceeds, the grain that was buried in the moiſture of the earth ſoon appears, while ſuch as was left near the ſurface lies baking in the heat of the ſun, and does not vegetate till plentiful rains have moiſtened the ſoil. Hence an inequality of the crop, an accident to which barley is particularly liable. The ſame obſervation, but in a more ſtriking manner, may be made upon the ſowing of turnips. It frequently happens that the huſbandman is obliged to ſow his ſeed in very dry weather, in hopes that rain will ſoon follow; and either rolls or covers it with a buſh harrow. We will ſuppoſe, that, contrary to his expectations, the dry weather continues. The ſeed, being near the ſurface, cannot ſprout without rain. The huſbandman is mortified at his diſappointment, but is ſoon ſatisfied and made eaſy by a perfect acquieſcence in what he thinks is the will of Providence. The ſcourge that he feels muſt not be placed to the diſpenſation of Providence, but has its ſource in the ignorance of the man himſelf. Had he judiciouſly buried the ſeed in the moiſt part of the ſoil with the drill plough, or harrowed it well with the common harrow, his ſeed would have vegetated in due ſeaſon, and bountifully repaid him for his toil.

"The excellence of the drill plow, is not confined to turnip ſeed; it is an uſeful inſtrument for ſowing all kinds of grain. By burying the ſeed at an equal depth, it ſecures an equal crop in all circumſtances of the weather. But this is not the only conſideration to the cultivator. It ſaves near one half of his ſeed, which is an object of importance to the tillage farmer."

The beſt inſtrument for drilling of grain, is the invention of the Rev. James Cooke, an ingenious gentleman, who has favoured us with many practical obſervations on drilling, and horſe-hoeing, with a mathematical definition to eſtabliſh his principle.

DRILLING is popularly uſed for exerciſing ſoldiers. The word is derived from the French *drille*, which ſignifies a raw ſoldier.

DRINK, a part of our ordinary food in a liquid form. The general uſe of drink is, to ſupply fluid; facilitate ſolution; and in conſequence of that, to expede the evacuation of the ſtomach, and promote the progreſs of the aliment through the inteſtines: for, by the contraction of the longitudinal fibres of the ſtomach, the pylorus is drawn up, and nothing but fluid can paſs; which by its bulk, makes a hurried progreſs through the inteſtines, and ſo determines a greater excretion by ſtool, as leſs then can be abſorbed by the lecteals. Hence a large quantity of common water has been found purgative; and, *cæteris paribus*, that aliment which is accompanied with the largeſt proportion of drink, makes the largeſt evacuation by ſtool. Here a queſtion has ariſen, about where the feculent part of the aliment is firſt remarkably collected. It is commonly thought to be in the great guts; but undoubtedly it often begins in the lower part of the ileum, eſpecially when the drink is in ſmall proportion, and when the progreſs of the aliment is ſlow; for when the contents of the guts are very fluid, they are quickly puſhed on, and reach the great guts before they depoſite any feculency. Another effect of drink is, to facilitate the mixture of the lymph, refluent from every part of the ſyſtem, with the chyle. In the blood-veſſels, where all muſt be kept fluid in order to proper mixture, drink increaſes the fluidity, and gives tenſion, by its bulk; without concomitant acrimony or too much elaſticity, and ſo ſtrength and oſcillatory motion: hence drink contributes to ſanguification, as ſometimes food gives too denſe a nutriment to be acted upon by the ſolids; and hence alſo we can ſee how drink promotes the ſecretions. Theſe are the effects of drink in general;

ral: but what has been ſaid muſt be taken with ſome limitations: for the more liquid the food, it is ſooner evacuated, and leſs nouriſhment is extracted. Hence drink is, in ſome degree, oppoſed to nouriſhment; and *cæteris paribus*, thoſe who uſe leaſt drink are moſt nouriſhed.

The drinks, in different countries, are different. Thoſe uſed among us, are water, malt liquors, wine, cyder, brandy, tea, &c. See each under its proper article. The firſt drinks of mankind were certainly water and milk; but luxury ſoon introduced the art of preparing intoxicating and inebriating drinks, out of vegetables. The vine gave the firſt of theſe liquors, after this wheat, barley, millet, oats, rice, apples, pears, and pomegranates; and after theſe the juices drained from the pine, ſycamore, and maple, were brought to this uſe; in latter times, roots, berries, and the pitch of the ſugar cane, have been employed for the ſame purpoſes. But before the uſe of the other things here mentioned, the vinous liquor made of honey and water was in the very higheſt eſtimation. The bees were natural purveyors, and their ſtores were one of the firſt delicacies probaby of the human race. The people who have ſtudied the human frame to moſt purpoſe, all agree, that among the ſtrong drinks, ſpirits and wine are the moſt pernicious; and that good water, milk, beer, and cyder, are greatly preferable to it, none of them bringing on the variety of diſorders, to which immoderate drinkers of wine and ſpirits are ſubject, ſuch as decay of ſight, trembling of the limbs, &c. Water Dr. Cheyne obſerves, is the only ſimple fluid (for there are but three more in nature, mercury, light, and air, none of which is fit for human drink) fitted for diluting, moiſtening, and cooling, the only ends of drink, appointed by nature; and happy had it been for the race of mankind, had other mixed, and artificial liquors, never been invented. Water alone is ſufficient, and effectual, for all the purpoſes of human wants in drink. Strong liquors were never deſigned for common uſe. They were formerly kept here in England, as other medicines are, in apothecaries ſhops, and preſcribed by phyſicians, as they do diſaſcordium, and Venice treacle, to refreſh the weary, ſtrengthen the weak, and raiſe the low-ſpirited. The effect of the ordinary uſe of wine and ſpirituous liquors, as natural cauſes will always produce their effects, is to inflame the blood into gout, ſtone, and rheumatiſm, fevers, pleuriſies, &c. to dry up the juices, and ſcorch and ſhrivel the ſolids. Thoſe whoſe appetite and digeſtion are good and entire, never want ſtrong liquors to ſupply them with ſpirits; ſuch ſpirits are too volatile, and fugitive, for any ſolid or uſeful purpoſes of life. Two ounces of fleſh meat, well digeſted, beget a greater ſtock of more durable and uſeful ſpirits, than ten times as much ſtrong liquors.

All ſtrong liquors are as hard to digeſt, and require as much labour of the concoctive powers, as ſtrong food itſelf. Water is the only univerſal diſſolvent, or menſtruum, and the moſt certain diluter of all bodies proper for food. There are a great many ſpirituous liquors which not only will not diſſolve, but which will harden, and make more indigeſtible, certain parts, eſpecially the ſalts of bodies, wherein their active qualities, that is, thoſe which can do moſt harm to human conſtitutions, conſiſt. And we have known perſons of tender conſtitutions, who could neither eat, nor digeſt, upon drinking wine, who, by drinking at meals common water, warmed, have recovered their appetites, and digeſtion, and have thriven, and grown plump. It is true, ſtrong liquors, by their heat, and ſtimulation on the organs of concoction, by increaſing the velocity of the motion of the fluids, and thereby quickening the other animal functions, will carry off the load that lies upon the ſtomach, with more preſent chearfulneſs. But then, beſide the future damages of ſuch a quantity of wine to the ſtomach, and the fluids, by its heat, and inflammation, the food is hurried into the habit unconnected, and lays a foundation for a fever, a fit of the cholic, or ſome chronical diſeaſe. Eſſay on Health, &c. 47, & ſeq.

With reſpect to fermented liquors, which are commonly uſed, it may be obſerved, that thoſe which are too ſtrong hurt digeſtion, and are ſo far from ſtrengthening the body, that they weaken and relax it. They keep up a conſtant fever, which exhauſts the ſpirits, heats and inflames the blood, diſpoſes to numberleſs diſeaſes, and occaſions a premature old age. But fermented liquors may be too weak, as well as too ſtrong: theſe muſt either be drank new, before the fermentation is over, and in this caſe will generate air in the bowels, and occaſion flatulencies; or they ſoon become ſtale, ſour the ſtomach, and injure digeſtion. On this account all malt liquors, cyders, &c. ſhould be ſufficiently ſtrong, to keep till they are ripe, and then they ſhould be uſed; and neither ſooner nor later. Liquors that are adulterated with a mixture of ingredients of the opiate kind, which are poiſonous in their quality, by thoſe who make them for ſale, hurt the nerves, relax and weaken the ſtomach, and ſpoil its digeſtive powers.

Sometimes we impregnate water with the *fructus acido-dulces*; and then, indeed, it acquires other qualities, of conſiderable uſe in the animal œconomy. All drinks, however, may be reduced to two heads: firſt, pure water, or where the additional ſubſtance gives no additional virtue; ſecondly, the *fermentatæ*. Of the firſt we have already ſpoken; and the latter have not only the qualities of the firſt, but alſo qualities peculiar to themſelves.

Fermented liquors are more or leſs poignant to the taſte, and better calculated to quench thirſt. Thirſt may be owing to various cauſes: firſt, to defect of fluid in the ſyſtem, which occaſions a ſcanty ſecretion in the mouth, fauces, and ſtomach; the dryneſs of the mouth and fauces will alſo in this caſe be increaſed, by their continual expoſure to the perpetual flux and reflux of the evaporating air. Secondly, thirſt depends on a large proportion of ſolid viſcid food: thirdly, on an alkaleſcent aliment, eſpecially if it has attained any thing of the putrefactive taint: fourthly, on the heat of the ſyſtem; but this ſeems to operate in the ſame manner as the firſt cauſe, giving a ſenſe of dryneſs from its diſſipation of the fluids. The fermented liquors are peculiarly adapted for obviating all theſe cauſes; ſtimulating the mouth, fauces, and ſtomach, to throw out the ſaliva and gaſtric liquor by their poignancy: by their aceſcency they are fitted to deſtroy alkaleſcent acrimony, to quench thirſt from that cauſe; by their fluidity they dilute viſcid food; though here, indeed, they anſwer no better than common water. In two ways they promote the evacuation by ſtool, and progreſs through the inteſtines; firſt, by their fluidity and bulk; ſecondly, by their aceſcency, which, uniting with the bile, forms the peculiar ſtimulus formerly mentioned. Carried into the blood-veſſels, in ſo far as they retain any of the ſaline nature, they ſtimulate the excretories, and promote urine and ſweet; correcting thus alkaleſcency, not only by mixture, but diſſipation of the degenerated fluids.

Many phyſicians, in treating of fermented liquors, have only mentioned theſe qualities, rejecting their nutritious virtue, which certainly ought to be taken in, though by expediting the evacuation by ſtool they make leſs of the nutritious parts of the aliment to be taken up, and by ſtimulating the excretories make theſe nutritious parts to be for a ſhorter time in the ſyſtem. All theſe, and many more effects, ariſe from fermented liquors. Their aceſcency ſometimes promotes the diſeaſe of aceſcency, by increaſing that of vegetables, acting as a ferment, and ſo producing flatulency, purging, cholera, &c: ſo that, with vegetable aliment, as little drink is neceſſary, the moſt innocent is pure water; and it is only with animal food that fermented liquors are neceſſary. In warmer climates, *fermentatæ* would ſeem neceſſary to obviate alkaleſcency and heat. But it ſhould be conſidered, that though fermented liquors contain an acid, yet they alſo contain alcohol; which, though it adds ſtimulus to the ſtomach, yet is extremely hurtful in the warmer climates, and wherever alkaleſcency prevails in the ſyſtem. Nature, in theſe climates, has given men an appetite for water impregnated with acid fruits, *e. g.* ſherbet; but the uſe of this needs caution, as in theſe countries they are apt to ſhun animal food, uſing too much of the vegetable, and often thus cauſing dangerous refrigerations, choleras, diarrhœas, &c.

Of varieties of fermented liquors; we ſhall only mention here the chief heads on which theſe varieties depend. Firſt, they are owing to the qualities of the ſubject, as more or leſs viſcid; and to its capacity alſo of undergoing an active fermentation, although perhaps the more viſcid be more nutritious. Hence the difference between ales and wines: by the firſt meaning fermented liquors from *farinacea*, by the ſecond from the fruits of plants. It depends, ſecondly, on the acerbity, acidity, nature, and maturation, of the fruit. Thirdly, the variety depends on the conduct of the fermentation. In general, fermentation is progreſſive, being at firſt active and rapid, detaching the fixed air or *gas ſylveſtre*, at the ſame time acquiring more acid than before. Theſe qualities of flatulency and acidity remain for ſome time; but as the fermentation goes on, the liquor becomes more perfect, no air is detached, and alcohol is produced; ſo that fermented liquors differ according to the progreſs of the fermentation, and have different effects on the ſyſtem. When fermentation is ſtopped before it comes to maturity, though naturally it proceeds in this way, yet by addition of new ferment it may again be renewed with a turbid inteſtine motion.

DRIPS, in building, a kind of ſteps, on flat roofs, to walk upon. This way of building is much uſed in Italy; where the roof is not made quite flat, but a little raiſed in the middle; with drips, or ſteps, lying a little inclining to the horizon.

DRIVE, in the ſea language. A ſhip is ſaid to drive, when an anchor being let fall, will not hold her faſt, but ſhe ſails away with the tide, and wind.

DRIVER, the name given by our ſportſmen to an inſtrument uſed in taking pheaſant powts, in the method called driving. This inſtrument conſiſts only of a parcel of ozier wands, ſuch as are uſed by the baſket-makers, which are made up into a bundle, or ſort of great whiſk, and faſtened in a handle; and to prevent their ſpreading too much at the points are tied round in one or two places in the length; with this inſtrument the ſportſman, having fixed his nets, drives the young birds into them. See DRIVING.

DRIVING, amongſt ſportſmen, a term applied to the taking of young pheaſants, and ſome other birds, in nets of an open ſtructure. The method of doing this, is, when an eye of pheaſants is found, the ground all about is to be ſearched, for finding their principal haunts. The induſtrious ſearcher will ſoon be able to make out ſome one of their paths which are beaten in the manner of ſheep tracts, only more ſlightly. When one of theſe is found, the place is to be marked by ſetting up a ſtick with another tied to its top like the hand of a road poſt, marking out the place where the path ſeems to run to. On examining the reſt of the ground thereabouts, having regard to the ſame direction, it is highly probable that ſeveral more of the ſame ſort of tracks will be found all running the ſame way. By one or other of theſe, probably the ſportſman will be led to their haunt, which he will not miſs knowing by the nakedneſs and barrenneſs of the ground, and its being covered with the dung and feathers of the young birds. When this is found, the nets are to be placed near this ſpot, looſe and circularly, in ſuch a manner, that the under part being faſtened down to the ground, the upper part may be a hollow, to give a paſſage to the young birds. When the nets are fixed, the perſon muſt go to the haunts, and call them together by the artificial noiſe of the pheaſant call, which is ſo like the real note of the pheaſant, that the powts, or young ones, will ſeldom fail being deceived by it. When they hear this, and begin to anſwer it with their chucking and piping, the call is to be ſtopped, and a perſon is to get behind them, taking the wind with himſelf, as they always run with the wind. He is to have in his hand the inſtrument called by the ſportſmen a driver.

When the perſon who carries this inſtrument perceives that he is come pretty near ſome of the powts, he muſt ſoftly beat the buſhes with the driver, or only lightly draw it over them; the little noiſe this makes will terrify theſe timorous creatures, and they will gather together in the track, and run a little way forward, and then all ſtop and turn about; on this the perſon is to make the ſame noiſe again, upon which they will run farther; and when they ſtop again, the ſame noiſe will again ſend them forward. Whatever other powts are in the way will join the main body in the fright, and the whole will be driven in this manner, like a flock of ſheep, and by a little addreſs in the ſportſman be ſent into the nets; ſo that out of a whole eye, it often happens that not one is miſſed. If in the fright the birds happen to run out of their track, and take a wrong way, then the driver is to make a raking noiſe with his inſtrument dragged along the ground, on that ſide on which they are running; this will amaze and terrify them ſo, that they will immediately ſtart back, and come into the beaten track that leads directly to their haunt. There are but two cautions neceſſary to the ſucceeding perfectly in this method of taking them: theſe are ſecrecy and patience. Whatever ſtops they make, or however tediouſly they move, the ſportſman who would make ſure of them, muſt bear with it; for over raſhneſs and hurrying will ſpoil all, and he muſt content himſelf with terrifying them by the noiſe alone, keeping himſelf carefully out of their ſight; for if they eſpy him, all the plan is diſconcerted, and they will no more move forwards, but will every one run a different way, and hide under the roots of trees, and thick buſhes, and all the art in the world will never bring them out again till night, when it will be too dark to watch them.

Driving *of Wild Foul*, is only practicable in the moulting time, which is in July and Auguſt; and it is to be done by means of a ſpaniel, well trained to the purpoſe. They are uſually indeed poor and out of fleſh at this time, but as they are always taken alive, and without any hurt, the people find it eaſy to fatten them with beaſts livers, barley, paſte, ſcalded bran, and the like; and they will on this become, in a very little time, fat and well taſted, excelling in flavour both the tame ducks, commonly kept in the yards, and the wild ducks in their natural ſtate. When the ſportſman takes the dog into places where they are not ſo frequent, he may hunt them ſingly, and the dog alone will take them. For the ſpaniel uſed for this purpoſe, ſee Dog; and the method of ſnaring them, ſee Decoy.

Driving, in metallurgy, is uſed by the refiners of ſilver to expreſs the riſing up of copper from its ſurface in red fiery bubbles. When the lead that was added for refining the ſilver is burnt away before the copper is gone from it, theſe bubbles appear very fiercely on the ſurface. They ſay, on this occaſion, that the metal drives, and then add more lead till the remainder of the copper is conſumed. Phil. Tranſ. N° 142.

DROIT, Jus, in our law-books, ſignifies right, or law.

DROMEDARY, the name of a ſpecies of camel; ſee Camel.

Drone, in entomology, a kind of male bee, larger than the common working or honey bees: it is ſo called from its idleneſs, as never going abroad to collect either honey or wax. Theſe are the males of the ſwarm; the common working bees are of no ſex at all, or rather females in diſguiſe, and the female is uſually only one in a hive, for there is reaſon to conclude, from numerous late experiments, that the queen bee lays only two kinds of eggs, thoſe that are to produce drones, and thoſe from which the working bees are to proceed. The proportions of drones to other bees in ſwarms are various; ſome having more than others.

This larger ſpecies of drones may be eaſily diſtinguiſhed from the working bees, by being nearly double their ſize. Their head is round, their eyes full, their tongue ſhort, and belly broader and more obtuſe than that of the other claſſes; they are likewiſe of a darker colour, and more thickly cloathed; and they make a much greater noiſe in flight, ſo that they may be eaſily known though unſeen. They have alſo no ſting, as the other bees have. The diſſection of the drone bee gives as great proof of its being the male, as that of the queen does of her being the female. In this creature there is no appearance of ovaries or eggs, nor any thing of the ſtructure of the common working bees, but the whole abdomen is filled with tranſparent veſſels, winding about in various ſinuoſities, and containing a white or milky fluid. This is plainly analogous to that fluid in the males of other animals, which is deſtined to render the eggs of the female prolific; and this whole apparatus of veſſels, which much reſembles the turnings and windings of the ſeminal veſſels in other animals, is plainly intended only for the preparation and retention of this matter, till the deſtined time of its being emitted on the eggs.

Drone-*Fly* or **Bee-***Fly*, a two winged fly, ſo extremely like the common bee as to be at firſt ſight not eaſily diſtinguiſhable from it. The diſtinction between the two inſects, however, beſide the different number of their wings, is, that the bee has a ſomewhat longer and leſs thick body, and the head is proportionably much ſmaller than that of the fly which ſo much reſembles them. The bee-fly alſo ever carries its wings parallel in their poſition, but without its body; whereas the bee itſelf uſually carries its wings croſſed on the back, and covers its body with them; this is not however an invariable poſture with the wings of the bee, though it is the moſt frequent one. The bee-fly is found among the flowers, as is the bee; and though it gathers no wax, it has a trunk, by means of which it ſucks the honey.

DROPAX, Δρωπαξ, in pharmacy, an external medicine in form of a plaſter, uſed to take off the hairs from any part. The dropax is of two kinds, ſimple, and compound. The ſimple is made of an ounce of dry pitch, and two drachms of oil. The compound is made with pitch, wax, colophony, common ſalt, bitumen, ſulphur vivum, pepper, euphorbium, cantharides, and caſtor. There are alſo other ways of making it, to be found in the diſpenſatories.

Drops, in medicine, a liquid remedy, whoſe doſe is eſtimated by a certain number of drops.

DROPS, in meteorology. The ſpherical figure, into which the drops of fluids conform themſelves, is a phenomenon that has a little perplexed the philoſophers. The ſolution commonly given, was, that the equable, uniform preſſure of the ambient, or incumbent atmoſphere, cloſed them into this form. But this account will no longer paſs; now that we find that the phenomenon holds in vacuo as well as in air. The Newtonian philoſophers, therefore, aſcribe it to their attraction, which being greater between the ſeveral particles of the fluids than between them and thoſe of the medium, they are, as it were, concentrated, and brought as near each other, and into as little compaſs, as may be; which cannot be without their being ſpherical.

DROPSY, Ὑδρωψ, in medicine, a preternatural collection of ſerum, or water, in ſome part of the body. The word is compounded of the Greek υδωρ, *water*. See Syſtem of Medicine.

DROPWORT, in botany. See Spiræa.

Dropwort, water, in botany. See Oenanthe.

Threlkeld mentions this plant as growing in Cumberland, where the people call it dead tongue, and uſe it as a poultice to the galled backs of their horſes. The German botaniſts do not mention it as growing among them, nor Haller in his Enumeratio Stirpium Helvetiæ; whence it ſeems to be ſeldom met with, except in England, Holland, and ſome parts of France.

DROSERA, ros ſolis, or ſun dew, in botany, a genus of the pentagynia order, belonging to the pentandria claſs of plants. The juice that exſudes from it unmixed, will deſtroy warts and corns.

DROVERS are perſons that buy cattle in one place, and drive them for ſale to another. They are to be married men, and houſholders, and to be licenſed by ſtatue 5 Eliz. cap. 12. And if they drive their cattle on the Lord's day, they ſhall forfeit 20s. by 1 Car. I. cap. 1.

DROUGHT, applied to the dry weather, want of rain; thirſt, or great want or deſire of drink.

DROWNING, ſignifies the extinction of life by a total immerſion in water. In ſome reſpects, there ſeems to be a great ſimilarity between the death occaſioned by immerſion in water, and that by ſtrangulation, ſuffocation by fixed air, apoplexies, epilepſies, ſudden faintings, violent ſhocks of electricity, or even violent falls and bruiſes. Phyſicians, however, are not agreed with regard to the nature of the injury done to the animal ſyſtem in any or all of theſe accidents. It is indeed certain, that in all the caſes above mentioned, particularly in drowning, there is very often ſuch a ſuſpenſion of the vital powers as to us hath the appearance of a total extinction of them; while yet they may be again ſet in motion, and the perſon reſtored to life, after a much longer ſubmerſion than hath been generally thought capable of producing abſolute death. It were to be wiſhed, however, that as it is now univerſally allowed, that drowning is only a ſuſpenſion of the action of the vital powers, phyſicians could as unanimouſly determine the means by which theſe powers are ſuſpended; becauſe on a knowledge of theſe means, the methods to be uſed for recovering drowned perſons muſt certainly depend.

Dr. de Haen, who hath written a treatiſe on this ſubject, aſcribes this diverſity of opinion among the phyſicians to their being ſo ready to draw general concluſions from a few experiments. Some, having never found water in the lungs, have thought that it never was there; and others, from its preſence, have drawn a contrary concluſion. Some have aſcribed the death which happens in caſes of drowning, to that ſpecies of apoplexy which ariſes from a great fullneſs of the ſtomach. But this opinion our author rejects, becauſe in 13 dogs which he had drowned and afterwards diſſected, no ſigns of ſuch a fulneſs appeared. Another reaſon is drawn from the want of the common marks of apoplexy on the diſſection of the brain; and from the actual preſence of water in the lungs. He is of opinion, that the death of drowned perſons happens in conſequence of water getting into the lungs, and ſtopping the blood in the arteries. He then diſcuſſes the queſtion how far the blowing of air into the lungs is uſeful in recovering drowned people. If their death is to be aſcribed to the water entering the lungs, this practice, he obſerves, muſt be hurtful, as it will increaſe the preſſure on the blood veſſels, or may even force the water into them; which, on the authority of Lewis's experiments, he alleges is poſſible. But, in ſpite of this reaſoning, he aſſerts, that from experience it has been found uſeful. He allows, that the practice of ſuſpending drowned people by the feet muſt be hurtful, by determining the blood too much to the head; but he obſerves, that remedies in ſome reſpects hurtful may be uſed when the advantages derived from them preponderate; and is of opinion, that the practice above mentioned may be uſeful by agitating the viſcera againſt each other, and thus renewing their motions. Cutting the larynx in order to admit air more freely to the lungs, he reckons to be of little or no uſe; but acknowledges, however, that it may ſometimes prove beneficial on account of the irritation occaſioned by the operation.

Dr. Cullen, in his letter to Lord Cathcart concerning the recovery of perſons drowned and ſeemingly dead, tells us, that "From the diſſection of drowned men, and other animals, it is known, that very often the water does not enter into the cavity of the lungs, nor even into the ſtomach, in any quantity to do hurt to the ſyſtem; and, in general, it is known, that in moſt caſes, no hurt is done to the organiſation of the vital parts. It is therefore probable, that the death which enſues, or ſeems to enſue, in drowned perſons, is owing to the ſtoppage of reſpiration, and to the ceaſing, in conſequence, of the circulation of the blood, whereby the body loſes it heat, and, with that, the cavity of the vital principle.

In the Phil. Tranſ. Vol. LXVI. Mr. Hunter gives the following theory. The loſs of motion in drowning, ſeems to ariſe from the loſs of reſpiration; and the immediate effect this has upon the other vital motions of the animal, at leaſt this privation of breathing, appears to be the firſt cauſe of the heart's motion ceaſing.

The following abſtract of the plan of the ſociety in London, called the Humane Society, and method of treatment recommended by it, will not, we apprehend, be unacceptable to our readers. This ſociety has undertaken to publiſh, in as extenſive a manner as poſſible, the proper methods of treating perſons in the unfortunate circumſtances to which they extend their relief; to diſtribute a premium of two guineas among the firſt perſons, not exceeding four in number, who attempt to recover any perſon, taken out of the water for dead, within thirty miles of the cities of London and Weſtminſter, provided they have not been longer than two hours under the water, and provided the aſſiſtants perſevere in the uſe of the means recommended for the ſpace of two hours, whether their attempts are ſucceſsful or not. Theſe rewards are alſo to include every other inſtance of ſudden death, whether by ſuffocation from noxious vapours, hanging, ſyncopies, freezing, &c. They propoſe to diſtribute in like manner four guineas wherever the patient has been reſtored to life: to give to any publican or other perſon, who ſhall admit the body into his houſe without delay, and furniſh the neceſſary accommodations, the ſum of one guinea, and to ſecure them from the charge of burial in unſucceſsful caſes; and to preſent an honorary medal to thoſe medical gentlemen, or others, who give their aſſiſtance gratis, and who are provided with a fumigator, and other neceſſaries always in readineſs, in all thoſe caſes in which they may prove inſtrumental to ſucceſs. The device on one ſide of their medal is a boy, who is repreſented blowing an extinguiſhed torch, with the hope, as the legend, *Lateat ſcintilula forſan* imports, that a little ſpark may ſtill remain. The reverſe exhibits a civic wreath, which was the Roman reward for ſaving the life of a citizen, with a blank for the name of a perſon to whom the medal may be given; the inſcription round the wreath, *Hoc pretium cive ſervato tulit,* expreſſes the merit that obtained it. The following is the method of treatment recommended by the ſociety.

1. In removing the body to a convenient place, great care muſt be taken that it be not bruiſed, nor ſhaken violently, nor roughly handled, nor carried over the ſhoulders with the head hanging downwards, nor rolled upon the ground, or over a barrel, nor lifted up by the heels. For experience proves, that all theſe methods are injurious, and often deſtroy the ſmall remains of life. The unfortunate object ſhould be cautiouſly conveyed by two or more perſons, or in a carriage upon ſtraw, lying as on a bed, with the head a little raiſed, and kept in as natural and eaſy a poſition as poſſible.

2. The body being well dried with a cloth ſhould be placed in a moderate degree of heat, but not too near a large fire. The windows or door of the room ſhould be left open, and no more perſons be admitted into it than thoſe who are abſolutely neceſſary; as the life of the patient greatly depends upon having the benefit of a pure air. The warmth moſt promiſing of ſucceſs is that of a bed or blanket properly warmed. Bottles of hot water ſhould be laid at the bottom of the feet, in the joints of the knees, and under the arm-pits; and a warming-pan, moderately heated, or hot bricks wrapped in cloths, ſhould be rubbed over the body, and particularly along the back. The natural and kindly warmth of a healthy perſon lying by the ſide of the body has been found in many caſes very efficacious. The ſhirt or cloaths of an attendant, or the ſkin of a ſheep freſh killed, may alſo be uſed with advantage. Should theſe accidents happen in the neighbourhood of a warm bath, brewhouſe, baker, glaſs-houſe, ſaltern, ſoap-boiler, or any fabrick where warm lees, aſhes, embers, grains, ſand, water, &c. are eaſily procured, it would be of the utmoſt ſervice to place the body in any of theſe, moderated to a degree of heat, but very little exceeding that of a healthy perſon.

3. The ſubject being placed in one or other of theſe advantageous circumſtances as ſpeedily as poſſible, various ſtimulating methods ſhould next be employed. The moſt efficacious are, to blow with force into the lungs, by applying the mouth to that of the patient, cloſing his noſtrils with one hand, and gently expelling the air again by preſſing the cheſt with the other, imitating the ſtrong breathing of a healthy perſon. The medium of a handkerchief or cloth, may be uſed, to render the operation leſs indelicate. If the lungs cannot be inflated in this manner, it may be attempted by blowing through one of the noſtrils, and at the ſame time keeping the other cloſe. Dr. Monro for this purpoſe recommends a wooden pipe, fitted at one end for filling the noſtril, and at the other for being blown into by a perſon's mouth, or for receiving the pipe of a pair of bellows, to be employed for the ſame purpoſe if neceſſary. Whilſt one aſſiſtant is conſtantly employed in this operation, another ſhould throw the ſmoke of tobacco up by the fundament into the bowels, by means of a pipe, or fumigator, ſuch as are uſed in adminiſtering clyſters; or by a pair of bellows, till the other inſtrument can be procured. A third attendant ſhould, in the mean time, rub the belly, cheſt, back, and arms, with a coarſe cloth, or flannel, dipped in brandy, rum, or gin, or with dry ſalt, ſo as not to rub off the ſkin; ſpirits of hartſhorn, volatile ſalts, or any other ſtimulating ſubſtance muſt alſo be applied to the noſtrils, and rubbed upon the temples very frequently. Electrical ſhocks made to paſs in different directions through the body, and particularly through the heart and lungs, have been recommended as very powerful *ſtimuli*; and from the trials that have already been made, promiſe conſiderable ſucceſs. The body ſhould at intervals be ſhaken alſo, and varied in its poſition.

4. If there be any ſigns of returning life, ſuch as ſighing, gaſping, twitching, or any convulſive motions, beating of the heart, the return of the natural colour and warmth, opening a vein in the arm or neck may prove beneficial; but the quantity of blood taken away ſhould not be large; nor ſhould an artery ever be opened, as profuſe bleeding has appeared prejudicial, and even deſtructive to the ſmall remains of life. The throat ſhould be tickled with a feather, in order to excite a propenſity to vomit; and the noſtrils alſo with a feather, ſnuff, or any other ſtimulant, ſo as to provoke ſneezings. A tea-ſpoonful of warm water may be occaſionally adminiſtered, in order to learn whether the power of ſwallowing be returned; and if it be, a table-ſpoonful of warm wine, or brandy and water, may be given with advantage; but not before, as the liquor may get into the lungs, before the power of ſwallowing returns. The other methods ſhould be continued with vigour, until the patient be gradually reſtored.

When the patient has been but a ſhort time ſenſeleſs, blowing into the lungs or bowels has been, in ſome caſes, found ſufficient; yet a ſpeedy recovery is not to be expected in general. On the contrary, the above methods are to be continued with ſpirit for two hours, or upwards, although there ſhould not be the leaſt ſymptoms of returning life. The ſame means of reſtoration are applicable to the various other caſes of ſudden death, recited in the beginning of this article.

When theſe meaſures prove unſucceſsful, the ſurgeon's laſt reſource is *Bronchotomy*, or opening the *arteria trachæa*; for perhaps the air entering freely into the lungs, through the aperture made in the canal, through which they received it in their natural ſtate, will reſtore the play of the lungs, and all the motions of the breaſt.

Mr. Hunter obſerves, that the reſtoration of breathing is all that is neceſſary to reſtore the heart's motion; for if a ſufficiency of life ſtill remains to produce that effect, we may ſuppoſe every part equally ready to move the very inſtant in which the action of the heart takes place, their actions depending ſo much upon it. What makes it very probable, that the principal effect depends upon throwing air into the lungs, is, that children in the birth, when too much time has been ſpent after the loſs of that life, which is peculiar to the fetus, loſe altogether the diſpoſition for the new life. In ſuch caſes there is a total ſuſpenſion of the actions of life; the child remains to all appearance dead; and would die, if air was not thrown into its lungs, and the firſt principle of action by that means reſtored. To put this in a clearer light, Mr. Hunter gives the reſult of ſome experiments made on a dog in 1755. A pair of double bellows were provided, which were ſo conſtructed, that, by one action, air was thrown into the lungs, and by the other the air was ſucked out which had been thrown in by the former, without mixing them together. The muzzle of theſe bellows was fixed into the trachæa of a dog, and by working them he was kept perfectly alive. While this artificial breathing was going on, the ſternum was taken off, ſo that the heart and lungs were expoſed to view. The heart then continued to act as before, only the frequency of its action was greatly increaſed. Mr. Hunter then ſtopped the motion of the bellows; and obſerved that the contraction of the heart became gradually weaker and leſs frequent, till it left off moving altogether; but, by renewing the operation, the motion of the heart alſo revived, and ſoon became as ſtrong and frequent as before. This proceſs was repeated upon the ſame dog ten times; ſometimes ſtopping for five, eight, or ten minutes. Mr. Hunter obſerved, that, every time he left off working the bellows, the heart became extremely turgid with blood, and the blood in the left ſide became as dark as that in the right, which was not the caſe when the bellows were working. Theſe ſituations of the animal, he obſerves, ſeem to be exactly ſimilar to drowning.

Mr. Hunter then obſerves that blowing air into the lungs, ſoon after the immerſion, may be ſufficient to effect a recovery; and the dephlogiſticated air of Dr. Prieſtley may prove more efficacious than common air. But if a conſiderable time, as an hour, has been loſt, it may be neceſſary to apply ſtimulating medicines, as the vapour of volatile alkali, mixed with the air; and theſe are beſt thrown in by the noſtrils, as applications of this kind to the olfactory nerves rouſe the living principle, and put the muſcles of reſpiration into action, while ſome applications to the mouth rather depreſs than rouſe, by producing ſickneſs. The larynx ſhould be at the ſame time preſſed againſt the œſophagus and ſpine, which will prevent the ſtomach and inteſtines from being too much diſtended by the air; however, the trachæa, and the aperture into the larynx, ſhould be both left perfectly free. Heat alſo is congenial with the living principle, which by increaſing the neceſſity of action, increaſes action; and to a due proportion of heat the living principle owes its vigour. Bed cloaths properly heated ſhould, therefore, be gently laid over the patient, and the ſteam of volatile alkali, or of warm balſams, and eſſential oils, may be thrown in, ſo as to come in contact with many parts of his body. The ſame ſteam may alſo be conveyed into the ſtomach by means of a hollow bougie, and a ſyringe; together with ſpirits of hartſhorn, pepper mint water, juice of horſe raddiſh, and alſo balſam, and turpentines, in ſuch ſmall quantities, as not to produce ſickneſs. Theſe may alſo be thrown up by the anus. When the heart begins to move, Mr. Hunter adviſes to leſſen the application of air to the lungs; he abſolutely forbids bleeding, becauſe it weakens the animal principle, or that principle which preſerves the body from diſſolution, and is the cauſe of all its actions, and which Mr. Hunter ſuppoſes to be inherent in the blood, and conſequently leſſens both the power and diſpoſition to action. Nothing ſhould be adminiſtered that ordinarily produces a nauſea or vomiting, or by the anus, that has a tendency to an evacuation that way; becauſe every ſuch evacuation tends to leſſen the animal powers. On this account he does not particularly recommend the fumes of tobacco, becauſe they always produce ſickneſs or purging, according to the mode of their application. He recommends the following apparatus, with a view to the purpoſes of this ſociety. Firſt, a pair of bellows; ſo contrived with two ſeparate cavities, that by opening them, when applied to the noſtrils or mouth of a patient, one cavity may be filled with the common air, and the other with air ſucking out from the lungs; and by ſhutting them again, the common air may be thrown into the lungs, and that ſucked out of the lungs diſcharged into the room. The pipe of theſe ſhould be flexible, in length a foot, or a foot and a half, and at leaſt three eighths of an inch in width; by this the artificial breathing may be continued, while the other operations, the application of the ſtimuli to the ſtomach excepted, are going on, which could not conveniently be the caſe, if the muzzle of the bellows were introduced into the noſe. The end next the noſe ſhould be double, and applied to both noſtrils. Secondly, a ſyringe with a hollow bougie, or flexible catheter, of ſufficient length to go into the ſtomach, and to convey any ſtimulating matter into it, without affecting the lungs. Thirdly, a pair of ſmall bellows, ſuch as are commonly uſed in throwing fumes of tobacco up the anus. Phil. Tranſ. vol. lxvi. part ii. p. 412. 425.

Notwithſtanding the differences in theory, however, between the phyſicians above mentioned, it is certain, that within theſe few years great numbers of drowned people have been reſtored to life, by a proper uſe of the remedies we have enumerated, and ſocieties for the recovery of drowned perſons have been inſtituted in different places. The firſt ſociety of this kind was inſtituted in Holland, where, from the great abundance of canals and inland ſeas, the inhabitants are particularly expoſed to accidents by water. The laudable and humane example of the Dutch was followed in the year 1768 by the magiſtrates of health in Milan and Venice; afterwards by the magiſtrates of Hamburgh in the year 1771, by thoſe of Paris in the year 1772, and by the magiſtrates of London in 1774.

Societies of a ſimilar nature, have been formed at Norwich, Briſtol, Liverpool, Colcheſter, and Hull, and likewiſe at Corke in Ireland. The board of Police in Scotland, has alſo intereſted itſelf in favour of the ſame benevolent deſign.

DRUG, in commerce, a general name for all ſpices, and other commodities, brought from diſtant countries, and uſed in the buſineſs of medicine, and the mechanic arts. The drugs uſed in medicine are very numerous, and make the greateſt part of the commerce of our druggiſts. Some of them grow in England, France, &c. but the greateſt part are brought from the Levant, and the Eaſt Indies. A liſt of them would be endleſs.

DRUGGET, in commerce, a ſort of ſtuff, very thin, and narrow, ſometimes all wool, and ſometimes half wool, and half thread; having ſometimes the whale, but more uſually without. Thoſe without the whale in the plain druggets are woven on a loom with two treddles, after the ſame manner as linen, camblet, &c. Thoſe with the whale, or the corded druggets, are wrought on a loom with four treddles. Thoſe are called threaded druggets, that have the woof of wool, and the warp of thread.

DRUIDS, the prieſts among the ancient Britons and Gauls. The word is formed from the Celtic, *deru*, an oak; becauſe they held that tree in the higheſt veneration.

Their antiquity is eſteemed equal to that of the Brachmans of India, the Magi of Perſia, and the Chaldees of Babylon. And whoever conſiders the ſurpriſing conformity of their doctrine, will find ſufficient reaſon to think that they all derived it from the ſame hand, we mean from Noah and his immediate deſcendants, who carried it with them at their diſperſion; for it cannot be ſuppoſed that the Britiſh druids derived their doctrine from any foreign ſect, to whom they were abſolutely unknown.

But the druids were not contented with the power annexed to the prieſthood: they introduced religion into every tranſaction both public and private, ſo that nothing could be done without their approbation; and by this means their authority was rendered almoſt abſolute. They elected the annual magiſtrates of every diſtrict, who ſhould have enjoyed during that term the ſupreme authority, and ſometimes the title of kings: but they could not even call a council without their approbation and advice; ſo that, notwithſtanding their pretended authority, they were in reality the creatures and ſlaves of the druids.

They exerciſed the ſame arbitrary power in their courts of juſtice; and whoever refuſed to ſubmit to their deciſions, were excluded from the public ſacrifices, which was conſidered as the greateſt puniſhment that could be inflicted.

Their garments were remarkably long; and, when employed in religious ceremonies, they always wore a white ſurplice. They generally carried a wand in their hands; and wore a kind of ornament enchaſed in gold about their necks, called the druid's egg. Their necks were likewiſe decorated with gold chains, and their hands and arms with bracelets; they wore their hair very ſhort, and their beards remarkably long.

They were all ſubordinate to a chief or ſovereign pontiff, ſtyled the arch-druid, choſen from among their fraternity by a plurality of voices: but, in caſe of a competition too powerful to be decided by a majority, the conteſt was determined by the ſword. He enjoyed his ſupremacy for life, had power to inſpect the conduct of kings, and either to elect or depoſe whenever he pleaſed.

It was one of the maxims of their religion, not to commit any thing to writing; but deliver all their myſteries and learning in verſes compoſed for that purpoſe. By this means their doctrines appeared more myſterious by being unknown to all but themſelves; and having no book to recur to, they were the more careful to fix them in their memory.

But what had ſtill a more direct tendency to impoſe on the public, was their pretended familiar intercourſe with the gods. And in order at once to conceal their own ignorance, and render the impoſition leſs ſuſceptible of detection, they boaſted of their great ſkill in magic, and cultivated ſeveral branches of the mathematics, particularly aſtronomy. The latter they carried to ſome degree of perfection; for they were able to fortel the times, quantities, and durations, of eclipſes: a circumſtance which could not fail of attracting reverence from an ignorant multitude, who were perſuaded that nothing leſs than a ſupernatural power was ſufficient to make ſuch aſtoniſhing predictions. They alſo ſtudied natural philoſophy, and practiſed phyſic.

They worſhipped the Supreme Being under the name of Eſus, or Heſus, and the ſymbol of the oak; and had no other temple than a wood or a grove, where all their religious rites were performed. Nor was any perſon admitted to enter that ſacred receſs, unleſs he carried with him a chain, in token of his abſolute dependence on the Deity. Indeed, their whole religion originally conſiſted in acknowledging, that the Supreme Being, who made his abode in theſe ſacred groves, governed the univerſe; and that every creature ought to obey his laws, and pay him divine homage. They conſidered the oak as the emblem, or rather the peculiar reſidence, of the Almighty; and accordingly chaplets of it were worn by the druids and people in their religious ceremonies, the altars were ſtrewed with its leaves and encircled with its branches. The fruit of it, eſpecially the miſletoe, was thought to contain a divine virtue, and to be the peculiar gift of heaven.

The conſecrated groves, in which they performed their religious rites, were fenced round with ſtones, to prevent any perſon's entering between the trees, except through the paſſages left open for that purpoſe, and which were guarded by ſome inferior druids, to prevent any ſtranger from intruding into their myſteries. Theſe groves were of different forms; ſome quite circular, others oblong. Within theſe circles were ſeveral ſmaller ones ſurrounded with large ſtones; and near the centre of theſe ſmaller circles, were ſtones of a prodigious ſize, and convenient height, on which the victims were ſlain and offered. Each of theſe being a kind of altar, was ſurrounded with another row of ſtones, the uſe of which cannot now be known, unleſs they were intended as cinctures to keep the people at a convenient diſtance from the officiating prieſt.

While the religion of the druids continued pure and unmixed with any foreign cuſtoms, they offered only oblations of fine flour ſprinkled with ſalt, and adored the Supreme Being in prayers and thankſgivings. But after they had for ſometime carried on a commerce with the Phœnicians, they loſt their original ſimplicity, adored a variety of gods, adopted the barbarous cuſtom of offering human victims, and even improved on the cruelty of other nations; uſing theſe unfortunate mortals for the purpoſes of divination, with ſuch barbarous cruelty as is ſhocking to human nature to relate. Practices like theſe ſoon rendered them ſo deaf to the voice of humanity, that on extraordinary occaſions they erected an huge hollow pile of oſier, which they filled with theſe unhappy wretches, and burnt them to their gods. Criminals were indeed choſen for this barbarous ſacrifice; but, in want of theſe, the innocent became victims to a cruel ſuperſtition.

We have already mentioned, that in their ſacred groves were ſeveral large ſtones, ſuppoſed to be the altars on which they offered their victims. Some of theſe ſtones are ſtill remaining in England, Wales, Ireland, and the iſland of Angleſey; and are of ſuch an amazing magnitude, that the bringing and rearing them was thought by the ſuperſtitious to have been the work of thoſe dæmons ſuppoſed to attend on that manner of worſhip.

Temples they had none before the coming of the Romans, nor in all probability for a long time after: for with regard to thoſe vaſt piles of ſtones ſtill remaining, they ſeem rather to have been funeral monuments than places of worſhip; eſpecially as all the ancient writers agree that their religious ceremonies were always performed in their conſecrated groves. Accordingly Tacitus, ſpeaking of the deſcent of the Romans, tells us, that their firſt care was to deſtroy thoſe groves and woods which had been polluted with the blood of ſo many human victims.

One of the chief tenets taught by the druids was the immortality of the ſoul, and its tranſmigration from one body to another; a doctrine which they conſidered as proper to inſpire them with courage, and a contempt of death. They alſo inſtructed their diſciples in ſeveral traditions concerning the ſtars and their motions, the extent of the world, the nature of things, and the power of the immortal gods. But as they never committed any of their tenets to writing, in order at once to conceal their myſterious learning from the vulgar, and exerciſe the minds of their diſciples, the greateſt part of them are now irrecoverably buried in oblivion. For a particular account of temples of the Druids, ſee Carnedde.

DRUM, is a martial muſical inſtrument by Le Clerc, ſaid to have been an Oriental invention, and to have been brought by the Arabians, or perhaps rather the Moors, into Spain.

Kettle Dbums, are two ſorts of large baſons of copper or braſs, rounded in the bottom, and covered with vellum, or goat ſkin, which is kept faſt by a circle of iron round the body of the drum, with a number of ſcrews to ſcrew up and down. They are much uſed among the horſe; as alſo in operas, oratorios, concerts, &c.

Drum, or Drummer, he that beats the drum; of whom each company of foot has one, and ſometimes two.

They are diſtinguiſhed from the ſoldiers, by cloaths of a different faſhion: their poſt, when a battalion is drawn up, is on the flanks, and on a march it is betwixt the diviſions.

Drum *Major*, is that perſon in a regiment who beats the beſt drum, commands the others, and teaches them their duty. Every regiment has a drum major.

Drum, in anatomy, or *Ear* Drum, *Tympanum*, denotes a cavity in the inner ear; thus called from the reſemblance it bears to the figure of a war-drum. Its outer extreme is covered with a membrane, by anatomiſts called alſo *tympanum*, *drum*; but, more properly, *membrana tympani*. The office of this *drum* or *membrana tympani*, has been greatly controverted by anatomiſts. The account beſt warranted is, that being a medium for the conveyance of the ſound to the auditory nerve, by its different degrees of tenſion, it ſerves to modify the ſound, and propagate it to the nerve well proportioned, and commenſurate thereto. See Syſtem of Anatomy, Part VI. Sect. X. and Plate on the Organs of Senſe, *Fig.* 6.

DRUNKENNESS, *Ebriety*, phyſically conſidered, conſiſts in a preternatural compreſſion of the brain, and a diſcompoſure of its fibres: occaſioned by the fumes, or ſpirituous parts of liquors. It is accounted for thus: an immoderate quantity of wine taken into the ſtomach is there heated, and undergoes a kind of efferveſcence; which ariſes the more readily, as the liquor abounds the more in ſulphur. By this action it becomes attenuated and rarefied; ſo that the groſſer parts being left behind, its finer parts are fitted to penetrate, and ſhoot through the veins to the brain, or are conveyed through the veins to the heart; whence, after a farther heat and rarefaction, they are ſent through the carotid arteries, &c. to the brain: hence neceſſarily ariſes a repletion of the meninges of the brain, and a compreſſion of the fibres of the brain itſelf, from the freſh ſtock of rarefied ſulphur continually aſcending into them: hence, alſo, ariſe obſtruction of the pores or paſſages of the brain, a frequent and diſorderly pulſation of the fibres, and the other ſymptoms of this diſtempered ſtate. Hence it is, that all liquors will not give drunkenneſs; but only ſuch as, by their ſulphur, or ſpirit, are diſpoſed for an efferveſcence in the ſtomach and heart, to diffuſe their ſubtle attenuated parts plentifully to the brain.

It is a popular miſtake, that the only remedy for gluttony, is drunkenneſs; or that the cure of a ſurfeit of meat, is a ſurfeit of of wine; than which nothing can be more contrary to nature.

The ancient Lacedæmonians uſed to make their ſlaves frequently drunk, to give their children an averſion and horror for this vice. The Indians hold drunkenneſs a ſpecies of madneſs; and in their languages, the ſame term *ramjam*, that ſignifies *drunkard*, ſignifies alſo a *phrenetic*.

DRY. A dry air, *cæteris paribus*, leſſens the weight of the human body, and the contrary quality increaſes it.

DRYADES, Dryads, in the heathen theology, the nymphs of the woods; a ſort of imaginary deities, which the ancients believed to inhabit the woods and groves, and to hide themſelves under the bark of the oak, called by the Greeks δϱυς.

The dryades differed from the hamadryades, in that theſe latter were attached to ſome particular tree, with which they were born, and with which they died; whereas the dryades were the goddeſſes of the trees and woods in general, and lived at large, in the middle thereof. For though δρυς properly ſignifies an oak, it was alſo uſed for tree in general.

We likewiſe find mention made, in divers authors, of a kind of propheteſſes, or witches, among the Gauls, called dryades, or rather druides.

DRYERS, in painting, are ſubſtances ſo called from their uſe in remedying the fault of oils, which dry too ſlowly.

DUCAL, in general, ſomething belonging to a duke. The letters patent granted by the ſenate of Venice, are called ducals: ſo alſo are the letters wrote in the name of the ſenate, to foreign princes. The denomination of ducal is derived hence; that, at the beginning of ſuch patents, the name of the duke, or doge, is wrote in capitals, thus, *N ——— Dei Gratia Dux Venetiarum*, &c. The date of ducals is uſually in Latin, but the body is in Italian.

Ducat, a foreign coin, either of gold or ſilver, being about the ſame value with the Spaniſh piece of eight, or a French crown, of four ſhillings and ſix pence ſterling, when of ſilver; and twice as much, when of gold.

The Spaniards have no ducats of gold; but, in lieu thereof, they make uſe of the ſilver one; which, with them, is no real ſpecies, but only a money of account, like our pound. The ſilver ducats of Florence ſerve there for crowns.

DUCATOON, a ſilver coin, ſtruck chiefly in Italy; particularly at Milan, Venice, Florence, Genoa, Lucca, Mantua, and Parma; though there are alſo Dutch and Flemiſh ducatoons. They are all nearly on the ſame footing; and, being a little both finer and heavier than the piece of eight, are valued at two-pence or three pence more, viz. at about four ſhillings and eight pence ſterling.

There is alſo a gold ducatoon, ſtruck and current chiefly in Holland: it is equivalent to twenty florins, on the footing of one ſhilling and eleven pence halfpenny the florin.

DUCK, *Anas*, in ornithology, the name of a very large genus of birds belonging to the 9th order, Anſeres, and the 2d diviſion. See Anas, and Decoy.

This fowl is furniſhed with a peculiar ſtructure of veſſels about the heart, which enable it to live without reſpiration a conſiderable time under water, as is neceſſary for it in diving. This made Mr. Boyle think it a more proper object for experiments by the air pump, than any of the other birds. A full grown duck being put into the receiver of the air pump, of which ſhe filled one third part, and the air exhauſted, the creature ſeemed to bear it better for the firſt moments, than a hen or other ſuch fowl; but after about a minute, ſhe gave great ſigns of diſcompoſure, and in leſs than two minutes her head fell down, and ſhe appeared dying, till revived by letting in the air. Thus, whatever facility of diving, this and other water fowl may have, it does not appear that they can ſubſiſt without air for reſpiration, any longer than other animals. A young callow duck was afterwards tried in the ſame manner, and with the ſame ſucceſs, being reduced very near death in leſs than two minutes. But it is obſervable, that both birds ſwelled extremely on the pumping out of the air, ſo as to appear much larger to the ſpectators, eſpecially about the crop. It not being intended that any water fowl ſhould live in an exceedingly rarified air, but only be able to continue on occaſion ſome time under water; nature, though ſhe has provided them with the means of this, has done nothing for them in regard to the other.

The ſtrongeſt inſtance of this creature's being calculated to live any where, we have in the accounts of the blind ducks of the Zirchnitzer lake in Carniola. It is now well known, that this lake communicates with another lake under ground in the mountain Savornick, and fills or empties itſelf according to the fulneſs or emptineſs of that lake; the waters of the upper lake running off at the time of its emptying by large holes in the bottom, and that in vaſt quantities. The ducks, which are very plentiful in the water, are often carried down with it, and forced into the ſubterraneous lake the waters retire to. In this unnatural habitation, many of them doubtleſs periſh, but ſome remain alive; theſe become blind, and loſe all their feathers, and in the next filling of the lake, both they and vaſt numbers of fiſh are thrown up with the water. They are fat at this time, but make a ſtrange appearance in their naked ſtate, and are eaſily caught, for want of ſight to avoid the danger. In about a fortnight they recover their ſight and their feathers, and are then of the ſize of a common wild duck, but of a black colour, having a white ſpot upon their forehead. When opened, on being taken at their firſt coming up in their blind ſtate, their ſtomachs are found full of ſmall fiſhes, ſomewhat reſembling weeds. It ſeems from this, that they cannot be abſolutely blind, but that the degree of light to which they ſeem accuſtomed in their dark habitation, had formed their eyes to ſee by that ſmall quantity, ſo well as to get their food by it; and their blindneſs on coming into broad day light again, is no other than that of a man who has been long in the dark, on having in an inſtant a large blaze of candles ſet juſt under his eyes. The eye in neither caſe can bear the ſudden change, and muſt be habituated to it, before it can ſee objects by it. Theſe blind ducks are not only caſt up in this lake, but after great rains they are frequently thrown up at a hole in the mountain Storſeg, near the town of Laas. The water guſhing out at this hole with great force on theſe occaſions, brings away with it theſe blind and bald ducks; and their frequency on theſe occaſions in theſe places, makes them eſteemed no rarity; but the common people underſtand that there are under ground lakes, which they inhabit, and out of which they are thus thrown. Phil. Tranſ. N° 191.

DUCKING, a penalty, which veteran ſailors pretend to inflict on thoſe who, for the firſt time, paſs the tropic of Cancer, the equator, or the ſtreights of Gibraltar, in conſequence of their refuſal or incapacity to pay the uſual fine, levied on this occaſion.

DUCT, Ductus, in anatomy, is applied in a general ſenſe to all the canals, or tubes, in the animal body, as veins, arteries, &c. through which the humours or juices are conveyed. Duct has alſo a more immediate application to ſeveral particular veſſels: as the

DUCTUS *Alimentalis*, a name given by Dr. Tyſon to the gula, ſtomach, and inteſtines; all which make but one continued canal, or duct. This duct he makes the proper characteriſtic of an animal.

Ductus, *Chyliferus*, or *Roriferus*, the ſame as *ductus thoracicus*, or thoracic duct. See Syſtem of Anatomy, Plate V. on the Viſcera, *Fig*. 4. letter H.

Ductus *Lachrymales*, the excretory veſſels of the glandulæ lachrymales, ſerving for the effuſion of tears. See Syſtem of Anatomy. Part VI. Sect. XI.

Ductus *Pancreaticus*, a little canal, ariſing from the pancreas, and opening into the duodenum; ſerving to diſcharge the pancreatic juice into the inteſtines. See Syſtem of Anatomy, Part V. Sect. VIII.

DUCTILITY, in phyſics, a property poſſeſſed by certain ſolid bodies, which conſiſts in their yeilding to percuſſion, or preſſure, and in receiving different forms without breaking.

Some bodies are ductile both when they are hot and when they are cold, and in all circumſtances. Such are metals, particularly gold and ſilver. Other bodies are ductile only when heated to a ſufficient degree; ſuch as wax and other ſubſtances of that kind, and glaſs. Other bodies, particularly ſome kinds of iron, called by the workmen red-ſhort, braſs and ſome other metallic mixtures, are ductile only when cold, and brittle when hot. The degrees of heat requiſite to produce ductility in bodies of the firſt kind, vary according to their different natures. In general, the heat of the body muſt be ſuch as is ſufficient to reduce it to a middle ſtate betwixt ſolidity and perfect fuſion. As wax, for inſtance, is fuſible with a very ſmall heat, it may be rendered ductile by a ſtill ſmaller one; and glaſs, which requires a moſt violent heat for its perfect fuſion, cannot acquire its greateſt ductility until it is made perfectly red-hot, and almoſt ready to fuſe. Laſtly, ſome bodies are made ductile by the abſorption of a fluid. Such are certain earths, particularly clay. When theſe earths have abſorbed a ſufficient quantity of water, to bring them into a middle ſtate betwixt ſolidity and fluidity, that is to the conſiſtence of a conſiderably firm paſte, they have then acquired their greateſt ductility. Water has preciſely the ſame effect upon them in this reſpect, that fire has upon the bodies above mentioned.

DUEL, a ſingle combat, at a time and place appointed, in conſequence of a challenge. This cuſtom came originally from the northern nations, among whom it was uſual to decide all their controverſies by arms. Both the accuſer and accuſed gave pledges to the judges on their reſpective behalf; and the cuſtom prevailed ſo far amongſt the Germans, Danes, and Franks, that none were excuſed from it but women, ſick people, cripples, and ſuch as were under 21 years of age, or above 60. Even eccleſiaſtics, prieſts, and monks, were obliged to find champions to fight in their ſtead. The puniſhment of the vanquiſhed was either death, by hanging or beheading; or, mutilation of members, according to the circumſtances of the caſe. Duels were at firſt admitted not only on criminal occaſions, but on ſome civil ones for the maintenance of rights to eſtates, and the like: in latter times, however, before they were entirely aboliſhed, they were reſtrained to theſe four caſes. 1. That the crime ſhould be capital. 2. That it ſhould be certain the crime was perpetrated. 3. The accuſed muſt by common fame be ſuppoſed guilty. And, 4. The matter not capable of proof by witneſſes.

Duel, at preſent, is uſed for ſingle combat on ſome private quarrel; and muſt be premeditated, otherwiſe it is called a rencounter. If a perſon is killed in a duel, both the principals and ſeconds are guilty whether the ſeconds engage or not. It is alſo a very high offence to challenge a perſon either by word or letter, or to be the meſſenger of a challenge. The ſevere edicts made by Lewis XIV. againſt duels have in a great meaſure put a ſtop to the practice in France.

The general practice of duelling, in this laſt ſenſe, took its riſe in the year 1527, at the breaking up of a treaty between the emperor Charles V. and Francis I. The former deſired Francis's herald to acquaint his ſovereign, that he would henceforth conſider him not only as a baſe violator of public faith, but as a ſtranger to the honour and integrity becoming a gentleman. Francis, too high-ſpirited to bear ſuch an imputation, had recourſe to an uncommon expedient to vindicate his character. He inſtantly ſent back the herald with a cartel of defiance, in which he gave the emperor the lie in form, challenged him to ſingle combat, requiring him to name the time and place of the encounter, and the weapons with which he choſe to fight. Charles, as he was not inferior to his rival in ſpirit or bravery, readily accepted the challenge; but after ſeveral meſſages concerning the arrangement of all the circumſtances relative to the combat, accompanied with mutual reproaches bordering on the moſt indecent ſcurrility, all thoughts of this duel, more becoming the heroes of romance than the two greateſt monarchs of their age, were entirely laid aſide.

The example of two perſonages ſo illuſtrious, drew ſuch general attention, and carried with it ſo much authority, that it had conſiderable influence in introducing an important change in manners all over Europe. Duels, as has already been obſerved, had been long permitted by the laws of all the European nations; and, forming a part of their juriſprudence, were authoriſed by the magiſtrate on many occaſions, as the moſt proper method of terminating queſtions with regard to property, or of deciding in thoſe which regarded crimes. But ſingle combats being conſidered as ſolemn appeals to the omniſcience and juſtice of the Supreme Being, they were allowed only in public cauſes, according to the preſcription of law, and carried on in a judicial form. Men, accuſtomed to this manner of deciſion in courts of juſtice, were naturally led to apply it to perſonal and private quarrels. Duels, which at firſt could be appointed by the civil judge alone, were fought without the interpoſition of his authority, and in caſes to which the laws did not extend. The tranſaction between Charles and Francis ſtrongly countenanced this practice. Upon every affront or injury which ſeemed to touch his honour, a gentleman thought himſelf entitled to draw his ſword, and to call on his adverſary to make preparation. Such an opinion, introduced among men of fierce courage, of high ſpirit, and of rude manners, where offence was often given, and revenge was always prompt, produced moſt fatal conſequences. Much of the beſt blood in Chriſtendom was ſhed; many uſeful lives were loſt; and, at ſome periods, war itſelf hath hardly been more deſtructive than theſe conteſts of honour. So powerful, however, is the dominion of faſhion, that neither the terror of penal laws, nor reverence for religion, have been able entirely to aboliſh a practice unknown among the ancients, and not juſtifiable by any principle of reaſon; though at the ſame time it muſt be admitted, that to this abſurd cuſtom we muſt aſcribe, in ſome degree, the extraordinary gentleneſs and complaiſance of modern manners, and that reſpectful attention of one man to another, which at preſent render the ſocial intercourſes of life far more agreeable and decent than among the moſt civilized nations of antiquity.

DUKE is either the title of a ſovereign prince, as the duke of Savoy, Parma, &c. the grand duke of Tuſcany, Muſcovy, &c.; or it is the title of honour and nobility next below princes. The commanders of armies in time of war, the governors of provinces and wardens of marches in times of peace, were called duces under the later emperors. The Goths and Vandals divided all Gaul into duchies and counties, the governors of which they ſometimes call duces, and ſometimes comites. In France, under the ſecond race of kings, though they retained the name and form of ducal government, there were ſcarce any dukes except thoſe of Burgundy, Aquitain, and France.

In Britain, a duke, though, in reſpect of his title of nobility, he is inferior in point of antiquity to many others, yet is ſuperior in rank to all of them; his being the firſt title of dignity after the royal family. Among the Saxons, the Latin name of dukes, *duces*, is very frequent; and ſignified, as among the Romans, the commanders or leaders of their armies. But after the Norman conqueſt, which changed the military polity of the nation, the kings themſelves continuing for many generations dukes of Normandy, they would not honour any ſubject with that title till the time of Edward III.; who claiming to be the king of France, and thereby loſing the ducal in the royal dignity, in the 11th year of his reign created his ſon, Edward the black prince, duke of Cornwall; and many, of the royal family eſpecially, were afterwards raiſed to the ſame honour. However, in the reign of Queen Elizabeth, A. D. 1572, the whole order became utterly extinct: but it was revived about 50 years afterwards by her ſucceſſor, who was remarkably prodigal of honours, in the perſon of George Villiers duke of Buckingham.

A duke is created by patent, cincture of ſword, mantle of ſtate, impoſition of a cap and coronet of gold on his head, and a verge of gold put into his hand. His title is Grace; and, in the ſtyle of the heralds, Moſt high, potent, high-born, and noble prince. For the different dukes of Great Britain and Ireland, ſee Syſtem of PEERAGE.

DULCIFYING, in chymiſtry, is the ſweetening any matter impregnated with ſalts, by frequently waſhing it in pure water.

DULCIMER, a muſical inſtrument, in the ſhape of a ſmall cheſt or box, with ſtrings on the lid of it.

DULWICH *Water*, a well known mineral water near London. It contains a kind of cathartic bitter ſalt: it ſeems not to have any iron in it. Phil. Tranſ. N° 461. § 22.

DUMBNESS, the privation of the faculty of ſpeech. The moſt general, or rather the ſole cauſe of dumbneſs, is the want of the ſenſe of hearing. The uſe of language is originally acquired by imitating articulate ſounds. From this ſource of intelligence, deaf people are entirely excluded: they cannot acquire articulate ſounds by the ear: unleſs, therefore, articulation be communicated to them by ſome other medium, theſe unhappy people muſt for ever be deprived of the uſe of language; and as language is the principal ſource of knowledge, whoever has the misfortune to want the ſenſe of hearing, muſt remain in a ſtate little ſuperior to that of the brute creation. Deafneſs has in all ages been conſidered as ſuch a total obſtruction to ſpeech, or written language, that an attempt to teach the deaf to ſpeak or read has been uniformly regarded as impracticable, till Doctor Wallis and ſome others have of late ſhewn, that although deaf people cannot learn to ſpeak or read by the direction of the ear, there are other ſources of imitation, by which the ſame effect may be produced. The organs of hearing and of ſpeech have little or no connection. Perſons deprived of the former generally poſſeſs the latter in ſuch perfection, that nothing further is neceſſary, in order to make them articulate, than to teach them how to uſe theſe organs. This indeed is no eaſy taſk; but experience ſhews that it is practicable. See DEAFNESS.

Mr. Thomas Braidwood, of Edinburgh, is perhaps the firſt who ever brought this ſurpriſing art to any degree of perfection. He began with a ſingle pupil in 1764; and for ſome years paſt, he has taught many people born deaf, to ſpeak diſtinctly, to read, to write, to underſtand figures, the principles of religion and morality, &c. This, at firſt ſight, may appear to be altogether incredible; but the fact is certain. Mr. Braidwood has, at preſent, a conſiderable number of deaf pupils, ſome of them above 20 years of age, all making a rapid and amazing progreſs in thoſe uſeful branches of education.

Mr. Braidwood's principal difficulty, after he had diſcovered this art, was to make people believe in the practicability of it. He advertiſed in the public papers; he exhibited his pupils to many noblemen and gentlemen; ſtill he found the generality of mankind unwilling to believe him. A remarkable inſtance of this incredulity occured ſome years ago. A gentleman in England ſent a deaf girl of his to Mr. Braidwood's care. A year or two afterwards, Mr. Braidwood wrote to the father, that his daughter could ſpeak, read, and write diſtinctly. The father returned an anſwer, begging Mr. Braidwood's excuſe, as he could not believe it; however, he deſired a friend of his, who was occaſionally going to Edinburgh, to call on Mr. Braidwood, and inquire into the truth of what he had wrote him; he did ſo; converſed with Mr. Braidwood, ſaw the young lady, heard her read, ſpeak, and anſwer any queſtions put to her. On his return, he told the father the ſurpriſing progreſs his child had made; but ſtill the father thought the whole an impoſition: the girl herſelf wrote to her father, but he looked upon the letter as a forgery. About this time the father died: and the mother ſent an uncle and couſin of the deaf lady's from Shrewſbury, in order to be ſatisfied of the truth. When they arrived, Mr. Braidwood told the girl her uncle and couſin were in the parlour; and deſired her to go and aſk them how they did, and how her mother and other friends did. The friends were aſtoniſhed, and could hardly credit their own ears and eyes.

We have converſed with Mr. Braidwood, concerning the nature and method of teaching this wonderful art: he ſeems to be very deſirous of communicating and tranſmitting his diſcovery to poſterity; but ſays, and, from the nature of the thing, we believe it to be true, that he cannot communicate it ſo fully in writing as to enable any other perſon to teach it. The firſt thing in the method is, to teach the pupil to pronounce the ſimple ſounds of the vowels and conſonants. We have even ſeen him performing this operation; but are unable to give a clear idea of it. He pronounces the ſound of *a* ſlowly, pointing out the figure of the letter at the ſame time; makes his pupil obſerve the motion of his mouth and throat; he then put his finger into the pupil's mouth, depreſſes or elevates the tongue, and makes him keep the parts in that poſition; then he lays hold of the outſide of the windpipe, and gives it ſome kind of ſqueeze, which it is impoſſible to deſcribe; all the while he is pronouncing *a*, the pupil is anxiouſly imitating him, but at firſt ſeems not to underſtand what he would have him to do. In this manner he proceeds, till the pupil has learned to pronounce the ſounds of the letters. He goes on in the ſame manner to join a vowel and a conſonant, till, at length the pupil is enabled both to ſpeak and read.

That Mr. Braidwood is capable of teaching his pupils not only the mere pronunciation, but alſo to underſtand the meaning of what they read, may be aſcertained by a converſation with any of his pupils. Of this Mr. Pennant gives a remarkable inſtance in a young lady of about 13 years of age, who had been ſome time under the care of Mr. Braidwood. "She readily apprehended (ſays he) all I ſaid, and returned me anſwers with the utmoſt facility. She read; ſhe wrote well. Her reading was not by rote. She could clothe the ſame thoughts in a new ſet of words, and never vary from the original ſenſe. I have forgot the book ſhe took up, or the ſentences ſhe made a new verſion of; but the effect was as follows:

"*Original paſſage.* Lord Bacon has divided the whole of human knowledge into hiſtory, poetry, and philoſophy; which are referred to the three powers of the mind, memory, imagination, and reaſon.

"*Verſion.* A nobleman has parted the total or all of man's ſtudy, or underſtanding, into an account of the life, manners, religion or cuſtoms of any people or country; verſe, or metre; moral or natural knowledge: which are pointed to the three faculties of the ſoul or ſpirit; the faculty of remembering what is paſt, thought or conception, and right judgment."

It is altogether in vain for us to attempt to ſay any more concerning the mode of operation. Mr. Braidwood undertakes every deaf perſon, who is not at the ſame time fooliſh or idiotical. The greateſt misfortune is, that this art is confined to a ſingle man, and his pupils muſt live in the houſe with him for ſome years. The expence neceſſarily attending education of this kind, excludes all but people in opulent circumſtances from deriving any advantage from it. Mr. Braidwood ſays, that the only way for preſerving the art, and communicating it to a number, is to take people in the way of apprentices: this he is unable to do at his own expence. What a pity, that ſuch a curious and uſeful art ſhould live and die with a ſingle man! There are many ſums applied in this kingdom, both by government and private perſons, to leſs important purpoſes, than the preſervation and extenſion of the art of raiſing a great number of our fellow creatures from the rank of brutes, to that of reaſonable beings and uſeful members of ſociety.

DUMOSÆ, (from *dumus, a buſh*), an order of plants in the *Fragmenta methodi naturalis* of Linnæus, containing the following genera, viz. *Viburnum, Tinus, Opulus, Sambucus, Rondeletia, Bellonia, Caſſine, Ilex, Tomax, &c.*

DUNDIVER, in ornithology, the name of a water fowl; according to Linnæus, it belongs to the 28th genus, called Mergus. See MERGUS.

DUNG, in agriculture, &c. All kinds of dung contain ſome matter, which, when mixed with the ſoil, ferments therein, and, by that fermentation, diſſolves the texture of the earth, and divides and crumbles its particles very much. This is the real uſe of dung in agriculture; for, as to the pure earthy part of it, the quantity is ſo very ſmall, that after a perfect putrefaction, it bears an extremely inconſiderable proportion to that of the earth it is intended to manure. See Syſtem of AGRICULTURE, Sect. II.

DUNG-WORMS, a ſpecies of fly-worms, of a ſhort and ſomewhat flat body, found in great plenty among the cow-dung in the months of September and October. Theſe have all their metarmorphoſes into the fly-ſtate, performed within a ſhell of their own ſkin.

DUODECIMO, a thing divided into twelve parts. A book is ſaid to be in duodecimo, when twelve of its leaves make a ſheet of paper.

DUODENA *Arteria*, and *Vena*, a branch of an artery, which the duodenum receives from the cœliac; to which anſwers a vein of the ſame name, returning the blood to the porta.

DUODENUM, in anatomy, the firſt of the *inteſtina tenuia*, or ſmall guts; being that which receives the food half chylified from the ſtomach. See Syſtem of ANATOMY, Part V. Sect. VI.

It has its name *duodenum*, as being above twelve fingers breadth long; on which account, ſome call it *dodeea, dactylum*.

The deſcription and draughts of the *duodenum*, as given by moſt anatomiſts, appearing faulty, Mr. Monro has endeavoured to rectify their omiſſions and miſtakes in the Med. Eſſ. Edinb. vol. iv. Art. 11.

This inteſtine is ſometimes found ſo large, as to be called *ventriculus ſuccenturiatus*.

Authors ſeldom take notice of the duodenum as the ſeat or cauſe of any particular diſeaſe; but its diſtention and preſſure on the many veſſels to which it is contiguous, may diſturb the functions of the animal œconomy; and accordingly it is the ſource of many diſorders, which may be relieved by emetics and purgatives.

DUPLICATE, a ſecond inſtrument, or act in writing; or a tranſcript, or copy of another. The word is formed from the latin *dupluma*, or *duplum*, double. It is uſual to ſend a duplicate, when it is apprehended the firſt diſpatch, &c. is loſt.

Duplicate, in chancery, is particularly uſed for a ſecond letter patent granted by the lord chancellor, in a caſe where he had formerly done the ſame.

Duplicate *Ratio*, the ratio between the ſquares of two quantities. Thus the duplicate ratio of *a* to *b* is the ratio of *a a* to *b b*, or of the ſquare of *a* to the ſquare of *b*. See Syſtem of Geometry.

DUPLICATURE, in anatomy, a doubling or folding of membranes, or other like parts. Such are the duplicatures of the peritonæum, of the omentum, of the pleura, &c.

DURA *Mater*, or *Menix*, a ſtrong, thick membrane, which lines or covers all the inner cavity of the cranium, and includes the whole brain; being itſelf lined on its inner, or concave, ſide, by the pia mater, or meninx tenuis. See Syſtem of Anatomy, Part VI. Sect. I. and Plate II. *Fig.* 3.

DURATION, an idea we get by attending to the fleeting, and perpetual periſhing parts of ſucceſſion. See Metaphysics.

Duration, as marked by certain periods and meaſures, is what we moſt properly call time. See Time.

DUST, minute and almoſt inſenſible particles broken off from any hard body. Thoſe broken from ſtones, or formed of extremely ſmall ſtones are more properly called ſand. The ſubtle matter of Des Cartes is a ſort of duſt produced by the colliſion of the matter of the ſecond element.

Gold and *Lead* Dust. See the reſpective Articles.

DUTCHY, in geography, an appellation given to the dominions of a duke.

DUTY, in general, denotes any thing that one is obliged to perform.

Duty, in a moral ſenſe. See Moral Philosophy.

Duty, in polity and commerce, ſignifies the impoſt laid on merchandizes, at importation or exportation, commonly called the duties of cuſtoms; alſo the taxes of exciſe, ſtamp-duties, &c. See Customs.

The principles on which all duties and cuſtoms ſhould be laid on foreign merchandizes which are imported into theſe kingdoms, are ſuch as tend to cement a mutual friendſhip and traffic between one nation and another; and therefore due care ſhould be taken in the laying of them, that they may anſwer ſo good an end, and be reciprocal in both countries; they ſhould be ſo laid as to make the exports of this nation at leaſt equal to our imports from thoſe nations wherewith we trade, ſo that a balance in money ſhould not be iſſued out of Great Britain, to pay for the goods and merchandizes of other countries; to the end that no greater number of our landholders and manufactures ſhould be deprived of their revenues ariſing from the product of the lands, and the labour of the people, by foreign importations, than are maintained by exportations to ſuch countries. Theſe are the national principles on which all our treaties of commerce with other countries ought to be grounded.

Duty, in the military art, is the exerciſe of thoſe functions that belong to a ſoldier; with this diſtinction, that mounting guard, and the like, where there is no enemy directly to be engaged, is called duty; but marching to meet and fight an enemy is called going on ſervice.

DUUMVIR, a general appellation among the ancient Romans, given to magiſtrates, commiſſioners, and officers, where two were joined together in the ſame function. So that they had almoſt as many duumviri, as they had officers joined two by two in commiſſion.

There are duumviri to direct the building, repairing, and conſecrating, of temples and altars; capital duumviri, who took cognizance of crimes, and condemned to death; duumviri of the marine, or navy, &c.

DUUMVIRATE, Duumviratus, the magiſtrature, office, or dignity, of the duumviri.

DWALE, or Dwal, in heraldry, the herb nightſhade; uſed by ſuch as blazon with flowers and herbs, inſtead of colours and metals, for ſable, or black.

DWARF, in general, an appellation given to things greatly inferior in ſize to that which is uſual in their ſeveral kinds: thus there are dwarfs of the human ſpecies, dwarf-dogs, dwarf-trees, &c.

The Romans were paſſionately fond of dwarfs, whom they called *nani* or *nanæ*, inſomuch that they often uſed artificial methods to prevent the growth of boys deſigned for dwarfs, by incloſing them in boxes, or by the uſe of tight bandages. Auguſtus's niece, Julia, was extremely fond of a dwarf called Sonopas, who was only two feet and an hand breadth high. We have many other accounts of human dwarfs, but moſt of them deformed in ſome way or other beſides the ſmallneſs of their ſize. Many relations alſo concerning dwarfs we muſt neceſſarily look upon to be fabulous, as well as thoſe concerning giants. The following hiſtory, however, which we have reaſon to look upon as authentic, is too remarkable not to be acceptable to the generality of our readers.

Jeffery Hudſon, the famous Engliſh dwarf, was born at Oakham in Rutlandſhire in 1619; and about the age of ſeven or eight, being then but 18 inches high, was retained in the ſervice of the duke of Buckingham, who reſided at Burleigh on the Hill. Soon after the marriage of Charles I. the king and queen being entertained at Burleigh, little Jeffery was ſerved up to table in a cold pye, and preſented by the ducheſs to the queen, who kept him as her dwarf. From 7 years of age till 30, he never grew taller; but after 30, he ſhot up to three feet nine inches, and there fixed. Jeffery became a conſiderable part of the entertainment of the court. Sir William Davenant wrote a poem called Jeffreidos, on a battle between him and a turkey-cock; and in 1638 was publiſhed a very ſmall book, called the New Year's Gift, preſented at court by the lady Parvula to the lord Minimus (commonly called Little Jeffery) her majeſty's ſervant, &c. written by Microphilus, with a little print of Jeffery prefixed. Before this period, Jeffery was employed on a negociation of great importance: he was ſent to France to fetch a midwife for the queen; and on his return with this gentlewoman, and her majeſty's dancing-maſter, and many rich preſents to the queen from her mother Mary de Medicis, he was taken by the Dunkirkers. Jeffery, thus made of conſequence, grew to think himſelf really ſo. He had borne with little temper the teazing of the courtiers and domeſtics, and had many ſquabbles with the king's gigantic porter. At laſt, being provoked by Mr. Crofts, a young gentleman of family, a challenge enſued: and Mr. Crofts coming to the rendezvous armed only with a ſquirt, the little creature was ſo enraged, that a real duel enſued; and the appointment being on horſeback with piſtols, to put him more on a level, Jeffery, with the firſt fire, ſhot his antagoniſt dead. This happened in France, whither he had attended his miſtreſs in the troubles. He was again taken priſoner by a Turkiſh rover, and ſold in Barbary. In 1644, he attended the queen to France, where he remained till the Reſtoration. At laſt, upon ſuſpicion of his being privy to the Popiſh plot, he was taken up in 1682, and confined in the Gatehouſe, Weſtminſter, where he ended his life, in the 63d year of his age.

In the Philoſophical Tranſactions we have well authenticated accounts of two dwarfs: one born in Norfolk, who, at the age of twenty-two, weighed no more than thirty-four pounds with all his cloaths on, and whoſe height, including hat, wig, and ſhoes, was only thirty-eight inches; and another in Wales, who, at the age of fifteen, meaſured no more than two feet ſeven inches, and weighed only 13 pounds; and who at that early period of life laboured under all the infirmities and calamities of very old age. Phil. Tranſ. vol. xlvi. p. 67, and vol. xlvii. p. 279.

Dwarf *Trees*, a ſort of diminutive fruit trees, frequently planted in the borders of gardens; thus called from the lowneſs of their ſtature.

Dwarf trees were formerly very much in requeſt in gardens; but ſince the introducing of eſpaliers, they are much neglected. The manner however of propagating dwarf pears, which have been found to ſucceed the beſt of any dwarfs, is this: they are to be grafted a quince ſtock, and that at about ſix inches above the ground; and when the bud has ſhot ſo far as to have four eyes, it is to be ſtopped, to give riſe to lateral branches. Two years after the budding, the trees will be fit to tranſplant to the ſpot where they muſt remain. They ſhould be ſet at five and twenty, or thirty feet ſquare diſtance, and the ground between may be ſown or planted for kitchen uſe, while the trees are young, only obſerving not to plant too near their roots. There ſhould be ſtakes driven down all round the tree, to which the branches muſt be nailed with liſt, while they are young, training them into an horizontal direction, and no branches are to be ſuffered afterwards to croſs one another, and in ſhortening the ſhoots, the uppermoſt eye muſt always be left outwards. The ſummer and autumn pears are thoſe which do beſt in dwarfs, for the winter ones never ſucceed well on them.

Apples are alſo ſometimes planted as dwarfs, and are for this purpoſe moſt commonly grafted on paradiſe ſtocks. Theſe ſpread much leſs than the pears, and therefore need only be ſet at about eight feet diſtance. Some alſo plant apricots and plums for dwarfs; but theſe being of a more tender conſtitution, ſeldom ſucceed well. Miller.

DYEING, in the utmoſt latitude of the word, may be defined, the art of tingeing cloth, ſtuff, or other matter, with a permanent colour, which penetrates the ſubſtance thereof. It is, however, commonly reſtrained to the art of tingeing ſilk, wool, cotton, and linen, with different colours; and, as ſuch, is practiſed as a trade by thoſe who do not meddle with any of the other branches, as ſtaining of leather, &c.

TREATISE ON DYEING.

Antiquities of the Art.

THE dyeing art is of great antiquity; as appears from the traces of it in the oldeſt ſacred, as well as profane writers. The honour of the invention is attributed to the Tyrians; though what leſſens the merit of it is, that it is ſaid to have owed its riſe to chance.

The juices of certain fruits, leaves, &c. accidentally cruſhed, are ſuppoſed to have furniſhed the firſt hint: Pliny aſſures us, that even in his time the Gauls made uſe of no other dyes: it is added, that coloured earths, and minerals, waſhed and ſoaked with rain, gave the next dyeing materials. But purple, an animal juice, found in a ſhell fiſh called murex, conchylium, and purpura, ſeems from hiſtory to have been prior to any of them. This indeed was reſerved for the uſe of kings and princes; private perſons were forbidden by law to wear the leaſt ſcrap of it. The diſcovery of its tingeing quality is ſaid to have been taken from a dog, which having caught one of the purple fiſhes among the rocks, and eaten it up, ſtained his mouth and beard with the precious liquor; which ſtruck the fancy of a Tyrian nymph ſo ſtrongly, that ſhe refuſed her lover Hercules any favours till he had brought her a mantle of the fine colour.

Pliny ſeems to aſcribe the invention of the art of dyeing wool to the Lydians of Sardis: "*Inficere lanas Sardibus Lydi*;" where the word *incipere* muſt be underſtood. But a modern critic ſuſpects a falſe reading here; and, not without reaſon, for *Lydi*, ſubſtitutes *Lydda*, the name of a city on the coaſt of Phœnicia, where the chief mart of the purple dye was.

After the Phœnicians, the Sardinians ſeem to have arrived at the greateſt perfection in the dyeing art; inſomuch, that *βαμμα Σαρδινιακον, Sardinian dye*, paſſed into a proverb among the Greeks. Till the time of Alexander, we find no other ſort of dye in uſe among the Greeks but purple and ſcarlet. It was under the ſucceſſors of that monarch, that theſe people applied themſelves to the other colours; and invented, or at leaſt perfected, blue, yellow, green, &c. For the ancient purple, it has been long loſt; but the perfection to which the moderns have carried the other colours, abundantly indemnifies them of the loſs. It is ſtill, however, greatly to be doubted whether the permanency of the modern colours at all equals that of the ancient ones; though it is certain, that the former greatly exceed them in brightneſs.

SECT. I. THEORY OF DYEING.

Salts the only Means of fixing Colours.

Before we can enter into any conſideration of the true theory of dyeing, it is neceſſary to make the following obſervation concerning the practice, namely, The ſalts are almoſt the only means we are acquainted with by which any colouring ſubſtance can be made to fix itſelf upon thoſe matters which are the common ſubjects of dyeing. A ſolution of cochineal, for inſtance, will of itſelf impart no permanent colour to a piece of woollen cloth put into it. The red colour of the cochineal will indeed ſtain the cloth while it remains immerſed in the ſolution; but as ſoon as it is taken out and waſhed, this temporary ſtain will immediately vaniſh, and the cloth become as white as before. If now the cloth is dipped in the ſolution of any ſaline ſubſtance, alkalies alone excepted, and then immerſed in the ſolution of cochineal for ſome time, it will come out permanently coloured; nor will the colour be diſcharged even by waſhing with ſoap and water. If a quantity of ſalt is added to the ſolution of cochineal, and the cloth put in without being impregnated with any ſaline ſubſtance, the effect will be the ſame; the cloth will come out coloured; only in this laſt caſe, it muſt be well dried before waſhing it with ſoap, or moſt of the colour will be diſcharged.

They operate by Coagulation.

A ſaline ſubſtance, (ſolution of tin in aqua regia), has a ſurpriſing power of coagulating the colouring matter of certain ſolutions, ſuch as cochineal, Brazil wood, logwood, &c. If therefore a piece of cloth is previouſly impregnated with this ſolution, and put into the colouring one, it is plain that ſome part of the colouring matter will be coagulated by the ſolution remaining in the cloth, in the very ſame manner that it would have been if a ſmall quantity of the ſaline ſolution had been poured into the other. The cloth therefore will take up a part of the colouring matter, which cannot be diſcharged but by entirely diſcharging the ſolution of tin. This, however, ſeems to unite itſelf with the cloth very firmly, ſo that ſcarce a particle of colour will be diſcharged by waſhing in plain water, or even with ſoap; nor can the whole be taken out, without boiling the cloth in a ſolution of fixed alkali.

Though ſolution of tin produces this coagulation in the moſt remarkable manner, it is not to be doubted that the ſame power is poſſeſt in ſome degree by moſt of the neutrals and imperfect ſalts. Alum poſſeſſes it very conſiderably, though not ſo much as ſolution of tin; and hence that ſalt is very much uſed in dyeing, as well as ſugar of lead, which alſo has a very ſtrong power of coagulation. The proceſs of dyeing, therefore, ſeems to be moſt analogous to that of the coagulation or curdling of milk. Before it has ſuffered this change, the milk is eaſily miſcible with water; but after it is once coagulated, the curd, or caſeous part, is very difficultly ſoluble in any liquid whatever. In like manner, the colouring matter in the ſolution of cochineal, before the cloth is put in, is eaſily ſoluble in water, and may be diffuſed through any quantity of fluid: but no ſooner is the cloth dipped in it, than the ſaline ſubſtance contained in the cloth coagulates that part of the colouring matter which lies in immediate contact with it; and, as all the fluid ſucceſſively comes into contact with it, the whole of the colour is by degrees coagulated and depoſited on the cloth.

Hypotheſes concerning the Adheſion of the Colour.

To account for the ſtrong adheſion of the colour to the dyed cloth, ſeveral hypotheſes have been formed. One is, That the fibres of wool, ſilk, &c. are hollow tubes; that the colouring matter enters them; and, after being there coagulated, ſhews itſelf through the fine tranſparent ſides of the tubes. Another conſiders theſe filaments as ſolid lengthwiſe, but having all round their ſides an infinite number of ſmall pores like the extremities of the fine abſorbing and exhaling veſſels of the human body. In theſe pores, according to the hypotheſis, the colour is lodged; and as the pores are placed exceedingly cloſe to one another, the fine threads appear to our eyes of one uniform colour. A third is, That the fibres are ſolid, or at leaſt with reſpect to us may be conſidered as ſuch. The ſaline ſubſtance, whatever it is, that is employed to make the colour ſtrike, ſinks into the ſurface, partly corrodes and unites itſelf with it into a third kind of ſubſtance no longer ſoluble in plain water, nor even eaſily by ſoap, but which ſtill preſerves its coagulating quality. According to this hypotheſis, the dye lies entirely on the out ſide of the ſtuff, and continues as long as the effect of the ſalt continues upon the fibres of the matter to be dyed.

Concerning the truth of theſe hypotheſes, or indeed any others that can be invented, it is impoſſible to bring any deciſive proof. It ſeems, however, more probable that the proceſs of dyeing is accompliſhed by a coagulation of the colouring matter itſelf, rather than by any agglutination of it to the fibres by means of a vitriolated tartar, as Mr. Hellot ſuppoſes.

Mr. Hellot's Hypotheſis diſproved.

According to this gentleman's theory, a vitriolated tartar is generated in every proceſs for dyeing, and proceeds from the acid of the alum and alkaline baſis of the tartar uſed in the preparations, or in ſome of the dyeing ingredients themſelves. He ſuppoſes that the pores of the ſtuff are cleanſed and enlarged by the preparatory ſalts, and by the boiling water, in ſuch a manner as to receive the colouring particles, which particles are afterwards detained by the contraction of the pores occaſioned by cold; and further, that theſe pores are lined with a ſaline cruſt of tartar or vitriolated tartar.

On this theory, the tranſlator of the Chymical Dictionary has the following obſervations. "Mr. Hellot has not ſhown that pure fixed alkali is incapable of producing the effects which he attributes to his tartar and vitriolated tartar; and both theſe ſalts, though they are difficult of ſolution, and require a great quantity of water for this purpoſe, will yet diſſolve at laſt; and therefore, if the colouring particles were fixed chiefly by means of theſe ſalts, they might be waſhed out by a large quantity of water.

Another Hypotheſis.

"We ſhall find it more difficult to ſubſtitute a true theory, than to refute that of Mr. Hellot. Many experiments ought to be previouſly made. Nevertheleſs it may be obſerved, That the colorific particles of moſt ſubſtances uſed in dyeing ſeem to be inſoluble in water, in ſpirit of wine, and even in alkaline lixiviums; that their diffuſion through theſe liquids is cauſed merely by their adheſion to certain gummous and reſinous particles: and that they may be diſengaged from thoſe gummy and reſinous matters, by applying a piece of ſtuff to which they have a greater adheſive power, which ſeems to be the caſe of the root coloured and blue dyes; or by applying another ſubſtance to which theſe particles have a greater power of adheſion; ſuch as the earth of alum, in thoſe dyes where that ſalt is uſed, together with ſome other ſubſtance, as fixed or volatile alkali, capable of decompoſing alum; or as the ferruginous earth of the green vitriol in black dyes, to which the colorific particles of the galls adhere; which earths are capable of applying themſelves and of adhering to the ſtuffs. The ſeparation of the colouring particles from the gummy and reſinous matters is probably facilitated by the addition of acids and neutral ſalts, which may coagulate in ſome meaſure the vegetable matters, and leave the colorific particles diſengaged; ſo that they may apply themſelves to the ſtuff, or to the earths above mentioned."

But, in whatever way the ſalts uſed in dyeing do act, it is certain they are capable, except in a very few inſtances, of fixing and giving a luſtre and permanency to the colour, which otherwiſe could never be obtained.

Exceptions to the General Rule.

The exception to this general rule moſt commonly known, is that of indigo. This is a fine blue fecula produced by fermentation from the leaves of the Indian plant called *anil*. It is very difficult of ſolution; however it may be diſſolved by alkaline ſalts, concentrated oil of vitriol, orpiment, or combinations of ſulphur with quicklime. If a quantity of indigo is diſſolved in a fixed alkali, (for volatile alkalies will not diſſolve it), the ſolution is always green, which is the natural colour, produced in all vegetable blues by the alkali: but if any piece of ſtuff is put into this ſolution, though it remains while immerſed in the liquid, the moment it comes in contact with the air, the diſſolving power of the alkali is totally deſtroyed; the indigo is precipitated upon the cloth, reſumes its native colour, and dyes the cloth blue.

The cauſe of this precipitation is very difficult to be inveſtigated. Perhaps it may be owing to an attraction of fixed air by the alkali from the atmoſphere, which renders the ſalt unable to diſſolve the indigo any longer. The adheſion of the colour ſeems merely owing to an attraction between it and the cloth; for the alkaline ſalt can contribute nothing to this, but would rather have the contrary effect. Perhaps, however, the great ſolvent power poſſeſſed by alkaline ſalts, by perfectly clearing away every kind of ſordes, may bring the indigo and cloth into nearer contact with each other, than when it is diſſolved in any other way; and conſequently the attraction will in theſe caſes be the ſtronger. This ſeems to have ſome probability; for when indigo is diſſolved in vitriolic acid, as in dyeing Saxon blue, the colour is much more eaſily diſcharged.

Another exception is in the juices of ſome vegetables, ſuch as the nuts of the anacardium. This produces, without addition, a moſt deep and laſting black, never to be waſhed out or diſcharged by any means whatever. Several other plants are to be found in different parts of the world, which give an indelible black ſtain upon linen without addition; and the colouring matter of theſe ſeems to adhere by means of a very tenacious gluten, with which it is mixed, and which, when once thoroughly dried, can never be again diſſolved. In this reſpect, theſe black ſtaining colours ſeem analogous to the *purpura* of the ancients; which ſtained indelibly without addition, and was of an exceedingly viſcous and adheſive nature.

SECT. II. PRACTICE OF DYEING.

Of the colouring Materials, and Ingredients for fixing the Colours.

True and falſe Dyes.—The materials for dyeing different colours are ſo many and various, that an enumeration of them all is ſcarce to be expected. Some ingredients produce durable colours, which cannot be diſcharged either by expoſure to the air, or by waſhing with ſoap: others, though they may be made to ſtand the action of ſoap pretty well, cannot by any means be enabled to reſiſt the action of the air. Theſe are diſtinguiſhed by the different names of *true* and *falſe*, *permanent* and *fading*, &c. nor is there any method yet diſcovered of giving the falſe colours an equal degree of durability with the true ones. This hath been attempted by mixing a permanent and a fading colour together; in which caſe it was thought that the former would impart ſomewhat of its durability to the latter: but this hath always been found to miſgive; the fading colour ſoon flying off, and leaving the permanent one behind. The ſame hath alſo been attempted by dyeing a piece of ſtuff partially with a fading colour, and then completing the dye with a permanent one. In this caſe, it was hoped that the fading colour being covered over, and defended from the injuries of the air, by the permanent one, would neceſſarily become equally durable, or at leaſt remain a much longer time than if the ſtuff was dyed with it alone. But this alſo hath been found ineffectual; and the fading colour hath been diſſipated as ſoon when covered with a permanent one, as when left without any ſuch cover. Solution of tin in aqua regia will give moſt of theſe fading colours an high degree of beauty, and ſome ſhare of durability, though even that is not able to make them equal to the others. The moſt permanent dyes we have are cochineal and gum lac for fine reds and ſcarlets; indigo and woad for blue; and when mixed in different proportions with cochineal, or lac, for purple and violet colours. Weld, and ſome other vegetables, for yellow; and madder for coarſe reds, purples, and blacks. The fading colours are much more numerous. In this claſs are included brazil-wood, log-wood, peach-wood, red-wood, fuſtic, turmeric root, annotto, archil, &c. &c.

Salts to be uſed in Dyeing.

With regard to the ſalts made uſe of in dyeing, it hath been but too often cuſtomary to jumble together ſuch a quantity of different ones, that it was not only impoſſible to know in what particular ſalt the virtue reſided, but often the efficacy of the whole hath been totally deſtroyed, and the colour entirely ſpoiled by ſuch injudicious management. It is proper, therefore, where a mixture of two or more ſalts is intended to be made for dyeing, firſt to try the change of colour produced by each of the ſalts upon the colouring ſubſtance. If the colours are nearly alike, the mixture may be ſafely made as to that particular. But if the two colours produced by the different ſalts are very different from one another, to mix them together muſt be very injudicious. Thus, ſuppoſe you want to dye ſcarlet, ſolution of tin in aqua regia produces the neceſſary change of colour on the decoction of cochineal, and converts it into a high flame colour, which ſhews it to be a proper ingredient; but, to the ſolution of tin, it would ſurely be the greateſt abſurdity to add a quantity of ſaccharum ſaturni, the effect of which is to change the colour of cochineal to a dull purple. But, though the ſalts taken ſeparately ſhould produce a colour nearly ſimilar, another thing muſt be regarded, namely, whether they can be mixed with ſafety to one another. It is the nature of many ſalts to deſtroy one another whenever they come into perfect contact by being diſſolved in water. Thus, ſolution of tin and ſaccharum ſaturni deſtroy one another; and ſo do ſolution of tin, and tartar, or cream of tartar. To mix theſe together muſt therefore be abſurd; and yet we find this laſt mixture ordered in almoſt every receipt for dyeing ſcarlet. It is alſo to be obſerved, that a mixture of different ſalts ought never to be made, out of a notion that the colour will keep the better on that account; for moſt commonly it will keep the worſe. A ſingle ſalt will anſwer for this purpoſe, better than a hundred. A mixture ſhould only be made where it is neceſſary to produce the colour deſired; and if a dyer proceeds in this ſimple manner, he may not only attain to great perfection in the art from his own experience without being taught by others, but even make conſiderable diſcoveries; as dyeing is at preſent far enough from being brought to perfection.—The ſalts chiefly to be uſed in dyeing are fixed alkalies; ſolutions of tin in the vitriolic and marine acids, and in aqua regia; ſugar of lead; cream of tartar; alum; oil of vitriol; and ſolution of iron in the acetous acid. By means of theſe, almoſt all kinds of colours may be dyed at an eaſy rate, and with very little trouble.

Of the Manner of uſing the Ingredients, and of producing the different Colours.

As the art of dyeing is, by the principles above laid down, reduced to a great degree of ſimplicity, almoſt all the directions for the practice will be contained in the following general rule.

General Rule for Dyeing all Colours.

Having cleaned the ſubſtance to be dyed as well as poſſible, and made choice of the ſalt proper for producing the colour deſired, diſſolve the ſalt in water, and ſteep the ſubſtance in that ſolution for 24 hours. Then take it out; and, without wringing, hang it up to dry, but without heat: and for this it will be proper to allow a pretty long time; for the more perfectly the ſalt penetrates the cloth, the more durable will the colour be. Having then prepared a coloured ſolution or decoction, put the cloth into it. The leſs heat that is applied during the time the cloth remains in the dye, the finer the colour will be, but the longer time will be required for completing the operation. If time cannot be ſpared, ſo that a ſtrong heat muſt be applied, it will be neceſſary to roll the the cloth during the time of dyeing, or the colour will be in danger of proving unequal. After the dyeing is completed, rinſe the cloth in cold water, but do not wring it ſeverely; and then hang it up to dry.

In this way may be dyed a great variety of colours, on wool, ſilk, cotton, and linen, without any variation in the proceſs. Solution of tin in the vitriolic acid will produce all degrees of red, from the paleſt pink or roſe colour, to the higheſt crimſon and ſcarlet; and that on all the abovementioned ſubſtances without exception.

Method of Dyeing Cotton and Linen Scarlet.

A method of producing theſe fine colours upon cotton and linen, as well as wool, hath been a great deſideratum in dyeing; but by the abovementioned ſolution theſe ſubſtances may be dyed of the moſt beautiful red, crimſon, and ſcarlet colours, as any one may very readily ſatisfy himſelf by a trial. The ſame thing may be done by ſolution of tin in aqua regia; but unleſs the nitrous acid prevails greatly in the mixture, the colours produced by this laſt will incline more to the purple than the former. With ſolution of tin in the marine acid, they incline remarkably to purple, and are likewiſe deficient in luſtre. The two firſt ſolutions therefore are capital ingredients in dyeing red.

Various other Colours.

The ſame preparations will alſo ſerve for dyeing all other colours, blue and green excepted. Thus, a piece of cloth prepared with ſolution of tin in the vitriolic acid, if boiled in a decoction of cochineal, will come out of a ſcarlet colour; if with turmeric, weld, fuſtic, or many of the common yellow flowers, it will come out of different degrees of yellow; with Brazil wood, peach wood, &c. it will give a fine purpliſh crimſon; with logwood, a fine deep purple, &c. and by combining theſe together in different ways, an infinity of different ſhades may be produced.

Directions for the Coarſer Colours.

For the coarſe reds produced from madder, the ſolutions of tin are not found to anſwer. The proper ſalts for theſe are alum and cream of tartar. In dyeing with madder, it is always neceſſary, more than when any other ingredient is uſed, to let the heat be gentle; becauſe the root, beſides the red colour it contains, has alſo a great quantity of browniſh matter in it, which is extracted by ſtrong boiling, and debaſes every colour with which it is mixed. Sugar of lead produces a purple with this root; which, however, will be brightened by an addition of alum and ſal ammoniac. A dark purple may alſo be produced from madder by mixing alum with a little ſolution of iron in the vegetable acids, particularly the acetous. With regard to blue colours, they are only to be dyed by means of indigo. This ſubſtance may be diſſolved, as we have already obſerved, by alkaline ſalts, concentrated acids, and orpiment. The firſt of theſe produces the common blues; the ſecond, the Saxon blue; and the third, the blue which is uſed in callico printing. The method of dyeing the common blue requires only the ſtuff to be dipped in a ſolution of indigo in the alkaline ſalt; and if the liquor is hot, the dyeing will be over almoſt inſtantaneouſly. For cotton and linen, another method hath been uſed. Lime is added to the pot aſh, and the ſtrength of the alkali being by this means increaſed, the indigo is very ſoon diſſolved. Some raiſins are now to be beat in a braſs or marble mortar to a pulp, and thrown into the ſolution of the indigo as ſoon as taken off the fire. It ſoon throws up a copper coloured ſcum to the ſurface; and the cotton being now put into the liquor receives the colour in an inſtant. This is a very beautiful blue; but in what manner the raiſins act, is a matter which yet remains to be determined. If a piece of cloth is dipped in a ſolution of copper in the nitrous acid, and then boiled in logwood, it will come out of a purpliſh blue colour. This dye, however, has very little beauty or durability, and is therefore ſcarce worthy of notice.

Common green vitriol or copperas is thought to improve blue colours in general: but on what foundation, is not very apparent. By means of it, however, the colour of Pruſſian blue may be ſtruck upon cloth in ſuch a manner as to produce a temporary ſtain of exceeding great beauty; and could any method of fixing this colour be fallen upon, it would undoubtedly be a moſt valuable acquiſition. The method is, to digeſt ſome Pruſſian blue in fixed alkali till the colour is extracted. In this ſolution dip the cloth intended to be dyed, and dry it; then let it lie for a little time in a weak ſolution of copperas, and it will immediately become of a moſt beautiful blue colour. This colour, however, is diſcharged by waſhing with ſoap, and even with ſimple water.

Mr. Woulfe's Receipt for Saxon Blues.

A receipt was publiſhed by Mr. Woulfe, in the philoſophical tranſactions, for an improved method of dyeing the Saxon blue; which is done by diſſolving indigo in concentrated oil of vitriol. The only improvement in Mr. Woulfe's proceſs, conſiſted in digeſting the oil of vitriol and indigo in the heat of boiling water inſtead of a ſand-heat, becauſe the latter was often found to ſpoil the colour. After the indigo is diſſolved, the ſolution may be weakened at pleaſure with water; and any piece of ſtuff then dipped in it will imbibe the colour, in proportion to the ſtrength of the ſolution. This dye is very beautiful; but will neither keep its colour, nor ſtand waſhing with ſoap: unleſs great care is taken, it is alſo very apt to prove unequal.

Green colours are to be produced only by a mixture of blue and yellow; for there is no ingredient yet diſcovered, that will, by itſelf, give a good green dye. Sap-green will indeed communicate its own colour to cloth of any kind, and for that purpoſe is uſed in ſome places; but the colours dyed with this ingredient are by no means eligible. It is common firſt to dye the cloth blue with indigo, and then yellow with any yellow colouring ingredient; by which means a green colour is produced. For the dying of Saxon green, however, it is neceſſary to produce a particular kind of yellow from indigo. This is obtained by diſſolving indigo in ſpirit of nitre. Mr. Woulfe recommends an ounce and an half of powdered indigo to be mixed with two ounces of ſpirit of nitre diluted with four times its quantity of water. The mixture is then to ſtand for a week; and, at the end of that ſpace, muſt be digeſted in a ſand heat for an hour or more; after which, four ounces more of water is to be added: the ſolution, when filtered, will be of a fine yellow colour. Strong ſpirit of nitre is apt to ſet fire to indigo; for which reaſon, as well as to hinder the mixture from frothing up, it muſt be diluted with water. Two ounces and an half of ſtrong ſpirit of nitre will ſet fire to one ounce and an half of indigo; but if the acid is highly concentrated, a leſs quantity will ſerve.

If the indigo be digeſted 24 hours after the ſpirit of nitre is poured on it, it will froth and boil over; but, after ſtanding a week or leſs, it has not that property.

One part of the ſolution of indigo in the acid of nitre, mixed with four or five parts of water, will dye ſilk or cloth of the paleſt yellow colour, or of any ſhade to the deepeſt, and that by letting them boil more or leſs in the colour. The addition of alum is uſeful, as it makes the colour more laſting. According as the ſolution boils away, more water muſt be added.

None of the colour in the operation ſeparates from the water, but what adheres to the ſilk or cloth; of conſequence, this colour goes far in dyeing.

Cochineal, Dutch litmus, archil, cudbear, and many other colouring ſubſtances, treated in this manner, will all dye ſilk and wool of a yellow colour.

The indigo which remains undiſſolved in making Saxon blue, and collected by filtration, if digeſted with ſpirit of nitre, dyes ſilk and wool of all ſhades of brown inclining to a yellow.

Cloth and ſilk may be dyed green with indigo; but they muſt firſt be boiled in the yellow dye, and then in the blue.

Black Colours dyed.

Black colours are dyed by preparing the cloth with any ſolution of iron, (but that in the acetous acid is beſt,) and then boiling it in a decoction of any aſtringent vegetable. Thoſe chiefly made uſe of for the purpoſes of dyeing, are galls, ſumach, logwood, and madder. Of theſe the laſt is the moſt durable; though galls will alſo produce a very pretty laſting colour, if properly managed. Logwood dyes a very pretty, but fading, black colour. It appears, however, from ſome experiments made by Mr. Clegg, that, by a proper preparation of the cloth with fixed alkaline ſalts, black colours dyed with logwood might be improved both as to beauty and durability; we ſhall therefore introduce his remarks on the ſubject contained in Percival's Eſſays, vol. 3. page 335. "I took (ſays he) two veſſels, containing equal meaſures of a ſtrong aſtringent liquor, compoſed of galls and logwood: into one veſſel I put a ſmall quantity of pearl aſhes; the other remained as a ſtandard. Pieces of linen and cotton cloth, after maceration in theſe liquors, were thrown together into a ſtrong ſolution of copperas; they were ſoon after taken out, and waſhed in cold water. When dry, the pieces prepared in aſhes were, all of them, much deeper than the others.

I made uſe of different kinds of pearl and pot aſhes, as well as many kinds of aſtringents: the aſhes had the ſame effect whatever aſtringent was made uſe of, and the ſtrongeſt alkali always produced the deepeſt colour; and though aſhes, uſed with an aſtringent, always gave a deeper colour than the ſame aſtringent without aſhes, yet logwood, which without aſhes gave not ſo deep a colour as galls with them, gave a much deeper black than galls with the ſame addition.

"There was a remarkable difference in this caſe between lime and aſhes in their effect upon logwood; with lime it gave no blackneſs, but with aſhes it produced a deeper black than any other aſtringent I made uſe of.

"Being deſirous of trying the duration of colours produced by aſtringents, in which different quantities of pearl aſhes had been diſſolved; in two pints of river water I boiled one ounce of logwood during ten minuets; I then added half an ounce of Aleppo galls, and boiled them together ten minuets longer; the liquor having ſtood to cool, was decanted off, and divided into ſix equal quantities. N° 1, remained as a ſtandard; into N° 2, I put ſix grains of fine pearl aſhes; N° 3, twelve grains; N° 4, eighteen grains; N° 5, twenty four grains; N° 6, thirty grains. To ſix drops of each of theſe liquors, I added two drops of a ſaturated ſolution of copperas. N° 2 and 3, ſtruck a deep black; N° 1 and 4, black, but inferior to 2 and 3; N° 5, a brown black; N° 6, brown.

"From this experiment it appears, that N° 5 and 6, were ſpoiled by an over proportion of aſhes. All theſe colours were tried by writing with them on paper, and the writings have now been expoſed ſix months to the air. In N° 5 and 6, the blackneſs is quite deſtroyed; N° 4 is ſomething faded: N° 1, 2, 3, remain nearly as they were, N° 2 and 3, being ſtill ſuperior to the ſtandard."

The fineſt blacks are firſt dyed blue, with indigo; and afterwards black with ſolution of iron, and ſome aſtringent vegetable, according to the directions already given.

Theſe are the beſt methods for producing permanent colours of all kinds. As it is neceſſary, however, often to give another colour to ſtuffs which have been already dyed, it is plain, that it is as neceſſary for a dyer to know how to diſcharge colours, as how to make the cloth imbibe them.

How to diſcharge Colours when dyed.

Concerning this, it is only neceſſary to obſerve, that alkaline ſalts are in general the beſt, and, where the colours are well dyed, the only means of diſcharging them. If a piece of cloth is dyed with logwood, and the colour ſtruck upon it with alum, that colour will be nearly diſcharged by oil of vitriol, or any other ſtrong acid; but if ſolution of tin has been employed in ſtriking the colour, acids have then no effect, and alkalies only can be employed. Neither will they diſcharge the colour totally, but the ſtuff muſt be bleached for ſome time to get out the remainder. If alkaline ſalts cannot be employed with ſafety to the ſtuff, it is then impoſſible to dye it any other colour than black; unleſs it be dyed a compound colour, of which the original one is a component part.

Of the Increaſe of Weight in Dyeing.

Concerning the weight that colours give to ſilk, (in which it is moſt taken notice of, being ſold by weight, and a commodity of great price), it is obſerved, that one pound of raw ſilk loſeth four ounces by waſhing out the gums and the natural ſordes; that the ſame ſcoured ſilk may be raiſed to above thirty ounces from the remaining twelve, if it be dyed black with ſome materials. Of all the materials uſed in dyeing, eſpecially of black, nothing increaſes weight ſo much as galls, by which black ſilks are reſtored to as much weight as they loſt by waſhing out their gum: nor is it counted extraordinary, that blacks ſhould gain about four or ſix ounces in the dyeing upon each pound. Next to the galls, old fuſtic increaſes the weight about $1\frac{1}{2}$ in 12; madder, an ounce; weſd half an ounce. The blue vats in deep blues of the fifth ſtall, give no conſiderable weight; neither do logwood, cochineal, nor even copperas, where galls are not.

Dyeing *of Thread* is begun by ſcouring it in a ley of good aſhes; after which, it is wrung, rinſed out in river water, and wrung again. For a bright blue, it is given with braziletto and indigo. Bright green is firſt dyed blue, then back-boiled with braziletto, and verditer, and laſtly woaded. For a dark green, it is given like the former, only darkening more before woading. Lemon, or pale yellow, is given with weld, mixt with rocou. Orange and Iſabella, with fuſtic, weld, and rocou. Red, both bright and dark, with flame-colour, &c. are given with brazil, either alone, or with a mixture of rocou. Violet, dry roſe, and amaranth, are given with brazil, taken down with indigo. Feuelmort and olive colour are given with galls and copperas, taken down with weld, rocou, or fuſtic. Black is given with galls and copperas, taken down and finiſhed with braziletto wood.

It is obſervable, that the black vitriolic dye, which is very durable on the ſubſtances already mentioned, is periſhable on linen and cotton. Pieces of both ſorts of cloth and ſkains of thread boiled firſt with gall, and afterwards infuſed and dipped repeatedly in a decoction of logwood with vitriol, received a good black colour, which was in ſome meaſure diſcharged by waſhing with ſoap; and the black dye proved equally periſhable, though the linen was ſteeped for a month previous to the dye, with galls and with oak bark. The dyers of thread obtain a colour ſomewhat more laſting, by ſteeping it firſt in alum water for ſeveral days, and then dipping it repeatedly in the dyeing liquor, cold, or only lukewarm. This liquor conſiſts of the irony and aſtringent matters mixed together; and in the room of, or along with vitriol, they uſe either filings of iron or ſlippe. Dr. Lewis made ſeveral unſucceſsful trials to fix the black dye in linen and cotton. He has given us, from the diſſertation of M. l'Abbé Mazeas, on the red printed cottons of the Eaſt Indies, an account of a method practiſed by the Indians, of impregnating their cotton with an animal matter, in order to its receiving a red ſtain.

A ley is made from the aſhes of a certain kind of wood, and with this is mixed ſome ſheep's dung, and a quantity of the oil of ſeſamum, in want of which oil they uſe hog's lard: theſe ingredients ſtirred together are ſaid to unite into a milky liquid. The cotton is ſteeped in this liquid during the night, and expoſed to the hotteſt ſun during the day for a fortnight. He applied a ſimilar preparation to the black dye; but the reſult was not ſuch a degree of ſucceſs as to render the proceſs intereſting to the workman. He obſerves, on the credit of a ſkilful artiſt, that ſome printed linens and cottons have a durable black ſtain, which is made with madder and a ſolution of iron. For this purpoſe a quantity of iron is put into ſour ſtrong beer; and to promote the diſſolution of the metal the whole is occaſionally well ſtirred, the liquor at times drawn off, the ruſt beaten from the iron, and the liquor poured on again; the ſolution is not fit for uſe in leſs than a twelvemonth. This ſolution ſtains linens yellow, and of different ſhades of buff colour, and is the only known material by which theſe colours can be fixed on linen. The cloth, ſtained deep with the iron liquor, being afterwards boiled with madder, without any other addition, becomes of the dark colour which is ſeen on printed linens and cottons; which, though not a perfect black, bears a very near reſemblance to it. He apprehends, that a better black might thus be dyed on threads, than that which the printer on linen produces; becauſe in this laſt buſineſs, while ſome parts of the linen are ſtained deep with the iron liquor, in order to their being made black; others are ſtained paler, with the ſame liquor diluted with water, for making purple; and others, deſigned to be red, are prepared with a ſolution of alum and ſugar of lead; all theſe colours are dyed in the ſame copper of madder, with a heat a little below boiling; but a boiling heat, which would injure the red colour, would deepen the black, and might be advantageouſly applied, if thread, or whole pieces of linen or cotton, were to be dyed of this colour. Com. Phil. Techn. p. 429, &c.

Dyeing *of Hats*, is done by boiling a hundred pounds of logwood, twelve pounds of gum, and ſix pounds of galls, in a proper quantity of water for ſome hours; after which about ſix pounds of verdigris, and ten pounds of green vitriol are added, and the liquor kept ſimmering, or of a heat a little below boiling. Ten or twelve dozen of hats are immediately put in, each on its block, and kept down by croſs bars for about an hour and a half; they are then taken out and aired, and the ſame number of others put in their room; the two ſets of hats are then dipped and aired alternately, eight times each; the liquor being refreſhed each time with more of the ingredients, but in leſs quantity than at firſt. This proceſs affords a very good black on woollen and ſilk ſtuffs as well as on hats. Com. Phil. Techn. p. 428.

Dyeing *of Leather, Skins*, &c. A black colour is eaſily given to tanned leather, by rubbing it over three or four times with a ſolution of vitriol, or with a ſolution of iron in the vegetable acids. For leathers that have not been tanned, ſome galls or other aſtringents are added, to the ſolution of iron; and in many caſes, particularly for the finer parts of leather, and for renewing the blackneſs, ivory, or lamp-black are uſed. A blue colour is given by ſteeping the ſubject a day in urine and indigo, then boiling it with alum: or it may be given by tempering the indigo with red wine, and waſhing the ſkins therewith. Red is given by waſhing the ſkins, and laying them two hours in galls; then wringing them out; dipping them in a liquor made with liguſtrum, alum, and verdigris in water; and laſtly, in a dye made of brazil wood boiled with ley. Purple is given by wetting the ſkins with a ſolution of roch alum in warm water, and when dry again, rubbing them with the hand with a decoction of logwood in cold water. Green is given by ſmearing the ſkin with ſap-green and alum-water boiled; to darken the colour, a little more indigo may be added. Dark green is alſo given with ſteel-filings, and ſal ammoniac ſteeped in urine till ſoft, then ſmeared over the ſkin, which is to be dried in the ſhade. Sky-colour is given with indigo ſteeped in boiling water, and the next morning warmed and ſmeared over the ſkin. Yellow, by ſmearing the ſkin over with aloes and linſeed oil diſſolved and ſtrained: or by infuſing it in weld. Orange-colour is given by ſmearing with fuſtic berries boiled in alum-water; or for a deep orange, with turmeric. Salm. Polyg. lib. iii. cap. 34. p. 272. For the mode of preparing the leather for dyeing, See Currying.

Dyeing, *or Staining of Wood, for Inlaying, Veneering, &c.* Red, is done by boiling the wood in water and alum; then taken it out, adding brazil to the liquor, and giving the wood another boil in it. Black, by bruſhing it over with logwood boiled in vinegar, hot; then waſh it over with a decoction of galls and copperas till it be of the hue required. Any other colour may be given by ſqueezing out the moiſture of horſe-dung through a ſieve, mixing it with roch alum and gum arabic; and to the whole adding green, blue, or any other colour deſigned. After ſtanding two or three days, pear-tree, or other wood, cut to the thickneſs of half a crown, is put into the liquor boiling hot, and ſuffered to remain till it be ſufficiently coloured, Park. Treat. of Japan. cap. xxvii. p. 82.

Dyeing *of Bone, Horn, or Ivory*. Black is performed by ſteeping braſs in aqua fortis till it be turned green: with this the bone, &c. is to be waſhed once or twice: and then put in a decoction of logwood and water, warm. Green, is begun by boiling the bone, &c. in alum-water; then with verdigris, ſal ammoniac, and white wine vinegar; keeping it hot therein till ſufficiently green. Red, is begun with boiling it in alum-water, and finiſhed by decoction in a liquor compounded of quicklime ſteeped in rain-water, ſtrained, and to every pint an ounce of brazil wood added: the bone, &c. to be boiled herein till ſufficiently red. Other methods are given by Salmon. And from him by Houghton. Park. lib. cit. p. 83. Salm. Polygraph. lib. iii. cap. 35. p. 275. Hought. Collect. N° 138. tom. i. p. 361. See Horn, Ivory, &c. The refuſe of the Bow-dye given to hogs to feed on, is ſaid to tinge their very bones red.

DYNAMICS, from *δυναμις*, *power*, is the ſcience of moving powers; more particularly of the motion of bodies which mutually act on one another. See Syſtem of Mechanics.

DYNASTY, a term in hiſtory, ſignifying a race or ſucceſſion of kings of the ſame line, or family. The word is formed from the Greek, *δυναϛεια*, of *δυναϛευω*, *to be powerful, to be king*.

DYSCRASY, from *δυς* and *κρασις*, an ill temperament or habit of the blood and humours, as in a jaundice or the like.

DYSENTERY, *Δυσεντερια*, in medicine, a bloody diarrhœa; or a flux of blood by ſtool, attended with pains and griping. Dr. Akenſide calls this diſeaſe a rheumatiſm of the bowels.

The word *dyſentery* is formed from the Greek, *δυς*, *difficulty*, and *εντερον*, *inteſtine*, and properly ſignifies that kind of flux of the belly, characterized by the frequency of ſtools, or ejections, mixed with blood, and accompanied with gripes. The fever, ulcers, &c. which attend it, are not eſſential to the diſeaſe; though many, both of the ancients and moderns, think the latter are. See Syſtem of Medicine.

DYSOREXIA, from *δυς* and *ορεξις*, *appetite*, in medicine, a want of appetite, proceeding from an ill diſpoſition, or diminiſhed action of the ſtomach.

DYSPEPSY, *Δυσπεψια*, from *δυς* and *πεπτειν*, *coquere, to concoct*, in medicine, a difficulty or weakneſs of digeſtion. Bitters and ſubaſtringents are its proper remedy.

DYSPNOEA, *Δυσπνοια*, from *δυς* and *πνεω*, *I breathe*, in medicine, a difficulty of breathing, uſually called aſthma.

DYSURIA, *Δυσουρια*, from *δυς* and *ουρειν*, *to make urine*, in medicine, a difficulty of making urine, accompanied with pain, and a ſenſe of heat. It is called *ardor urinæ*, becauſe the urine ſeems to burn the urethra as it iſſues forth. The dyſuria differs chiefly from the ſtrangury in this, that in the ſtrangury the urine only ouſes out, as it were drop by drop; whereas in the dyſuria, when it is made, it ſtreams out without any interruption, and frequently in the proper quantity; thus it alſo differs from the iſchuria, which is a total ſuppreſſion of urine. The ordinary cauſes of the dyſuria are, the acrimony, or ſharpneſs of the urine, and this excoriation, or exulceration of the neck of the bladder, or of the urinary paſſage. The uſual remedies in this caſe are cooling laxatives and mucilaginous medicines, as gum arabic, diſſolved in barley-water; decoctions of marſhmallow-root, with or without nitre; camphor, and ſmall doſes of laudanum.

DYTISCUS, water-beetle, in entomology, a genus of inſects of the order of Coleoptera.

E, THE ſecond vowel, and fifth letter, of the alphabet. The letter E is moſt evidently derived from the old character Ǝ in the ancient Hebrew and Phœnician alphabets, inverted by the Greeks to this poſition E, and not from the Hebrew He ה. From the ſame origin is alſo derived the Saxon *e*, which is the firſt letter in their alphabet that differs from the Latin one. It is formed by a narrower opening of the larynx than the letter A; but the other parts of the mouth are uſed nearly in the ſame manner as in that letter.

It has a long and ſhort ſound in moſt languages. The ſhort ſound is audible in *bed*, *fret*, *den*, and other words ending in conſonants; its long ſound is produced by a final *e*, or an *e* at the end of words; as in *glebe*, *here*, *hire*, *ſcene*, *ſphere*, *interfere*, *revere*, *ſincere*, &c. in moſt of which it ſounds like *ee*; as alſo in ſome others by coming after *i*, as in *believe*, *chief*, *grief*, *reprieve*, &c. and ſometimes this long ſound is expreſſed by *ee*, as in *bleed*, *beer*, *creed*, &c. Sometimes the final *e* is ſilent, and only ſerves to lengthen the ſound of the preceding vowel, as in *rag*, *rage*, *ſtag*, *ſtage*, *hug*, *huge*, &c. The ſound of *e* is obſcure in the following words, *oxen*, *heaven*, *bounden*, *fire*, *maſſacre*, *maugre*, &c.

The Greeks have their long and ſhort *e*, which they call *epſilon* and *eta*. The French have at leaſt ſix kinds of *e*'s: the Latins have likewiſe a long and ſhort *e*; they alſo write *e* inſtead of *a*, as *dicem* for *dicam*, &c. and this is, no doubt, the reaſon why *a* is ſo often changed into *e*, in the preter tenſe, as, *ago*, *egi*; *facio*, *feci*, &c. As a numeral, E ſtands for 250, according to the verſe,

E, *quoque ducentos et quinquaginta tenebit.*

In muſic it denotes the tone *e-la-mi*. In the calendar it is the fifth of the dominical letters. And in ſea charts it diſtinguiſhes all the eaſterly points: thus, E alone denotes eaſt; and E. by S. and E by N. Eaſt by South, and Eaſt by North.

EAGLE, *Aquila*, in ornithology, according to Linnæus, a ſpecies of the 2d genus called falco, belonging to the firſt order accipitres or rapacious. It is alſo of the ſame genus and order in Latham's improved arrangement. See Plate I.

Its aery, or neſt, is uſually on the higheſt rocks, ſometimes on the tops of old trees. It feeds its young till ſuch time as they are able to fly, and then drives them out of the neſt.

Its food is birds, hares, lambs, kids, and fawns; nay, Sir Robert Sibbald aſſures us, children too, when it can catch them; of which he gives an inſtance in the Orcades iſlands. Prod. Nat. Hiſt. Scot. lib. iii. p. 2. and 14. The eagle frequently watches the fiſhing hawk, and as ſoon as it perceives it to have ſtruck a fiſh, takes wing, and purſues the bird till it lets fall its prey, and often catches it before it reaches the earth or water. Phil. Tranſ. N° 201. Eagles are remarkable for their longevity, and for their faculty of ſuſtaining a long abſence from food. Keyſler relates, that an eagle died at Vienna after a confinement of a hundred and four years, which juſtifies the alluſion of the Pſalmiſt. Pſalm. ciii. 5. Its ſight is quick, ſtrong, and piercing, to a proverb. Job xxxix. 29. The reaſon why the eagle, the fibres of whoſe optic nerves are not ſtronger than thoſe of other animals, is able to face the ſun, and endure its brighteſt rays, the Jeſuit Angelus, in his optics, aſſures us, is, that it has two ſets of eyelids, the one thick and cloſe, and the other thinner and finer, which laſt it draws over the eye, when it looks at any luminous body, and thus breaks the force of its rays.

Eagle, in heraldry, is accounted one of the moſt noble bearings in armoury; and, according to the learned in this ſcience, ought to be given to none but ſuch as greatly excel in the virtues of generoſity and courage, or for having done ſingular ſervices to their ſovereigns; in which caſes they may be allowed a whole eagle, or an eagle naiſſant, or only the head or other parts thereof, as may be moſt agreeable to their exploits.

The eagle has been borne, by way of enſign or ſtandard, by ſeveral nations. The firſt who ſeem to have aſſumed the eagle, are the Perſians; according to the teſtimony of Xenophon. Afterwards, it was taken by the Romans; who, after a great variety of ſtandards, at length fixed on the eagle, in the ſecond year of the conſulate of C. Marius: till that time, they uſed indifferently wolves, leopards, and eagles, according to the humour of the commander. The Roman eagles, it muſt be obſerved, were not painted on a cloth, or flag: but were figures in relievo, of ſilver or gold, borne on the tops of pikes; the wings being diſplayed, and frequently a thunder-bolt in their talons. Under the eagle on the pike, were piled bucklers, and ſometimes crowns. Thus much we learn from the medals.

Eagle, *Aquila*, in aſtronomy, a conſtellation of the northern hemiſphere. See Syſtem of Astronomy, Sect. VIII.

Black Eagle, an order of knighthood, inſtituted by the elector of Brandenburgh, in 1701, on his being crowned king of Pruſſia. The knights of this order wear an orange coloured ribband ſuſpending a black eagle.

White Eagle, a like order in Poland, inſtituted in 1325, by Uladiſlaus V. on occaſion of the marriage of his ſon Caſimir to the daughter of the great duke of Lithuania. The knights of this order wear a chain of gold, ſuſpending a ſilver eagle crowned.

EAGLET, a diminutive of eagle, properly ſignifying a young eagle. In heraldry, when there are ſeveral eagles on the ſame eſcutcheon, they are termed eaglets.

EAR, *Auris*, the organ of hearing; or that part whereby animals receive the impreſſion of ſounds. See Syſtem of Anatomy, Part VI. Sect. X. and Plate XI.

The comparative anatomy of the ear furniſhes abundant inſtances of the Creator's wiſdom. In birds, the outer ear is of a form proper for flight; not protuberant, as that would obſtruct their progreſs, but cloſe and covered. In quadrupeds, its form is agreeable to the poſture and motion of the body, but admirably varied, according to their various occaſions: in ſome, as the hare, it is large, open, and erect; by which means that timorous, defenceleſs creature is warned of the leaſt approach of danger: in others, it is covered, to keep out noxious bodies. In the ſubterraneous quadrupeds, who are forced to mine and dig for their food and habitation, as a protuberant ear would obſtruct them, and be liable to injuries, their ears are very ſhort, and are lodged deep, and backwards in the head.

Thus moles have no auricle at all, but only a round hole, between the neck and ſhoulder. Some authors obſerve, that this meatus, or paſſage, is cloſed with a little ſkin, which opens and ſhuts like an eyelid. The ſea-calf and the ſeveral ſpecies of lizards and ſerpents, are likewiſe without any external ear. And the tortoiſe, camelion, and generality of fiſhes, have the paſſage of the ear quite ſtopped, or covered over. And there is a ſort of whale, which has the aperture of the ear under the ſhoulder. See Comparative Anatomy.—Sect. II. for Birds.—Sect. I. for Quadrupeds.

The ear has its beauties, which a good painter ought by no means to diſregard; where it is well formed, it would be an injury to the head to be hidden.

By a ſtatute of Henry VIII. maliciouſly cutting off the ear of a perſon is made a treſpaſs, for which treble damages ſhall be recovered; and the offender is to pay a fine of ten pounds to the king. 37 Hen. VIII. cap. 6. § 4. In the index to the ſtatutes at large, it is ſaid, that this offence may be puniſhed as felony, by 22 and 23 Car. II. cap. 1. § 7. commonly called Coventry's Act; but ear is not mentioned in that ſtatute.

Ear, in muſic, denotes a kind of internal ſenſe, whereby we perceive and judge of harmony and muſical ſounds. See Music. In muſic we ſeem univerſally to acknowledge ſomething like a diſtinct ſenſe from the external one of hearing; and call it a good ear. And the like diſtinction we ſhould probably acknowledge in other affairs, had we got diſtinct names to denote theſe powers of perception by. Thus a greater capacity of perceiving the beauties of painting, architecture, &c. is called a fine taſte.

Ear *of Fiſhes*. All the cetaceous fiſhes have external meatus auditorii, or paſſages for hearing; but other fiſh have nothing of theſe external appearances, and ſeem neither to be intended by nature to make any ſounds, or to hear any. Though ſound being a tremulation in the air, it may be felt by them as motion, though not diſtinguiſhed as ſound. It may eaſily be proved, that they do not hear our voices in ſpeaking, by walking near the ſide of a pond or river well ſtored with fiſh about the hedges: if the body and its ſhadow be kept out of their ſight, they will never ſtart at the voice. Yet how far fiſhes are deaf and dumb, ſeems a queſtion not yet perfectly decided. See Comparative Anatomy, Sect. III.

Ear, in gardening, a name given to the ſeminal leaves of plants, or thoſe two green and ſucculent leaves which firſt appear from the ſeed, and are very different, in all reſpects, from thoſe which follow. Thus in the melon plants, the two firſt leaves are called ears; and the leaves, with their ſtalks, which ſhoot out afterwards, are called knots, and denominated the firſt, ſecond, and third knot, according to their place, and time of growing. The cutting off every third knot in this plant, is the great means of procuring the fineſt and largeſt fruit. Phil. Tranſ. N° 45.

Ear, in botany, is alſo applied to a long cluſter of flowers, or ſeeds, produced by certain plants; and uſually called, by botaniſts, ſpica. The flowers and ſeeds of wheat, rye, barley, &c. grow in ears. The ſame holds of the flowers of lavender, &c. We ſay, the ſtem of the ear, i. e. its tube, or ſtraw; the knot of the ear; the lobes, or cells, wherein the grains are encloſed; the beard of the ear, &c. great numbers of ears of wheat have been known to ariſe from the ſame root.

Ear *Pick*, an inſtrument of ivory, ſilver, or other metal, ſomewhat in form of a probe, for cleanſing the ear. The Chineſe have a variety of theſe inſtruments, with which they are mighty fond of tickling their ears; but this practice, Sir Hans Sloane obſerves, muſt be very prejudicial to ſo delicate an organ, by bringing too great a flow of humours on it.

Ear *Wig*, *forficula*, in entomology, the Engliſh name of a genus of inſects, of the order of coleoptera. For deſcription of the different ſpecies of this genus, ſee Forficula. For the Claſſification, ſee Syſtem of Entomology.

Ear *Shell*, *auris marina*, a genus of ſhell fiſh, called in the Linnæan diſtribution, *haliotis*. See ſyſtem of Conchology, genus 31.

EARED, in heraldry, when the ears of any bearing hath its ears of a different tincture, it is ſaid to be eared.

EARING, in a ſhip, that part of the bolt rope, which, at the four corners of the ſail, is left open, in the ſhape of a ring. The two uppermoſt parts are put over the ends of the yard arms, and ſo the ſail is made faſt to the yard; and into the lowermoſt earings the ſheet and tackles are ſeized, or bent at the clew.

EARL, a Britiſh title of nobility, next below a marquis, and above a viſcount. The title is ſo ancient, that its original cannot be clearly traced out. This much, however, ſeems tolerably certain, that among the Saxons they were called *ealdormen, quaſi* elder men, ſignifying the ſame with *ſenior* or *ſenator* among the Romans; and alſo *ſchiremen*, becauſe they had each of them the civil government of a ſeveral diviſion or ſhire. On the irruption of the Danes they changed their names to *eorles*, which, according to Cambden, ſignified the ſame in their language. In Latin they are called *comites*, (a title firſt uſed in the empire), from being the king's attendants; *a ſocietate nomen ſumpſerunt, regis enim tales ſibi aſſociant.* After the Norman conqueſt they were for ſome time called *counts* or *countees*, from the French; but they did not long retain that name themſelves, though their ſhires are from thence called counties to this day. It is now become a mere title: they have nothing to do with the government of the county; which is now entirely devolved on the ſheriff, the earl's deputy, or vicecomes. In writs, commiſſions, and other formal inſtruments, the king, when he mentions any peer of the degree of an earl, uſually ſtiles him "truſty and well beloved couſin:" an appellation as ancient as the reign of Henry IV; who being either by his wife, his mother, or his ſiſters, actually related or allied to every earl in the kingdom, artfully and conſtantly acknowledged that connexion in all his letters and other public acts: from whence the uſage has deſcended to his ſucceſſors, though the reaſon has long ago failed.

An earl is created by cincture of ſword, mantle of ſtate put upon him by the king himſelf, a cap and a coronet put upon his head, and a charter in his hand. All the earls of England are denominated from ſome ſhire, town, or place, except three; two of whom, viz. earl Rivers, and earl Paulet, take their denomination from illuſtrious families: the third is not only honorary as all the reſt, but alſo officiary, as the earl marſhal of England. See Syſtem of PEERAGE.

EARL *Marſhal of England*, is a great officer who had anciently ſeveral courts under his juriſdiction, as the court of chivalry, and the court of honour. Under him is alſo the herald's office or college of arms. He hath ſome pre-eminence in the court of Marſhalſea, where he may ſit in judgment againſt thoſe who offend within the verge of the king's court. The office is of great antiquity in England, and anciently of greater power than now: and has been for ſeveral ages hereditary in the moſt noble family of Howard.

EARNEST, ARRHÆ, money advanced to bind the parties to the performance of a verbal bargain. By the civil law, he who recedes from his bargain loſes his earneſt, and if the perſon who received the earneſt give back, he is to return the earneſt double. But with us, the perſon who gave it, is in ſtrictneſs obliged to abide by his bargain; and in caſe he decline it, is not diſcharged upon forfeiting his earneſt, but may be ſued for the whole money ſtipulated.

EARTH, among ancient philoſophers and chymiſts, one of the four elements of which the whole ſyſtem of nature was thought to be compoſed. See ELEMENT.

EARTH, in aſtronomy and geography, one of the primary planets; being this terraqueous globe which we inhabit.

THEORY OF THE EARTH.

Different Opinions reſpecting the Coſmogony.

The coſmogony, or knowledge of the original formation of the earth, the materials of which it was compoſed, and by what means they were diſpoſed in the order in which we ſee them at preſent, is a ſubject which, though perhaps above the reach of human ſagacity, has exerciſed the ſtudy of philoſophers in all ages. To recount the opinions of all the eminent philoſophers of antiquity upon this ſubject would be too tedious; it may therefore ſuffice to obſerve, that, ever ſince the ſubject began to be canvaſſed, the opinions of thoſe who have treated it may be divided into two claſſes.

1. Thoſe who believed the earth, and whole viſible ſyſtem of nature, to be the Deity himſelf, or connected with him in the ſame manner that a human body is with its ſoul. 2. Thoſe who believed the materials of it to have been eternal, but diſtinct from the Deity, and put into the preſent order by ſome power either inherent in themſelves, or belonging to the Deity. Of the firſt opinion were Xenophanes, the founder of the Eleatic ſect, Strato of Lampſacus, the Peripatetics, &c.

The ſecond opinion, namely, that the ſubſtance of the earth or univerſe (for it is impoſſible to ſpeak of the one without the other) was eternal, though not the form, was moſt generally held among the ancients. From that eſtabliſhed axiom, that "nothing can be produced from nothing," they concluded that creation was an impoſſibility; but at the ſame time they thought they had good reaſon to believe the world had not been always in its preſent form. They who held this opinion may again be divided into two claſſes; firſt, thoſe who endeavoured to account for the generation of the world, or its reduction into the preſent form, by principles merely mechanical, without having recourſe to any aſſiſtance from divine power; and ſecondly, thoſe who introduced an intelligent mind as the author and diſpoſer of all things. To the firſt of theſe claſſes belonged the coſmogony of the Babylonians, Phœnicians, and Egyptians; the particulars of which are too abſurd to deſerve notice. Of the ſame opinion alſo were moſt of the poets; the philoſophers Thales, Anaximander, Anaximenes, Anaxagoras, &c. The latter attempted to reform the philoſophy of his maſter Anaximenes by introducing an intelligent principle into the world, diſtinct from matter; thus making his intelligent principle, or God, the ſoul of the world. Diogenes of Apollonia ſuppoſed air, which he made the firſt principle of all things, to be endued with reaſon: His manner of philoſophiſing differed very little from that of Des Cartes. "All things, (ſays he,) being in motion, ſome became condenſed, and others rarefied. In thoſe places where condenſation prevailed, a whirling motion, or vortex, was formed; which by its revolution drew in the reſt, and the lighter parts flying upwards formed the ſun."

The hypotheſis of Democritus agrees in the main with that of Epicurus as repreſented by Lucretius. The moſt material difference between the two ſyſtems, however, was, that Epicurus admitted no principle but the atoms themſelves; whereas Democritus believed them to be animated.

Opinions of Pythagoras, Plato, and Ariſtotle.

Of thoſe who held two diſtinct and coeternal principles, viz. God and Matter, we ſhall only take notice of the opinions of Pythagoras, Plato, and Ariſtotle, as being the moſt remarkable. Pythagoras is ſaid to have aſſerted two ſubſtantial ſelf-exiſtent principles; a *monad*, or unity: and a *dyad*, or duality. The meaning of theſe terms is now ſomewhat uncertain. Some think, that by the monad, he meant the Deity; and, by the dyad, matter. Others think, that the Pythagoric monads were atoms. The dyad is ſometimes thought to ſignify a demon or evil principle; but Porphyry's interpretation, which ſeems the moſt probable, is as follows. The cauſe, ſays he, of that ſympathy, harmony, and agreement which is in things, and of the conſervation of the whole, which is always the ſame and like itſelf, was by Pythagoras called *unity*; that unity which is in the things, themſelves, being but a participation of the firſt cauſe: but the reaſon of difference, inequality, and conſtant irregularity in things, was by him called a *dyad*. This philoſopher held *numbers* to be the principles of all things, and from them he accounted for the production of the world in the following manner: He ſuppoſed that the moad and dyad were the two ſources of numbers, from whence proceeded points; from points, lines; from lines, plane figures; from planes, ſolids; from ſolids, ſenſible bodies. The elements of ſenſible bodies are four; but beſides theſe, there is a fifth (never yet diſcovered.) The four elements which manifeſt themſelves to our ſenſes are fire, air, earth, and water. Theſe are in a perpetual change, and from them the world was formed; which is animated, intelligent, and ſpherical; containing, in the midſt of it, the earth, a globoſe and inhabited body. The world, he ſaid, began from fire, and the fifth element; and that as there were five figures of ſolid bodies, called mathematical or regular, the earth was made of the cube, fire of the pyramid or tetrahedron, the air of the octahedron, water of the icoſahedron, and the ſphere of the univerſe of the dodecahedron. This method of philoſophizing, which has no manner of foundation in nature, was adopted by Plato and Ariſtotle: and hence proceeded all the abſurdities concerning ideas, forms, qualities, &c. with which the Ariſtotelian philoſophy was loaded.

For a long time, however, the philoſophy of Ariſtotle prevailed, and the world was thought to be upheld by forms, qualities, and other unintelligible and imaginary beings. At laſt the French philoſopher, Deſcartes, ſuperſeded the Ariſtotelian, by introducing the atomic, or Democritic, and Epicurean philoſophy. The Carteſian ſyſtem was quickly ſuperſeded by the Newtonian: which ſtill continues, though conſiderably different from what it was left by that great man.

Newtonian Syſtem ſupercedes the Ariſtotelian and Carteſian.

His opinions, indeed, concerning the coſmogony ſeem to have been in a fluctuating ſtate: and hence he delivers himſelf in ſuch a manner, that he hath often incurred the charge of contradicting himſelf. He maintained, for inſtance, that matter was infinitely diviſible, and the mathematical demonſtrations of this propoſition are well known. Notwithſtanding this, however, when he comes particularly to ſpeak of the original conſtruction of the world, he ſeems to retract this opinion, and adopt the atomic philoſophy. He tells us, that it ſeems probable, that in the beginning God formed matter in *ſolid, maſſy, impenetrable*, particles, &c.; and that of theſe particles, endowed with various powers of attraction and repulſion, the preſent ſyſtem of nature is formed.

Three Laws of Nature laid down by Sir Iſaac.

His primary laws of nature are only three in number, and very ſimple. The firſt is, that all matter has a tendency to continue in that ſtate in which it is once placed, whether of reſt or motion. If it is at reſt, for example, it will continue at reſt for ever, without beginning motion of itſelf; but if it is once ſet in motion, by any cauſe whatever, it will for ever continue to move in a right line, until ſomething either ſtops it altogether, or forces it to move in another direction. 2. That the change of motion is always equivalent to the moving force employed to produce it, and in the direction of the right line in which it is impreſſed; that is, if a certain force produces a certain motion, double that force will produce double that motion, &c. 3. Reaction is always contrary and equal to action; or the actions of two bodies upon one another are always equal and contrary to one another.

From theſe three laws, together with the two contrary forces of attraction and repulſion, Sir Iſaac Newton and his followers have attempted to explain all the phenomena of nature. When they come to explain the nature of the attractive and repulſive forces, however, they are exceedingly embarraſſed. Sir Iſaac hath expreſſed himſelf in two different ways concerning them. In his Principia, he pretty poſitively determines them to be owing to a cauſe that is not material; and in his queries, he ſuppoſes they may be effects of ſome ſubtile matter which he calls *ether*.

Diſagreement among his Followers.

This diſagreement with himſelf hath produced no ſmall diſagreement among his followers. One party, laying hold of his aſſertions in the Principia, determine the world to be upheld by immaterial powers; while the other, neglecting the Principia, and taking notice only of the queries at the end of the optics, ſtrenuouſly maintain, that attraction and repulſion are owing to the action of ſome exceedingly fine and ſubtile ether. The firſt of theſe ſuppoſitions, it is argued, neceſſarily involves us in one of the following dilemmas. 1. If the attractive and repulſive forces are not material, they muſt either be occaſioned by ſpiritual beings, or they muſt be qualities of matter. If they are occaſioned by the action of immaterial beings, theſe beings muſt either be created or uncreated. If they are produced by the action of created beings, we run into the ſuppoſition of ſome of the ancient heathens, that the world is governed by demons or ſubordinate intelligences; and thus may make an eaſy tranſition to polytheiſm. If attraction and repulſion are the immediate action of the deity himſelf, we run into the doctrine of making God the ſoul of the world. This laſt hypotheſis hath been moſt ſtrenuouſly adopted by Mr. Baxter in his treatiſe of the Immateriality of the human Soul.

Mr. Mitchel, Boſcovich, and Dr. Prieſtley's Opinions.

Mr. Boſcovich, Mr. Mitchel, and Dr. Prieſtley, have likewiſe adopted the hypotheſis of immaterial powers to ſuch a degree, that, according to them, the whole world conſiſts of nothing elſe but attractions and repulſions mixed with phyſical points. If we ſuppoſe the attractive and repulſive powers to be only properties, qualities, or laws, impreſſed on matter by the deity, we might as well have been contented with the occult qualities of Ariſtotle. If attraction and repulſion are occaſioned by the action of mere matter, and all the powers in nature are only material, the charge is incurred of making nature direct itſelf in ſuch a manner, that there is no occaſion for the interpoſition, or even the exiſtence, of a deity at all.

Thus we ſee, the Newtonian coſmogony muſt incline either to the Platonic and Ariſtotelian, or to the Atomic or Epicurean; according to the hypotheſis we lay down concerning the nature of attraction. Des Cartes's ſyſtem was plainly a revival of that of Democritus and Epicurus, with ſome corrections and improvements.

Mr. Hutchinſon's Syſtem.

It was further improved and corrected by Mr. Hutchinſon, who added to it the authority of Revelation. The created agents he choſe in his coſmogony were fire, light, and air. Theſe, we ſee, have indeed a very conſiderable ſhare in the operations of nature; but unleſs we explain the manner in which they operate, our knowledge is not at all increaſed, and we might as well have been contented with the Newtonian attraction and repulſion, or even the occult qualities of Ariſtotle. Attempts have indeed been made to ſolve the phenomena of nature, from the action of theſe three agents, both by Hutchinſon himſelf, and many of his followers. Theſe attempts, however, have always proved unſucceſsful. Some phenomena indeed may be explained pretty plauſibly from the known action of theſe three; but when we come to ſpeak of what may be called the nicer operations of nature, ſuch as the growth of plants and animals, we are utterly at a loſs.

A Deficiency of active Principles in all the Theories yet invented.

The manifeſt deficiency of active principles in all the theories of the earth that have yet been invented, hath occaſioned a conſtant ſearch after others which ſhould be able, by their ſuperior activity, to fill up the blank which neceſſarily remained in the ſyſtem. Pythagoras, Plato, and Ariſtotle, being unable to account for the formation of the earth from their four elements, called in the aſſiſtance of a fifth, which was never yet diſcovered. Epicurus, finding the motions attributed to his atoms by Democritus to be inſufficient, had recourſe to an imaginary, and on his own principles impoſſible, declination of the atoms. Deſcartes finding the atoms, themſelves inſufficient, aſſerted that they were not atoms, but might be broken into ſmaller parts, and thus conſtitute matter of various degrees of ſubtilty. The Newtonian philoſophers have found Des Cartes's ſyſtem inſufficient; but being greatly diſtreſſed in their attempts to ſolve all the phenomena of nature by mere attraction and repulſion, have been obliged to call in the action of mind to their aſſiſtance. The Hutchinſonians were hardly put to it in accounting for every thing by the action of fire, light, and air, when luckily the diſcoveries in electricity, came to their aſſiſtance. It muſt be owned that this fluid does indeed come in like a kind of fifth element, which in many caſes appears to be the animating principle of nature. For ſome time paſt, almoſt all the remarkable phenomena in nature have been explained by electricity, or the action of the electric fluid. But unleſs this action is explained, we are got no farther than we were before. To ſay any thing is done by electricity, is not more intelligible than to ſay it was done by attraction. If we explain an effect by a material cauſe, it ought to be done upon mechanical principles. We ought to be ſenſible how one part of matter acts upon another part in ſuch a manner as to produce the effect we deſire to explain. The electrical philoſophers, however, have not yet been able to inveſtigate the manner in which this ſubtile fluid operates; and hence the many diſcoveries in electricity have not contributed to throw that light on the theory of the earth, which perhaps they may do hereafter. With ſome philoſophers, however, the electric fluid itſelf, and indeed all the powers of nature, ſeem in danger of being ſuperſeded by a principle, at preſent very little known, called the phlogiſton.

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Dr. Burnet's Theory.

According to Dr. Burnet, the earth was originally a fluid maſs, or chaos compoſed of various ſubſtances differing both in denſity and figure. Thoſe which were moſt heavy ſunk to the centre, and formed there a hard ſolid body: thoſe which were ſpecifically lighter remaining next above: and the waters, which were lighteſt of all, covered the earth all round. The air, and other ethereal fluids, which are ſtill lighter than water, floated above it, and ſurrounded the globe alſo. Between the waters, however, and the circumambient air, was formed a coat of oily and unctuous matters lighter than water. The air at firſt was very impure, and muſt neceſſarily have carried up with it many of thoſe earthy particles with which it was once blended: however, it ſoon began to purify itſelf, and depoſit thoſe particles upon the oily cruſt abovementioned; which ſoon uniting together, the earth and oil became the cruſt of vegetable earth, with which the whole globe is now covered. His account of the deſtruction of the primæval world by the flood, by the falling down of the ſhell of earth into the waters of the abyſs, is given under the article **Deluge**. It only remains then to give his account of the manner in which he relieves the earth from this univerſal deſtruction; and this he does as follows: Theſe great maſſes of earth, ſays he, falling into the abyſs, drew down with them vaſt quantities alſo of air; and by daſhing againſt each other, and breaking into ſmall parts by the repeated violence of the ſhock, they at length left between them large cavities filled with nothing but air. Theſe cavities naturally offered a bed to receive the influent waters; and in proportion as they filled, the face of the earth became once more viſible. The higher parts of its broken ſurface, now become the tops of mountains, were the firſt that appeared; the plains ſoon after came forward; and at length the whole globe was delivered from the waters, except the places in the loweſt ſituations; ſo that the ocean and ſeas are ſtill a part of the ancient abyſs, that have had no place to which they might return. Iſlands and rocks are fragments of the earth's former cruſt; continents are larger maſſes of its broken ſubſtance; and all the inequalities that are to be found on the ſurface of the preſent earth are effects of the confuſion into which both earth and water were at that time thrown.

Dr. Woodward's.

Dr. Woodward begins with aſſerting, that all terrene ſubſtances are diſpoſed in beds of various natures, lying horizontally one over the other, ſomewhat like the coats of an onion: that they are replete with ſhells, and other productions of the ſea; theſe ſhells being found in the deepeſt cavities, and on the tops of the higheſt mountains. From theſe obſervations, which are warranted by experience, he proceeds to obſerve, that theſe ſhells, and extraneous foſſils, are not productions of the earth, but are all actual remains of thoſe animals which they are known to reſemble; that all the ſtrata or beds of the earth lie under each other in the order of their ſpecific gravity, and that they are diſpoſed as if they had been left there by ſubſiding waters. All this he very confidently affirms, though daily experience contradicts him in ſome and ſo the ſail is made faſt to the yard; and into the lowermoſt earings the ſheet and tackles are ſeized, or bent at the clew.

EARL, a Britiſh title of nobility, next below a marquis, and above a viſcount. The title is ſo ancient, that its original cannot be clearly traced out. This much, however, ſeems tolerably certain, that among the Saxons they were called *ealdormen*, *quaſi* elder men, ſignifying the ſame with *ſenior* or *ſenator* among the Romans; and alſo *ſchiremen*, becauſe they had each of them the civil government of a ſeveral diviſion or ſhire. On the irruption of the Danes they changed their names to *eorles*, which, according to Cambden, ſignified the ſame in their language. In Latin they are called *comites*, (a title firſt uſed in the empire), from being the king's attendants; *a ſocietate nomen ſumpſerunt, regis enim tales ſibi aſſociant.* After the Norman conqueſt they were for ſome time called *counts* or *countees*, from the French; but they did not long retain that name themſelves, though their ſhires are from thence called counties to this day. It is now become a mere title: they have nothing to do with the government of the county; which is now, entirely devolved on the ſheriff, the earl's deputy, or vicecomes. In writs, commiſſions, and other formal inſtruments, the king, when he mentions any peer of the degree of an earl, uſually ſtiles him "truſty and well beloved couſin:" an appellation as ancient as the reign of Henry IV; who being either by his wife, his mother, or his ſiſters, actually related or allied to every earl in the kingdom, artfully and conſtantly acknowledged that connexion in all his letters and other public acts: from whence the uſage has deſcended to his ſucceſſors, though the reaſon has long ago failed.

An earl is created by cincture of ſword, mantle of ſtate put upon him by the king himſelf, a cap and a coronet put upon his head, and a charter in his hand. All the earls of England are denominated from ſome ſhire, town, or place, except three; two of whom, viz. earl Rivers, and earl Paulet, take their denomination from illuſtrious families: the third is not only honorary as all the reſt, but alſo officiary, as the earl marſhal of England. See Syſtem of PEERAGE.

EARL *Marſhal of England*, is a great officer who had anciently ſeveral courts under his juriſdiction, as the court of chivalry, and the court of honour. Under him is alſo the herald's office or college of arms. He hath ſome pre-eminence in the court of Marſhalſea, where he may ſit in judgment againſt thoſe who offend within the verge of the king's court. The office is of great antiquity in England, and anciently of greater power than now: and has been for ſeveral ages hereditary in the moſt noble family of Howard.

EARNEST, ARRHÆ, money advanced to bind the parties to the performance of a verbal bargain. By the civil law, he who recedes from his bargain loſes his earneſt, and if the perſon who received the earneſt give back, he is to return the earneſt double. But with us, the perſon who gave it, is in ſtrictneſs obliged to abide by his bargain; and in caſe he decline it, is not diſcharged upon forfeiting his earneſt, but may be ſued for the whole money ſtipulated.

EARTH, among ancient philoſophers and chymiſts, one of the four elements of which the whole ſyſtem of nature was thought to be compoſed. See ELEMENT.

EARTH, in aſtronomy and geography, one of the primary planets; being this terraqueous globe which we inhabit.

THEORY OF THE EARTH.

Different Opinions reſpecting the Coſmogony.

The coſmogony, or knowledge of the original formation of the earth, the materials of which it was compoſed, and by what means they were diſpoſed in the order in which we ſee them at preſent, is a ſubject which, though perhaps above the reach of human ſagacity, has exerciſed the ſtudy of philoſophers in all ages. To recount the opinions of all the eminent philoſophers of antiquity upon this ſubject would be too tedious; it may therefore ſuffice to obſerve, that, ever ſince the ſubject began to be canvaſſed, the opinions of thoſe who have treated it may be divided into two claſſes.

1. Thoſe who believed the earth, and whole viſible ſyſtem of nature, to be the Deity himſelf, or connected with him in the ſame manner that a human body is with its ſoul. 2. Thoſe who believed the materials of it to have been eternal, but diſtinct from the Deity, and put into the preſent order by ſome power either inherent in themſelves, or belonging to the Deity. Of the firſt opinion were Xenophanes, the founder of the Eleatic ſect, Strato of Lampſacus, the Peripatetics, &c.

The ſecond opinion, namely, that the ſubſtance of the earth or univerſe (for it is impoſſible to ſpeak of the one without the other) was eternal, though not the form, was moſt generally held among the ancients. From that eſtabliſhed axiom, that "nothing can be produced from nothing," they concluded that creation was an impoſſibility; but at the ſame time they thought they had good reaſon to believe the world had not been always in its preſent form. They who held this opinion may again be divided into two claſſes; firſt, thoſe who endeavoured to account for the generation of the world, or its reduction into the preſent form, by principles merely mechanical, without having recourſe to any aſſiſtance from divine power; and ſecondly, thoſe who introduced an intelligent mind as the author and diſpoſer of all things. To the firſt of theſe claſſes belonged the coſmogony of the Babylonians, Phœnicians, and Egyptians; the particulars of which are too abſurd to deſerve notice. Of the ſame opinion alſo were moſt of the poets; the philoſophers Thales, Anaximander, Anaximenes, Anaxagoras, &c. The latter attempted to reform the philoſophy of his maſter Anaximenes by introducing an intelligent principle into the world, diſtinct from matter; thus making his intelligent principle, or God, the ſoul of the world. Diogenes of Apollonia ſuppoſed air, which he made the firſt principle of all things, to be endued with reaſon: His manner of philoſophiſing differed very little from that of Des Cartes. "All things, (ſays he,) being in motion, ſome became condenſed, and others rarefied. In thoſe places where condenſation prevailed, a whirling motion, or vortex, was formed; which by its revolution drew in the reſt, and the lighter parts flying upwards formed the ſun."

The hypotheſis of Democritus agrees in the main with that of Epicurus as repreſented by Lucretius. The moſt material difference between the two ſyſtems, however, was, that Epicurus admitted no principle but the atoms themſelves; whereas Democritus believed them to be animated.

Opinions of Pythagoras, Plato, and Ariſtotle.

Of thoſe who held two diſtinct and coeternal principles, viz. God and Matter, we ſhall only take notice of the opinions of Pythagoras, Plato, and Ariſtotle, as being the moſt remarkable. Pythagoras is ſaid to have aſſerted two ſubſtantial ſelf-exiſtent principles; a *monad*, or unity: and a *dyad*, or duality. The meaning of theſe terms is now ſomewhat uncertain. Some think, that by the monad, he meant the Deity; and, by the dyad, matter. Others think, that the Pythagoric monads were atoms. The dyad is ſometimes thought to ſignify a demon or evil principle; but Porphyry's interpretation, which ſeems the moſt probable, is as follows. The cauſe, ſays he, of that ſympathy, harmony, and agreement which is in things, and of the conſervation of the whole, which is always the ſame and like itſelf, was by Pythagoras called *unity*; that unity which is in the things, themſelves, being but a participation of the firſt cauſe: but the reaſon of difference, inequality, and conſtant irregularity in things, was by him called a *dyad*. This philoſopher held *numbers* to be the principles of all things, and from them he accounted for the production of the world in the following manner: He ſuppoſed that the moad and dyad were the two ſources of numbers, from whence proceeded points; from points, lines; from lines, plane figures; from planes, ſolids; from ſolids, ſenſible bodies. The elements of ſenſible bodies are four; but beſides theſe, there is a fifth (never yet diſcovered.) The four elements which manifeſt themſelves to our ſenſes are fire, air, earth, and water. Theſe are in a perpetual change, and from them the world was formed; which is animated, intelligent, and ſpherical; containing, in the midſt of it, the earth, a globoſe and inhabited body. The world, he ſaid, began from fire, and the fifth element; and that as there were five figures of ſolid bodies, called mathematical or regular, the earth was made of the cube, fire of the pyramid or tetrahedron, the air of the octahedron, water of the icoſahedron, and the ſphere of the univerſe of the dodecahedron. This method of philoſophizing, which has no manner of foundation in nature, was adopted by Plato and Ariſtotle: and hence proceeded all the abſurdities concerning ideas, forms, qualities, &c. with which the Ariſtotelian philoſophy was loaded.

For a long time, however, the philoſophy of Ariſtotle prevailed, and the world was thought to be upheld by forms, qualities, and other unintelligible and imaginary beings. At laſt the French philoſopher, Deſcartes, ſuperſeded the Ariſtotelian, by introducing the atomic, or Democritic, and Epicurean philoſophy. The Carteſian ſyſtem was quickly ſuperſeded by the Newtonian: which ſtill continues, though conſiderably different from what it was left by that great man.

Newtonian Syſtem ſupercedes the Ariſtotelian and Carteſian.

His opinions, indeed, concerning the coſmogony ſeem to have been in a fluctuating ſtate: and hence he delivers himſelf in ſuch a manner, that he hath often incurred the charge of contradicting himſelf. He maintained, for inſtance, that matter was infinitely diviſible, and the mathematical demonſtrations of this propoſition are well known. Notwithſtanding this, however, when he comes particularly to ſpeak of the original conſtruction of the world, he ſeems to retract this opinion, and adopt the atomic philoſophy. He tells us, that it ſeems probable, that in the beginning God formed matter in *ſolid, maſſy, impenetrable*, particles, &c.; and that of theſe particles, endowed with various powers of attraction and repulſion, the preſent ſyſtem of nature is formed.

Three Laws of Nature laid down by Sir Iſaac.

His primary laws of nature are only three in number, and very ſimple. The firſt is, that all matter has a tendency to continue in that ſtate in which it is once placed, whether of reſt or motion. If it is at reſt, for example, it will continue at reſt for ever, without beginning motion of itſelf; but if it is once ſet in motion, by any cauſe whatever, it will for ever continue to move in a right line, until ſomething either ſtops it altogether, or forces it to move in another direction. 2. That the change of motion is always equivalent to the moving force employed to produce it, and in the direction of the right line in which it is impreſſed; that is, if a cerrain force produces a certain motion, double that force will produce double that motion, &c. 3. Reaction is always contrary and equal to action; or the actions of two bodies upon one another are always equal and contrary to one another.

From theſe three laws, together with the two contrary forces of attraction and repulſion, Sir Iſaac Newton and his followers have attempted to explain all the phenomena of nature. When they come to explain the nature of the attractive and repulſive forces, however, they are exceedingly embarraſſed. Sir Iſaac hath expreſſed himſelf in two different ways concerning them. In his Principia, he pretty poſitively determines them to be owing to a cauſe that is not material; and in his queries, he ſuppoſes they may be effects of ſome ſubtile matter which he calls *ether*.

Diſagreement among his Followers.

This diſagreement with himſelf hath produced no ſmall diſagreement among his followers. One party, laying hold of his aſſertions in the Principia, determine the world to be upheld by immaterial powers; while the other, neglecting the Principia, and taking notice only of the queries at the end of the optics, ſtrenuouſly maintain, that attraction and repulſion are owing to the action of ſome exceedingly fine and ſubtile ether. The firſt of theſe ſuppoſitions, it is argued, neceſſarily involves us in one of the following dilemmas. 1. If the attractive and repulſive forces are not material, they muſt either be occaſioned by ſpiritual beings, or they muſt be qualities of matter. If they are occaſioned by the action of immaterial beings, theſe beings muſt either be created or uncreated. If they are produced by the action of created beings, we run into the ſuppoſition of ſome of the ancient heathens, that the world is governed by demons or ſubordinate intelligences; and thus may make an eaſy tranſition to polytheiſm. If attraction and repulſion are the immediate action of the deity himſelf, we run into the doctrine of making God the ſoul of the world. This laſt hypotheſis hath been moſt ſtrenuouſly adopted by Mr. Baxter in his treatiſe of the Immateriality of the human Soul.

Mr. Mitchel, Boſcovich, and Dr. Prieſtley's Opinions.

Mr. Boſcovich, Mr. Mitchel, and Dr. Prieſtley, have likewiſe adopted the hypotheſis of immaterial powers to ſuch a degree, that, according to them, the whole world conſiſts of nothing elſe but attractions and repulſions mixed with phyſical points. If we ſuppoſe the attractive and repulſive powers to be only properties, qualities, or laws, impreſſed on matter by the deity, we might as well have been contented with the occult qualities of Ariſtotle. If attraction and repulſion are occaſioned by the action of mere matter, and all the powers in nature are only material, the charge is incurred of making nature direct itſelf in ſuch a manner, that there is no occaſion for the interpoſition, or even the exiſtence, of a deity at all.

Thus we ſee, the Newtonian coſmogony muſt incline either to the Platonic and Ariſtotelian, or to the Atomic or Epicurean; according to the hypotheſis we lay down concerning the nature of attraction. Des Cartes's ſyſtem was plainly a revival of that of Democritus and Epicurus, with ſome corrections and improvements.

Mr. Hutchinſon's Syſtem.

It was further improved and corrected by Mr. Hutchinſon, who added to it the authority of Revelation. The created agents he choſe in his coſmogony were fire, light, and air. Theſe, we ſee, have indeed a very conſiderable ſhare in the operations of nature; but unleſs we explain the manner in which they operate, our knowledge is not at all increaſed, and we might as well have been contented with the Newtonian attraction and repulſion, or even the occult qualities of Ariſtotle. Attempts have indeed been made to ſolve the phenomena of nature, from the action of theſe three agents, both by Hutchinſon himſelf, and many of his followers. Theſe attempts, however, have always proved unſucceſsful. Some phenomena indeed may be explained pretty plauſibly from the known action of theſe three; but when we come to ſpeak of what may be called the nicer operations of nature, ſuch as the growth of plants and animals, we are utterly at a loſs.

A Deficiency of active Principles in all the Theories yet invented.

The manifeſt deficiency of active principles in all the theories of the earth that have yet been invented, hath occaſioned a conſtant ſearch after others which ſhould be able, by their ſuperior activity, to fill up the blank which neceſſarily remained in the ſyſtem. Pythagoras, Plato, and Ariſtotle, being unable to account for the formation of the earth from their four elements, called in the aſſiſtance of a fifth, which was never yet diſcovered. Epicurus, finding the motions attributed to his atoms by Democritus to be inſufficient, had recourſe to an imaginary, and on his own principles impoſſible, declination of the atoms. Deſcartes finding the atoms, themſelves inſufficient, aſſerted that they were not atoms, but might be broken into ſmaller parts, and thus conſtitute matter of various degrees of ſubtilty. The Newtonian philoſophers have found Des Cartes's ſyſtem inſufficient; but being greatly diſtreſſed in their attempts to ſolve all the phenomena of nature by mere attraction and repuſion, have been obliged to call in the action of mind to their aſſiſtance. The Hutchinſonians were hardly put to it in accounting for every thing by the action of fire, light, and air, when luckily the diſcoveries in electricity came to their aſſiſtance. It muſt be owned that this fluid does indeed come in like a kind of fifth element, which in many caſes appears to be the animating principle of nature. For ſome time paſt, almoſt all the remarkable phenomena in nature have been explained by electricity, or the action of the electric fluid. But unleſs this action is explained, we are got no farther than we were before. To ſay any thing is done by electricity, is not more intelligible than to ſay it was done by attraction. If we explain an effect by a material cauſe, it ought to be done upon mechanical principles. We ought to be ſenſible how one part of matter acts upon another part in ſuch a manner as to produce the effect we deſire to explain. The electrical philoſophers, however, have not yet been able to inveſtigate the manner in which this ſubtile fluid operates; and hence the many diſcoveries in electricity have not contributed to throw that light on the theory of the earth, which perhaps they may do hereafter. With ſome philoſophers, however, the electric fluid itſelf, and indeed all the powers of nature, ſeem in danger of being ſuperſeded by a principle, at preſent very little known, called the phlogiſton.

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Many difficulties preſent themſelves to one who undertakes to write a natural hiſtory or theory of the earth. The moſt remarkable attempts to produce a theory of this kind are thoſe of Burnet, Woodward, Whiſton, and Buffon.

Dr. Burnet's Theory.

According to Dr. Burnet, the earth was originally a fluid maſs, or chaos compoſed of various ſubſtances differing both in denſity and figure. Thoſe which were moſt heavy ſunk to the centre, and formed there a hard ſolid body: thoſe which were ſpecifically lighter remaining next above: and the waters, which were lighteſt of all, covered the earth all round. The air, and other ethereal fluids, which are ſtill lighter than water, floated above it, and ſurrounded the globe alſo. Between the waters, however, and the circumambient air, was formed a coat of oily and unctuous matters lighter than water. The air at firſt was very impure, and muſt neceſſarily have carried up with it many of thoſe earthy particles with which it was once blended: however, it ſoon began to purify itſelf, and depoſit thoſe particles upon the oily cruſt abovementioned; which ſoon uniting together, the earth and oil became the cruſt of vegetable earth, with which the whole globe is now covered. His account of the deſtruction of the primæval world by the flood, by the falling down of the ſhell of earth into the waters of the abyſs, is given under the article DELUGE. It only remains then to give his account of the manner in which he relieves the earth from this univerſal deſtruction; and this he does as follows: Theſe great maſſes of earth, ſays he, falling into the abyſs, drew down with them vaſt quantities alſo of air; and by daſhing againſt each other, and breaking into ſmall parts by the repeated violence of the ſhock, they at length left between them large cavities filled with nothing but air. Theſe cavities naturally offered a bed to receive the influent waters; and in proportion as they filled, the face of the earth became once more viſible. The higher parts of its broken ſurface, now become the tops of mountains, were the firſt that appeared; the plains ſoon after came forward; and at length the whole globe was delivered from the waters, except the places in the loweſt ſituations; ſo that the ocean and ſeas are ſtill a part of the ancient abyſs, that have had no place to which they might return. Iſlands and rocks are fragments of the earth's former cruſt; continents are larger maſſes of its broken ſubſtance; and all the inequalities that are to be found on the ſurface of the preſent earth are effects of the confuſion into which both earth and water were at that time thrown.

Dr. Woodward's.

Dr. Woodward begins with aſſerting, that all terrene ſubſtances are diſpoſed in beds of various natures, lying horizontally one over the other, ſomewhat like the coats of an onion: that they are replete with ſhells, and other productions of the ſea; theſe ſhells being found in the deepeſt cavities, and on the tops of the higheſt mountains. From theſe obſervations, which are warranted by experience, he proceeds to obſerve, that theſe ſhells, and extraneous foſſils, are not productions of the earth, but are all actual remains of thoſe animals which they are known to reſemble; that all the ſtrata or beds of the earth lie under each other in the order of their ſpecific gravity, and that they are diſpoſed as if they had been left there by ſubſiding waters. All this he very confidently affirms, though daily experience contradicts him in ſome of them; particularly, we often find layers of ſtone over the lighteſt ſoils, and the ſofteſt earth under the hardeſt bodies. However, having taken it for granted, that all the layers of the earth are found in the order of their ſpecific gravity, the lighteſt at top, and the heavieſt next the centre, he conſequently aſſerts, that all the ſubſtances of which the earth is compoſed, were originally in a ſtate of diſſolution. This diſſolution he ſuppoſes to have taken place at the flood: but being aware of an objection, that the ſhells, &c. ſuppoſed to have been depoſited at the flood are not diſſolved, he exempts them from the ſolvent power of the waters, and endeavours to ſhew that they have a ſtronger coheſion than minerals; and that, while even the hardeſt rocks are diſſolved, bones and ſhells may remain entire.

Mr. Whiſton's.

Mr. Whiſton ſuppoſes the earth to have been originally a comet; and conſiders the Moſaic account of the creation as commencing at the time when the Creator placed this comet in a more regular manner, and made it a planet in the ſolar ſyſtem. Before that time, he ſuppoſes it to have been a globe without beauty or proportion; a world in diſorder ſubject to all the viciſſitudes which comets endure; which, according to the preſent ſyſtem of philoſophy, muſt be alternately expoſed to the extremes of heat and cold. Theſe alterations of heat, and cold, continually melting and freezing the ſurface of the earth, he ſuppoſes to have produced to a certain depth, a chaos reſembling that deſcribed by the poets, ſurrounding the ſolid contents of the earth, which ſtill continued unchanged in the midſt; making a great burning globe of more than 2000 leagues in diameter. This ſurrounding chaos, however, was far from being ſolid: he reſembles it to a denſe, though fluid atmoſphere, compoſed of ſubſtances mingled, agitated and ſhocked againſt each other: and in this diſorder he ſuppoſes the earth to have been juſt at the eve of the Moſaic creation. But upon its orbit being then changed, when it was more regularly wheeled round the ſun, every thing took its proper place, every part of the ſurrounding fluid then fell into a certain ſituation according as it was light or heavy. The middle, or central part, which always remained unchanged, ſtill continued ſo; retaining a part of that heat which it received in its primæval approaches towards the ſun; which heat he calculates may continue about 6000 years. Next to this fell the heavier parts of the chaotic atmoſphere, which ſerve to ſuſtain the lighter: but as in deſcending they could not entirely be ſeparated from many watery parts, with which they were intimately mixed, they drew down theſe alſo along with them; and theſe could not mount again after the ſurface of the earth was conſolidated: they therefore ſurrounded the heavy firſt deſcending parts in the ſame manner as theſe ſurrounded the central globe. Thus the entire body of the earth is compoſed next the centre of a great burning globe: next this is placed an heavy terrene ſubſtance that encompaſſes it; round which is circumfuſed a body of water. Upon this body of waters is placed the cruſt of earth on which we inhabit: ſo that, according to Mr. Whiſton, the globe is compoſed of a number of coats, or ſhells, one within the other, all of different denſities. The body of the earth being thus formed, the air, which is the lighteſt ſuſtance of all, ſurrounded its ſurface; and the beams of the ſun darting through, produced the light, which, we are told by Moſes, firſt obeyed the Divine command.

The whole œconomy of the creation being thus adjuſted, it only remained to account for the riſings and depreſſions on the ſurface of the earth, with the other ſeeming irregularities, of its preſent appearance. The hills and valleys are by him conſidered as formed by their preſſing upon the internal fluid which ſuſtains the external ſhell of earth, with greater or leſs weight: thoſe parts of the earth which are heavieſt ſink the loweſt into the ſubjacent fluid, and thus become valleys: thoſe that are lighteſt riſe higher upon the earth's ſurface, and are called mountains.

Such was the face of nature before the deluge: the earth was then more fertile and populous than it is at preſent; the life of men and animals was extended to ten times its preſent duration; and all theſe advantages aroſe from the ſuperior heat of the central globe, which has ever ſince been cooling. As its heat was then in its full power, the genial principle was alſo much greater than at preſent; vegetation and animal increaſe were carried on with more vigour; and all nature ſeemed teeming with the ſeeds of life. But as theſe advantages were productive only of moral evil, it was found neceſſary to deſtroy all living creatures by a flood.

Mr. Buffon's Theory.

Mr. Buffon's theory differs very widely from all the reſt. He begins with attempting to prove, that this world which we inhabit is no more than the ruins of a world. "The ſurface of this immenſe globe, ſays he, exhibits to our obſervation, heights, depths, plains, ſeas, marſhes, rivers, caverns, gulfs, volcanoes; and, on a curſory view, we can diſcover in the diſpoſition of theſe objects neither order nor regularity. If we penetrate into the bowels of the earth, we find metals, minerals, ſtones, bitumens, ſands, earths, waters, and matter of every kind, placed as it were by mere accident, and without any apparent deſign. Upon a nearer and more attentive inſpection, we diſcover ſunk mountains, caverns filled up, ſhattered rocks, whole countries ſwallowed up, new iſlands emerged from the ocean, heavy ſubſtances placed above light ones, hard bodies incloſed within ſoft bodies: in a word, we find matter in every form, dry and humid, warm and cold, ſolid and brittle, blended in a chaos of confuſion, which can be compared to nothing but a heap of rubbiſh, or the ruins of a world."

I am convinced, ſays Mr. Buffon, from repeated obſervation, that marbles, limeſtones, chalks, marles, clays, ſand, and almoſt all terreſtrial ſubſtances, wherever ſituated, are full of ſhells and other ſpoils of the ocean.

From theſe poſitions, which he lays down as facts, Mr. Buffon draws the following concluſions:

1. The changes which the earth has undergone within theſe laſt 2000 or 3000 years muſt be inconſiderable, when compared with the great revolutions that took place in thoſe ages immediately ſucceeding the creation. The reaſon he gives for this aſſertion is, that terreſtrial ſubſtances could not acquire ſolidity but by the continued action of gravity: hence, the earth muſt have been originally much ſofter than it is now, and therefore more apt to be changed by cauſes which cannot now affect it.

2. It ſeems an uncontrovertible fact, that the dry land which we now inhabit, and even the ſummits of the higheſt mountains, were formerly covered with the waters of the ſea; for ſhells and other marine bodies are ſtill found upon the very tops of mountains.

3. The waters of the ſea have remained for a long track of time upon the ſurface: becauſe in many places, ſuch immenſe banks of ſhells have been diſcovered, that it is impoſſible ſo great a multitude of animals could exiſt at the ſame time.

4. From this circumſtance it likewiſe appears, that, although the materials on the ſurface of the earth were then ſoft, eaſily diſunited, moved, and tranſported by the waters, yet theſe tranſportations could not be ſuddenly effected: they muſt have been gradual and ſucceſſive, as ſea bodies are ſometimes found more than 1000 feet below the ſurface; and ſuch a thickneſs of earth, or ſtone, could not be accumulated in a ſhort time.

5. It is impoſſible theſe effects could be owing to the univerſal deluge. For, though we ſhould ſuppoſe that all the ſhells in the bottom of the ocean ſhould be depoſited upon the dry land; yet, beſides the difficulty of eſtabliſhing this ſuppoſition, it is plain, that as ſhells are found incorporated in marble, and in the rocks of the higheſt mountains, we muſt ſuppoſe theſe rocks and marbles to have been formed all at the very inſtant when the deluge took place; and that before this grand revolution, there were neither mountains, nor marbles, nor rocks, nor clays, nor matter of any kind ſimilar to what we are now acquainted with; as they all, with few exceptions, contain ſhells, and other productions of the ocean; Beſides, at the time of the univerſal deluge, the earth muſt have acquired a conſiderable degree of ſolidity, by the action of gravity for more than ſixteen centuries. During the ſhort time the deluge laſted, therefore, it is impoſſible that the waters ſhould have overturned and diſſolved the whole ſurface of the earth to the greateſt depths.

6. It is certain, (for what reaſon he does not mention), that the waters of the ſea have, at ſome period or other, remained for a ſucceſſion of ages upon what we know to be dry land; and conſequently that the vaſt continents of Aſia, Europe, Africa, and America, were then the bottom of an immenſe ocean, replete with every thing which the preſent ocean produces.

How the Earth was deſerted by the Ocean and left dry.

Having thus diſcuſſed ſome very important points reſpecting the theory of the earth, our author now proceeds to anſwer other queſtions which ſeem more difficult of ſolution.

7. But how has it happened that this earth, which we and our anceſtors have inhabited for ages, which, from time immemorial, has been an immenſe continent, dry, compact, and removed from the reach of water, ſhould, if formerly the bottom of an ocean, be now exalted to ſuch a height above the waters, and ſo completely ſeparated from them. Since the waters remained ſo long upon the earth, why have they now deſerted it? What accident, what cauſe, could introduce a change ſo great? A little reflection, ſays he, will furniſh us with at leaſt plauſible ſolutions to theſe ſeemingly ſo difficult queſtions. We daily obſerve the ſea gaining ground on certain coaſts, and loſing it on others. We know that the ocean has a general and uniform motion from eaſt to weſt: that it makes violent efforts againſt the rocks and low grounds which encircle it; that there are whole provinces which human induſtry can hardly defend from the fury of the waves; and that there are inſtances of iſlands which have but lately emerged from the waters, and of regular inundations. Hiſtory informs us of inundations and deluges of a more extenſive nature. Ought not all this to convince us, that the ſurface of the earth has experienced very great revolutions, and that the ſea may have actually given up poſſeſſion of the greateſt part of the ground which it formerly occupied? For example, let us ſuppoſe, that the old and new worlds were formerly but one continent; and that, by a violent earthquake, the ancient Atlantis of Plato was ſunk. The conſequence of this mighty revolution muſt neceſſarily be, that the ſea would ruſh in from all quarters, and form what is now called the Atlantic ocean; and vaſt continents, perhaps thoſe we now inhabit, would of courſe be left dry. This great revolution might be effected by the ſudden failure of ſome immenſe cavern in the

interior parts of the globe, and an univerſal deluge would infallibly ſucceed.

8. But, however conjectures of this kind may ſtand, it is certain that ſuch a revolution hath happened: and we may even believe that it hath happened naturally; for if a judgment of the future is to be formed from the paſt, we have only to attend carefully to what paſſes before our eyes. It is a fact eſtabliſhed by the repeated obſervation of voyagers, that the ocean has a conſtant motion from eaſt to weſt. This motion, like the trade-winds, is not only perceived between the tropics, but though the whole temperate climates, and as near the poles as navigators have approached. As a neceſſary conſequence of this motion, the Pacific Ocean muſt make continual efforts againſt the coaſts of Tartary, China, and India; the Indian ocean muſt act againſt the eaſt coaſt of Africa; and the Atlantic muſt in a ſimilar manner act againſt all the eaſtern coaſts of America. Hence the ſea muſt have gained, and will always continue to gain, on the eaſt, and to loſe on the weſt. This of itſelf would be ſufficient to prove the poſſibility of the change of the ſea into land, and land into ſea. If ſuch is the natural effect of the ſea's motion from eaſt to weſt, may it not reaſonably be ſuppoſed, that Aſia, and all the eaſtern continent, is the moſt ancient country in the world; and that Europe, and part of Africa, eſpecially the weſt parts of theſe continents, as Britain, France, Spain, &c. are countries of a more recent date?

Buffon's Account of the Formation of the Planets.

Thus far our author preſerves ſome degree of plauſibility in his reaſoning; but in his account of the original formation of the earth, he certainly goes to the utmoſt verge of probability, or perhaps of poſſibility, in his ſuppoſitions. According to him, all the planets in our ſyſtem were originally parts of the ſun himſelf. They were detached from his body all at once by a mighty ſtroke of a comet. The poſſibility of driving off ſuch a quantity of matter from the ſun by a ſingle ſtroke, he labours hard to prove; but this is far from being the greateſt difficulty in his ſyſtem. "To this theory, ſays he, it may be objected, that if the planets had been driven off from the ſun by a comet, in place of deſcribing circles round him, they muſt, according to the law of projectiles, have returned to the ſame place from whence they had been forced; and therefore, that the projectile force of the planets cannot be attributed to the impulſe of a comet."

All Theories inſufficient, as well as Powers of Attraction and Repulſion.

From the preceding extracts, the theories of Drs. Burnet and Woodward, as well as Meſſrs. Whiſton and Buffon, will be eaſily underſtood; but the deficiency of all of them muſt be exceedingly obvious even to the moſt ſuperficial reader. They all aſſume only the powers of attraction and repulſion as agents; without conſidering, that theſe two powers, or indeed any other two with which we are acquainted, could only have compoſed matters nearly ſimilar to each other. If the original particles of matter are homogeneous, and endowed with ſimilar powers, all the matter we ſee ought to be homogeneous alſo. But this is far from being the caſe. Some parts of it we ſee are exceedingly hard, others proportionably ſoft. The parts of ſome bodies attract each other violently; thoſe of others have hardly any attraction for each other, but are ſeparable by the ſmalleſt force. And though it ſhould be granted, that the powers of attraction and repulſion were originally different in different parts of matter, we have ſtill to explain by what means the ſimilar parts of matter found out each other in ſuch a chaos as the earth originally was. This ſeems an inſuperable difficulty in the ſyſtems of Drs. Burnet and Woodward; and is equally, though leſs conſpicuouſly ſo, in thoſe of Whiſton and Buffon.

Deficiency of Mr. Whiſton's Theory.

Mr. Whiſton's ſyſtem has another and very remarkable defect. He ſuppoſes the earth to have been originally a comet, and at a certain time to have become a planet: but he forgets to tell us by what means this comet was originally formed, or what kind of bodies the comets are. Yet certainly this theory of the comet was as neceſſary to his ſyſtem, as the theory of the earth itſelf: for all the ſubſtances now exiſting on the earth muſt originally have exiſted in the comet; and if the natural powers were known, which made a diſtinction between one ſubſtance and another in the comet, we ſhould alſo know thoſe which diſtinguiſhed terreſtrial ſubſtances from one another. But though even this great deficiency ſhould be overlooked, the ſuppoſition of a chaos or original confuſion of any kind involves us in the greateſt difficulties. If the whole ſurface of the earth conſiſted of a chaos of melted matter, we cannot reaſonably think it would have appeared otherwiſe when cool than the lavas of burning mountains do juſt now; and this is a conſequence of his ſyſtem which Mr. Whiſton ſeems to have entirely overlooked.

Of Mr. Buffon's.

Mr. Buffon's theory is liable to the ſame difficulties with the reſt. He places his chaos in the ſun, and therefore ought to have given a theory of the ſun before he gave one of the earth. It ought alſo to have been ſhewn for what purpoſe the ſun was created when he had nothing to ſhine upon, or what probability there is that comets exiſted when there were no planets. His account of the formation of the planets by the ſtroke of a comet, is juſt within the verge of poſſibility; but his account of the formation of mountains by the motion of the winds and tides, is certainly inconſiſtent with the common principles of mechanics.

But what in the ſtrongeſt manner ſhews the fallacy of Mr. Buffon's hypotheſis, is the analogy he draws between mountains on dry land, and iſlands in the ſea. The iſlands, he ſays, are only the tops of great mountains in the ocean. If therefore the ocean had for a ſeries of many ages covered the preſent habitable part of the world, as our author ſuppoſes, we ſhould undoubtedly find many mountains upon the dry land, the tops of which had formerly been iſlands. But no ſuch thing is to be found. There is not on earth a mountain with a top broad and flat like the iſland of Great-Britain or Ireland, or even like iſlands of much leſs conſideration.

Theſe, and many other objections that will naturally occur to an attentive reader, ſhew the extreme difficulties under which the hypotheſis of Mr. Buffon labours, as well as others.

A Number of Natural Powers beſides Attraction and Repulſion proved to exiſt.

Though it is certain that the powers of attraction and repulſion exiſt in nature, it is no leſs certain that there are many others. One very remarkable power entirely different from thoſe of attraction and repulſion, may be called the power of aſſimilation or tranſmutation. By this, each animal, and each plant, changes the nutritious particles thrown into its ſtomach, or which it meets with in the earth, into a ſubſtance of its own peculiar kind. Thus, a ſtalk of wheat, by means of its roots, always aſſimilates the nutritious particles of the ground into that particular grain we call wheat, and no other. This power naturaliſts have not been able to explain, on the principles of attraction and repulſion, or any others with which we are acquainted; and therefore it may juſtly be called one of the primary laws of this earth at leaſt, whether we underſtand the manner in which it operates or not. Another power which ſeems to be diffuſed throughout this terraqueous globe, and common to all ſubſtances, water alone excepted, is that of multiplying themſelves, or producing others of the ſame ſpecies. With regard to plants and animals, this is exceedingly evident; but may be diſputed in the caſe of minerals. It is certain, however, that mines which have been exhauſted, will in time be again repleniſhed with ore; that ſpars and cryſtals, if broken or cut while their connection with the earth remains, will protrude a ſubſtance ſimilar to the reſt, as certainly as the wounded body of an animal will protrude fleſh of a kind ſimilar to what was taken away. The earth itſelf is capable of this multiplication. We ſee how it has a tendency to aſcend, and cover ſtones, &c. which lie a long time on the ſurface; and thus does this element, ſeemingly the moſt ſluggiſh of all others, ſwallow up every thing that lies for ſome time undiſturbed upon it. Hence we now meet with many monuments of antiquity below ground, which formerly were undoubtedly above it.

Changes may naturally happen in the Strata of the Earth.

With regard to the ſtrata, it ſeems undeniable that they may be produced from natural cauſes. Clay will ſometimes be conſolidated into ſtone; flint, marble, and limeſtone, are all found to grow naturally in the earth; ſo that we cannot draw any concluſion from the order in which we now find them. Though we find a bed of ſhells, then, in the heart of a ſolid rock, this makes no difficulty in the theory of the earth; ſince we know that the rock hath by ſome natural cauſe been conſolidated around them. In fact, this is not ſo wonderful, as what is related by Mr. Price in his treatiſe of minerals, mines, &c. viz. That at the town of Redruth in Cornwall, "ſome labourers being put to clear and level the ſtreet for a pavement, they found a piece of hard ſtone in the ground, with abundance of common ſmall pins of braſs interſperſed in and throughout the ſtone, in ſuch manner and form, that all thoſe who ſaw it afterwards, were convinced it was not done artificially, but that the ſtone was formed and produced by petrifaction, ſubſequent to the time the pins were dropped into the ground. Doctor Plot, in his Natural Hiſtory of Staffordſhire, ſays, that near Newcaſtle under Lyne, there was found a ſtone with a man's ſkull, teeth and all, incloſed in it."—From theſe and other facts in ſome meaſure ſimilar, this author concludes, that "every earth or clay, in ſome places, may be converted into ſtone in proceſs of time, at ſuch a depth where it is undiſturbed by being never lacerated nor moleſted, and alſo were it abounds with an uncommon quantity of juices of a lapideſcent quality: but this property being extenuated or deſtroyed, the earthy ſtones may not improbably again return to their primitive clay. Thus we ſee ſome ſorts of ſtone, when dug out of the ground and expoſed to the air for a conſiderable time, do moulder again into earth, at leaſt in appearance; while others, of an earth-like quality, are indurated, and become more compact and durable by lying above ground."

No ſufficient Proof of extraordinary Changes on the Surface of the Earth.

With regard to the extraordinary changes which Mr. Buffon and others imagine to have taken place on the ſurface of the earth, they do not appear to have any ſolid foundation. Changes, no doubt, have happened in particular parts; new iſlands have been thrown up from the bottom of the ſea by the force of ſubterraneous fire, and others have been ſwallowed up. But theſe appear to be merely the effects of volcanoes, which are common in many parts of the world; and we are not warranted to conclude, becauſe we ſee a ſmall volcanic iſland ariſe, and another ſwallowed up, that this has been the caſe with the whole habitable world.

Volcanic Theory.

An imperfect theory hath indeed been ſuggeſted by Sir William Hamilton, Mr. Brydone, and others, concerning the uſe of volcanoes and ſubterraneous fires; from whence it might ſeem probable, though they do not indeed ſay ſo in direct terms, that all the dry land was originally thrown up from the bottom of the ſea by the force of theſe fires. Sir William Hamilton, in his letter to Doctor Maty, broaches this theory in the following words. "I am myſelf convinced, that the whole circuit, ſo far as I have examined, within the boundaries marked in the map, (extending at leaſt 50 Italian miles in length, and 30 in breadth where broadeſt), is wholly and totally the production of ſubterraneous fires; and that moſt probably the ſea formerly reached the mountains, that lie behind Capua and Caſerta, and are a continuation of the Appenines. If I may be allowed to compare ſmall things with great, I imagine the ſubterraneous fires to have worked in this country under the bottom of the ſea, as moles in a field, throwing up here and there a hillock; and that the matter thrown out of ſome of theſe hillocks formed into ſettled volcanoes, filling up the ſpace between the one and the other, has compoſed this part of the continent, and many of the iſlands adjoining.

"From the obſervations I have made upon Mount Ætna, Veſuvius, and the neighbourhood, I dare ſay, that, after a careful examination, moſt mountains that are, or have been, volcanoes, would be found to owe their exiſtence to ſubterraneous fire; the direct reverſe of what I find the commonly received opinion.—Nature, though varied, is certainly in general uniform in her operations; and I cannot conceive, that two ſuch conſiderable volcanoes as Ætna, and Veſuvius, ſhould have been formed otherwiſe than every other conſiderable volcano of the known world. I do not wonder that ſo little progreſs hath been made in the improvement of natural hiſtory, and particularly in that branch of it which regards the theory of the earth: nature acts ſlowly; it is difficult to catch her in the fact.

Bracini, however, in his account of the eruption of 1613, ſays, that he found many ſorts of ſea ſhells on Veſuvius after that eruption; and P. Ignatio, in his account of the ſame eruption, ſays, that he and his companions picked up many ſhells likewiſe at that time upon the mountain: this circumſtance would induce one to believe, that the water thrown out of Veſuvius during that formidable eruption, came from the ſea."

Inſufficiency of the Volcanic Theory.

This may ſerve to ſhew upon what grounds the volcanic theory ſtands; but though we ſhould admit it in its utmoſt extent, the theory of the earth can receive but very little aſſiſtance from it. Mr. Hamilton himſelf does not ſay that all the mountains have been volcanoes, or that all the ſoil throughout the different quarters of the world hath been thrown up from the bottom of the ſea. If therefore, there remains but one mountain in the whole world which never was a volcano, we ſhall be as much difficulted to account for the production of that one, as though there were ever ſo many; and at any rate our theory will be abſolutely uſeleſs, becauſe what will account for the origin of that mountain, will alſo account for the origin of others. If we go a ſtep beyond Mr. Hamilton, and ſay, that there are no mountains whatever that have not been originally volcanoes, but that all the dry land is the production of ſubterraneous fire, our difficulties are ſo far from being removed, that they are greatly increaſed. The lavas and volcanic aſhes, though in time they become covered with an exceedingly fertile ſoil, remain abſolutely barren for a great number of years, inſomuch that, by the adopters of the volcanic hypotheſis, the period at which Moſes fixes the creation is reckoned by far too late to have given time for covering the many lavas of Italy and Sicily with the depth of earth they juſt now have upon them. The whole world therefore muſt have remained for many ages in a ſtate of abſolute ſterility; and by what means vegetation firſt began, or in what corner of the world, remains to be inquired into.

Without entering further into the theories either of Mr. Hamilton, or any other perſon, it is eaſy to ſee, that all of them are inſufficient to ſolve the difficulties mentioned. The difficulties with regard to the ſtrata and ſhells ſeem inſolveable by any other means than ſuppoſing that there are in the terreſtrial matter ſeveral diſtinct powers, by which the ſtrata of any particular kind are occaſionally transformed into others; and that the ſhells and other marine bodies were originally depoſited on the ſurface by the deluge. The volcanic hypotheſis, by which ſome attempt to account for the appearance of theſe bodies, will in no ſhape anſwer the purpoſe. By the exploſions of a volcano, ſhells, mud, ſand, &c. might be indiſcriminately thrown up, and ſcattered irregularly about; but we could never find the large beds of ſhells which are frequently to be met with of a conſiderable extent, in different parts of the earth.

Notion of Chaos ought not to be adopted.

With regard to any degree of certainty, it is ſcarcely to be hoped for on this ſubject. The common notion of the earth's being originally a chaos, ſeems neither to have a foundation in reaſon, nor in the Moſaic account of the creation. It is ſurely inconſiſtent with the wiſdom aſcribed to the deity to think that he would create this viſible ſyſtem in confuſion, and then employ it to put itſelf in order. It ſeems more probable, that the earth was originally created with the inequalities of ſurface we ſee it have, and that the natural powers for preſerving it were afterwards ſuperadded. Thus, according to Moſes, the firſt natural agent created, or produced, by directing matter to move in a certain manner, was light. This, we know, was abſolutely neceſſary for the evaporation of the water which took place on the ſecond day. Moſes tells us, that the earth was originally covered with water: and we ſee a natural reaſon why it ſhould be ſo; namely, that the evaporation by the atmoſphere might more eaſily take place. When this was done, there being then no more occaſion for the waters in that diffuſed ſtate, they were commanded to retire into the place appointed for them, and thus formed the ocean. Whether this was done by the action of gravity then firſt taking place, or by any other means, we have it not in our power to know, nor will our ſpeculations on this ſubject probably be attended with much benefit. We ſee, however, that the Moſaic account of the creation is perfectly conſiſtent with itſelf, and free from thoſe difficulties with which other ſyſtems are clogged. It is impoſſible to ſhew, how, by any natural power, a confuſed maſs of matter, ſuch as the chaos of the ancient poets, of Drs. Burnet and Woodward, the hollow globe of Mr. Hutchinſon, the comet of Mr. Whiſton, or the vitrified matter of Mr. Buffon, could put itſelf in the order in which we ſee it. The ſacred hiſtorian ſimply tells us, that God created the heavens and the earth; that the heavens gave no light, and the earth was covered with water. He firſt commanded the light to ſhine, then the air to take up what quantity of water he thought proper for the purpoſes of vegetation. After this, the dry land was made to appear; and the different powers of vegetation already taken notice of, were given to it. Next the ſun and moon were created as ſubordinate agents, to do what we are told the deity had done before by his own immediate action, namely, *to divide the light from the darkneſs, &c.* Then followed the formation of animals and of man.

Moſaic Account of the Creation perfectly conſiſtent.

According to this account, it would appear, that what we call the *laws of nature*, were given to preſerve the earth in that ſhape which the Deity thought proper to give it originally by his own power: and by no means to form it in any particular way, much leſs to put it out of the form which he had already given it: and thus the world, according to the beſt accounts we have, is very little altered in its appearance; and, according to what we can judge, will continue unaltered for ever, unleſs the Creator thinks proper to interpoſe in ſuch a manner as to ſuperſede all the laws he hath given it, and change it into ſome other form.

Objections to the Moſaic Chronology.

From ſome obſervations of Mr. Hamilton and others, objections have been drawn, as hath been already mentioned, to the Moſaic chronology. Theſe objections are in ſubſtance as follows. In pits, and other natural and artificial openings of the ground, in the neighbourhood of Veſuvius and Ætna, ſeveral beds of lava have been diſcovered at conſiderable depths below each other. Theſe beds of lava in ſome places are covered with ſucceſſive ſtrata of vegetable mould. From this diſpoſition of materials, Sir William concludes, that the world muſt have been created at a much more remote period than is generally believed. The different ſtrata of lava found below ground, he obſerves, muſt have proceeded from an equal number of eruptions from the mountain; and, ſuch of them as are covered with vegetable ſoil, muſt have remained at leaſt 1000 years on the ſurface before they could acquire a ſoil ſufficient for the purpoſes of vegetation. Ten or twelve ſucceſſive ſtrata overlaid with ſoil, have already been diſcovered in the bowels of the earth; and it has been ſtrongly aſſerted, that, by digging deeper, many more might have been found. Now, allowing 1000 years for each ſtratum of lava, which the ſupporters of this theory affirm to be too little, the antiquity of the earth cannot be leſs than 12,000 years, which is more than double its age according to the Moſaic account.

The principal fact in this theory is, that 1000 years are neceſſary to the production of a ſoil ſufficient for the nouriſhment and growth of vegetables upon volcanic lavas. This notion is confirmed by a conjecture of the Canonico Recupero, that ſtreams of lava in Sicily have lain for centuries without acquiring a vegetable mould; and by ſome obſcure accounts, that theſe lavas have proceeded from eruptions of Ætna above 1000 years ago.

The correſpondence of theſe facts, related by Sir William himſelf, with his favourite notion that 1000 years are neceſſary for the production of a vegetable ſoil, we leave the reader to determine; and ſhall conclude with a few remarks of a different kind.

The appearance of a ſtratum of lava below ground, though not covered with vegetable ſoil, our author conſiders as demonſtrative evidence, that ſuch ſtratum formerly lay above the ſurface, and was thrown out by an eruption. This inference, however, ſeems not altogether juſt. Nothing, with propriety, receives the denomination of an eruption, unleſs when lava or other matter is vomited from the crater, or from ſome new opening made in the mountain. But it deſerves notice, that, in the environs of volcanoes, earthquakes are frequent. That theſe violent concuſſions are the genuine

produce

roduce of ſubterraneous fire expanding itſelf in every direction, nd making ſtrong efforts againſt every ſubſtance which reſiſts the atural tendency of its courſe, is a fact that cannot admit of doubt. t is no leſs certain, that theſe frequent concuſſions ſhake and diſ-ocate the internal parts of the earth. They cannot fail to ſhatter nd diſarrange the natural direction of the original ſtrata; and, of ourſe, they muſt give riſe to many ſubterraneous cavities and iſures. The nearer the great furnace, which confines the fury of e flames, the greater and more frequent will be the cavities. very earthquake occaſioned by a volcano is nothing elſe than an ffort of the burning matter to enlarge the boundaries by which it uſually limited. If the quantity of matter and degree of inflam-ation require a ſpace greatly ſuperior to the internal cavities, an ruption above the ſurface is an infallible conſequence. But when e quantity of matter, or the expanſive force occaſioned by the de-ree of inflammation, is inſufficient to raiſe the lava to the top of e mountain, an earthquake may be produced; and the lava, ithout ever appearing above the ſurface, may run below ground plentiful ſtreams, and fill up all the ſubterraneous cavities and hannels. Theſe internal ſtrata of lava may often lie ſo deep as to e below the level of the ſea. In this manner, we conceive it to e not only poſſible, but extremely probable, that beds of lava, aving no covering of vegetable ſoil, may be found at great depths, lthough they never were above the ſurface.

It is much more reaſonable to conclude, that lavas with a layer f ſoil were produced by eruptions, and once lay above the ſur-ace, till covered by the operation of time, or ſubſequent ſtreams rom the mouth of the volcano. But even in this caſe, the argu-ment is not altogether complete; for, as above remarked, earth-uakes, with which countries adjacent to volcanoes are perpe-ually infeſted, often ſink large tracts of land to great depths.

For the other parts of the theory of the earth which regard the ſitu-tion of the different parts of its ſurface with reſpect to each other; ts annual motion round the ſun as a planet; its diurnal motion round ts axis; and the different ſtrata whereof it is compoſed, as far as t hath been hitherto found practicable to penetrate into. See the rticles GEOGRAPHY, ASTRONOMY, &c.

EARTH *Worm*, in entomology. See LUMBRICUS.

DISSERTATION ON THE CAUSES AND EFFECTS OF EARTHQUAKES,

ACCORDING TO THE HYPOTHESES OF ANCIENT AND MODERN PHILOSOPHERS.

EARTHQUAKE, in natural hiſtory, a ſudden and violent concuſſion of the earth, generally attended with ſtrange noiſes un-der-ground or in the air; often deſtroying whole cities at once, hrowing down rocks, altering the courſe of rivers, and producing he moſt terrible devaſtations.

Though there is hardly any country known in which ſhocks of n earthquake have not at ſome time or other been felt, yet there re ſome much more ſubject to them than others.

What Countries are moſt ſubject to Earthquakes.

It hath been obſerved, that northern countries in general are eſs ſubject to earthquakes than thoſe ſituated near the equator, or in the ſouthern latitudes; but this does not hold univerſally. The ſlands of Japan, which are ſituated pretty far north, are neverthe-leſs exceedingly liable to theſe deſtructive phenomena. Iſlands in general, are alſo more ſubject to earthquakes than continents; but neither does this hold without exceptions. Some particular parts of continents, and ſome particular iſlands, are more ſubject to them than others lying in the neighbourhood, and differing very little from them in external appearance. Thus, Portugal is more ſubject to earthquakes than Spain, and the latter much more than France: Mexico and Peru more than the other coun-tries of America, and Jamaica more than the other Caribbee iſlands. Earthquakes are frequent, though not often violent, in Italy; but in Sicily they are often terribly deſtructive. Aſia Minor hath been remarkably ſubject to them from the remoteſt antiquity, and the city of Antioch in particular hath ſuffered more from earthquakes than any other in that country. The ſame phe-nomena are ſaid alſo to occur very frequently in the north-eaſtern extremities of Aſia, even in very high latitudes.

Hiſtory of their Phenomena incomplete.

Though there are no phenomena in nature more calculated to impreſs the human mind with terror, and conſequently to be well remembered and taken notice of, than earthquakes, yet the philoſophy of them is but lately arrived at any degree of perfec-tion; and even at this day, the hiſtory of earthquakes is very in-complete. The deſtruction occaſioned by them engroſſes the mind too much to admit of philoſophical ſpeculations at the time they happen: the ſame thing prevents the attentive conſideration of the alterations that take place in the atmoſphere after the earth-quake is over, and which might probably throw ſome light on the cauſes which produced them; and the ſuddenneſs of its coming on prevents an exact attention to thoſe ſlight appearances in the earth or air, which, if carefully obſerved, might ſerve as warnings to avoid the deſtruction.

Account of the Earthquakes in different Parts of the World.

The following deſcriptions of earthquakes have been verified by accounts of witneſſes of indiſputable veracity. In 1692, an earthquake happened in Jamaica, attended with almoſt all the terrible circumſtances above mentioned. In two minutes, it de-ſtroyed the town of Port Royal, at that time the capital of the iſland; and ſunk the houſes in a gulph 40 fathoms deep. It was attended with an hollow rumbling noiſe like that of thunder: the ſtreets roſe like the waves of the ſea, firſt lifting up the houſes, and then immediately throwing them down into deep pits. All the wells diſcharged their waters with the moſt violent agitation. The ſea burſt over its bounds, and deluged all that ſtood in its way. The fiſſures of the earth were in ſome places ſo great, that one of the ſtreets appeared twice as broad as formerly. In many places it opened and cloſed again; and continued this agitation for ſome time. Of theſe openings, great numbers might be ſeen at once. In ſome of them, the people were ſwallowed up at once: in others, the earth caught them by the middle, and cruſhed them to death; while others, more fortunate, were ſwallowed up in one chaſm, and thrown out alive by another. Other chaſms were large enough to ſwallow up whole ſtreets; and others, ſtill more formidable, ſpouted up immenſe quantities of water, drown-ing ſuch as the earthquake had ſpared. The whole was attended with ſtenches and offenſive ſmells, the noiſe of falling mountains at a diſtance, &c. and the ſky, in a minute's time, was turned dull and reddiſh, like a glowing oven. Yet, as great a ſufferer as Port Royal was, more houſes were left ſtanding therein, than on the whole iſland beſide.

Scarce a planting houſe, or ſugar houſe, was left ſtanding in all Jamaica. A great part of them were ſwallowed up, houſes, peo-ple, trees, and all, in one gap: in lieu of which, afterwards ap-peared great pools of water; which, when dried up, left nothing but ſand, without any mark that ever tree or plant had grown thereon. The ſhock was ſo violent, that it threw people down on their knees or their faces as they were running about for ſhelter. Several houſes were ſhuffled ſome yards out of their places, and yet continued ſtanding. One Hopkins had his plantation removed half a mile from the place where it ſtood, without any conſidera-ble alteration. All the wells in the iſland, as well as thoſe of Port Royal, from one fathom to ſix or ſeven deep, threw their water out at the top with great violence. About 12 miles from the ſea, the earth gaped and ſpouted out, with a prodigious force, vaſt quantities of water into the air: yet the greateſt violences were among the mountains and rocks; and it is a general opinion that the nearer the mountains, the greater the ſhock; and that the cauſe thereof lay among them. Moſt of the rivers were ſtopped up 24 hours, by the falling of the mountains; till, ſwelling up, they made themſelves new tracks and channels; tearing up, in their paſſage, trees, &c. After the great ſhock, thoſe people who eſcaped got on board ſhips in the harbour, where many con-tinued above two months; the ſhocks all that time being ſo vio-lent, and coming ſo thick, ſometimes two or three in an hour, ac-companied with frightful noiſes like a ruffling wind, or a hollow rumbling thunder, with brimſtone-blaſts, that they durſt not come aſhore. The conſequence of the earthquake was a general ſick-neſs, from the noiſome vapours belched forth, which ſwept away above 3000 perſons.

A ſtill more terrible account, if poſſible, is that given by Kir-cher, of the earthquake which happened in Calabria in the year 1638. This inſtance is an exception to the ſecond general poſi-tion above laid down. In Italy, there had been an eruption of Mount Veſuvius, five years before; and in Sicily there had been an eruption of Ætna, only two years before this earthquake. The event, however, plainly ſhewed, that the cauſe of the earth-quake, whatever it was, had a connection not only with Mount Ætna, which lies in the neighbourhood, but alſo with the volca-no of Stromboli, which is 60 miles diſtant. "On the 24th of March, (ſays Kircher,) we lanched (in a ſmall boat) from the har-bour of Meſſina in Sicily, and arrived the ſame day at the pro-montary of Pelorus. Our deſtination was for the city of Eu-phemia in Calabria; but on account of the weather, we were obliged to continue three days at Pelorus. At length, wearied with the delay, we reſolved to proſecute our voyage; and, although the ſea ſeemed more than uſually agitated, yet we ventured for-ward. The gulph of Charibdis, which we approached, ſeemed whirled round in ſuch a manner as to form a vaſt hollow, verging to a point in the centre. Proceeding onward, and turning my eyes to Mount Ætna, I ſaw it caſt forth large volumes of ſmoak, of mountainous ſizes, which entirely covered the iſland, and blotted out even the ſhores from my view. This, together with the dreadful noiſe, and the ſulphureous ſtench, which was ſtrongly perceived, filled me with apprehenſions, that ſome more dreadful calamity was impending. The ſea itſelf ſeemed to wear a very unuſual appearance; thoſe who have ſeen a lake in a violent ſhower of rain all covered over with bubbles, will have ſome idea of its agitation. My ſurpriſe was ſtill increaſed by the calmneſs and ſerenity of the weather; not a breeze, not a cloud, which might be ſuppoſed to put all nature thus into motion. I there-fore warned my companions, that an earthquake was approaching; and, after ſome time, making for the ſhore with all poſſible dili-gence, we landed at Tropæa. But we had ſcarce arrived at the Jeſuits college in that city, when our ears were ſtunned with an horrid ſound, reſembling that of an infinite number of chariot driven fiercely forward, the wheels rattling, and the thongs cracking. Soon after this, a moſt dreadful earthquake enſued; ſo that the whole track upon which we ſtood ſeemed to vibrate, as if we were in the ſcale of a balance that continued wavering. This motion, however, ſoon grew more violent; and being no longer able to keep my legs, I was thrown proſtrate upon the ground. After ſome time, however, finding that I remained unhurt amidſt the general concuſſion, I reſolved to venture for ſafety; and running as faſt as I could, reached the ſhore. I did not ſearch long here, till I found the boat in which I had landed, and my companions alſo. Leaving this ſeat of deſolation, we proſecuted our voyage along the coaſts; and the next day came to Rochetta, where we landed, although the earth ſtill continued in violent agitations. But we were ſcarce arrived at our inn, when we were once more obliged to return to our boat; and in about half an hour, we ſaw the greateſt part of the town, and the inn at which we had ſet up, daſhed to the ground, and burying all its inhabitants beneath its ruins. Proceeding onward in our little veſſel, we at length landed at Lopizium, a caſtle mid-way between Tropæa and Euphemia the city to which we were bound. Here, wherever I turned my eyes, nothing but ſcenes of ruin and horror appeared; towns and caſtles levelled to the ground: Stromboli, though at 60 miles diſtance, belching forth flames in an unuſual manner, and with a noiſe which I could diſtinctly hear. But my attention was quickly turned from more remote, to contiguous, danger. The rumbling ſound of an approaching earthquake, which by this time we were grown acquainted with, alarmed us for the conſequences. It every moment ſeemed to grow louder, and to approach more near. The place on which we ſtood now began to ſhake moſt dreadfully; ſo that, being unable to ſtand, my companions and I caught hold of whatever ſhrub grew next us, and ſupported ourſelves in that manner. After ſome time, the violent paroxyſm ceaſing, we again ſtood up, in order to proſecute our voyage to Euphemia, which lay within ſight. In the mean time, while we were preparing for this purpoſe, I turned my eyes towards the city; but could ſee only a frightful dark cloud, that ſeemed to reſt upon the place. This the more ſurpriſed us, as the weather was ſo very ſerene. We waited, therefore, till the cloud was paſſed away; then turning to look for the city, it was totally ſunk; and nothing but a diſmal and putrid lake was to be ſeen where it ſtood."

Of the Earthquake in Sicily in 1693.

In 1693 an earthquake happened in Sicily, which may juſtly be accounted one of the moſt terrible of which we have an account. It ſhook the whole iſland: and not only that, but Naples and Malta ſhared in the ſhock. It was impoſſible for any body, in this country, to keep on their legs on the dancing earth; nay, thoſe that lay on the ground were toſſed from ſide to ſide, as on a rolling billow: high walls leaped from their foundations ſeveral paces, &c. The miſchief it did is amazing: almoſt all the buildings in the countries were thrown down. Fifty four cities and towns, beſide an incredible number of villages, were either deſtroyed or greatly damaged. We ſhall only inſtance the fate of Catania, one of the moſt famous, ancient, and flouriſhing cities in the kingdom; the reſidence of ſeveral monarchs, and an univerſity. This once famous city had the greateſt ſhare in the tragedy. Father Anthon. Serrovita, being on his way thither, and at the diſtance of a few miles, obſerved a black cloud like night hovering over the city; and there aroſe from the mouth of Montgibello, great ſpires of flame, which ſpread all around. The ſea all of a ſudden began to roar, and riſe in billows; and there was a blow, as if all the artillery in the world had been at once diſcharged. The birds flew about aſtoniſhed; the cattle in the fields ran crying, &c. His and his companions horſes ſtopped ſhort, trembling; ſo that they were forced to alight. They were no ſooner off, than they were lifted from the ground above two palms; when, caſting his eyes towards Catania, he with amazement ſaw nothing but a thick cloud of duſt in the air. This was the ſcene of their calamity: for of the magnificent Catania, there was not the leaſt footſtep to be ſeen. S. Bonajutus aſſures us, that of 18900 inhabitants, 18000 periſhed therein.

Phenomena of the Great Earthquake, November 1, 1755.

The great earthquake, however, which happened on the 1ſt of November 1755, affords the cleareſt example of all the phenomena above-mentioned; early in the morning, a thick fog aroſe, which was ſoon diſſipated by the heat of the ſun; no wind was ſtirring, the ſea was calm, and the weather as warm as in June or July in this country. At 35 minutes after nine, without the leaſt warning, except a rumbling noiſe not unlike the artificial thunder in our theatres, a moſt dreadful earthquake ſhook, by ſhort but quick vibrations, the foundations of all the city, ſo that many buildings inſtantly fell. Then, with a ſcarce perceptible pauſe, the nature of the motion was changed, and the houſes were toſſed from ſide to ſide, with a motion like that of a waggon violently driven over rough ſtones. This ſecond ſhock laid almoſt the whole city in ruins, with prodigious ſlaughter of the people. The earthquake laſted in all about ſix minutes. At the moment of its beginning, ſome perſons on the river, near a mile from the city, heard their boat make a noiſe as if it had run aground, though they were then in deep water; and at the ſame time they ſaw the houſes falling on both ſides of the river. The bed of the river Tagus was, in many places, raiſed to its ſurface. Ships were drove from their anchors, and joſtled together with great violence; nor did their maſters know whether they were afloat or aground. A large new quay ſunk to an unfathomable depth, with ſeveral hundreds of people who were upon it; nor was one of the dead bodies ever found. The bar was at firſt ſeen dry from ſhore to ſhore; but ſuddenly the ſea came rolling in like a mountain; and about Belem Caſtle, the water roſe 50 feet almoſt in an inſtant. About noon, there was another ſhock; when the walls of ſeveral houſes that yet remained, were ſeen to open from top to bottom more than a quarter of a yard, and afterwards cloſed again ſo exactly that ſcarce any mark of the injury was left.

This ſhock was felt the ſame day at Madrid, Seville and Oporto, Cadiz and Gibraltar; alſo, at Arzilla, Morocco, and other places on the African coaſt, and in the iſlands of Madeira, Barbadoes, and Antigua, and its effects reached Norway, Sweden, Germany, Holland, Italy and Switzerland; nor were England, Scotland, or Ireland, free from its convulſions.—In France ſhocks were perceived in ſeveral places, as at Bayonne, Bourdeaux and Lyons. Commotions of the waters were alſo obſerved at Angouleme, Beville, Havre de Grace, &c. but not attended with the remarkable circumſtances abovementioned.

Hypotheſes concerning the Cauſes of Earthquakes.

Theſe are the phenomena which attended this moſt remarkable earthquake in many parts of the world. We have accounts of its effects over the ſpace of 4,000,000 ſquare miles, and undoubtedly it would be felt in a ſmall degree much farther to the ſouthward than we can have any account of. To explain the phenomena of earthquakes, various hypotheſes have been invented. Till lately, the hypotheſis of the modern philoſophers was much the ſame with that of the ancients. Anaxagoras ſuppoſed the cauſe of earthquakes to be ſubterraneous clouds burſting out into lightning, which ſhook the vaults that confined them. Others imagined, that the arches, which had been weakened by continual ſubterraneous fires, at length fell in: Others derived theſe accidents from the rarefied ſteam of waters, heated by ſome neighbouring fires; and ſome, among whom was Epicurus, and ſeveral of the Peripatetic ſchool, aſcribed theſe terrible accidents to the ignition of certain inflammable exhalations.

This laſt hypotheſis has been adopted by many of the moſt celebrated moderns, as Gaſſendus, Kircher, Schottus, Varenius, Des Cartes, Du Hamel, Honorius Fabri, &c. The philoſopher laſt mentioned indeed ſuppoſed, that waters prodigiouſly rarefied by heat might ſometimes occaſion earthquakes. The others ſuppoſed, as their hypotheſis neceſſarily requires, that there are many vaſt cavities underground which have a communication with one another; ſome of which abound with waters; others with vapours and exhalations, ariſing from inflammable ſubſtances, as nitre, bitumen, ſulphur, &c. Theſe combuſtible exhalations they ſuppoſed to be kindled by a ſubterraneous ſpark, or by ſome active flame gliding through a narrow fiſſure from without, or by the fermentation of ſome mixture; and when this happened, they muſt neceſſarily produce pulſes, tremors, and ruptures at the ſurface, according to the number and diverſity of the cavities, and the quantity and activity of the inflammable matter. This hypotheſis is illuſtrated by a variety of experiments, ſuch as mixtures of iron-filings and brimſtone buried in the earth, gun-powder confined in pits, &c. by all which a ſhaking of the earth will be produced.

Dr. Woodward ſuggeſts another hypotheſis. He ſuppoſes that the ſubterraneous heat or fire, which is continually elevating water out of the abyſs, which, according to him, occupies the centre of the earth, to furniſh rain, dew, ſprings, and rivers, may be ſtopped in ſome particular part. When this obſtruction happens, the heat cauſes a great ſwelling and commotion in the waters of the abyſs: and at the ſame time, making the like effort againſt the ſuperincumbent earth, that agitation and concuſſion of it is occaſioned what we call an earthquake.

Mr. Amontons of the Royal Academy of Sciences, ſuggeſts an hypotheſis entirely different from any of the abovementioned ones. According to the received philoſophical principles, which ſuppoſe the atmoſphere to be about 45 miles high, and that the denſity of the air increaſes in proportion to the abſolute height of the ſuperincumbent column of fluid; it is ſhewn, that at the depth of 43,528 fathoms below the ſurface of the earth, air is but one fourth lighter than mercury. Now, this depth of 43,528 fathoms is only a 74th part of the ſemi-diameter of the earth. And the vaſt ſphere beyond this depth, in diameter 6,451,538 fathoms, may probably be only filled with air; which will be here greatly condenſed, and much heavier than the heavieſt bodies we know of in nature. But it is found by experiment, that the more air is compreſſed, the more does the ſame degree of heat increaſe its ſpring, and the more capable does it render it of a violent effect; and that, for inſtance, the degree of heat of boiling water increaſes the ſpring of the air above what it has in its natural ſtate, in our climate, by a quantity equal to a third of the weight wherewith it is preſſed.

Whence we may conclude, that a degree of heat, which on the ſurface of the earth will only have a moderate effect, may be capable of a very violent one below. And as we are aſſured, that there are in nature degrees of heat much more conſiderable than that of boiling water, it is very poſſible there may be ſome, whoſe violence, further aſſiſted by the exceeding weight of the air, may be more than ſufficient to break and overturn this ſolid orb of 43,528 fathoms; whoſe weight, compared to that of the included air, would be but a trifle.

All theſe Hypotheſes rejected by Dr. Stukely.

Though none of theſe hypotheſes were ſufficient for explaining the phenomena of earthquakes in a ſatisfactory manner, one or other of them continued to be adopted by almoſt all philoſophers, till the year 1749. In the month of March that year, an earthquake was felt at London and ſeveral other places in Britain. Dr. Stukely, who had been much engaged in electrical experiments, began to ſuſpect that phenomena of this kind ought to be attributed not to vapours or fermentations generated in the bowels of the earth, but to electricity. In a paper publiſhed by him on this ſubject, he rejects all the above-mentioned hypotheſes for the following reaſons.

1. That there is no evidence of any remarkable cavernous ſtructure of the earth; but that, on the contrary, there is rather reaſon to preſume that it is in a great meaſure ſolid, ſo as to leave little room for internal changes and fermentations within its ſubſtance; nor do coal-pits, he ſays, when on fire, ever produce any thing reſembling an earthquake.

2. In the earthquake at London, in March 1749, there was no ſuch thing as fire, vapour, ſmoke, ſmell, or an eruption of any kind obſerved, though the ſhock affected a circuit of 30 miles in diameter. This conſideration alone of the extent of ſurface ſhaken by an earthquake, he thought ſufficient to overthrow the ſuppoſition of its being owing to the expanſion of any ſubterraneous vapours. For as ſmall fire-balls burſting in the air propagate a ſulphureous ſmell to the diſtance of ſeveral miles, it cannot be ſuppoſed, that ſo immenſe a force acting inſtantaneouſly on that compaſs of ground ſhould never break the ſurface of it, nor become diſcoverable either to the ſight or the ſmell: beſides, that the operation of ſuch a fermentation would be many days in continuance, and the evaporation of ſo much inflammable matter would require a long ſpace of time. That ſuch an effect, therefore, ſhould be produced inſtantaneouſly, can be accounted for by electricity only; which acknowledges no ſenſible tranſition of time, no bounds.

3. If vapours, and ſubterraneous fermentations, exploſions, and eruptions, were the cauſe of earthquakes, they would abſolutely ruin the whole ſyſtem of ſprings and fountains, wherever they had once been; which is contrary to fact, even when they have been frequently repeated. Even in the earthquake in Aſia Minor, A. D. 17, which deſtroyed 13 great cities, and ſhook a maſs of earth 300 miles in diameter, nothing ſuffered but the cities; neither the ſprings nor the face of the country being injured, which indeed remains the ſame to this day.

4. That any ſubterraneous power ſufficient to move 30 miles in diameter, as in the earthquake which happened at London, muſt be lodged at leaſt 15 or 20 miles below the ſurface; and therefore muſt move an invented cone of ſolid earth, the baſe of which is 30 miles in diameter, and the axis 15 or 20: an effect impoſſible to any natural power whatever, except electricity. So in Aſia Minor, ſuch a cone muſt have been 300 miles in the diameter of the baſe, and 200 in the axis; which not all the gun-powder that has been made ſince the invention of it, much leſs any vapours generated ſo far below the ſurface, could poſſibly effect.

5. A ſubterraneous exploſion will not account for the manner in which ſhips, far from land, are effected during an earthquake; which ſeem as if they ſtruck upon a rock, or as if ſomething thumped againſt the bottoms. Even the fiſhes are affected. A ſubterraneous exploſion could only produce a gradual ſwell, and not give ſo quick an impulſe to the water as would make it feel like a ſtone.

His Method of Accounting for Eearthquakes.

From comparing theſe circumſtances, the Doctor ſays, he had always thought that an earthquake was a ſhock of the ſame kind as thoſe which commonly occur in electrical experiments. And this hypotheſis was confirmed by the phenomena attending earthquakes: particularly thoſe of 1749 and 1750, which gave riſe to his publication.

The weather, for five or ſix months before, had been uncommonly warm; the wind ſouth and ſouth-weſt, without rain; ſo that the earth muſt have been in a ſtate peculiarly ready for an electrical ſhock. The flat country of Lincolnſhire had been under an exceeding great drought. The uncommonneſs of the firſt of theſe circumſtances, he remarks, is the reaſon why earthquakes are leſs frequently experienced in the northern than in the ſouthern regions of the world, where the warmth and dryneſs of the air, ſo neceſſary to electricity, are more uſual; and the latter ſhows how fit the dry ſurface was for an electrical vibration; and (which is of great importance) that earthquakes reach but little below the ſurface of the earth.

Before the earthquake at London, all vegetables had been uncommonly forward. And electricity is well known to quicken vegetation. The aurora borealis had been frequent about that time; and, juſt before the earthquake, had been twice repeated in ſuch colours as had never been ſeen before. It had alſo removed ſoutherly, contrary to what is common in England; ſo that the Italians, and thoſe among whom earthquakes were frequent, actually foretold the earthquake. The year had been remarkable for fire-balls, lightning, and coruſcations; and theſe are rightly judged to be meteors of an electrical nature.

In theſe circumſtances of the earth and air, nothing, he ſays, is wanting to produce an earthquake, but the touch of ſome non-electric body; which muſt neceſſarily be had *ab extra*, from the region of the air or atmoſphere. Hence he infers, that, if a non-electric cloud diſcharge its contents upon any part of the earth, in that highly electrical ſtate, an earthquake muſt neceſſarily enſue. As the diſcharge from an excited tube produces a commotion in the human body, ſo the diſcharge of electric matter from the compaſs of many miles of ſolid earth, muſt needs be an earthquake; and the ſnap from the contact, the horrid uncouth noiſe attending it, ſufficiently point out what ſort of a motion it is: not a convulſion of the bowels of the earth; but an uniform vibration along its ſurface, like that of a muſical ſtring or a glaſs when rubbed on the edge with one's finger.

The circumſtance of earthquakes chiefly affecting the ſea-coaſt, places along rivers, (and, adds Doctor Prieſtley, eminences) is a farther argument of their being electrical phenomena. This is illuſtrated by a particular account of the direction in which the earthquake was conveyed.

The laſt argument he uſes is taken from the effects which it had on perſons of weak conſtitutions, who were, for a day or two after it happened, troubled with pains in the back, rhuematiſms, hyſterics, and nervous diſorders; juſt in the ſame manner as they would have been after an actual electrification: to ſome theſe diſorders proved fatal.

As to the manner in which the earth and atmoſphere are put into this ſtate, which prepares them to receive ſuch a ſhock, and whence the electric matter comes, the Doctor does not pretend to determine; but thinks it as difficult to be accounted for, as magnetiſm, gravitation, and many other ſecrets of nature.

Hypotheſis of Doctor Prieſtley.

Dr. Prieſtley, in his Hiſt. of Electricity, obſerves upon theſe theories, that a more probable hypotheſis may perhaps be formed out of both of them. "Suppoſe (ſays he) the electric matter to be, ſome way or other, accumulated on one part of the ſurface of the earth, and, on account of the dryneſs of the ſeaſon, not eaſily to diffuſe itſelf; it may, as Signior Beccaria ſuppoſes, force its way into the higher regions of the air, forming clouds in its paſſage, out of the vapours which float in the atmoſphere, and occaſion a ſudden ſhower, which may further promote the paſſage of the fluid. The whole ſurface, thus unloaded, will receive a concuſſion, like any other conducting ſubſtance, on parting with, or receiving, a quantity of the electric fluid. The ruſhing noiſe will likewiſe ſweep over the whole extent of the country. And, upon this ſuppoſition alſo, the fluid, in its diſcharge from the country, will naturally follow the courſe of the rivers, and alſo take the advantage of any eminences to facilitate its aſcent into the higher regions of the air."

The Doctor, making experiments with a battery on the paſſage of the electrical fluid over different conducting ſubſtances, and among theſe, over water; and remarking a reſemblance between its paſſage over the ſurface of the water, and that which Doctor Stukeley ſuppoſed to ſweep the ſurface of the earth, when a conſiderable quantity of it is diſcharged to the clouds during an earthquake; immediately ſuſpected that the water over which it paſſed, and which was viſibly thrown into a tremulous motion, muſt receive a concuſſion reſembling that which is given to the waves of the ſea on ſuch an occaſion.

To try this, he himſelf and others preſent put their hands into the water at the time that the electrical flaſh paſſed over its ſurface; and they felt a ſudden concuſſion given to them, exactly like that which is ſuppoſed to affect ſhips at ſea during an earthquake. This percuſſion was felt in various parts of the water, but was ſtrongeſt near the place where the exploſion was made. The ſame experiment, with a little variation, being afterwards made with a ſingle jar, at ſome diſtance below the ſurface of the water, produced the like effect, though in a weaker degree. "This ſimilarity in the effect," the Doctor obſerves, "is a conſiderable evidence of a ſimilarity in the cauſe."

"Pleaſed with this reſemblance of the earthquake, (ſays he) I endeavoured to imitate that great natural phenomenon in other reſpects: and, it being froſty weather, I took a plate of ice, and placed two ſticks, about three inches high, on their ends, ſo that they would juſt ſtand with eaſe; and upon another part of the ice, I placed a bottle, from the cork of which was ſuſpended a braſs ball with a fine thread. Then, making the electrical flaſh paſs over the furface of the ice, which it did with a very loud report, the nearer pillar fell down, while the more remote ſtood; and the ball, which had hung nearly ſtill, immediately began to make vibrations about an inch in length, and nearly in a right line from the place of the flaſh."

"I afterwards diverſified this apparatus, erecting more pillars, and ſuſpending more pendulums, &c. ſometimes upon bladders ſtretched on the mouth of open veſſels, and other times upon wet boards ſwimming in a veſſel of water. This laſt method ſeemed to anſwer the beſt of any: for the board repreſenting the earth, and the water the ſea, the phenomena of them both during an earthquake may be imitated at the ſame time; pillars, &c. being erected on the board, and the electric flaſh being made to paſs either over the board, over the water, or over them both."

Deficiency of all theſe Hypotheſes.

Theſe three hypotheſes concerning the cauſe of earthquakes, though ſomewhat differing from one another, yet agree in the main; but, if a particular ſolution of the phenomena is required, every one of them will be found deficient.

If, according to Dr. Stukeley's hypotheſis, the electric matter is lodged only on the ſurface of the earth, or but at a ſmall depth below; how are we to account for thoſe violent effects which often take place in the bowels of the earth. In the earthquake at Liſbon, a large quay ſunk to an unfathomable depth. We are certain, that the cauſe of the earthquake muſt have been below this depth however great it was, and have opened the earth for an immenſe way downwards. At the ſame time an hill in Barbary clave aſunder, and the two halves of it fell different ways. This ſhews, that the cauſe of the earthquake operated not on the ſurface of the hill, but on the ſolid foundation and contents of it; nor can it be explained by any ſuperficial action whatever. From what the miners at Eyam bridge in Derbyſhire obſerved, it is alſo evident, that the ſhock was felt at the depth of 396 feet below the ſurface of the ground more than at the ſurface itſelf; and conſeduently there is all the reaſon in the world to think that the cauſe lay at a depth vaſtly greater.

Again, though the earthquake at London was ſuppoſed to begin with a black cloud and ſhower; yet in that of 1755, the effects of which were incomparably greater, the air was calm and ſerene almoſt in every place where it was felt. It doth not appear that there is at any time a conſiderable difference between the electricity of the atmoſphere and that of the earth, or indeed that there can be ſo. For, if the earth is electrified *plus*, and the atmoſphere *minus*, there are innumerable points on the ſurface of the earth which muſt be imperceptibly drawing off the ſuperfluous electric matter into the air. The vapours alſo, with which the atmoſphere abounds, would always be ready in the ſame ſervice; and thus thunder and lightning might indeed ſometimes be produced, but not earthquakes. But laſtly, neither the air nor the earth does always ſhow any remarkable ſigns of electricity before earthquakes happen. For, the ſummer before the earthquake at Mancheſter in 1777, there had ſcarce been any thunder, lightning, or other ſigns of electricity in the atmoſphere, and vegetation had been extremely backward; and, according to the beſt accounts, the weather continued remarkably fine. For theſe reaſons, Dr. Stukeley's hypotheſis ſeems not to be ſatisfactory.

Dr. Prieſtley's hypotheſis is liable to the ſame objections with that of Dr. Stukeley: for any ſuperficial operation will never account for thoſe effects above mentioned, which take at great depths below the ſurface. His experiment cannot be admitted as any way concluſive with regard to the cauſe of earthquakes, becauſe no quantity of electric fire is ſeen to paſs over the earth and ſea, like the flaſh attending the exploſion of an electric battery; and the force of his earthquake, (being but juſt able to throw down a ſtick that could hardly ſtand by itſelf) ſeems by far too little. The utmoſt force of electricity which man can raiſe, is indeed very trifling, when compared with the great operations of nature: but it is certain, that the force of an electric battery, is by no means contemptible; was its whole power to be employed in producing an imitation of an earthquake, it certainly would do much more than throw down a ſmall ſtick. The bad ſucceſs of this experiment therefore ſhows, that the doctor's theory is erroneous: for, almoſt the whole of his electric power was ſpent another way; and we cannot ſuppoſe, that any conſiderable part of the force which produces earthquakes is ſpent any other way than in the very production of the earthquake itſelf.

Principles on which the Phenomena may be explained.

If it is attempted to give an explanation of the phenomena of earthquakes, which ſhall be free from the objections abovementioned, and from all others, it will be neceſſary, in the firſt place, to conſider thoſe parts of the ſyſtem of nature which ſeem to be moſt affected during the terrible phenomena we treat of. Theſe parts are, the air, the ſolid earth, and the water. Of theſe the two former are electrics *per ſe*; the latter is a conductor, though a bad on. Hence it follows:

1. That in proportion to the quantity of earth which is mixed with any quantity of water, that mixture will approach nearer to the nature of an electric *per ſe* and *vice verſa*.

2. It alſo follows, that whatever quantity of electricity is communicated to the ſolid earth, will be quickly taken off from it by the water which is mixed with it, in the ſame manner that the electric matter is carried off from an excited globe by a metallic conductor.

3. The whole earth is moiſt, and therefore in ſome degree a conductor. Nevertheleſs, as earth of all kinds, when perfectly dry, is found to be an electric, capable of receiving a charge like glaſs, it is therefore poſſible, that the electric power of the earth may be excited to ſuch a degree, that the moiſture of the ſolid parts cannot eaſily contain the quantity of electricity communicated.

4. In this caſe, the earth muſt either give undoubted ſigns of its being excited in the ſame manner that other excited electrics do, or the electricity muſt be diſcharged ſomewhere elſe.

5. To receive any ſuperfluous quantity of electric matter that may be communicated to the ſolid earth, the waters of the ocean are always ready. Theſe, being a much better conductor than earth, muſt be a principal mean of preſerving the equilibrium of electricity in the different parts of the earth; and hence we ſee a natural reaſon why the waters of the ocean ſhould cover ſo large a proportion of the globe as they are known to do.

6. It is known, that fire is alſo a conductor of electricity. Therefore, wherever a quantity of electric matter is collected in any part of the ſolid earth, if it can neither be conveniently received by the moiſture which the earth naturally contains, nor by the ocean in its neighhourhood, it will diſcharge itſelf by any volcano that happens to be in an active ſtate, near the place where that collection of electric matter is.

7. It is alſo found, that the electric fluid, being violently reſiſted by the ſuperincumbent atmoſphere, hath always a tendency to diſcharge itſelf in thoſe places where that reſiſtance is leaſt. The tops of very high mountains, therefore, where the weight of the atmoſphere is greatly diminiſhed, will alſo afford a ready paſſage for the electric fluid when it is collected in very great quantity in the bowels of the earth.

8. If, from ſome natural cauſes, the electric matter ſhall happen to be collected in the bowels of the earth in any particular place; and at the ſame time ſuch obſtacles are thrown in its way, that it can neither diſcharge itſelf into the ocean, nor into the atmoſphere, by the tops of high mountains, nor by the more open paſſages of volcanoes; the moſt terrible conſequences muſt enſue: the matter being pent up, and the cauſe by which it is collected continuing ſtill to act, its impulſe becomes at laſt irreſiſtible. It then flies againſt every obſtacle with inconceivable violence. It breaks out in all thoſe places where there is the leaſt reſiſtance, and therefore the ſhock is directed a great number of different ways at once.

The height of the mountains renders them the objects of the deſtructive force of this fluid much more than any buildings whatever. Hence they are often rent, and rocks thrown down from them. The water contained in the ſolid parts of the earth, being a conductor of electricity, becomes overloaded with it; and, when it can receive no more, is forced to yield to the impulſe of the reſt, and therefore is thrown out of the earth in great quantities. For the ſame reaſon, the waters on the ſurface of the earth are moſt violently agitated. The ſmall quantities contained in wells are thrown out at the tops of them: the rivers and lakes, which contain too great a quantity of water to be thrown off from the earth, riſe in billows: the ocean itſelf, receiving more electric matter than can immediately be diſperſed through the whole body of water, or evaporate into the atmoſphere, retreats from the land, and is raiſed in vaſt mountains. The ſolid earth itſelf, being unable either to conduct the fluid quietly to thoſe parts where it is wanted, or to retain it, is violently ſhaken, or rent in multitudes of places; and this not only on the ſurface, but to great depths. The electricity being now in ſome meaſure diſcharged from the earth, the ocean ruſhes forward with fury to diſcharge in its turn the exceſs of electric matter it juſt before received from the earth. If there are volcanoes in the neighbourhood, the violent diſcharge of electricity is ſure to manifeſt itſelf by ſetting them in a flame; and thus, till the equilibrium is reſtored, all nature ſeems to be threatened with diſſolution. Even in thoſe places where the force of the electric fluid is not able to ſhake the ſolid parts of the earth, it manifeſts its power by agitating the waters in the manner above deſcribed. Water being a much better conductor of electricity than earth, this ſubtile fluid, as ſoon as it can get out from the ſolid earth, flies to the water. The conſequence is, that the water immediately ſwells up, and is attracted by whatever part of the earth has leſs electricity than itſelf. Hence thoſe ſtrange irregular motions of the waters in different places, ſo particularly obſerved at the time of the earthquake at Liſbon; and which it ſeems impoſſible to account for from any other cauſe than an immediate diſcharge of electric matter from the earth into them.

9. As it is impoſſible that any part of the earth can be electrified without communicating a proportionable ſhare of electricity to the animals that live upon it, and have a conſtant communication with it, it thence follows, that there can be no conſiderable commotion in the electric matter lodged in the bowels of the earth, without affecting that which is contained in the bodies of the animals. Hence the brutes, who ſeem to be more ſenſible of ſuch commotions than we, run about, and ſhew ſigns of fear, before the earthquake comes on; and hence the giddineſs, ſickneſs, &c. which the human race are ſubject to during the time of the ſhock, even though they do not feel it, as was the caſe at Gibraltar.

10. As the atmoſphere hath a communication with the earth, it is ſcarce to be ſuppoſed that the earth can, for any length of time, contain a conſiderable quantity of electric matter, without communicating to the atmoſphere a proportionable quantity. Before an earthquake, therefore, we muſt ſuppoſe the electricity

of the earth and air to be in perfect equilibrio. Hence the weather is ſerene, there is no wind, nor any other ſign in the atmoſphere, of the terrible cataſtrophe that is about to enſue. But the moment the diſcharge is made from the earth, the equilibrium between the terreſtrial and atmoſpherical electricity is broken; the air either begins to receive the fluid from the earth, or the earth from the air. As there is not then time for the collection of thunder-clouds by which the electricity may be brought down in ſudden flaſhes of lightning, the fluid breaks through the ſubſtance of the air itſelf with diſmal and horrid noiſes, which always accompany an earthquake. That this is the caſe, ſeems highly probable from an experiment of M. de Romas, when, having brought down a vaſt quantity of electric matter from the clouds by means of a kite, he heard the noiſe it made in the air, like the continual blowing of a ſmall forge bellows. In general, there is a conſiderable change of weather takes place at the time of an earthquake, though not always. In the earthquake which happened in England in 1777, there was no remarkable change of weather there; but, ſoon after, there was a great deal of thunder and lightning in the ſouthern parts of Scotland: which ſeems to indicate, that the electric fluid diſcharged from the earth in England had taken its courſe northward, and produced the phenomena before mentioned in Scotland.

Ultimate Cauſe of all the Phenomena.

Having thus explained all the phenomena attending earthquakes, it remains only to ſhow by what means the equilibrium of electricity can be broken in the bowels of the earth in ſuch a manner as to produce theſe phenomena.

The ultimate cauſe of this is, that the warmth of the ſun moſt neceſſarily bring down to the earth much greater quantities of electric matter in the regions within the tropics, than in the northern and ſouthern climates. It is impoſſible, that there can be a perpetual accumulation of electricity in one part of the earth, unleſs there is a paſſage for it into the atmoſphere through ſome other. Hence, if the electric matter deſcends from the air into one place of the earth, it muſt neceſſarily aſcend from the earth into the air in ſome other place. There muſt be therefore a continual current of electricity through the bowels of the earth, beginning at the equator, and extending northward and ſouthward to both poles. While this current has a free paſſage from the earth in the northern and ſouthern regions, every thing goes on quietly; and whatever ſtorms may happen in the atmoſphere, the ſolid earth cannot be affected. Innumerable circumſtances, however, may tend to hinder this diſcharge, and conſequently to accumulate the electric matter in particular places. One very obvious cauſe of this kind, is an exceſſive froſt taking place in any part of the earth whence the electric matter was wont to be diſcharged. This renders the air itſelf ſo electric, that it cannot receive the fluid; at the ſame time that the water on the ſurface of the earth, being hard frozen, becomes electric alſo, and incapable of conducting. Very dry ſeaſons likewiſe contribute to produce the ſame effect; and thus the accumulation of electricity in the warmer climates becomes prodigiouſly great.

It muſt here be obſerved, that, with regard to the operatious of nature, we cannot always reaſon analogically from our electric experiments. If a quantity of electricity is collected in any ſubſtance by artificial means, that quantity is taken off in a moment by the touch of any metallic ſubſtance, or other good conductor. As the whole earth, therefore, is filled with a conducting ſubſtance, namely water, it may very naturally be aſked, Why does not the ſuperfluous quantity of electric matter collected in one place, immediately diſperſe itſelf through all other parts of the earth by means of water with which it abounds? To obviate this difficulty, however, it needs only be remembered, that as the earth is quite full of electric matter all round, no quantity can enter any particular part, without being reſiſted by the reſt which is diffuſed through the whole globe. This reſiſtance will be proportioned to the facility with which it can eſcape at other places; and this it never can do, unleſs the earth is in a proper condition for emitting, and the atmoſphere for receiving, it. The preſſure, therefore, upon the accumulated quantity of electric matter ſoon becomes exceedingly great, and its diſpoſition to burſt out with violence is every day increaſed. At laſt, as the ſun ſtill continues to occaſion the deſcent of more and more of the electric fluid, that particular part of the earth becomes fully charged. The conſequence of this is, that the waters of fountains become foul; the electric matter being lodged in great quantity in the water, forces it into unuſual agitations, by which the earth is mixed with it. The ocean, for the ſame reaſon, is raiſed in huge billows, &c. and theſe appearances prognoſticate the ſhock, in the ſame manner that ſlight flaſhes from the knob of an electrified bottle prognoſticate a diſcharge of all the electricity contained in it.

Beſides the earthquakes above deſcribed, whoſe cauſe ſeems to depend entirely on a collection of electric matter in the bowels of the earth, there are others frequently felt in the neighbourhood of volcanoes, which are plainly owing to the efforts of the burning matter to diſcharge itſelf. Theſe, however, are but ſlight, and ſeldom extend to any conſiderable diſtance from the burning mountain. For a particular account of them, ſee the article VOLCANO.

EARTHQUAKES, *Artificial*. Chymiſtry furniſhes us with a method of making artificial earthquakes, which ſhall have all the great effects of natural ones; and, as it may illuſtrate the proceſs of nature in the production of theſe terrible phenomena underground, we ſhall add it here.

To twenty pounds of iron filings, add as many of ſulphur; mix, work, and temper the whole together with a little water, ſo as to form a maſs of the conſiſtence of a firm paſte. This being buried three or four feet under-ground, in ſix or ſeven hours time, will have a prodigious effect; the earth will begin to tremble, crack, and ſmoke, and fire and flame will burſt through. Such is the effect even of two cold bodies, in cold ground; and there wants only a ſufficient quantity of this mixture to produce a true Ætna. If it were ſuppoſed to burſt out under the ſea, it would produce a water ſpout; and if it were in the clouds, that effect would be thunder and lightning. However, water ſpouts and lightning are, without doubt, electrical phenomena.

EASE, in the ſea language, ſignifies as much as ſlacken, or let go ſlacker. Thus we ſay, *eaſe* the bowline, *eaſe* the ſheet; that is let them go ſlacker.

EASE *the Ship*, in ſea language, is the command given by the pilot to the ſteerſman, to put the helm cloſe to the lee ſide; or *hard-alee*, when the ſhip is expected to pitch or plunge her fore-part deep in the water while cloſe hauled.

EAST, in coſmography, one of the cardinal points of the horizon; being the point wherein the prime vertical interſects that quarter of the horizon in which the ſun riſes when in the equinoctial.

EASTER, a feſtival of the Chriſtian church, obſerved in memory of our Saviour's reſurrection.

The Greeks call it *paſga*, the Latins *paſcha*, an Hebrew word ſignifying *paſſage*, applied to the Jewiſh feaſt of the paſſover. It it is called *eaſter* in Engliſh, from the goddeſs Eoſtre, worſhipped by the Saxons with peculiar ceremonies in the month of April.

The Aſiatic churches kept their eaſter upon the very ſame day the Jews obſerved their paſſover; and others, on the firſt Sunday after the firſt full moon in the new year. This controverſy was determined in the council of Nice; when it was ordained, that eaſter ſhould be kept upon one and the ſame day, which ſhould always be a Sunday, in all Chriſtian churches in the world.

EATOOAS, in modern hiſtory, a name which the inhabitants of Otaheite give to an imaginary race of deities; two of whom, they ſay, at ſome remote period of time, inhabited the earth, and were the parents of the firſt man. The term is derived from *eothe*, which ſignifies *finiſhed*.

It had been aſſerted by Monſ. Bougainville, on the teſtimony of a native, whom he took with him to France, that human ſacrifices conſtitute a part of the religious ceremonies of the people of Otaheite which are offered to the Deities, called Eatooas: Captain Cook therefore on his voyage there, deſirous of having farther information concerning ſo intereſting a matter, went to a Morai, or place of worſhip, accompanied by Captain Furneaux of the adventure, having with them a ſeaman who ſpoke the language tolerably well, and ſeveral of the natives. Obſerving in the Morai a kind of bier with a ſhed erected over it, on which lay a corpſe and ſome proviſions, enquiry was made if the plantains were for the Eatooa or divinity, and if they ſacrificed to him hogs, dogs, fowls, &c. To all this a native replied in the affirmative. On enquiry being made whether they ſacrificed men to the Eatooa, the anſwer was *taato eno*, "bad men," firſt *typarrhy*, beating them till they were dead. When the queſtion was put, if good men were put to death in this manner, the reply was in the negative. Being aſked whether Towtows, that is, men of the loweſt claſs, were ever thus ſacrificed, if good men, a native replied in the negative, repeating the words *taato eno*, or bad men. It appeared, from what could be gathered upon this occaſion, that men, for certain crimes, were condemned to be ſacrificed to the Deity, provided they did not poſſeſs any property to purchaſe their redemption. But as more certain information, as well as a view of the ceremony, was obtained, by the laſt mentioned navigators on the voyage following, we are thereby enabled to preſent our readers with ſuch an account of the ceremony of human ſacrifices to the Eatooas, or inferior Deities, as we hope will prove ſatisfactory.

Captain Cook receiving information that a man was to be ſacrificed at the great morai, at Attahooroo, where the preſence of the king (Otoo) was neceſſary, requeſted the liberty to accompany him, and be preſent at the ſolemnity. This being readily granted, he ſet out, attended by ſome officers and others, and followed by Omai, a native of Otaheite, who was brought to England, and returned to his own country by Captain Cook.

As ſoon as they landed at Attahooroo, Otoo deſired that the ſailors might be ordered to continue in the boat; and that the perſons preſent would take off their hats as they ſhould come to the Morai. To this they immediately proceeded, followed by numbers of men and ſome boys; but not one woman was preſent. They found four prieſts with their aſſiſtants waiting for them, and on their arrival the ceremonies commenced. Here Otoo placed himſelf; the European viſitors and a few others ſtanding by him while the bulk of the people were removed to a greater diſtance.

The ceremonies now commenced. One of the aſſiſtants of the prieſts brought a young plantain tree, and laid it down before the king. Another approached, bearing a ſmall tuft of red feathers, twiſted on ſome fibres of the cocoa-nut huſk, with which he touched one of Otoo's feet, and afterwards retired with it to his companions. One of the prieſts who were ſeated at the Morai then began a long prayer, and at particular times ſent down young plantain trees, which were placed upon the ſacrifice. During this prayer, one of the natives who ſtood by the officiating prieſt, held in his hands two bundles, in one of which, as was afterwards found, was the royal maro: and the other, if it may be allowed the expreſſion, the ark of the Eatooa. Then one of the prieſts ſtanding at the feet of the corpſe, pronounced a long prayer, in which he was joined occaſionally by others, each of them holding a tuft of red feathers in his hand. While this prayer was repeating, ſome hair was pulled off the head of the intended ſacrifice, and the left eye was taken out; both which being wrapped in a green leaf, were preſented to the king, who, however, did not touch them, but gave to the man, who brought them to him, the tuft of red feathers which he had received from Towha, who was related to the king and chief of the diſtrict of Tettaha. This, with the eye and hair, were taken to the prieſts. Not long after this, the king ſent them another bunch of feathers.

In the courſe of this laſt ceremony, a king-fiſher making a noiſe, Otoo ſaid to Captain Cook, "That is the Eatooa;" and he ſeemed to conſider it as a favourable prognoſtic. The corpſe was then carried a little way, and laid under a tree, near which were fixed three thin pieces of wood neatly carved in various figures. He who ſeemed to be the chief prieſt, ſpoke for about a quarter of an hour, with different tones and geſtures; ſometimes appearing to expoſtulate with the deceaſed, at other times aſking ſeveral queſtions; then making various demands, as if the dead body had power himſelf, or intereſt with the Deity, to engage him to grant ſuch requeſts; among which, he deſired him particularly to deliver Eimeo, an adjacent iſland, with the inhabitants of which they were at war, Maheine its chief, the women, hogs, and other things of the iſland, into their hands; which was, indeed, the expreſs object of the ſacrifice. He then prayed near half an hour, in a whining tone, and two other prieſts joined in the prayer, in the courſe of which one of them plucked ſome more hair from the head of the corpſe, and put it upon one of the bundles. Then all the tufts of feathers were placed upon the bundles of cloth, which concluded the ceremony at this place.

The dead body was now carried to the moſt conſpicuous part of the Morai, with the feathers, and the two bundles of cloth, while the drums beat ſlowly. The feathers and bundles were laid againſt a pile of ſtones, and the body at the foot of them. The prieſts having again ſeated themſelves round the corpſe, renewed their prayers, while ſome of their aſſiſtants dug a hole about the depth of two feet, into which they threw the victim, and covered it over with ſtones and earth. While they were depoſiting the body in the grave, a boy ſqueaked aloud, upon which Omai told the captain, it was the Eatooa. In the mean time, a fire having been made, a lean dog half ſtarved was produced, and killed by twiſting the neck. The hair was then ſinged off, and the entrails being taken out, they were thrown into the fire, and left there to be conſumed; but the kidney, heart and liver, were baked on heated ſtones.

The carcaſe, after having been rubbed over with the blood of the animal, were with the liver, &c. laid down before the prieſts, who were ſeated round the grave praying. They, for ſome time, uttered ejaculations over the dog, while two men, at intervals, beat very loud on two drums; and a boy ſcreamed in a loud ſhrill voice three times. This, they ſaid, was to invite the Eatooa to feaſt on the banquet that they had prepared for him.

When the prieſts had finiſhed their prayers, the body, heart, liver, &c. of the dog, were placed on a whatta, or ſcaffold, about ſix feet in height, on which lay the remains of two other dogs, and of two pigs, that had been lately ſacrificed. The prieſts and their attendants now gave a ſhout, and this proclaimed the ceremonies ended for the preſent.

The unfortunate victim offered on this occaſion was, to appearance, a middle aged man, and one of the loweſt claſs of the people; but it did not appear that they had fixed upon him on account of his having committed any particular crime that deſerved death. It is certain, however, that they uſually ſelect ſuch guilty perſons for ſacrifices, or elſe vagabonds, who have no viſible way of procuring an honeſt livelihood. Having examined the body of the unhappy ſufferer, now offered up as the object of theſe people's adoration, our party obſerved, that it was bloody about the head, and much bruiſed upon the right temple, which denoted the manner in which he had been killed; and they were informed, that he had been knocked on the head with a ſtone.

The wretches who are devoted on theſe occaſions are never previouſly appriſed of their fate. Whenever any one of the principal chiefs conceives a human ſacrifice neceſſary, on any great emergency, he fixes upon the victim, and then diſpatches ſome of his truſty ſervants, who fall upon him ſuddenly, and either ſtone him to death or beat out his brains with a club. The king is then acquainted with it, whoſe preſence is ſaid to be abſolutely neceſſary at the ſolemn rites that follow; and, indeed, in the late performance, Otoo bore a capital part. The ſolemnity itſelf is called Poore Eree, or the prayer of the chief: and the victim is termed Taata-taboo, or conſecrated man. The Morai, where the late ſacrifice was offered, is always appropriated for the burial of the king of the whole iſland, and likewiſe of his family, and ſome other perſons of diſtinguſhed rank. It differs little, except in extent, from the common Morais. Its principal part is a large oblong pile of ſtones, about 13 feet in height, and contracted towards the top, with a quadrangular area on each ſide, looſely paved with pebbles, under which their gods are ſuppoſed to reſide occaſionally.

Not far from the end neareſt the ſea, is the place of ſacrifice, where is a very large whatta, or ſcaffold, on which the offerings of fruits, and other vegetables are placed; but the animals are laid on a ſmaller one, and the human ſacrifices are interred under the pavement. There are ſeveral reliques ſcattered about this place; ſuch as ſmall ſtones raiſed in ſeveral parts of the pavement; ſome with bits of cloth faſtened round them; others intirely covered with it; and upon the ſide of the large pile fronting the area are a great number of pieces of carved wood, in which their gods are ſuppoſed to reſide occaſionally.

There is an heap of ſtones at one end of the large ſcaffold, with a ſort of platform on one ſide. On this are depoſited all the ſkulls of the human ſacrifices, which are taken up after they have remained under ground for ſome months. Juſt above them many of the carved pieces of wood are placed; and here the Maro, and the other bundle, ſuppoſed to contain the god Ooro, were laid during the celebration of the late ſolemn rites.

It is probable, that this barbarous cuſtom of offering human ſacrifices prevails in all, or moſt of the iſlands of the Pacific Ocean, however diſtant from each other ſome of them may be. And though it may be ſuppoſed that not more than one perſon is offered at one time, either at Otahetite, or other iſlands, yet theſe occaſions, in all probabilty occur ſo frequently, as to make a terrible havock of the human ſpecies; for no leſs than 49 ſkulls of former victims were counted lying before the Morai at Attahooroo; and as none of thoſe ſkulls appeared to have ſuffered any conſiderable change or decay from the weather, it may be inferred that a ſhort time had elapſed ſince the victims to whom they belonged had been offered.

This horrid practice, though no conſideration whatever can make it ceaſe to be deteſtable, might, perhaps, be thought to be leſs detrimental, in ſome reſpects, if it contributed to impreſs any awe for the deity, or veneration for religion, upon the minds of the ſpectators; but this was far from being the caſe on the late occaſion; for though a vaſt multitude had aſſembled at the Morai, they ſhewed very little reverence for what was tranſacting: and Omai happening to arrive after the ceremonies had begun, many of the iſlanders thronged round him, and were engaged, for the remaining part of the time, in making him recount ſome of his adventures; to which they liſtened with great eagerneſs of attention, regardleſs of the ſolemn offices which their prieſts were then performing. Indeed, the prieſts themſelves, except the one who ſuſtained the principal part, either from their being familiarized to ſuch objects, or from their repoſing no great degree of confidence in the efficacy of their religious inſtitutions, maintained very little of that ſolemnity, ſo neceſſary to give to acts of devotion their proper effect.

Their habit was but an ordinary one; they converſed together with great familiarity; and the only attempt they made to preſerve decorum, was by exerting their authority, to prevent the populace from encroaching on the ſpot, and to ſuffer our party, as ſtrangers, to come forward. They were, however, very candid in the anſwers which they gave to any interrogatories that were put to them, with regard to this inhuman inſtitution. Being aſked, what was the deſign of it? They replied, that it was an antient cuſtom, and highly pleaſing to their god, who came and fed upon the ſacrifices; in conſequence of which, he granted their petitions. It was then objected, that he certainly did not feed on theſe, as he was neither ſeen to do it, nor were the bodies of the ſacrificed animals ſoon conſumed; and that as to the corpſe of a human victim, they prevented his feeding on that by interring it. In anſwer to theſe objections, they obſerved, that he came in the night, inviſibly, and fed only on the ſoul, or immaterial part, which (as theſe people ſay) remains about the place of ſacrifice, till the carcaſe of the victim is wholly waſted by putrefaction.

Human ſacrifices are not the only ſtrange cuſtoms that ſtill prevail among the inhabitants of Otaheite, though, in many reſpects, they have emerged from the brutal manners of ſavage life. Beſides cutting out the jaw bones of their enemies ſlain in battle, which they carry about with them as trophies, they, in ſome meaſure, offer up their bodies to the Eatooa: for after an engagement, in which they have come off victorious, they collect all the dead, and bring them to the Morai, where, with great form and ceremony, they dig a large hole and bury them all in it, as ſo many offerings to their divinities.

The ſame religious ceremonies, and the ſame horrid practices of human ſacrifices to the deities, called Eatooha, prevail through the whole of Sandwich iſlands, where they hold the Morais or

Burial places, in which theſe deities are ſuppoſed to reſide, in the moſt profound veneration. Although the voyagers, who laſt viſited theſe iſlands, had ſuch repeated proofs of the ſacred regard the natives had for theſe Morais; yet ſuch was the wantonneſs of the common crew, that, unknown to their officers, they removed their gods, and diſturbed the aſhes of the dead. The compiler of the narrative of the voyage, deſirous of concealing a circumſtance ſo reproachful to this country, cautiouſly omitted it; and to obviate enquiry into the reaſon of the very different reception with which our people met on their ſpeedy return, to repair ſome damages which the ſhip had received; affected the utmoſt ſurpriſe at the hoſtilities offered them, unwilling to ſtate the real cauſe.

To this event may be imputed the fatal loſs of that ſkilful, intrepid, and enterpriſing navigator Captain Cook, who was ſo much eſteemed by his country; and revered by all nations.

For the particulars of the death and tranſactions of that immortal man, during his three voyages round the world, together with thoſe of all the navigators from his time, down to the laſt account of the New Settlement at Port Jackſon in Botany Bay, we refer our readers to the TEN *firſt numbers of Bankes's Geography*, which may be purchaſed ſeparate from the work.

EAU *de Luce*, is a kind of volatile liquid ſoap, of a ſtrong, penetrating ſmell. The following inſtructions will ſerve for making it: take four ounces of rectified ſpirit of wine, and in it diſſolve ten or twelve grains of white ſoap; filtrate this ſolution; then diſſolve in it a dram of rectified oil of amber, and filtrate again: mix as much of this ſolution with the ſtrongeſt volatile ſpirit of ſal ammoniac, in a cryſtal glaſs bottle, as when ſufficiently ſhook, ſhall produce a beautiful milky liquor. If upon its ſurface be formed a cream, ſome more of the oily ſpirit of wine ought to be added.

EBBING *and* **Flowing** *of the Sea*. See Tides.

EBENUS, the ebony tree, a genus of the decandria order, belonging to the diadelphia claſs of plants. There is but one ſpecies, a native of Crete and ſome other iſlands of the Archipelago.

Ebony wood, is brought from the Indies, exceedingly hard and heavy, ſuſceptible of a very fine poliſh, and on that account uſed in Moſaic and inlaid works, toys, &c. There are divers kinds of ebony: the moſt uſual among us are black, red, and green, all of them the product of the iſland of Madagaſcar, where the natives call them, indifferently, *hazon mainthi*, q. d. *black wood*. The iſland of St. Maurice, belonging to the Dutch, likewiſe furniſhes part of the ebonies uſed in Europe.

The cabinet-makers, inlayers, &c. make pear-tree, and other woods, paſs for ebony, by giving them the black colour thereof. This ſome do by a few waſhes of a hot decoction of galls; and when dry, adding writing ink thereon, and poliſhing it with a ſtiff bruſh, and a little hot wax; and others heat or burn their wood black. See the article, Dyeing or Staining Wood in the Treatiſe on Dyeing.

EBULLITION, in phyſics, the act of emitting bubbles, by a vehement agitation of the parts of a fluid, produced by fire, or otherwiſe. Philoſophers are diſagreed about the cauſe and manner of ebullition. See Boiling.

Ebullition, in chymiſtry, is uſed for a violent inteſtine motion, or colluctation of parts, occaſioned by the mixtures of ſalts of different natures.

ECARTELE, in heraldry, a French term for quartering.

ECCE-HOMO, among painters, a name given to a picture, wherein our Saviour is repreſented in a purple robe, with a crown on his head, and a reed in his hand, ſuch as he was preſented before Pilate by the Jews. The phraſe is Latin, borrowed from the words of the Jews themſelves: q. d. this is the man.

ECCHYMOSIS, Εϰχυμωσις, the effuſion of blood from a rupture in ſome of the ſmall veins near the ſkin, cauſing a lividity or blueneſs thereof. This is alſo called *echymoma*, εϰχυμωμα, and ſtands diſtinguiſhed from *enchymoſis*, where there is no extravaſation.

ECCLESIASTES, a canonical book of the Old Teſtament, the deſign of which is to ſhew the vanity of all ſublunary things.

It was compoſed by Solomon; who enumerates the ſeveral objects on which men place their happineſs, and then ſhews the inſufficiency of all worldly enjoyments.

The Talmudiſts make king Hezekiah to be the author of it; Grotius aſcribes it to Zorobabel, and others to Iſaiah; but the generality of commentators believe this book to be the produce of Solomon's repentance, after having experienced all the follies and pleaſures of life.

ECCLESIASTIC, or **Eccleſiastical**, ſomething belonging to, or ſet apart for the church, in contradiſtinction to *civil* or *ſecular*, which regard the world. There are *eccleſiaſtical* things and perſons; *eccleſiaſtical law, juriſdiction, hiſtory, ceremonies, diſcipline, preferments*, &c. *Eccleſiaſtical* perſons are either regular or ſecular. See Regular and Secular. In the empire there are three *eccleſiaſtical* electors, viz. the archbiſhops of Mentz, Treves, and Cologne. In France, they have *eccleſiaſtical peers*, &c.

Eccleſiaſtic *Courts*. See Court.

ECCLESIASTICAL *State*, in geography, the pope's dominions in Italy. Theſe dominions are differently divided by geographers. The pope may be conſidered in two reſpects, as the ſpiritual head and monarch of the Roman church, and as a conſiderable temporal prince in Italy. In the firſt character, his ſubjects may be divided into two claſſes, viz. clergy and laity; the former may not unfitly be compared to a ſpiritual ſtanding army, whoſe buſineſs is to maintain his rights and conqueſts; and the reſt, the laity, as his tributary ſubjects, who are obliged to maintain thoſe forces at their own charge; and if one may judge of the greatneſs of their number, by what pope Paul IV. uſed to boaſt, that he had 228,000 pariſhes under his juriſdiction (all of whom have at leaſt one or more prieſts,) and 4400 monaſteries, it will appear no inconſiderable army. But their number has been much leſſened ſince the Reformation.

Indeed the power of the pope has been gradually declining for ſome time, and more eſpecially ſo within theſe few years, as appears from his reception by the preſent emperor of Germany.

ECCLESIASTICUS, an apocryphal book, generally bound up with the ſcriptures, ſo called, from its being read in the church, *eccleſia*, as a book of piety and inſtruction, but not of infallible authority. The author of this book was a Jew, called *Jeſus the ſon of Sirach*. The Greeks call it the *Wiſdom of the ſon of Sirach*.

ECCOPE, Εϰϰοπη, in ſurgery, the ſame with exciſion or amputation. The word is formed from the Greek, εϰϰοπλειν, *exſcindere, to cut off*. Eccope is likewiſe uſed for a kind of fracture, or ſolution of continuity, of the ſkull, by a ſimple inciſion.

ECCOPROTICS, Εϰϰοπρωτιϰα, in medicine. See Cathartics.

ECHINITES, or Echinitæ, in natural hiſtory, a name given to the foſſil ſhells of the ſeveral ſpecies of *echini marini*, and to the ſtones formed in them. See Centronia.

ECHINUS, in vermeology, a genus of inſects belonging to the order of vermes molluſca. The body is roundiſh, covered with a bony cruſt, and often beſet with moveable prickles; and the mouth is below, and conſiſts of five valves. The eſculentus, or eatable echinus, is of a hemiſpherical form, covered with ſharp ſtrong ſpines, above half an inch long; commonly of a violet colour; moveable; adherent to ſmall tubercles elegantly diſpoſed in rows. Theſe are their inſtruments of motion by which they change their place. This ſpecies is taken in dredging, and often lodges in cavities of rocks juſt within low water mark. They are eaten by the poor in many parts of England, and by the better ſort abroad. In old times they were a favourite diſh. They were dreſſed with vinegar, honied wine or mead, parſley or mint; and thought to agree with the ſtomach. They were the firſt diſh in the famous ſupper of Lentulus, when he was made *flamen Martialis*, or prieſt of mars. By ſome of the concomitant diſhes, they ſeem deſigned as a whet for the ſecond courſe, to the holy perſonages, prieſts and veſtals, invited on that occaſion. Many ſpecies of ſhell fiſh made part of that entertainment. The lacunoſus, or oval echinus, is of on oval depreſſed form; on the top it is of a purple colour, marked with a quadrefoil, and the ſpaces between tuberculated in waved rows; the lower ſide, ſtudded, and divided by two ſmooth ſpaces. Length, four inches. When clothed, it is covered with ſhort thickſet briſtles mixed with very long ones. There are 15 other ſpecies, all natives of the ſea. For the claſſification, ſee Syſtem of Vermeology.

ECHIUM, viper's bugloſs; a genus of the monogynia order, belonging to the pentandria claſs of plants. There are ſeven ſpecies, three of which are natives of Britain. None of them have any remarkable property except that the flowers of one ſpecies (the vulgare) are very grateful to bees.

ECHO, or Eccho, a ſound reflexed, or reverberated from a ſolid, concave body, and ſo repeated to the ear. The word is formed of the Greek ηχος, *ſound*, of the verb ηχεω, *ſono, I ſound*. See Syſtem of Acouſtics, Definition III.

Echo is alſo uſed for the place where the repetition of the ſound is produced, or heard. This is either natural or artificial. In echoes, the place where the ſpeaker ſtands, is called the *centrum phonicum*; and the object, or place, that returns the voice, the *centrum phonocampticum*.

Echo, in architecture, is applied to certain vaults, and arches, moſt commonly of elliptical, or parabolical figures; uſed to redouble ſounds, and produce artificial echoes.

Echo, in muſic, pieces compoſed in imitation of echoes. Organs and harpſichords have what they call an echo ſtop.

Echo, in poetry, a kind of compoſition wherein the laſt words or ſyllables of each verſe contain ſome meaning, which, being repeated apart, anſwers to ſome queſtion or other matter contained in the verſe; as in this beautiful one from Virgil.

Crudelis mater magis, an puer improbus ille?
Improbus ille puer, crudelis tu quoque mater.

The elegance of an echo conſiſts in giving a new ſenſe to the laſt words; which reverberate, as it were, the motions of the mind, and by that means affect it with ſurpriſe and admiration.

ECHOMETER, in muſic, a kind of ſcale, or rule, with ſeveral lines divided thereon, ſerving to meaſure the duration, or length, of ſounds, and to find their intervals and ratios. The word is formed of the Greek ηχος, *ſound*, and μετρον, *meaſure*.

ECHOS, Ηχος, a ſound, in phyſic. In Hippocrates, this frequently imports what the Latins call *tinnitus aurium*, and the Engliſh a ringing of the ears; a ſymptom very frequent in acute diſtempers.

ECLECTICS, ancient philoſophers, who, without attaching themſelves to any particular ſect, ſelected whatever appeared to them the be ſtand moſt rational, from each. Hence their denomination: which, in the original Greek, ſignifies, *that may be choſen*, or, *that chooſes*; of the verb εκλεγω, *I chooſe*.

ECLIPSE, from εκλειψις, of εκλειπω, *deficio*, *I fail*, in aſtronomy, a privation of the light of one of the luminaries, by the interpoſition of ſome opaque body, either between it and the eye, or between it and the ſun. See Syſtem of ASTRONOMY, Sect. XIV.

ECLIPTIC, in aſtronomy, a great circle of the ſphere, ſuppoſed to be drawn through the middle of the zodiac, making an angle with the equinoctial of about 23° 30′, which is the ſun's greateſt declination; or, more ſtrictly ſpeaking, it is that path or way among the fixed ſtars, that the earth appears to deſcribe to an eye placed in the ſun.

Some call it *via Solis*, "the way of the ſun;" becauſe the ſun in his apparent annual motion never deviates from it, as all the other planets do more or leſs. It is called *ecliptic*, by reaſon all eclipſes happen when the planets are in, or near its node. See Syſtem of ASTRONOMY, Sect. IX.

ECLIPTIC, in geography, a great circle on the terreſtrial globe, not only anſwering to, but falling within, the plane of the celeſtial ecliptic. See Syſtem of GEOGRAPHY.

ECLOGUE, in poetry, a kind of paſtoral compoſition, wherein ſhepherds are introduced converſing together. The word is formed from the Greek εκλογη, *choice*; ſo that, according to the etymology, *eclogue* ſhould be no more than a ſelect or choice piece; but cuſtom has determined it to a farther ſignification, viz. a little elegant compoſition in a ſimple, natural ſtyle and manner. Idyllion and eclogue, in their primary intention, are the ſame thing: thus, the idyllia, ειδυλλια of Theocritus, are pieces wrote perfectly in the ſame vein with the *eclogæ* of Virgil. But cuſtom has made a difference between them, and appropriated the name *eclogue*, to pieces wherein ſhepherds are introduced ſpeaking; idyllion, to thoſe wrote like the *eclogue*, in a ſimple natural ſtyle, but without any ſhepherds in them.

ECTHLIPSIS, in the Latin proſody, a figure whereby an *m* is retrenched, or cut off, chiefly at the end of a word, when the following word begins with a vowel, or an *h*. The word is Greek, εκθλιψις, which ſignifies *eliſion*. Thus, in *multum ille*, *&* *terris jactatus & alto*. Virg. In ſcanning the verſe, we drop the *m* at the end of *multum*, and only make three ſyllables in the two firſt words, *mult-il-le*.

ECTHYMA, from εκθυω, *I break out*, a name given by Hippocrates to any puſtule, or cutaneous eruption.

ECTHYMOSIS, of εκ, *ex*, and θυμος, *animus*, *mind*, in medicine, a vehement agitation and dilatation of the blood and ſpirits; ſuch as happens in extraordinary emotions of joy.

ECTOMIAS, from εκτεμνω, *I cut off*, a name uſed by the ancient phyſicians, to expreſs a caſtrated animal.

ECU, or ESCU, the French crown. See CROWN.

ECUSSON, in heraldry, an ineſcutcheon, or little eſcutcheon. See ESCUTCHEON.

EDDA, in antiquities, is a ſyſtem of the ancient Icelandic, or Runic mythology, containing many curious particulars of theology, philoſophy, and manners, of the northern nations of Europe; or of the Scandinavians, who had migrated from Aſia, and from whom our Saxon anceſtors were deſcended. Mr. Mallet apprehends that it was originally compiled, ſoon after the Pagan religion was aboliſhed, as a courſe of poetical lectures, for the uſe of ſuch young Icelanders as devoted themſelves to the profeſſion of a ſcald or poet. It conſiſts of two principal parts; the firſt containing a brief ſyſtem of mythology, properly called the Edda; and the ſecond being a kind of art of poetry, and called Scalda or Poetics.

EDDISH, or EADISH, the latter paſture, or graſs, which comes after mowing or reaping; otherwiſe called *eargraſs*, *earſh*, and *etch*.

EDDY, Sax. of *ed*, *backward*, and *ea*, *water*, in ſea language, is when the water, at any place, runs back, contrary to the tide, or ſtream, and ſo falls into the current again. The ſeamen call that *eddy water* which falls back, as it were, on the rudder of a ſhip under ſail, the *dead water*. An *eddy wind* is that which returns, or is beat back, from any ſail, &c.

EDGE *in with a Ship*, in the ſea language, is ſaid of a chace, that is making up to it.

EDGE *away*, is to decline gradually from the ſhore, or from the line of the courſe which the ſhip formerly ſteered, when ſhe ſails nearer the direction of the wind, or larger before the wind.

EDGINGS, in gardening, rows of ſhrubs, herbs, or flowers, placed by way of borders around beds, compartiments, &c. For the edgings of compartiments, box ſeems the moſt proper. See Treatiſe on GARDENING.

EDICT, an inſtrument, ſigned and ſealed by a prince, to ſerve as a law to his ſubjects. Edicts have no room in England, where the enacting of laws is not lodged in the king, but in the parliament. In the Roman law we find frequent mention of the *edict of the prætor*, *quod prætor edixit*, which was a phraſe appropriated to the ordinances of the prætor; though it was ſometimes alſo uſed on other occaſions. In the French law, *edicts*, *edits*, make a great figure; they are of various kinds; ſome importing a new law, or regulation, as the edict of duels, that of ſecond marriages, &c. Others the erection of new offices, eſtabliſhment of duties, rents, &c. Sometimes articles of pacification, as the edict of Nantz, paſſed by Henry IV. in 1598, and revoked by Louis XIV. in 1685, &c. Edicts are all ſealed with green wax, to ſhew that they are perpetual and irrevocable. Edicts with them are much the ſame as proclamations with us; but with this difference, that the former have the authority of a law, in themſelves, from the power which iſſues forth; whereas the latter are only declarations of a law, to which they refer, and have no power in themſelves.

EDIFICE, ÆDIFICIUM, a building. The word is formed of the Latin, *ædes* and *facio*, *I make*. See Syſtem of ARCHITECTURE, on the principles of the art.

EDILE, or rather ÆDILE. See ÆDILE.

EDITOR, of *edo*, *I publiſh*, in the commonwealth of learning, a perſon who takes care of publiſhing the work of another author. Eraſmus was a great editor of ancient writings; the Louvain doctors, Scaliger, Petavius, Fa. Sirmond, biſhop Walton, Mr. Hearn, &c. are learned editors; the Benedictines of the fathers; the Dauphins, of the claſſics; Hardouin, of the councils, &c.

EDUCATION, the art of bringing up, forming, and inſtructing children. The follies of a too delicate education are well expreſſed in that device of an ape; which, by over careſſing and hugging its young ones, ſtrangles them; with this motto, *complectando necat*. Octavius Ferrarius has a very good Latin treatiſe on the ſubject of education, intitled *Chiron*; the name of the centaur who was Achilles's tutor.

Mr. Lock's excellent treatiſe of education is known to every body. Quintillian employs the ſecond chapter of his firſt book in enquiring whether a domeſtic, or a college, education, be preferable, i. e. whether it be better to bring up one's children at home, or ſend them to the colleges and public ſchools. After urging all that can be ſaid on either ſide, he concludes for a college or ſchool education.

The plan of education, whether it be domeſtic or collegiate, ſhould be ſuited to the ſtation and views of parents, and to the genius of their children; and it is alſo right to conſult their conſtitution and inclination. It is of great importance, that thoſe who are deſtined to occupy ſuperior ſtations in ſociety, ſhould enjoy the benefits of an enlarged and liberal education; that they ſhould be furniſhed with every ſubſtantial and ornamental accompliſhment; and thoſe that are intended for any particular profeſſion or employment ſhould be principally directed to thoſe ſtudies which are appropriated to their reſpective views; and in every rank of life, an attention to the morals of youth ſhould be a primary object. Though the municipal laws of moſt countries have made no proviſion for conſtraining a parent to beſtow a proper education on his children; yet in the caſe of religion they are under peculiar reſtrictions in our own country. Some of theſe reſtrictions, as they affect proteſtants who diſſent from the religion of the ſtate, may be thought both impolitic and injurious, and have, therefore, lately been conſiderably relaxed; but thoſe who are deſigned to prevent the progreſs of popery are prudent and neceſſary. Thus, if any perſon ſends a child under his care beyond the ſeas, to be inſtructed in any popiſh college, &c. in the principles of the popiſh religion, or ſhall contribute towards his maintenance, he ſhall forfeit one hundred pounds, beſides the diſabilities incurred by the child ſo ſent. 1 Jac. I. cap. 4. and 3 Jac. I. cap. 5. 11 and 12 W. III. cap. 4. and both ſhall be incapable of ſuing in law or equity, of being executor or adminiſtrator, of enjoying any legacy or deed of gift, or of bearing any office in the realm; and he ſhall forfeit all his goods and chattels, and likewiſe all his real eſtate for life. 3 Car. I. cap. II.

EDULCORATION, of *edulco*, *I ſweeten*, in pharmacy, is the dulcifying or ſweetening of any food, or remedy, by means of honey, ſugar, or ſyrups.

EDULCORATION, in chymiſtry, denotes the freſhening or purging of any thing of its ſalts, by repeated lotions, or waſhings in cold water. Such is the dulcifying of the precipitates of mercury, metals, &c. by waſhing away thoſe ſharp ſalts, by whoſe means they had been diſſolved, or which had been mingled with them, to effect a diſſolution.

EDULCORATION, in metallurgy, is the ſeparating, by a ſolution of water, of the ſalts that have been left adhering to a body after any operation. This is properly a kind of moiſt ſolution, the ſaline parts adhering to bodies, not ſoluble in water, being by that menſtruum taken up and eaten off from the body, and the ſolution afterwards ſeparated from the remaining ſolid, either by ſubſidence or filtration.

EDYSTONE *Light-houſe*, lying off Plymouth harbour, was firſt erected by the corporation of the Trinity houſe, in 1696; in conſideration of which, the maſters, &c. of Engliſh ſhipping agreed to pay one penny a ton outwards and inwards. It was demoliſhed by the ſtorm of 1703, and re-erected by act of parliament in the 4th of queen Anne, and the ſame duty on tonnage of ſhips granted for its ſupport, which law was enforced in the 8th of Anne. It has been ſince deſtroyed and rebuilt.

EEL, *Anguilla*, in ichthyology, a ſpecies of the muræna. See MURÆNA.

EELS, *Microſcopic*, in ſour paſte. The long-bodied animalcules, diſcovered by the microſcope in vinegar, ſour paſte, and many other ſubjects, have, from their figure, been generally diſtinguiſhed from the reſt of the microſcopic animalcules, by the name of eels. See ANIMALCULES, and MICROSCOPICAL OBJECTS.

EELS *in Vinegar*, are ſimilar to thoſe in ſour paſte. The taſte of vinegar was formerly thought to be occaſioned by the biting of theſe little animals, but that opinion has been long ago exploded. Mentzelius ſays, he has obſerved the actual transformation of theſe little creatures into flies: but as this hath never been obſerved by any other perſon, nor is there an inſtance of ſuch a transformation in any other animalcule, it ſeems probable that Mentzelius hath been miſtaken in his obſervations.

EEL *Spear*, a forked inſtrument with three or four jagged teeth, uſed for catching eels; that with four teeth is the beſt. This is ſtruck into the mud at the bottom of the river; where, if it ſtrikes againſt eels, it is ſure to bring them up.

EFFEARE', in heraldry, a French term for a beaſt reared on its hind legs as if frighted, and reſembling ſalient.

EFFECT, the reſult or conſequence of the application of a cauſe, or agent, on ſome ſubject. It is one of the great axioms of philoſophy, that full or adequate effects are always proportionable to the powers of their cauſes.

EFFECT is alſo of ſome farther import in the arts; as when we ſay in painting and architecture, that ſuch a contraſt, or ſuch a drapery, or ſuch an attitude, have a fine or an ill effect, i. e. are beautiful, noble, or the contrary. Too many breaks, and little enrichments, in a building, have a poor effect, i. e. they give it a mean aſpect. See Treatiſe on PAINTING, and Syſtem of ARCHITECTURE, on the principles of the Art.

EFFECTS, in commerce, &c. the goods poſſeſſed by any perſon, whether moveables or immoveable; particularly thoſe which merchants and dealers acquire by trade. See CHATTELS.

EFFECTIVE *Men*, in military language, are ſoldiers fit for ſervice.

EFFEMINATE, void of the qualities which diſtinguiſh and adorn the male ſex; acting or behaving like a woman: voluptuous or luxurious.

EFFEMINATE, *effeminati*, according to the Vulgate, are mentioned in ſeveral places of Scripture. The word is there uſed to ſignify ſuch as were conſecrated to ſome profane god, and proſtituted themſelves in honour of him.

The Hebrew word, *kadeſh*, tranſlated *effeminatus*, properly ſignifies *conſecrated*, and hence was attributed to thoſe of either ſex, who publicly proſtituted themſelves in honour of Baal and Aſtarte. Moſes expreſly forbids theſe irregularities among the Iſraelites; but the hiſtory of the Jews ſhews that they were notwithſtanding frequently practiſed. Levit. xxiii. 18. Calmet. Dict. Bibl. in voc.

EFFENDI, in the Turkiſh language, ſignifies maſter: and accordingly it is a title very extenſively applied; as to the mufti and emirs: to the prieſts of moſques, to men of learning, and of the law. The grand chancellor of the empire is called *reieffendi*.

EFFERVESCENCE, is commonly uſed for a light ebullition, or a briſk inteſtine motion produced in a liquor by the firſt action of heat, without any notable ſeparation of its parts.

EFFERVESCENCE, in chymiſtry, is not applied to all ebullitions or motions produced by fire, but only to thoſe reſulting from the mixture of bodies of different natures, which, by their acting on one another, occaſion a heat, reſembling the ebullition or boiling produced by fire.

EFFERVESCENCE, in vintage, a term appropriated by Portzius and others, to ſignify that working of wine, which is by ſome, though improperly, called fermentation.

EFFICACIOUS, EFFECTUAL, in theology. Within theſe 150 years there have been great diſputes on the ſubject of *efficacious* grace. Grace is uſually divided into ſufficient and *efficacious*; though the Janſeniſts hold, that there is no grace ſufficient but what is *efficacious*, i. e. but what effectually determines the will to act. *Efficacious* grace is that which enlightens the mind, and touches the heart, in ſuch a manner, as always to produce its effect, however it be oppoſed or reſiſted by the will.

EFFICIENT, in philoſophy. An EFFICIENT *cauſe* is that which produces an effect. See CAUSE and EFFECT. Philoſophers uſually diſtinguiſh four kinds of cauſes in nature; the *efficient*, *final*, *formal*, and *material*.

EFFIGY, EFFIGIES, a portrait, or repreſentation of a perſon to the life.

EFFIGY is alſo uſed for the print or impreſſion of a coin, repreſenting the prince's head who ſtruck it.

EFFIGY, *to execute or degrade in*, denotes the execution or degradation of a condemned, contumacious criminal, who cannot be apprehended or ſeized. In France they hang a picture on a gallows, or gibbet, wherein is repreſented the criminal, with the quality or manner of the puniſhment: at the bottom is written the ſentence of condemnation. Such perſons as are ſentenced to death are executed in *effigy*.

EFFLORESCENCE, of *ex*, *out*, and *flos*, *flower*, in botany, denotes the blooming of a flower.

EFFLORESCENCE, in chymiſtry, denotes an operation which certain bodies undergo, when a kind of metal or powder is formed on their ſurfaces; and this may happen either by decompoſition or drying; as to cobalt in the firſt caſe, and to the cryſtals of marine alkali, Glauber's ſalt, alum, &c. in the ſecond.

EFEFORESCENCF, in medicine, a breaking out of humours in the ſkin; as in the meaſles, or the like. See EXANTHEMA.

EFFLORESCENTIA, in botany, (from *effloreſco*, to bloom); the preciſe time of the year and month in which every plant ſhews its firſt flowers. Some plants flower twice a year, as is common between the tropics; others oftener, as the monthly roſe. The former are called by botaniſts *biferæ*; the latter, *multiferæ*. Linnæus and Adanſon have given a ſketch of the different times in which plants flower at Upſal and Paris.

EFFLUVIUM, in phyſiology, a term much uſed by philoſophers and phyſicians, to expreſs the minute particles which exhale from moſt, if not all, terreſtrial bodies, in form of inſenſible vapours. See PERSPIRATION.

EFFLUVIA, in medicine, are aſſigned as the cauſe of various diſorders, eſpecially of the contagious kind. Thus, when a conſiderable quantity of putrid *effluvia* has been admitted into the blood, beſides acting thereupon ſlowly, by way of inquinamentum, or ferment, they ſeem immediately to affect the nerves, and thereby to bring on ſome extraordinary diſorder of the whole frame. Hence ariſe ſpaſms, obſtructions, palpitation, a high degree of fever, or a languid circulation, chilneſs, or intenſe heat, and a variety of contrary ſymptoms, according to the different affection of the nerves. To putrid *effluvia* is likewiſe owing the jaii diſtemper, which is the ſame with the hoſpital fever.

Effluvia iſſuing from corrupted ſubſtances chiefly conſiſt of the phlogiſton or ſulphur principle, ſince they ſo readily unite with, and volatilize acids, as appears from the increaſe and particular change of the ſmell. But it is proper to remark, that from a ſimple putrid ſubſtance the phlogiſton does not ariſe alone, but combined with the ſaline parts of the body: for this principle, when ſingle, is perhaps imperceptible to the ſmell; and, when diveſted of theſe ſalts, is never, ſo far as is known, peſtilential; ſo that the deleterious particles of rotten ſubſtances ſeem to conſiſt of a certain combination of the ſuphureous with the ſaline principle, which united, not only become the moſt irritating ſtimuli to the nerves, but act upon the humours as a putrid ferment in promoting their corruption. Pringle's Obſ. on Diſeaſes of the Army, p. 186, 385, &c. Dr. White, availing himſelf of the diſcoveries of Dr. Prieſtley, has applied *nitrous air*, in the manner propoſed by him, for aſcertaining the ſalubrity of different ſpecimens of air, and the effects of various kinds of *effluvia* upon it.

The earth ſends forth effluvia and ſteams in great abundance, and many things attributed to other agents, are really performed by them. Dr. Woodward has very juſtly attributed great effects to them on foſſils of many kinds; and it is poſſible many more of the preſent appearances of ſubterranean bodies may be owing to them than are at preſent imagined. The figures and delineations on ſtones, in form of trees and ſhrubs, have often their origin from theſe effluvia, getting into the cracks of them; and it is poſſible, that the ſtalactitæ, which we find on the roofs of caverns, may be in great part alſo formed by their means. Phil. Tranſ. N° 169. p. 920.

EFFLUXION, a flowing out, from *ex*, *out of*, and *fluere*, *to flow*.

EFFUSION, the pouring out of any liquid thing with ſome degree of force. In the ancient heathen ſacrifices there were divers effuſions of wine, and other liquors, called libations.

EFFUSION, or FUSION, in aſtronomy, denotes that part of the ſign Aquarius, repreſented on celeſtial globes and planiſpheres, by the water iſſuing out of the urn of the water bearer. See AQUARIUS.

EFFUSION *of Blood*, *effuſio ſanguinis*, in our old writers, is uſed for the mulct, fine, or penalty, impoſed for the ſhedding of blood. This the king uſed frequently to grant to lords of manors. Among others it was granted to the abbot of Glaſtonbury.

EFT, in amphibiology, the Engliſh name of the common lizard, a ſpecies of the genus lacerta. See LACERTA.

EGG, in natural hiſtory, a part formed in the females of certain animals; which under a ſhell or cortex, includes an embryo, or fœtus of the ſame ſpecies; the parts whereof are afterwards diſplayed and dilated; either by incubation, or by the acceſſion of a nutritious juice. The ſpecies of animals that lay eggs are particularly denominated *oviparous*; and the part wherein the egg is formed, the *ovary*. Of the various kinds of eggs thoſe of hens or pullets being the moſt uſual, and which have been the moſt obſerved, we ſhall ſay ſomething of the ſtructure thereof, and the generation of the chick therein.

The chick in the egg is firſt nouriſhed by the albumen; and when this is conſumed, by the vitellus, as with milk. If we compare the chalazæ to the extremities of an axis paſſing through the vitellus, which is of a ſpherical form, this ſphere will be compoſed of two unequal portions, its axis not paſſing through its centre; conſequently, ſince it is heavier than the white, its ſmaller portion muſt always be uppermoſt in all poſitions of the egg.

The yellowiſh white round ſpot, called *cicatricula*, is placed on the middle of the ſmaller portion of the yolk; and therefore, from what has been ſaid in the laſt paragraph, muſt always appear on the ſuperior part of the vitellus.

Not long before the excluſion of the chick, the whole yolk is taken into its abdomen; and the ſhell, at the obtuſe end of the egg, frequently appears cracked ſome time before the excluſion of the chick. The chick is ſometimes obſerved to perforate the ſhell with its beak. After excluſion, the yolk is gradually waſted, being conveyed into the ſmall guts by a ſmall duct.

Eggs, *Preſervation of.* Mr. de Reaumur, of the Paris academy, thinking nothing that could be a public benefit beneath the cognizance of a philoſopher, beſtowed conſiderable pains on finding a method of preſerving eggs for a long time, and ſucceeded at length ſo far in it, as to be able to produce eggs of months, nay years old, which taſted as freſh and well as if they had been laid but the day before. The egg always is quite full, when it is firſt laid by the hen, but from that time it gradually becomes leſs and leſs to its decay; and however compact and cloſe its ſhell may appear, it is nevertheleſs perforated with a multitude of ſmall holes, though too minute for the diſcernment of our eyes. The effect of theſe, however, is evident, by the daily decreaſe of matter within the egg, from the time of its being laid, a fluid matter is continually perſpiring through theſe perforations of the ſhell, which occaſions the decay; and this is carried on in a much quicker manner in hot weather than in cold. To preſerve the egg freſh, there needs no more to be done than to preſerve it full, and ſtop its tranſpiration; and the plain and rational method of doing this, is by ſtopping up thoſe pores through which the matter tranſpires, with a matter which is not ſoluble in watery fluids, and therefore cannot be waſhed away by the matter perſpired by the egg; and on this principle, all kinds of varniſh, prepared with ſpirit of wine, will preſerve eggs freſh for a long time, if they are carefully rubbed all over the ſhell. This might ſeem to moſt people a very common and cheap ſubſtance for this purpoſe: but the misfortune is, that in country places, where it ſhould be put in practice, no ſuch thing is to be had; and the poorer ſort of country people are not eaſily brought into the uſe of any thing to which they are not accuſtomed.

To obviate the difficulty ariſing from this, Mr. Reaumur thought of ſubſtituting in the place of varniſh ſome other ſubſtance more common; and ſoon found, that another ſubſtance, which is very cheap, and every where to be had, would very well ſupply the office of varniſh; for experiments proved, that any hard fat would have the ſame effect. The beſt of all fat for this purpoſe, is found to be a mixture of that of mutton and of beef; theſe ſhould be melted together over the fire, and ſtrained through a linen cloth into an earthen pan: and when thoroughly melted, an egg is to be dipped into it, and immediately taken out again; and it is then in a ſtate to keep perfectly freſh more than a twelvemonth. Memoirs Acad. Scienc. Par. 1735.

The only difficulty attending this method is, that the eggs cannot be ſo eaſily plunged into the fat, as that all their ſurfaces ſhall be covered by it; for if they are held in a pair of pincers, the parts of the egg where the pincers touch will be bare; but the eggs may be ſuſpended by a loop at the end of a thread, and by that means plunged in; and the thread being then coated over with the fat, as well as the ſurface of the egg, will preſerve that part which it covers as well as the coat of fat will the reſt. The great care is to uſe this means while the eggs are perfectly freſh; it ought indeed to be done on the very day when they are laid: for if the evaporation is begun, and the empty ſpace once made, there is room for a fermentation, which never terminates but in the deſtruction of the egg.

In Egypt they hatch their eggs by the heat of a furnace, or oven, and frequently have ſeven or eight thouſand chickens come forth at a time. An account of the method hereof we have in the Philoſophical Tranſactions. See Hatching.

Eggs *of Flies.* See Syſtem of Entomology.

EGYPTIANS, or *Gypſies*, in our ſtatutes, a kind of impoſters and jugglers, who diſguiſe themſelves in uncouth habits, ſmearing their faces and bodies, and framing to themſelves a canting language, wander up and down, and under pretence of telling fortunes, curing diſeaſes, &c. abuſe the common people, trick them of their money, and ſteal all that they can come at. There are ſeveral ſtatutes made againſt them. See Gypsies.

EJACULATOR, in anatomy, a name applied to two muſcles of the genitals, from their office in the ejaculation of the ſeed. The ejaculatores ariſe from the ſphincter of the anus, and advance along the urethra as far as the middle thereof, where they are inſerted laterally. The ſame denomination is likewiſe given to two muſcles of the clitoris, which ariſing from the ſphincter ani, advance laterally along the labia, and are inſerted aſide of the clitoris.

EJACULATORY, in anatomy, is a term applied to two little ducts, or canals, ariſing from the veſiculæ ſeminales. The ejaculatory ducts are about an inch in length: towards the veſiculæ, they are pretty wide; but they contract themſelves as they approach towards the urethra, which they penetrate together. Some authors alſo apply the name ejaculatory to the vaſa deferentia.

EJECTION, the act of throwing out, or diſcharging any thing at ſome of the emunctories, as by ſtool, vomiting, or the like.

Ejectione *Firmæ*, a writ that lies for the leſſee for years, who is ejected before the expiration of his term, either by the leſſor or a ſtranger.

EJECTMENT may be brought by a leſſor againſt the leſſee, for rent in arrears, or holding over his term, &c. Reg. Orig. 227. But ejectment is now become an action in the place of many real actions, as writs of right, formedons, &c. which are very difficult, as well as tedious and chargeable; and this is the common action for trying of titles, and recovering of lands, &c. illegally kept from the right owner. Though, where entry is taken away by deſcents, fines, and recoveries, diſſeiſins, &c. ejectments may not be brought; ſo that all titles cannot be tried by this action.

The method of proceeding in the action of ejectment is, to draw a declaration, and therein feign a leaſe, for three, five, or ſeven years, to him that would try the title; and alſo feign a caſual ejector or defendant; and then deliver the declaration to the ejector, who ſerves a copy of it on the tenant in poſſeſſion, and gives notice in writing at the bottom, for him to appear and defend his title; or that he, the feigned defendant, will ſuffer judgment by default, whereby the true tenant will be turned out of poſſeſſion; to this declaration the tenant is to appear, at the beginning of next term, by his attorney, and conſent to a rule to be made defendant, inſtead of the caſual ejector, and take upon him the defence; in which, he muſt confeſs leaſe, judgment, entry, and ouſter, and at the trial ſtand upon the title only: but in caſe the tenant in poſſeſſion does not appear, and enter into the ſaid rule in time, after the declaration ſerved, then, on affidavit being made of the ſervice of the declaration, with the notice to appear, the court will order judgment to be entered againſt the caſual ejector by default; and thereupon the tenant in poſſeſſion by writ *habere facias poſſeſſionem*, is turned out of his poſſeſſion. On the trial in ejectment, the plaintiff's title is to ſet forth from the perſon laſt ſeiſed in fee of the lands in queſtion, under whom the leſſor claims down to the plaintiff, proving the deeds, &c. and the plaintiff ſhall recover only according to the right which he has at the time of bringing his action. And here, another who had title to the land, upon a motion made for that purpoſe, may be defendant in the action, with the tenant in poſſeſſion, to defend his title; for the poſſeſſion of the lands is primarily in queſtion, and to be recovered, which concerns the tenant, and the title thereto is tried collaterally, which may concern ſome other.

By a late ſtatute, in all caſes between landlord and tenant, where half a year's rent ſhall be in arrear, the landlord, having lawful right to re-enter for non-payment, may ſerve a declaration in ejectment on the tenant, without a formal demand or reentry; or he may affix ſuch declaration on the door of the demiſed meſſuage, or notorious place of the lands, which ſhall be deemed a legal ſervice; and upon proof that half a year's rent was due before the declaration was ſerved, and no ſufficient diſtreſs on the premiſſes, the leſſor ſhall have judgment and execution; which if the leſſee ſuffer without paying the arrears and coſts, and without filing a bill in equity to be relieved within ſix months, he ſhall be barred from all relief, except by writ of error; and the leſſor ſhall hold the premiſſes diſcharged from the leaſe; but if the tenant or leſſee tender to the leſſor, or bring into court the rent in arrear, together with coſts, all farther proceedings ſhall ceaſe, and if the leſſee be relieved in equity, he ſhall enjoy the demiſed premiſſes according to his leaſe, without obtaining a new one. Stat. 4 Geo. II. cap. 28. and 11 Geo. II. cap. 19.

ELABORATION, the act of finiſhing or perfecting any thing with labour and time. The term is chiefly uſed in medicine, where the chyle, blood, and ſemen, are ſaid to be well elaborated, when they are well conditioned, have undergone all the ſecretions, mixtions, impregnations, and circulations, neceſſary to bring them to perfection. If the chyle went directly from its receptaculum to the breaſts, it would not be ſufficiently elaborated to afford good milk.

ELABORATORY. See Laboratory.

ELÆOCARPUS, in botany, oleaſter or wild olive. A genus of the monogynia order, belonging to the tetrandria claſs of plants.

ELASMIS, in foſſiology, the name of a genus of foſſil bodies, of the talc claſs, the diſtinguiſhing characters of which are, that they are compoſed of ſmall plates, in form of ſpangles, each of which is either ſingle, and not farther fiſſile; or, if complex, only to a certain degree, and that into ſomewhat thick laminæ. The word is derived from the Greek ἐλασμος, *a lamina*, or *plate*: the ſeveral component parts of theſe maſſes being ſo many ſmall plates. See Syſtem of Fossilogy.

ELASTICITY, or Elastic *Force*, that property of bodies wherewith they reſtore themſelves to their former figure, after any external preſſure. The cauſe or principle of this important property elaſticity, or ſpringineſs, is variouſly aſſigned. The Carteſians account for it from the materia ſubtilis making an effort to paſs through pores that are too narrow for it. Thus, ſay they, in bending, or compreſſing, a hard elaſtic body, e. gr. a bow, its parts recede from each other on the convex ſide, and approach on the concave; conſequently the pores are contracted or ſtraitened on the concave ſide: and if they were before round, are now, for inſtance, oval; ſo that the materia ſubtilis, or matter of the ſecond element, endeavouring to paſs out of thoſe pores thus ſtraitened, muſt make an effort, at the ſame time, to reſtore the body to the ſtate it was in when the pores were more patent and round, i. e. before the bow was bent: and in this conſiſts its elaſticity.

Other later and more wary philoſophers account for elaſticity much after the ſame manner as the Carteſians; with this only difference, that in lieu of the ſubtile matter of the Carteſians, theſe ſubſtitute ether, or a fine etherial medium that pervades all bodies. Others, ſetting aſide the precarious notion of a materia ſubtilis, account for elaſticity from the great law of nature attraction, or the cauſe of the coheſion of the parts of ſolid and firm bodies. Thus, ſay they, when a hard body is ſtruck or bent, ſo that the component parts are moved a little from each other, but not quite disjoined or broke off, or ſeparated ſo far as to be out of the power of that attracting force whereby they cohere; they muſt certainly, on the ceſſation of the external violence, ſpring back to their former natural ſtate.

Others reſolve elaſticity into the preſſure of the atmoſphere: for a violent tenſion, or compreſſion, though not ſo great as to ſeparate the conſtituent particles of bodies far enough to let in any foreign matter, muſt yet occaſion many little vacuola between the ſeparated ſurfaces; ſo that upon the removal of the force they will cloſe again, by the preſſure of the aerial fluid upon the external parts.

Laſtly, others attribute the elaſticity of all hard bodies to the power of reſilition in the air included within them; and ſo make the elaſtic force of the air the principle of elaſticity in all other bodies.

The **Elasticity** *of Fluids* is accounted for from their particles being all endowed with a centrifugal force; when Sir Iſaac Newton, prop. 23. lib. 2. demonſtrates, that particles, which mutually avoid or fly off from one another by ſuch forces as are reciprocally proportioned to the diſtances of their centre, will compoſe an elaſtic fluid, whoſe denſity ſhall be proportional to its compreſſion; and *vice verſa*, if any fluid be compoſed of particles that fly off and avoid one another, and hath its denſity proportional to its compreſſion, then the centrifugal forces of thoſe particles will be reciprocally as the diſtances of their centres.

Elasticity *of the Air* is the force wherewith that element dilates itſelf, upon removing the force whereby it was before compreſſed. The elaſticity or ſpring of the air was firſt diſcovered by Galileo. Its exiſtence is proved by this experiment of that philoſopher: an extraordinary quantity of air being intruded by means of a ſyringe into a glaſs or metal ball, till ſuch time as the ball, with this acceſſion of air, weigh conſiderably more in the balance than it did before; upon opening the mouth thereof, the air ruſhes out, till the ball ſinks to its former weight. From hence we argue, that there is juſt as much air gone out, as compreſſed air had been crowded in. Air, therefore, returns to its former degree of expanſion, upon removing the force that compreſſed or reſiſted its expanſion; conſequently it is endowed with an elaſtic force. It muſt be added, that as the air is found to ruſh out in every ſituation or direction of the orifice, the elaſtic force acts every way, or in every direction. The elaſticity of the air makes a conſiderable article in Pneumatics.

The cauſe of the elaſticity of the atmoſphere hath been commonly aſcribed to a repulſion between its particles; but this can give us only a very ſlight idea of the nature of its elaſticity. The term repulſion, like that of attraction, requires to be defined, and in all probability will be found in moſt caſes to be the effect of the action of ſome other fluid. Thus, we find, that the elaſticity of the atmoſphere is very conſiderably affected by heat. Thus, ſuppoſing a quantity of air heated to ſuch a degree as is ſufficient to raiſe Fahrenheit's thermometer to 212, it will then occupy a conſiderable ſpace. If it is cooled to ſuch a degree as to ſink the thermometeter to 0, it will ſhrink up into leſs than half the former bulk. The quantity of repulſive power therefore acquired by the air, while paſſing from one of theſe ſtates to the other, is evidently owing to the heat added to or taken away from it. Nor have we any reaſon to ſuppoſe, that the quantity of elaſticity or repulſive power it ſtill poſſeſſes is owing to any other thing than the fire contained in it. The ſuppoſing repulſion to be a primary cauſe independent of all others, hath given riſe to many erroncous theories, and been one very great means of embarraſſing philoſophers in their accounting for the phenomena of Electricity.

ELATER, in entomology, a genus of inſects, belonging to the order of coleoptera. The feelers are ſetaceous. There are 38 ſpecies, diſtinguiſhed by their colour, &c. See Syſtem of Entomology.

ELATINE, in the Linnæan ſyſtem of botany, a genus of plants of the octandria tetragynia claſs.

ELBOW, the outer angle made by the flexure, or bend of the arm. That eminence whereon the arm reſts, called by us *elbow*, by the Latins called *cubitus*, and the Greeks *αγκων*, and by others *ολεκρανον*.

Elbow is alſo uſed by architects, maſons, &c. for an obtuſe angle of a wall, building, or road, which diverts it from its ſtraight line.

ELDER, a word uſed in ſome parts of the kingdom for fuel. Dict. Buſt.

Elder or **Alder** *Tree*, the Engliſh name of the genus, ſambucus, in botany. See Sambucus.

ELDERS, *Seniors*, in the Jewiſh hiſtory, were the moſt conſiderable perſons, for age, experience, and virtue, among the antient people. Moſes, we read, aſſembled the *elders* of the people together, and acquainted them with what the Lord had commanded.

Long afterwards, thoſe who held the firſt rank in the ſynagogues were uſually called זקנים, *zekenim*, *elders*, in imitation of the ſeventy *elders* whom Moſes eſtabliſhed for the judges of the ſanhedrim. Numbers xi. 16, 17, 24, 25. Exod. xxiv. 1, 9, 14. See Sanhedrim.

The preſident, or chief had, in a particular manner, the appellation of *elder*; being, as it were the *decanus ſeniorum*, *dean of the elders*.

In the aſſemblies of the primitive Chriſtians, thoſe who held the firſt place, or rank, aſſumed the denomination of preſbyters, or *elders*; for the word *preſbyters*, which occurs ſo frequently in the Old Teſtament, and which includes alike both biſhops and prieſts, does properly ſignify *elders*. See M. Simon's obſervation thereon, in his Supplement aux Ceremonies des Juifs.

The preſident, or biſhop, as being the chief of the *elders*, did likewiſe aſſume the denomination of *elder*; whence it is, that in the New Teſtament the name *biſhop* is frequently confounded with that of *preſbyter*. See Bishop, and Presbyter.

For the like reaſon, the council of the firſt churches was called *preſbyterium*, or council of the *elders*, where the biſhop precided in quality of firſt *elder* being ſeated in the middle of the other *elders*. The prieſts, or *elders*, who ſat by him, had each his judge's chair; for which reaſon they are called, by the fathers, *aſſeſſores epiſcoporum*. Nothing of any importance was done till it had firſt been examined, and reſolved, in this aſſembly, where the biſhop only made one body with the other *elders*, or prieſts; the juriſdiction which we now call epiſcopal, not being then dependent on the biſhop alone, but on all the *elders*, over whom he was only the preſident.

Elders is alſo a denomination ſtill retained in the preſbyterian diſcipline.

The *elders* are officers, who, in conjunction with the paſtors, or miniſters, and deacons, compoſe the conſiſtories, or kirk ſeſſions, meeting to conſider, inſpect, and regulate matters of religion and diſcipline. They are choſen from among the people, and are received publicly with ſome degree of ceremony. In Scotland, there is an indefinite number of *elders* in each pariſh; generally about twelve. See Presbytery.

ELECT, from *eligo*, *I chuſe*, *choſen*, in the *Scripture*, is applied to the primitive Chriſtians. In which ſenſe, the *elect* are thoſe choſen and admitted to the favour and bleſſing of Chriſtianity.

Elect, in ſome ſyſtems of theology, is a term appropriated to the ſaints, or the predeſtinated. In which ſenſe, the *elect* are thoſe perſons who are ſaid to be predeſtinated to glory as the end, and to ſanctification as the means.

Elect is likewiſe applied to archbiſhops, biſhops, and others officers, who are choſen, but not yet conſecrated, or actually inveſted with their office, or juriſdiction. The emperor is ſaid to be *elect*, before he is inaugurated and crowned; a lord mayor is *elect* before his predeceſſor's mayoralty is expired, or the ſword is put in his hands.

ELECTION, a choice made of any thing, or perſon, whereby it is preferred to ſome other. There ſeems this difference, however, between choice and election, that election has uſually regard to a company or community, which makes the choice; whereas choice is ſeldom uſed, but when a ſingle perſon makes it.

Election is alſo the ſtate of a perſon who is left to his own free will, to take or do either one thing, or another, which he pleaſes.

Election, in theology, ſignifies the choice which God, of his good pleaſure, makes of angels or men, for the objects of mercy and grace. The election of the Jews, was the choice God made of that people to be more immediately attached to his worſhip and ſervice, and for the Meſſiah to be born of them. And thus particular nations were elected to the participation of the outward bleſſings of Chriſtianity.

Election alſo, in the language of ſome divines, ſignifies a predeſtination to grace and glory, and ſometimes to glory only. And it has been enjoined as an article of faith, that predeſtination to grace is gratuitous, merely and ſimply ſo; *gratia, quia gratis data*. But the divines are much divided as to the point, whether election to glory be gratuitous, or whether it ſuppoſes obedience and goods works, i. e. whether it be before, or after, the previſion of our obedience.

Election, in Britiſh polity, is the people's choice of their repreſentatives in parliament. In this conſiſts the exerciſe of the democratical part of our conſtitution: for in a democracy there can be no exerciſe of ſovereignty but by ſuffrage, which is the declaration of the people's will. In all democracies, therefore, it is of the utmoſt importance to regulate by whom, aud in what manner, the ſuffrages are to be given. And the Athenians were ſo juſtly jealous of this prerogative, that a ſtranger, who interfered in the aſſemblies of the people, was puniſhed by their laws with death; becauſe ſuch a man was eſteemed guilty of high treaſon, by uſurping thoſe rights of ſovereignty to which he had no title. In Britain, where the people do not debate in a collective body, but by a repreſentation, the exerciſe of this ſovereignty conſiſts in the choice of repreſentatives. The laws have therefore very ſtrictly guarded againſt uſurpation or abuſe of this power, by many ſalutary proviſions; which may be reduced to theſe three points. The qualifications of the electors. The qualifications of the elected; and the proceedings at elections.

The reaſon of requiring any qualification, with regard to property, in voters, is to exclude ſuch perſons as are in ſo mean a ſituation, that they are eſteemed to have no will of their own. If theſe perſons had votes, they would be tempted to diſpoſe of them under ſome undue influence or other. This would give a great, an artful, or a wealthy man, a larger ſhare in elections than is conſiſtent with general liberty. If it were probable that every man would give his vote freely, and without influence of any kind; then, upon the true theory and genuine principles of liberty, every member of the community, however poor, ſhould have a vote in electing thoſe delegates, to whoſe charge is committed the diſpoſal of his property, his liberty, and his life. But, ſince that can hardly be expected, in perſons of indigent fortunes, or ſuch as are under the immediate dominion of others, all popular ſtates have been obliged to eſtabliſh certain qualifications; whereby ſome, who are ſupected to have no will of their own, are excluded from voting, in order to ſet other individuals, whoſe wills may be ſuppoſed independent, more thoroughly upon a level with each other.

This conſtitution of ſuffrages is framed upon a wiſer principle, with us, than either of the methods of voting, by centuries or by tribes, among the Romans. In the method by centuries, inſtituted by Servius Tullius, it was principally property, and not numbers, that turned the ſcale: in the method by tribes, gradually introduced by the tribunes of the people, numbers only were regarded, and property entirely overlooked. Hence the laws paſſed by the former method had uſually too great a tendency to aggrandize the Patricians or rich nobles; and thoſe by the latter had too much of a levelling principle. Our conſtitution ſteers between the two extremes. Only ſuch are intirely excluded, as can have no will of their own: there is hardly a free agent to be found, but what is entitled to a vote in ſome place or other in the kingdom. Nor is comparative wealth, or property, entirely diſregarded in elections; for though the richeſt man has only one vote at one place, yet, if his property be at all diffuſed, he has probably a right to vote at more places than one, and therefore has many repreſentatives. This is the ſpirit of our conſtitution: not that we aſſert it is in fact quite ſo perfect as we have here endeavoured to deſcribe it; for, if any alteration might be wiſhed or ſuggeſted in the preſent frame of parliaments, it ſhould be in favour of a more complete repreſentation of the people.

As it is eſſential to the very being of parliament that elections ſhould be abſolutely free, therefore all undue influences upon the electors are illegal, and ſtrongly prohibited. For Mr. Locke ranks it among thoſe breaches of truſt in the executive magiſtrate, which, according to his notions, amount to a diſſolution of the government, "if he employs the force, treaſure, and offices of the "ſociety to corrupt the repreſentatives, or openly to pre-engage "the electors, and preſcribe what manner of perſons ſhall be "choſen: for thus to regulate candidates and electors, and new "model the way of election, what is it, (ſays he,) but to cut up "the government by the roots, and poiſon the very fountain of "public ſecurity?" As ſoon, therefore, as the time and place of election, either in counties or boroughs, are fixed, all ſoldiers quartered in the place are to remove, at leaſt one day before the election, to the diſtance of two miles or more; and not to return till one day after the pole is ended. Riots likewiſe have been frequently determined to make an election void. By vote alſo of the houſe of commons to whom alone belongs the power of determining conteſted elections, no lord of parliment, or lord lieutenant of a county, hath any right to interfere in the election of commoners; and, by ſtatute, the lord warden of the cinque ports ſhall not recommend any members there. If any officer of the exciſe, cuſtoms, ſtamps, or certain other branch of the revenue, preſumes to intermeddle in elections, by perſuading any voter, or diſſuading him, he forfeits 100l. and is diſabled to hold any office.

The firſt inſtance that occurs, of election bribery, was ſo early as 13 Eliz. when one Thomas Longe (being a ſimple man, and of ſmall capacity, to ſerve in parliament) acknowledged that he had given the returning officer and others of the borough for which he was choſen, four pounds to be returned member, and was for that premium elected. But for this offence the borough was amerced, the member was removed, and the officer fined and impriſoned. But as this practice hath ſince taken much deeper and more univerſal root, it hath occaſioned the making many ſtatutes; to complete the efficacy of which, there is nothing wanting but reſolution and integrity to put them in ſtrict execution.

Undue influence being thus guarded againſt, the election is to be proceeded to on the day appointed; the ſheriff or other returning officer firſt taking an oath againſt bribery, and for the due execution of his office. The candidates likewiſe, if required, muſt ſwear to their qualification, and the electors in counties to theirs; and the electors both in counties and boroughs are alſo compellable to take the oath of abjuration, and that againſt bribery and corruption. And it might not be amiſs, if the members elected were bound to take the latter oath, as well as the former; which, in all probability, would be much more effectual, than adminiſtring it only to the electors.

The election being cloſed, the returning officer in boroughs return his precept to the ſheriff, with the perſons elected by the majority: and the ſheriff returns the whole, together with the writ for the county and the knights elected thereupon, to the clerk of the crown in chancery; before the day of meeting, if it be a new parliament, or within 14 days after the election, if it be an occaſional vacancy; and this under penalty of 500l. If the ſheriff does not return ſuch knights only as are duly elected, he forfeits, by the old ſtatutes of Henry VI. 100l. and the returning officer in boroughs for a like falſe return, 40l. and they are beſides liable to an action, in which double damages ſhall be recovered, by the later ſtatutes of king William: and any perſon bribing the returning officer ſhall alſo forfeit 300l. But the members returned by him are the ſitting members, until the houſe of commons, upon petition, ſhall adjudge the return to be falſe and illegal. The form and manner of proceeding upon ſuch petition are now regulated by ſtatute 10 Geo. III. c. 16. (amended by 11 Geo. III. c. 42. and made perpetual by 14 Geo. III. c. 15.) which directs the method of chuſing by lot a ſelect committee of 15 members, who are ſworn well and truly to try the ſame, and a true judgment to give, according to the evidence. See PARLIAMENT.

Some benefices are elective, others collative. Municipal offices in England are generally elective; in Spain, venal. Poland is an elective kingdom. All prelatures in France are elective, ſince the Concordat.

ELECTOR, a perſon who has a right to elect, or chooſe another to an office, honour, &c. The word is formed of the Latin *eligere, to chooſe*. We ſay the electors of a burgeſs, a knight of the ſhire, a grand-maſter of an order, &c.

ELECTOR is particularly, and by way of eminence, applied to certain princes of Germany, in whom lies the right of electing the emperor, being all ſovereigns, and the principal members of the empire.

The firſt author who mentions the ſeven electors is Martinus Polonus, and this reſtrictive privilege was propably obtained by degrees. The princes of greater authority were firſt allowed to name the perſon whom they wiſhed to be choſen emperor, and the people retained the right of approving or diſapproving the nomination; and when they had ſecured the right of voting firſt, or of prætaxation, as it was called, it became needleſs for the inferior eccleſiaſtics or barons to attend, merely to confirm their choice; more eſpecially as their attendance would become troubleſome and expenſive. Beſides, the aſſumed privilege of the ſeven electors, who poſſeſſed the moſt extenſive terretories, was ſtrongly ſupported by their numerous dependants and allies; and they were conſidered as the repreſentatives of all the orders which compoſed the higheſt claſs of German nobility. See Robertſon's Hiſt. chap. v. vol. i. p. 458, &c. 8vo. edit.

The electors have not only the power of chuſing the emperor, but they have actually exerciſed that of depoſing him. Thus they depoſed Adolphus of Naſſau in 1298, and Wenceſlaus in 1401. The ſeveral functions of the electors are as follow: the election of Mentz is chancellor of Germany; he convokes the ſtates, and gives his vote before any of the reſt. The elector of Cologne is grand chancellor of Italy, and conſecrates the emperor. The elector of Treves is grand chancellor of the Gauls, and confers the impoſition of hands on the emperor. The count palatine of the Rhine is grand maſter of the imperial palace, and preſents the emperor with a globe at his coronation. The marquis of Brandenburgh is grand chamberlain, and puts the ring on the emperor's finger. The duke of Saxony is grand marſhal, and gives the ſword to the emperor. The king of Bohemia, who was anciently only duke, is grand butler, and puts Charlemagne's crown on the emperor's head. Laſtly the elector of Hanover, now king of Great Britain, is arch-treaſurer; though firſt elected under the title of ſtandard bearer of the empire.

The electoral prince is the eldeſt ſon of an elector, and the preſumptive heir of his dignity. Electors are always addreſſed under the title of electoral highneſſes. The electoral college, conſiſting of all the electors of the empire, is the moſt illuſtrious and auguſt body in Europe.

ELECTORAL *Crown* or *Coronet*. See Syſtem of HERALDRY, Plate V.

ELECTORATE, the dignity of an elector, with the territory, or dominions, to which that quality is annexed.

Though the cuſtom ordinarily be, in Germany, for the ſons of princes to ſhare their fathers lands and territories among them, thoſe whereto the electorate is annexed are not uſed to be divided, but paſs entire to the eldeſt ſon who ſucceeds to the electorate.

ELECTRICITY, in general, ſignifies the operations of a very ſubtile fluid, in moſt caſes inviſible, but which ſometimes becomes the object of our ſight and other ſenſes, diſcovering itſelf to be one of the chief agents employed in producing the phenomena of nature.

SYSTEM OF ELECTRICITY.

INTRODUCTION.

THE ſcience of electricity is now generally acknowledged to be uſeful and important; and there is great reaſon to think, that at a future period it will be looked up to as the ſource from whence the principles and properties of natural philoſophy muſt be derived. It's utility to man will not be inferior to it's dignity as a ſcience.

It has been our endeavour, in the following Syſtem, to collect and arrange, in a methodical and conciſe manner, the eſſential parts of electricity, by theſe means to render its application eaſy, pleaſant, and obvious to the practitioner; and by bringing together experiments of the ſame kind, make them mutually illuſtrate each other, and thus point out the ſtrength, or diſcover the weakneſs, of the theories that have been deduced from them. Though the nature and confined limits of our plan do not admit of a formal enumeration of every particular, yet, we truſt, we have not omitted any article that can convey important information, or facilitate improvement, in the knowledge of the ſcience.

Arts and ſciences, like kingdoms and nations, have each in their turn ſome happy period of glory and ſplendor, in which they more than ever attract the human attention, and, by caſting a ſtronger light than at other times, become the favourite object and purſuit of the age; but theſe periods are ſoon over, and a few years of luſtre and fame are often overbalanced by centuries of oblivion. From undergoing this fate, ſome ſciences are, however, excepted, which, owing to the vaſt and neceſſary extent of their uſe, and to the fruitfulneſs of their productions, are ever flouriſhing; and although once unknown, yet when fame had proclaimed their birth, or publiſhed their advancement, they never afterwards declined. Of this kind is Electricity, one of the moſt pleaſing and ſurpriſing among all the branches of natural philoſophy that ever were cultivated by man. This ſcience, after it began to ſhew the extent and generality of its power; after it was known to be one of the greateſt agents of nature; remained always in vogue, was profitably cultivated, irremittedly advanced, and is now brought to a ſtate, in which, inſtead of becoming ſterile, it ſeems further to engage the general attention, and to promiſe to its followers more munificent rewards. Optics, indeed, ſhews many enchanting and uſeful properties, but concerning viſion only; Magnetiſm exhibits the force of attraction, repulſion, and polarity in that ſubſtance called a Magnet: but Electricity, containing, as it were, all within its power, alone exhibits the effects of many ſciences, combines together different powers, and, by ſtriking the ſenſes in a particular and ſurpriſing manner, affords pleaſure, and is of uſe to the ignorant as well as the philoſopher, the rich as well as the poor. In Electricity, we are pleaſed with beholding its penetrating light, exhibited in numberleſs different forms; we admire its attraction and repulſion, acting upon every kind of body; we are ſurpriſed by the ſhock, terrified by the exploſion and force of its battery; but when we conſider and examine it as the cauſe of thunder, lightning, aurora borealis, and other appearances of nature, whoſe direful effects we can in part imitate, explain, and even avert, we are then involved in a maze, that leaves nothing to contemplate but the inexpreſſible and permanent idea of admiration and wonder.

It muſt appear ſurpriſing to every ſearcher after truth, that electricity, which is now allowed to be one of the principal agents employed in producing the phænomena of nature, ſhould have remained ſo long in obſcurity; for, comparatively ſpeaking, its exiſtence was not known to the ancients. They were not, indeed, altogether ignorant of the peculiar properties of thoſe bodies that we now term electrics *per ſe*; nevertheleſs their knowledge was circumſcribed, being confined to the obſervation only of thoſe phænomena which nature preſented to their ſenſes, in the ordinary courſe of her operations; hence near two thouſand years elapſed, before any addition was made to the little which was known to Theophraſtus, and this branch of natural hiſtory remained uncultivated, till the happy period arrived, when the philoſopher was emancipated from the chains of hypothetic reaſoning, and the uncertainties of vague conjecture.

The exiſtence of this ſubtle, and in moſt caſes inviſible, power, was then traced, and many of its properties developed; its agency was diſcovered to be univerſal, and its extent unlimited.

Electricity has been dignified in a peculiar manner, by engaging the attention of the philoſophic hiſtorian; who by delineating the gradual progreſs of its diſcoveries, deſcribing the different theories which have been invented to account for its effects, and pointing out the *deſiderata* which ſtill remain to be explored, has contributed, in a high degree, to enlarge the boundaries of electricity, and to increaſe the number of thoſe who cultivate it.

Since the publication of Dr. Prieſtley's hiſtory, the electrical apparatus has been conſiderably augmented, and many new experiments have been made. To deſcribe the one, and to arrange the other, under ſuch heads as will point out the connection between the experiments and the received theory of electricity, is the principle deſign of this Syſtem.

As electricity is in its infancy, when conſidered as a ſcience, its definitions and axioms cannot be ſtated with geometric accuracy. We ſhall endeavour to avoid, as much as poſſible, the uſe of poſitive expreſſion, in order to invite the reader to examine the experiments himſelf, to compare them one with another, and then draw his own concluſions; beginning with thoſe experiments which were the foundation of the preſent ſtate of electricity, and which gave riſe to the principal technical terms made uſe of in this ſcience.

In this Syſtem we ſhall firſt give a brief hiſtory of the ſcience, afterwards an account of its uſes, and then divide it into three parts, in each of which are contained ſuch particulars, as had leſs connection with the reſt; and the diſtinct view of which, it was thought, might be a means of preventing a confuſion of ideas in the minds of thoſe readers, who before have not been much converſant with the ſubject.

The firſt part treats of the laws of electricity only; i. e. of ſuch natural laws concerning electricity, as by innumerable experiments, have been found uniformly true, and are independent on any hypotheſis. In this part, we have not deſcended to particulars, which were not clearly aſcertained, or which were inconſiderable; but we have, at the ſame time, taken care not to omit any thing material, or which ſeemed to promiſe future diſcoveries.

The ſecond part contains the practical branch of electricity. Here we have taken care to inſert a deſcription of all the new improvements in the apparatus; which ſerve to leſſen the expence of it, and at the ſame time, to facilitate the performance of the experiments. As to the experiments themſelves, we have chiefly inſiſted on a few principal ones, which ſeemed moſt neceſſary to illuſtrate and confirm the laws of electricity.

The third part contains the practice of medical electricity, on which we have been rather copious in conſideration of its great importance and utility. To render the ſyſtem more intelligible and uſeful we have added two plates, the firſt repreſenting the machines, as made by Mr. Adams, of Fleet Street, in which are united all the late improvements of modern profeſſors; the ſecond contains a variety of apparatus neceſſary for philoſophical and entertaining experiments.

HISTORY OF ELECTRICITY.

The earlieſt account we have of any known electrical effect, is by the famous antient naturaliſt Theophraſtus, who flouriſhed about 300 years before the preſent era. He tells us that *amber* (whoſe Greek name is ηλεκτρον, and from whence the name *Electricity* is derived) as well as the *lyncurium*, has the property of attracting light bodies. This was all that was known of the ſubject, for about fifteen centuries after Theophraſtus; in which long period we find no mention in hiſtory of any perſon having made any diſcoveries, nor even any experiments in this branch of philoſophy; the ſcience remaining quite in the dark till the time of Wm. Gilbert, an Engliſh phyſician, whoſe work *de magnete*, which contains ſeveral electrical experiments, was publiſhed in the year 1600; and who, for his diſcoveries in this new and uncultivated field, may be juſtly deemed the father of Electricity. He obſerved, that the property of attracting light bodies, after rubbing,, was not peculiar to amber, or the *lyncurium*; but that many other bodies poſſeſſed it as well as amber. He mentions a great number of thoſe, together with many particulars, which, conſidering the ſtate of the ſcience at that time, may be deemed truly great and intereſting.

After Gilbert, the ſcience advancing, although by ſmall degrees, paſſed, as it were, from infancy to puerility; many an excellent philoſopher undertaking to examine nature in this walk: ſuch was Sir Francis Bacon, Mr. Boyle, Otto Guericke, Sir Iſaac Newton, and moſt of all Mr. Hawkeſbee, a perſon to whom we are much indebted for many important diſcoveries, and a real advancement of Electricity. Mr. Hawkeſbee was the firſt who obſerved the great electric power of glaſs; a ſubſtance, that, ſince his time, has been generally uſed by all Electricians, in preference to any other electric. He firſt remarked various appearances of the electric light, and the noiſe accompanied with it, together with a variety of phenomena relating to electric attraction and repulſion.

After Mr. Hawkeſbee, the ſcience of Electricity, however hitherto advanced, remained for above 20 years in a ſtate of quieſcence, the attention of philoſophers being at that time engaged in other philoſophical ſubjects, which, on account of the new diſcoveries of the incomparable Sir Iſaac Newton, were then greatly in repute. Mr. Grey was the firſt, after this period of oblivion, to bring the ſcience again to light. He, by his great diſcoveries, re-introduced it to the acquaintance of philoſophers, and from him the true flouriſhing era of Electricity may be ſaid to take date.

The number of Electricians that hath been daily multiplying ſince Mr. Grey, the diſcoveries made, and the uſe derived from thoſe, till the preſent time, are matters really worthy of attention, and deſerve to be admired by every lover of the ſciences, and well-wiſher to the human race.

Whoever would make himſelf acquainted with the particular tranſactions concerning thoſe advances, ſhould read the elaborate Hiſtory of Electricity compiled by the learned Dr. Prieſtley; we forebear making any long hiſtorical detail; this treatiſe being intended to give an account of the preſent ſtate of Electricity, in a methodical manner, and not an hiſtory of the ſame. We ſhall in general only obſerve, that although the ſcience had through the Indefatigable attention of ſo many ingenious perſons, and by the diſcoveries that were daily produced, excited the curioſity of philoſophers, and engaged their attention; yet, as the cauſes of any thing, whether ſmall or great, known or unknown, are ſeldom much attended to, if their effects are not ſtriking and ſingular; ſo Electricity had, till the year 1746, been ſtudied by none but Philoſophers. Its attraction could in part be imitated by a loadſtone; its light by a phoſphorus; and, in ſhort, nothing contributed to make Electricity the ſubject of the public attention, and excite a general curioſity, until the capital diſcovery of the vaſt accumulation of its power, in what is commonly called the *Leyden phial*, which was accidentally made in the memorable year 1745. This great diſcovery was made by Mr. Von Kleiſt, Dean of the Cathedral in Comin. See the third edition of Dr. Prieſtley's Hiſt. of Elect. Per. VIII. Sect. I. Then, and not till then, the ſtudy of Electricity became general, ſurpriſed every beholder, and invited to the houſes of Electricians a greater number of ſpectators, than were before aſſembled together to obſerve any philoſophical experiments whatſoever.

Since the time of this diſcovery, the prodigious number of Electricians, experiments, and new facts that have been daily produced from every corner of Europe, and other parts of the world, is almoſt incredible. Diſcoveries crouded upon diſcoveries; improvements upon improvements: and the ſcience ever ſince that time went on with ſo rapid a courſe, and is now ſpreading ſo amazingly faſt, that it ſeems as if the ſubject would be ſoon exhauſted, and Electricians arrive at an end of their reſearches; but, however, the *ne plus ultra* is, in all probability, as yet at a great diſtance, and the young Electrician has a vaſt field before him, highly deſerving his attention, and promiſing further diſcoveries, perhaps equally, or more important than thoſe already made.

USES OF ELECTRICITY.

Nature, ever wiſe and admirable in her actions, ſeems to follow a certain ſimilarity in her works with a conformity of operations, and, from the ſimpleſt to the moſt complicated of her objects, an analogy is obſervable, which, as it is wonderful to be conſidered, ſo it is inſtructive and uſeful. It is on account of this analogy, that whenever a diſcovery is made in any part of natural philoſophy; whenever a ſcience is advanced, we not only attain to the knowledge of that ſingle law, or particular ſcience, but at the ſame time acquire means in general of inveſtigating the operations of nature with ſomewhat more certainty and accuracy; and by purſuing that analogy we are enabled to make further diſcoveries, and to improve every branch of knowledge. How far electricity has contributed towards this purpoſe, we think is unneceſſary to be further proved, when its action has been ſhown to be ſo general, and ſo powerful, as to perform what no art can operate. But, beſides the field that electricity has opened for further diſcoveries, and the ſatisfaction of that curioſity, which before attended the contemplation of ſo many wonderful phenomena as have been explained by this ſcience, there are two great advantages derived from electricity; the one is a defence againſt the direful effects of lightning, and the other a remedy for many diſorders incident to the human body.

In order to guard edifices or ſhips from being damaged by lightning, it was judiciouſly propoſed, by Dr. Franklin, to raiſe a metallic conductor ſome feet above the higheſt part of the building, and continue it down the wall till it penetrated ſome feet into the ground; by this means the houſe could never receive any damage; for whenever the lightning ſhould happen to fall upon it, it is evident that the conductor, being of metal, and higher than any part of the building, would certainly attract it, and, by conducting it to the ground, hinder that building from receiving any damage; for it is known that electricity always ſtrikes the neareſt and beſt conductors that it meets with in its way.

The reaſonableneſs and truth of this aſſertion has been confirmed by numberleſs facts, and the practice of raiſing ſuch conductors has been found exceedingly uſeful, particularly in hot climates, where thunder ſtorms are very frequent, and the damages occaſioned by the ſame too often experienced.

In regard to the conſtruction of ſuch conductors, there have been ſome controverſies among electricians; and the moſt advantageous manner of uſing them has not, without a great many experiments, and but very lately, been aſcertained. Some philoſophers have aſſerted that ſuch conductors ſhould terminate in a blunt end, that they might the leſs invite the lightning from the cloud; for a blunt end will not attract electricity from ſo great diſtance as a ſharp point. But ſome other philoſophers have thought a pointed termination to be much preferable to a blunt one; and their aſſertion is founded on much better reaſoning.

On board ſhips a chain has often been uſed for this purpoſe, which, on account of its pliableneſs, has been found very convenient, and eaſy to be managed among the rigging of the veſſel; but as the electricity finds a great obſtruction in going through the ſeveral links, for which reaſon chains have been actually broken by the lightning, ſo their uſe has now been almoſt entirely laid aſide; and, in their ſtead, copper wires a little thicker than a gooſe-quill have been ſubſtituted, and found to anſwer very well. One of theſe wires ſhould be elevated two or three feet above the higheſt maſt in the veſſel; this ſhould be continued down the maſt, as far as the deck, where, by bending, it ſhould be adapted to the ſurface of ſuch parts, over which it may moſt conveniently be placed, and, by continuing it down the ſide of the veſſel, it ſhould be always made to communicate with the water of the ſea.

In regard to perſonal ſecurity, in caſe a thunder-ſtorm were to happen while a perſon is in a houſe not furniſhed with a proper conductor, it is adviſable not to ſtand near places where there is any metal, as chimnies, gilt frames, iron caſements, or the like; but to go into the middle of a room, and endeavour to ſtand or ſit upon the beſt non-conductor that can be found at hand, as an old chair, a ſtool, &c. "It is ſtill ſafer (ſays Dr. Franklin) to bring two or three mattraſſes or beds into the middle of the room, and, folding them up double, put the chair upon them; for, they not being ſo good conductors as the walls, the lightning will not chooſe an interrupted courſe through the air of the room and the bedding, when it can go through a continued better conductor, the wall. But where it can be had, a hammock or ſwinging bed, ſuſpended by ſilk cords, equally diſtant from the walls on every ſide, and from the cieling and floor above and below, affords the ſafeſt ſituation a perſon can have in any room whatever, and what indeed may be deemed quite free from danger of any ſtroke by lightning."

If a ſtorm was to happen whilſt a perſon is in the open fields, and far from any building, the beſt thing he can do is to retire within a ſmall diſtance of the higheſt tree or trees he can get at; he muſt by no means go quite near them, but ſhould ſtop at about fifteen or twenty feet from their outermoſt branches; for if the lightning ſhould fall thereabout, it will very probably ſtrike the trees; and in caſe a tree was to be ſplit, he is ſafe enough at that diſtance from it.

In regard to the other great uſe of electricity, viz. its application as a medicine, there have been many opinions *pro* and *contra*, and the reputation of medical electricity has been very dubious and fluctuating; owing to the exaggerations, the miſtakes, the prejudices, and the intereſt of thoſe who have adminiſtered it in phyſical caſes. But after many experiments, and after overcoming the rooted prejudice of ſeveral phyſicians againſt medical electricity, it has been clearly obſerved, that, when properly managed, it is an harmleſs remedy, which ſometimes inſtantaneouſly removes divers complaints, generally relieves and often perfectly cures various diſorders, ſome of which could not be removed by the utmoſt endeavours of phyſicians and ſurgeons. Electricity when properly managed, if it does not effect a cure, at leaſt it produces no bad effect; the few caſes in which it ſeems to have produced any harm, are of a doubtful nature.

PART I. THEORY.

SECT. I.

EXPLANATION OF TERMS PRINCIPALLY USED IN ELECTRICITY.

If a perſon, holding with one of his hands a clean and dry glaſs tube, rubs it with his other hand, alſo clean and dry, ſtroking it alternately upwards and downwards; and after a few ſtrokes, preſents to it ſmall light bits of paper, thread, metal, or any other ſubſtance, the rubbed tube will immediately attract them, and after a little time will repel them—preſently, attract them again; and ſo alternately contribute this attraction, and repulſion, for a conſiderable time. If this tube be rubbed in the dark, and, after having been rubbed, a finger be preſented to it at the diſtance of about half an inch, a lucid ſpark will be ſeen between the finger and the tube, accompanied with a ſnapping noiſe; the finger at the ſame time receiving a puſh, as if it was from air iſſuing with violence out of a ſmall pipe.

In this experiment, the attraction, repulſion, ſparklings, &c. are the effects of that unknown cauſe called electricity; and hence they are called electrical appearances. The glaſs tube itſelf is called the electric, and all thoſe bodies which are capable by any means to produce ſuch effects, are called electrics; and as the rubbing awakes, as it were, in them the power of producing electrical appearances, they are therefore ſaid to be excited by the rubbing. The hand, or any other body that rubs an electric, is called the rubber; and if, inſtead of the perſon rubbing the glaſs tube, a machine be conſtructed capable by any means to excite an electric, this will be an electrical machine.

If at the end of the tube oppoſite to that held by the hand, a wire of any length be tied, ſuſpending a metallic ball at its end, and the tube be excited as before, the metallic ball will, in this caſe, acquire all the properties of the excited tube, i. e. it will attract, ſparkle, &c. like the tube itſelf, the electric virtue paſſing through the wire to the ball; hence, the wire is ſaid to be a conductor of electricity; and all ſuch bodies as are capable to tranſmit the electric virtue, like the above-mentioned wire, are called conductors.

But if, inſtead of the wire, a ſilk ſtring be uſed in the above experiment, and the tube be excited as before, the ball in this caſe will not ſhew any ſigns of electricity; the ſilk ſtring not permitting the electric virtue to paſs from the tube to the ball: hence the ſilk ſtring in this caſe, and all thoſe ſubſtances through which the electric virtue cannot be tranſmitted, are called non-conductors.

A body reſting intirely upon non-conductors is ſaid to be inſulated;

lated; ſo in the laſt experiment, the metallic ball was inſulated; ſince it was ſuſpended intirely by the ſilk ſtring, which is a non-conductor. The bodies which are conductors, and thoſe which are non-conductors of electricity, together with their peculiar properties, as far as they are known, will be plainly laid down in the following ſection.

SECT. II.

ELECTRICS AND CONDUCTORS.

The firſt and principal maxim in electricity is, that all the known bodies in nature are divided into two claſſes, viz. electrics, and conductors; experiments ſhewing, that whatever ſubſtance is a conductor of electricity, cannot be excited, (hence conductors are alſo called non-electrics); and that whatever ſubſtance can be excited, is not a conductor, (hence electrics and non-conductors become ſynonymous terms; electrics are often alſo called *electrics per ſe*. This maxim, however, is not to be conſidered as ſtrictly true and general; for in reality we know of no ſubſtance that may be called a perfect electric, nor of any, that may be called a perfect conductor: the electric virtue finding ſome reſiſtance in going through the beſt conductors, and being in part tranſmitted through, or over the ſurface of moſt, and perhaps all the electrics. The leſs perfect conductor any ſubſtance is, the nearer it comes to the nature of an electric; and, on the other hand, the leſs perfect electrics come neareſt to the nature of conductors. The limits of thoſe two claſſes come ſo far one within the other, that there are many ſubſtances which may be actually excited, and at the ſame time are pretty good conductors. If the reader deſires to know thoſe ambiguous ſubſtances, he muſt ſeek for the worſt electrics among the electrics, and for the worſt conductors among the conductors, excepting ſuch on which the experiment cannot be tried, as fluids, powders, &c.

The two following liſts contain, in general, all the electrics and conductors, diſpoſed in the order of their perfection, beginning in each liſt with the moſt perfect of their claſs. In this order, however, the reader muſt not expect a great exactneſs; that being impracticable, when ſubſtances are ſet under general articles.

Electrics.

Glaſs, and all vitrifications, even thoſe of metals. All precious ſtones of which the moſt tranſparent are generally the beſt.

All reſins *, and reſinous compounds. — [* Under the name of reſins, we would be underſtood to mean all ſuch conſiſtent, oily, vegetable productions, as are inflammable, and not ſoluble in water; gum-lac, therefore, and all ſuch ſubſtances, improperly called gums, are alſo meant under this article. See MACQUER's Chymiſtry, vol. i. chap. 11.] —Amber. Sulphur. Baked wood. All bituminous ſubſtances. Wax. Silk. Cotton. All dry animal ſubſtances, as feathers, wool, hair, &c. Paper. White ſugar, and ſugar candy. Air. Oils. Calces of metals and ſemi-metals. The aſhes of animal and vegetable ſubſtances. All dry vegetable ſubſtances. All hard ſtones, of which the hardeſt are the beſt.

Many of the above mentioned ſubſtances, and perhaps all thoſe upon which the experiment can be made, when very hot, loſe their electric property, and become quite, though not equally good, conductors; ſo red hot glaſs, melted reſin, hot air, baked wood made very hot, &c. become conductors of electricity. But it is very remarkable, that the focus of a burning glaſs is not a conductor of electricity. It has been obſerved, that glaſs, eſpecially the hardeſt and beſt vitrified, is often a very bad electric, ſometimes being quite a conductor. The Abbé Nollet and others have made various experiments relative to this property of glaſs, but without determining intirely the cauſes which occaſion the difference. Glaſs veſſels, made for electrical purpoſes, are often rendered very good electrics by uſe and time, though they might be very bad ones when new. On the other hand, ſome glaſs veſſels, which had been long uſed for excitation, have ſometimes loſt their power almoſt intirely.

A glaſs veſſel, out of which the air has been exhauſted, on being rubbed, ſhews no ſigns of electricity upon its external ſurface, but all the electric power appears within the veſſel; and a glaſs tube, or globe, with the air condenſed in it, or full of ſome conducting ſubſtance, is incapable of being excited. But a ſolid ſtick of glaſs, of ſealing-wax, &c. may be excited.

Conductors.

Gold. Silver. Copper. Braſs. Iron. Tin. Quickſilver. Lead. Semi-metals. Ores, of which the beſt are thoſe that contain the metallic part in the greateſt quantity, and come neareſt to a metalline ſtate. Charcoal, made either of animal or of vegetable ſubſtances. The fluids of an animal body. All fluids, excepting air and oils. The effluvia of flaming bodies. Ice. Snow. Moſt ſaline ſubſtances, of which the metallic ſalts are the beſt. Stony ſubſtances, of which the hardeſt are the worſt. Smoke. The vapour of hot water. Electricity pervades alſo vacuum, or the abſence of air cauſed by an air pump, almoſt as freely as the ſubſtance of a good conductor.

Beſides theſe, all bodies, in which more or leſs of ſome of the above mentioned conductors are contained, are alſo proportionably conductors; thus, green vegetables, raw meat, &c. are conductors, on account of the fluids they contain.

From this principle it follows, that all electrics, before excitation, ſhould be well cleaned, dried, and ſome made even very hot, in order to free them from every humidity; otherwiſe they are ſo far from the nature of electrics, that they become actually conductors, on account of the moiſture which they contain within their pores, or upon their ſurfaces.

In regard to the conducting power of charcoal, it muſt be obſerved, that all charcoal will not conduct equally well, there being ſome that will hardly conduct at all; and ſometimes is in ſuch a ſtate, that it will aſſiſt the paſſage of a large quantity of electric fluid along its ſurface, when it will not conduct it any other way. This difference, however, is not occaſioned by the difference of the wood from which the coals are made, but by the degree of deat that is applied in the proceſs of making them; the beſt conhuctors being ſuch as have been expoſed to the greateſt heat. See Dr. Prieſtley's ſecond volume of Obſervations on different Kinds of Air, Sect. XIV.

Whether the piece of wood in the proceſs of coaling is ſuffered to flame, or not, is quite immaterial; and the continuance of the ſame degree of heat has no apparent effect with reſpect to the conducting power of the charcoal.

It will not be improper to obſerve in this place, the different changes from conductor to non-conductor, occaſioned in the ſame ſubſtance by different preparations. A piece of wood juſt cut from a tree is a good conductor; let it be baked, and it becomes an electric; burn it to a coal, and it is a good conductor again; laſtly, let this coal be redneed to aſhes, and theſe will be impervious to electricity. Such changes are alſo obſervable in many other bodies; and very likely in all ſubſtances there is a gradation from the beſt conductors to the beſt non-conductors of electricity.

SECT. III.

POSITIVE AND NEGATIVE ELECTRICITY..

The firſt of theſe two electricities, i. e. that poſſeſſed by the glaſs tube in two experiments, mentioned in the above Section, as it was thought to be the conſtant production of rubbed glaſs, was called the vitreous electricity; and the other, as it was firſt obſerved to be produced by reſinous ſubſtances was called the reſinous electricity. The vitreous electricity is alſo called poſitive or plus electricity, for a reaſon that will be conſidered in the courſe of this Syſtem; and the reſinous is called alſo negative or minus electricity. A body, therefore, poſſeſſed of the vitreous, poſitive, or plus electricity, is that which ſhews ſuch ſigns as the tube was ſaid to exhibit; and a body poſſeſſed of the reſinous, negative, or minus electricity, that is which ſhews ſuch ſigns as the inſulated perſon was ſaid to exhibit in the above-mentioned experiment.

In the following table may be ſeen what electricity will be excited in different bodies, when rubbed with different ſubſtances. Smooth glaſs, for inſtance, will be found by this table to acquire a poſitive electricity, when rubbed with any ſubſtance hitherto tried, except the back of a cat (by which we mean the ſkin of a cat while on the animal alive); rough glaſs, viz. glaſs, the poliſh of which has been deſtroyed by emery or otherwiſe, will be found to acquire the poſitive electricity, when rubbed with dry oiled ſilk, ſulphur, &c. and the negative, when rubbed with woollen cloth, the hand, &c. and ſo of the reſt.

The back of a cat	Poſitive	Every ſubſtance with which it has been hitherto tried.
Smooth glaſs	Poſitive	Every ſubſtance hitherto tried, except the back of a cat.
Rough glaſs*	Poſitive	Dry oiled ſilk, ſulphur, metals.
	Negative	Woolen cloth, quills, wood, paper, ſealing wax, white wax, the human hand.
Tourmalin	Poſitive	Amber, air †.
	Negative	Diamond, the human hand.
Hare's ſkin	Poſitive	Metals, ſilk, loadſtone, leather, hand, paper, baked wood.
	Negative	Other fine furs.
White ſilk	Poſitive	Black ſilk, metals, black cloth.
	Negative	Paper, hand, hares, weaſel's ſkin.
Black ſilk	Poſitive	Sealing wax.
	Negative	Hare's, weaſel's, and ferret's ſkin, loadſtone, braſs, ſilver, iron, hand.
Sealing wax	Poſitive	Metals.
	Negative	Hare's, weaſel's, and ferret's ſkin, hand, leather, woolen cloth, paper.
Baked wood	Poſitive	Silk.
	Negative	Flannel

* Glaſs may be made rough by rubbing it with ſand, or emery.

† i. e. By blowing with a pair of bellows upon it. By this means many Electrics may be ſenſibly excited, and ſome better if the air blown is hot; although, in both caſes, very little Electricity can be obtained.

The preceding table might have been much extended, had we choſen to bring into it all the minutiæ attending this matter as far as is known; but this we think unneceſſary, becauſe experiments of this kind are of ſo nice a nature, that they require the moſt ſcrupulous attention in making them; and their effects depend upon ſuch ſmall and variable circumſtances, that often the very ſame electric, rubbed with the ſame rubber, gives at one time ſigns of one electricity, and at another time ſigns of the contrary. A very little alteration in the ſurface, a different degree of dryneſs, and even a different application of the ſame ſubſtances, often occaſions a difference in the electricity. We ſhall only obſerve in general, that as far as may be deduced from the greateſt number of experiments, it appears, that when different ſubſtances are rubbed together, that whoſe electric power is the ſtrongeſt, in general, acquires the poſitive, and the other the negative electricity; and when two bodies, differing in the ſmoothneſs or roughneſs of their ſurfaces, are rubbed together, the ſmootheſt acquires the poſitive, and the rougheſt the negative electricity. Theſe two qualities are often to be conſidered both together; for, except the two bodies are of the ſame ſubſtance, as ſmooth and rough glaſs, white and black ſilk, &c. they generally differ in both, viz. they have not the ſame electric power, and at the ſame time their ſurfaces differ in ſmoothneſs. This rule, however, is not to be conſidered as a conſtant and general one: for, according to this principle, it ſhould ſeem that a piece of ſealing-wax, when rubbed with the hand, or paper, would acquire the poſitive electricity; but this is contrary to experience.

SECT. IV.

OF THE DIFFERENT METHODS OF EXCITING ELECTRICS.

Rubbing, as we obſerved before, is the general mean by which all electric ſubſtances that are at all excitable, may be excited. Whether they be rubbed with electrics of a different ſort, or conductors, they always ſhew ſigns of electricity, and in general ſtronger when rubbed with conductors, and weaker when rubbed with electrics. But beſides friction, there are other means by which ſome electrics may be cauſed to ſhew electric appearances: theſe are, by melting, or pouring a melted electric into another ſubſtance; by heating or cooling; and by evaporating or effervſcing. The particulars obſerved by uſing the firſt of theſe two methods are the following:

If ſulphur be melted in an earthen veſſel, and left to cool upon conductors: if taken out of the veſſel, when cold, it will be found ſtrongly electrical: but not all ſo, if it be left to cool upon electrics.

If melted ſulphur be poured into a veſſel of baked wood, it acquires a negative, and the wood a poſitive electricity; but if it be poured into ſulphur, or rough glaſs, it acquires no ſenſible electricity.

Melted wax, poured into glaſs, or wood, acquires a negative electricity, and leaves the glaſs or wood poſitive. But ſealing-wax poured into ſulphur, acquires a poſitive electricity, and leaves the ſulphur negative.

Chocolate, freſh from the mill, as it cools in the tin pans in which it is received, becomes ſtrongly electrical; when turned out of the pans, it retains for ſome time this property, but ſoon loſes it by handling. Melting it again in an iron ladle, and pouring it into the tin pans as at firſt, will for once, or twice, renew the power; but, when the maſs becomes very dry and powdery in the ladle, the electricity is revived no more by ſimple melting; but if then a little olive oil be added, and mixed well with the chocolate in the ladle, on pouring it into the tin pan, as at firſt, it will be found to have completely recovered its electric power. The above remark on chocolate, together with the method of reſtoring its power by means of olive oil, is a diſcovery of the late Mr. W. Henly, F. R. S.

Now that we are ſpeaking of melted electrics, it will not be improper to obſerve, that it ſometimes happens, that ſome electric ſubſtances, by being melted and left to cool, acquire an electrical power, which they retain for a conſiderable time, often for months together, eſpecially if they are preſerved free from dampneſs and duſt. Such effects have ſometimes induced electricians to think, that ſome bodies are poſſeſſed of a permanent or perpetual electricity, which is as inherent in their ſubſtance as the magnetic power of a loadſtone: in truth, however, no ſuch ſubſtance has yet been found; and although roſin, ſulphur, amber, ſilk, and ſome other electrics, ſhew ſigns of electricity for a conſiderable time after they have been rendered electrical, yet their power is continually diminiſhing till it quite vaniſhes. It is remarkable, however, that ſulphur, reſinous, bituminous ſubſtances, and ſilk, retain in general the electric power much longer than glaſs, or any other electrics; the reaſon may be, that they do not attract moiſture like glaſs and other ſubſtances, or perhaps becauſe they are more porous.

If a ſtick of ſealing-wax be broken into two pieces, the extremities that were contiguous will be found electrified, one poſitively, and the other negatively.

The property of exhibiting electrical phenomena, by means of heating and cooling, was firſt obſerved in a hard ſemi-pellucid foſſil, known under the name of Tourmalin. This ſtone is called *aſchentrickker* by the Dutch, from its property of attracting the aſhes, when laid near the fire. Linnæus calls it *lapis electricus*. See his Flora Zeylonica. The Tourmalin, which is generally of a deep red or purple colour, and ſeldom exceeds the ſize of a ſmall walnut, is common in ſeveral parts of the Eaſt Indies, and eſpecially in the iſland of Ceylon.

While kept in the ſame degree of heat, it ſhews no ſigns of Electricity, but it will become electrical by increaſing or diminiſhing its heat, and ſtronger in the latter than in the former circumſtance. An exceedingly ſmall variation of temperature is often ſufficient to render the Tourmalin ſenſibly electrical.

Its Electricity does not appear all over its ſurface, but only on two oppoſite ſides, which may be called its poles, and they are always in one right line with the center of the ſtone, and in the direction of its ſtrata; in which direction the ſtone is abſolutely opaque, though on the other, ſemitranſparent.

Mr. William Canton hath lately obſerved a very vivid light to appear upon the Tourmalin, while heating in the dark: he can by this determine, which end of the ſtone will be poſitive, and which negative. Further, when the ſtone is ſtrongly excited, it emits very ſtrong flaſhes from the poſitive to the negative end, in the dark. The Brazilian emerald, Mr. Canton has obſerved to have alſo this property of emitting light, whilſt heating in the dark: but we imagine that every other precious ſtone will ſhew it, if its electric power is ſufficiently ſtrong; ſince the light is a conſequence of the paſſage of a ſufficient quantity of electricity through the air, or other partly reſiſting medium.

Moſt of the above properties, which were firſt obſerved, and thought peculiar to the Tourmalin, have been found to belong to ſeveral hard precious ſtones; they being alſo made electrical by heating and cooling, and have their poſitive and negative ſides laying in the direction of their ſtrata or cryſtals; and, in ſhort, as far as has been obſerved, they have been found to act exactly like tourmalins; though ſome poſſeſs this property in a much higher degree than others.

The other method of producing electricity, namely, by evaporation, &c. was lately diſcovered by Mr. Volta; and it ſeems to open the way to an ample field of ſpeculation. This ingenious philoſopher diſcovered that the evaporation of water, and of ſome other fluids, and likewiſe that ſeveral effervſcences, generated electricity. His experiments ſeem to ſhew the generality of the following law, viz. that fluids, or bodies in general, when reduced in the form of vapour, become electrified poſitively, and leave the bodies, with which they were laſt in contact, electrified negatively; but, on the contrary, when the vapours are condenſed in the form of a fluid, then they become electrified negatively, and leave thoſe bodies, with which they were laſtly in contact, poſitively electrified. Farther explanations and exemplifications of this principle will be found in the practical part of this Syſtem.

We ſhall laſtly obſerve, in this ſection of excitation, that whenever an electric is rubbed with another inſulated ſubſtance, although it acquires an electric power, and ſhews electrical appearances, yet that power is very weak; aud in order to obtain a conſiderable electricity, it is neceſſary that the rubber ſhould have a regular communication with the earth, by means of good conductors.

SECT. V.

OF COMMUNICATING ELECTRICITY.

In the preceding ſections we have conſidered electricity no further than in reſpect to its quality; we have remarked the differences between the poſitive and the negative, and have noted which bodies, and by what means, they could acquire this property. But now a vaſt proſpect is opening to our view, full of extraordinary appearances; and we are to conſider in this ſection, not the mere kind of electricity, but its numerous effects. Under the title of Communicated Electricity, falls almoſt all that is known of the ſubject; the paſſage of this virtue from one body to another is what cauſes its light; by being communicated to other bodies, we ſee its attraction; by its quick tranſition it is that it melts meltals, deſtroys animal and vegetable life; and, in ſhort, it is by this communication that the ſcience is at all known and cultivated.

Whenever electricity is by any means ſuperinduced on a body, it is there confined only by electrics, and remains with that body a longer or a ſhorter time, according as the electrics that confine it are more or leſs perfect. A glaſs tube, for inſtance, when rubbed, acquires a quantity of that power, whatever it is, which we call electricity. That electricity remains, and is perceivable upon the glaſs, inſomuch as it is ſurrounded by the air, which is an electric; and as the air is in a more or leſs perfect electric ſtate, ſo that virtue is retained upon the glaſs longer or ſhorter. An excited glaſs tube, if kept in a dry and rather warm place, for inſtance, at ſome diſtance from a good fire, will continue electrified above twenty hours. And becauſe the air is never a perfect electric, therefore the excited tube can never preſerve the acquired electricity perpetually, but is continually imparting ſome of it to the contiguous air, or to the conducting particles that float in that element, till at laſt it quite loſes its power. If a finger, or any other conductor, be preſented towards an excited electric, it will receive a ſpark, and in that ſpark part only of the electricity of the electric; but why not all? Becauſe the excited electric, being a non-conductor, cannot convey the electricity of all its ſurface to that ſide, to which the conductor has been preſented. Hence, if a conducting ſubſtance be ſucceſſively preſented to different parts of an excited electric, it will receive at every approach a ſpark, without repeating the excitation, till all the power of that electric is exhauſted, and then a new excitation is neceſſary in order to revive it.

An inſulated conductor having received the electricity from an excited electric (in which ſtate it is ſaid to be electrified by communication) will act in every reſpect like the excited electric itſelf, except that, when it is touched by another conductor communicating with the earth, the former gives one ſpark to the latter, and by that diſcharges all its electricity. The reaſon why an electrified conductor loſeth its electricity all at once, when touched with another conductor communicating with the earth, and not part of it only, like the excited electric, is, becauſe the electricity belonging to the whole of the conductor is eaſily conducted through its own ſubſtance, to that ſide, to which the other conductor is preſented. This propoſition muſt be conſidered under ſome limitations, ariſing from various circumſtances; for inſtance, if the electrified conductor is very much extended, and is touched with an imperfect conductor, or for a very ſhort time, then it is not unlikely that ſome electricity will remain in it even after the ſpark. Hence it appears that, in general, the electricity diſcharged from an electrified conductor, is much more powerful, than when diſcharged from an electric; for the conductor may acquire a great quantity of electricity from an electric, by receiving ſpark after ſpark, and afterwards, if touched, will diſcharge it all at once, and not by little and little as it was received.

It is remarkable, in the caſe of points throwing off or receiving electricity, that a current of air is ſenſible at an electrified point, which is always in the direction of the point, whether the electricity is poſitive or negative. The electric ſpark, taken upon any part of a living animal body, cauſeth a diſagreeable ſenſation, which is more or leſs troubleſome, as the ſpark is ſtronger or weaker, and the part, upon which it is taken, is more or leſs delicate; and alſo according to the particular conſtitution of individuals. A pretty large quantity of electricity pervades the ſubſtance of a conductor of a conſiderable length, with a ſurpriſing and imperceptible velocity; but a ſmall quantity of it has been found to take ſome little time in paſſing through a long, and leſs perfect, conductor. Bodies poſſeſſed of the ſame electricity, whether poſitive or negative, repel each other. But bodies poſſeſſed of different electricities, attract each other; and there is no electric repulſion, but between bodies poſſeſſed of the ſame electricity; nor electric attraction, but between bodies poſſeſſed of different electricities, i. e. between bodies poſitively and bodies negatively electrified. This law, i. e. that there is no electric attraction, except between bodies poſſeſſed of different electricities, will, perhaps, appear paradoxical, upon obſerving, that an excited electric attracts ſmall bodies, which never were by any means made electrical before; but the paradox will ſoon vaniſh, if what has been ſaid above be conſidered, i. e. that when conductors, and indeed electrics too, come near an electrified body, they become actually poſſeſſed of a different electricity. But this will appear much clearer from the experiments that are to be mentioned hereafter.

Electricity, ſtrongly communicated to inſulated animal bodies, quickens their pulſe, and promotes their perſpiration. If it is communicated to inſulated fruits, fluids, and in general to every kind of bodies that are actually in a ſtate of evaporation, it alſo increaſeth that evaporation; and that in a greater or leſs degree, as thoſe bodies are more or leſs ſubject to evaporate of themſelves; as the veſſels, that contain the ſame, are conductors or electrics; and as they have a greater or leſs ſurface expoſed to the open air. Although it has been by ſome pretended, that electricity cauſed ſeveral ſubſtances to evaporate through the pores of glaſs and metals, yet that could never be obſerved, though many accurate experiments were made for that purpoſe; beſides, this pretended evaporation ſeems on all accounts exceedingly improbable.

By increaſing the perſpiration of vegetables, electricity promotes their growth; it having been found, after ſeveral accurate experiments, that ſuch plants, which have been often and long electrified, have ſhewed a more lively and forward appearance, than others of the ſame kind that were not electrified. It is ſaid by Mr. Koeſtlin to have been found, that negative electrization retards both animal and vegetable life. See his Latin Diſſertation on the effects of electricity upon ſome organic bodies.

We ſhall conclude this ſection with remarking, that if the face, or any part of the body, is preſented to an excited electric, or to a conductor ſtrongly electrified, it will feel as if a wind was blowing, or rather as if a ſpider's web was drawn over it; alſo, if the noſtrils are preſented to an excited electric, they will be affected by a ſmell, much reſembling that of phoſphorous; but communicated electricity does not occaſion any ſuch ſenſation, except when a large quantity of it does ſuddenly paſs from one body to another. If bodies are kept for ſome time within the electric effluvia when ſtrong, they will retain the ſmell that they acquire for a conſiderable time after.

SECT. VI.

OF CHARGED ELECTRICS, OR THE LEYDEN PHIAL.

That glaſs is an electric ſubſtance, was firſt diſcovered by Dr. Gilbert. It was for a long time, however, thought to poſſeſs but a very weak electric virtue; though now it is found to be one of the beſt, if not the very beſt electric as yet known. Notwithſtanding the many experiments made upon this ſubſtance, it is not yet aſcertained what kind of glaſs is moſt proper for electrical purpoſes. It has been obſerved, that the hardeſt and moſt completely vitrified glaſs is often a very bad electric, being ſometimes quite a conductor. Glaſs veſſels made for electrical purpoſes are often rendered fit for them by uſe and time, though very bad electrics when new. Mr. Bergman of Upſal ſays, that very often, when his glaſs globes could not be excited to a ſufficient degree of ſtrength, he lined them with a thin coating of ſulphur, and that then they gave a much ſtronger poſitive electricity than before. In Italy, and other places, according to Mr. Nollet, it is the cuſtom of electricians to put a coating of pitch or other reſinous matter on the inſide of their globes, which they ſay always makes them work well. He gives the preference to the cryſtal glaſs of England, Bohemia, &c. It ſeems doubtful, however, whether the common bottle glaſs does not anſwer equally well, or even better.

The moſt remarkable phenomenon producible by excited glaſs is that of the Leyden phial. It depends entirely upon the following property of glaſs, viz. that it is impoſſible to electrify the outſide of a glaſs poſitively, at leaſt, to any conſiderable degree, without at the ſame time electrifying the inſide of it negatively: in like manner, it is impoſſible to electrify the outſide negatively; without at the ſame time electrifying the inſide poſitively. It is alſo the nature of glaſs and all other electric ſubſtances, when once electrified either by excitation or communication, to part with their electricity very ſlowly and gradually. Thus, ſuppoſing a tube, cylinder, or plate of glaſs, to be highly electrified; if a finger is brought near any part of it, a ſpark will be felt to ſtrike the finger with a ſnapping noiſe. Part of the electricity will then be diſcharged from the glaſs, but not all. If the finger is brought near another part of the glaſs, a ſimilar ſpark will be again produced; and ſo on, by moving the finger to different parts of the glaſs, till all its electricity is exhauſted. It is the nature of conducting ſubſtances to diſcharge all their electricity at once, by a ſingle ſpark, if another conducting ſubſtance is brought near them. This being the caſe, therefore, it follows, that if every part of one ſide of a glaſs plate is covered over with a conducting ſubſtance, every point of the glaſs will give out its electricity to the conductor; and conſequently, if another conducting ſubſtance is brought near to that by which the glaſs is covered, the whole electric power in the glaſs ought to be diſcharged in one ſingle flaſh or large ſpark.

This would no doubt be the caſe, if it was poſſible to electrify the glaſs only on one ſide. But this is found to be impoſſible. No method hath yet been found of electrifying one ſide of a peice of glaſs poſitively, without electrifying the other negatively at the ſame time. There is therefore a neceſſity for taking off the electricity from both ſides of the glaſs at the ſame time. This can only be done by covering both ſides of the glaſs with a conducting ſubſtance, and, preſenting other conductors to both ſides at the ſame time. Then the electricity of both is diſcharged in an inſtant. A ſtrong ſpark is perceived between both ſides of the coated glaſs and the conducting ſubſtances; and if a perſon holds one in each hand, he will, at the inſtant of the diſcharge, feel a very diſagreeable ſenſation, which cannot well be deſcribed, in his arms and breaſt: and this is ſaid to be receiving the electric ſhock.

If, inſtead of preſenting a conducting ſubſtance to both ſides of the plate at once, a finger is preſented to one ſide, ſuppoſe that which is poſitively electrified, and another ſubſtance very highly electrified poſitively is preſented to the negative ſide of the glaſs, a like diſcharge will enſue, but the ſhock will be much gentler than in the former caſe, and probably the electricity of the glaſs will not be all diſcharged. If two conducting ſubſtances, inſulated, ſuppoſe two cylinders of metal fixed upon ſticks of ſealing wax, or ſuſpended by ſilk threads, are brought to the ſides of the coated glaſs at the ſame time; each of them will receive a ſpark of poſitive or negative electricity, according as the ſide to which it was applied is poſitively or negatively electrified. When the metallic cylinders are taken away, they will communicate the electricity they have received to other bodies; and if again applied to the coated glaſs, they will receive ſparks as before; and thus; the electricity of both ſides will be gradually diſcharged.

After the diſcharge has been once made, the glaſs is found in a ſhort time to recover its electricity, though in a ſmall degree. The ſide which was originally electrified poſitively, becomes electrified in the ſame manner the ſecond time, and ſo of the negative ſide. This ſecond electrification is called the *reſiduum* of a charge; and, where there is a large ſurface of coating glaſs, hath a very conſiderable degree of power. The ſame thing, which we have juſt now obſerved with regard to a flat ſurface of glaſs, takes place with tubes and phials, or glaſs veſſels of any kind; and it is always obſerved, that the thinneſt glaſs anſwers beſt for this purpoſe. The Leyden phial conſiſts of a glaſs phial, jar, or bottle, covered on the outſide and inſide with tin foil, yet leaving an interval of two or three inches at top, without any metallic covering, that the electricity of the one ſide may not be communicated to the other as faſt as it is collected. A more particular deſcription of it will be given when we ſpeak of the electric apparatus.

SECT. VII.

OF ATMOSPHERICAL ELECTRICITY.

Whoever has remarked the numerous properties of electricity already mentioned, and has conſidered their extenſive power, will, we doubt not, be greatly ſurprized, when he compares the ſtate, in which the ſcience remained half a century ago, with that in which it is at preſent; but his wonder will ſtill increaſe, when he is told that electricity is not only to be obſerved by rubbing an electric, or warming a tourmalin, but that it has been found to exiſt in the air, rain, and clouds: that thunder and lightning have been diſcovered to be its effects; and that, in ſhort, whatever has the appearance of fire, or of any thing extraordinary in the atmoſphere, and upon the earth, has been attributed to electricity.

That the effects of electricity bore a great reſemblance to thunder and lightning, had been ſeveral times remarked by philoſophers, and eſpecially by the Abbé Nollet; but that they ſhould actually be found to be effects of the ſame cauſe, and that the phenomena of electricity ſhould be imitated by lightning, or thoſe of lightning by electricity, was neither thought poſſible, nor ſuſpected, till the celebrated Dr. Franklin made the bold aſſertion; and the French philoſophers firſt, and afterwards Dr. Franklin, proved the fact by undeniable arguments in the year 1752.

The ſimilarity of lightning and electricity is not to be remarked in a few appearances only, but it is obſervable throughout all their numerous effects, and there is not a ſingle phenomenon of the one, but may be imitated by the other. Lightning deſtroys edifices, animals, trees, &c. lightning goes through the beſt conductors which it meets in its way, and, if its paſſage is obſtructed by electrics, or leſs perfect conductors, it rends them, and diſperſes them in every direction: lightning burns, and melts metals and other ſubſtances; a ſtroke of lightning often diſturbs the virtue of a magnet, and gives polarity to ferruginous ſubſtances; and all theſe effects, as has been obſerved above, may be produced by electricity. But, independent of the great ſimilarity exiſting between lightning and electricity, what fully proves their identity is, that the matter of lightning may be actually brought down from the clouds by mean of inſulated and pointed metallic rods, or by electrical kites, and with it any known electrical experiment may be performed.

Clouds, as well as rain, ſnow, and hail, that fall from them, are almoſt always electrified, but oftener negatively than poſitively; and the lightning, accompanied with the thunder, is the effect of the electricity, which, darting from a cloud, or a number of clouds, highly electrified, ſtrikes into another cloud, or elſe upon the earth; in which caſe it prefers the moſt lofty and pointed places, and by this ſtroke produces all thoſe dreadful effects, that are known to be occaſioned by lightning.

The air, at ſome diſtance from houſes, trees, maſts of ſhips, &c. is generally electrified poſitively, particularly in froſty, clear, or foggy weather; but how the air, the fogs, and the clouds become electrified, has not yet been clearly aſcertained, although ſeveral conjectures have been offered; excepting however the principle of the electricity produced by evaporation and condenſation.

After that electricity and the matter of lightning were found to be the ſame thing, philoſophers began to ſuſpect the action of electricity to be where it had before been leſs imagined, and not without reaſon endeavoured to reconcile to it ſeveral other natural appearances. The aurora borealis, or northern light, was ſoon attributed to electricity, on obſerving that by this that flaming light may be imitated, and that the aurora borealis, when very ſtrong, has been known to diſturb the magnetic needle, which is alſo an effect of electricity. The late Mr. Canton frequently collected electricity in a conſiderable degree, during the time of an aurora borealis. His apparatus for that purpoſe conſiſted of an inſulated fiſhing rod, erected on the top of his houſe, having a wire twiſted round. See Phil. Tranſ. vol. LIX. page 88.

The accentions, that are often ſeen in the atmoſphere (commonly called ſtfalling ſtars) are thought to be electrical appearances. The ſame is alſo ſuppoſed to be the cauſe of ſuch other meteors, like white clouds, that often appear by night-time, particularly in hot climates. Beſides thoſe phenomena, water-ſpouts, hurricanes, whirl-winds, and even earthquakes, have been attributed to electricity. But now, perhaps, the reader will think philoſophers too extravagant, in going ſo far with electricity. Such thoughts ſeem at firſt ſight to be extravagancies; but if it be conſidered, that they do not appear to contradict the known laws of nature, that they are not aſſertions abſolutely void of proofs, add that they are the thoughts of great philoſophers, we think, they may be admitted, at leaſt ſo far as to be tried on proper occaſions, and to be conſidered as the moſt plauſible conjectures yet offered in explanation of the moſt ſurpriſing phenomena of nature. For further conjectures, ſee Dr. Franklin's letters and Dr. Prieſtley's Hiſt. of Electricity.

PART II.

PRACTICAL ELECTRICITY.

Hitherto we have treated of electricity only theoretically, having noted what has been found uniformly certain relative to this ſubject, and having exhibited a view of the moſt propable conjectures offered in explanation of electrical appearances; but electricity being a ſcience, that requires a more practical management, than perhaps any other branch of natural philoſophy, it is neceſſary that we ſhould now treat of it practically, and give the beſt directions we are able, both in regard to the conſtruction of the neceſſary apparatus, and to the performance of the experiments, not only requiſite in proving the foregoing propoſitions, but ſuch alſo as are pleaſing and entertaining.

In this part of the ſyſtem the reader will perhaps find more novelty than he expects; for, conſidering the number of books that have been publiſhed on this ſubject, one would imagine that all the experiments poſſible to be exhibited with an electrical machine, and its appendages, have already been deſcribed. The caſe, however is much the contrary; for not only the old experiments have been diverſified, but a variety of new ones have been invented, and even the principal part of the apparatus has undergone ſeveral changes and improvements.

In order the more regularly to proceed in the deſcription of the electrical apparatus, it will not be improper to divide its parts into three claſſes; conſidering in the firſt, the inſtruments neceſſary to produce electricity; in the ſecond, thoſe proper to accumulate, retain, and employ it; and laſtly, thoſe neceſſary to meaſure its quantity, and aſcertain its quality.

The principal inſtrument to produce electricity, is the electrical machine, i. e. a machine capable by any means of exciting an electric, ſo as to produce electrical appearances. The conſtruction of thoſe machines, from their firſt invention to the preſent time, has undergone ſo many changes, and their forms have been ſo much varied, that it would be very difficult, and even tedious, to deſcribe thoſe only which are moſt frequently in uſe. Every maker, and almoſt every electrician, conſtructs his own machines in a manner different from the reſt; and, as new facts or long practice points out ſome imperfections, the electrician is ready to contrive a new method to correct the preceding errors. Indeed the rapid advance of the ſcience is moſtly owing to this change, and variety of conſtructions; for whether caſual, or deſigned, a new conſtruction has generally either produced ſome diſcovery of importance, or expoſed ſome defect in the apparatus, and management of the ſame.

That the reader may be left at the liberty of chooſing the form of his machine, we ſhall in the next Section, give a particular deſcription of ſome machines, that are the moſt uſeful, and which contain all the improvements hitherto made.

The principal parts of the machine are the electric, the moving engine, the rubber, and the prime conductor, i. e. an inſulated conductor, which immediately receives the electricity from the excited electric.

SECT. I.

ELECTRICAL MACHINES, WITH DIRECTIONS FOR EXCITING THEM AND KEEPING THEM IN ORDER.

As ſoon as the properties of electricity were in ſome meaſure developed, the philoſopher and the artiſt concurred in contriving and executing a variety of machines to excite and accumulate this extraordinary agent. The greater part of theſe have been laid aſide, in proportion as the ſcience advanced, and its boundaries were extended. We ſhall, therefore, only deſcribe that electrical machine which is now in general uſe, whoſe conſtruction is ſimple, and well adapted to produce the electric fluid in great quantities, and tranſmit it in full and continued ſtreams to the prime conductor.

That the operator may ſucceed in producing this effect, we ſhall firſt enumerate thoſe parts of the machine which acquire moſt attention; then deſcribe the machine itſelf, and afterwards give inſtructions to enable him to excite it powerfully.

The following are the parts of an electrical machine, which fall more immediately under the care of the electrician.

1. The electric, which is to be excited, as the glaſs cylinder.
2. The mechanical contrivances by which the electric is put in motion.
3. The cuſhion and its appendages.
4. The conductor or conductors.

Explanation of Plate I.

Fig. 1. repreſents an electrical machine made on the moſt approved conſtruction. It is mounted and uſed in the ſame manner as *Fig.* 5. and differs only in the mechaniſm by which the cylinder is put in motion.

The cylinder of the machine, *Fig.* 5. is turned round by means of the two wheels, which act on each other by a catgut band, as in *Fig.* 5.

The cylinder of the machine, which is repreſented in *Fig.* 1, is put in motion by a ſimple winch, which is leſs complicated than the multiplying wheel, and therefore not ſo liable to be out of order. Mr. Adams lately improved the machines made with a multiplying wheel, rendered them more durable, and not more liable to be put out of order than thoſe which turn only with a winch. Moſt practical electricians, however, prefer a machine which is moved by a multiplying wheel, as it fatigues the operator leſs than that which is moved by a ſimple winch; while at the ſame time a moderate

Electrical Machines_See System of Electricity.

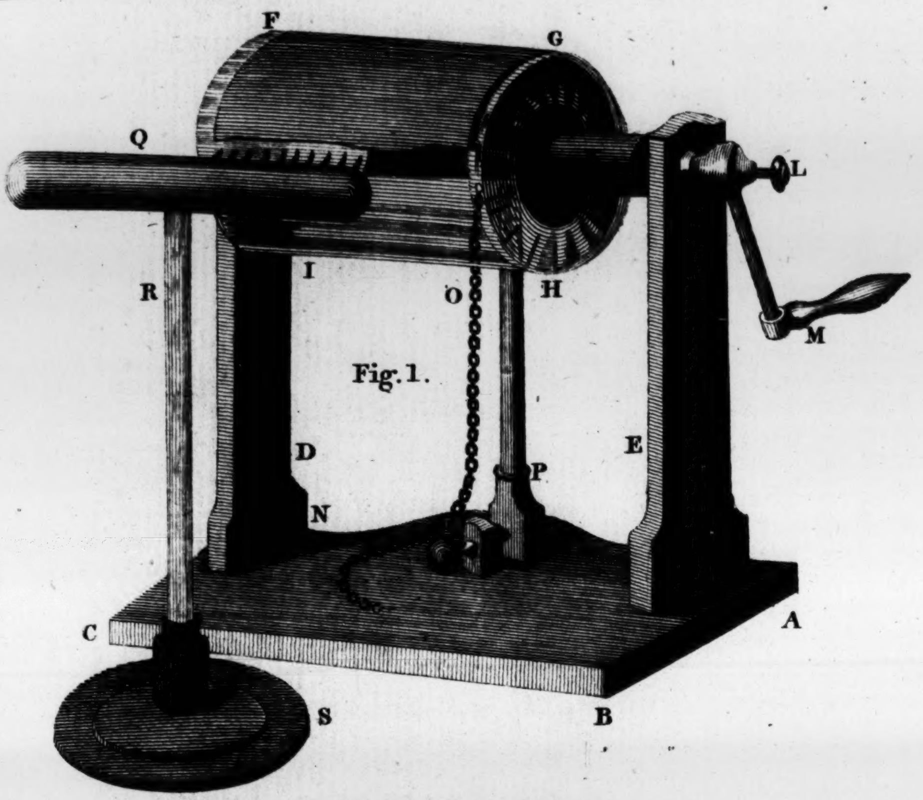

Fig.1.

Fig.1. Simple Electrical Machine.

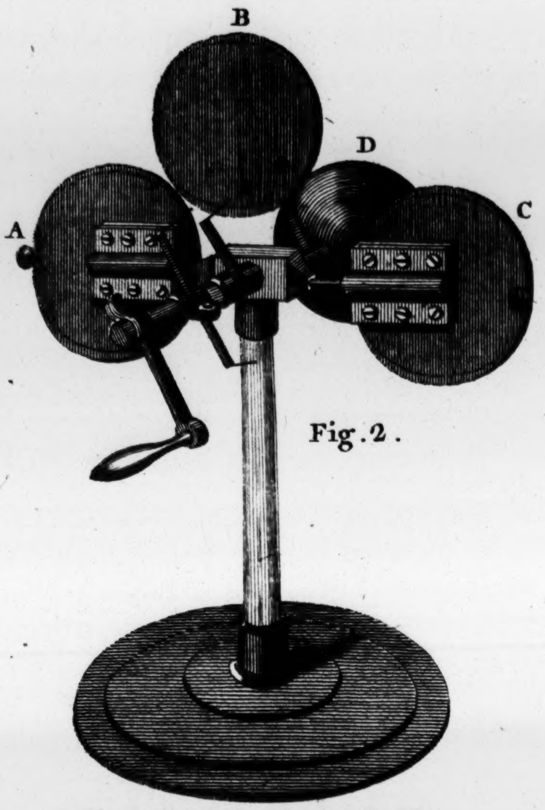

Fig.2.

Fig.2. Nicholsons Electrical Doubler.

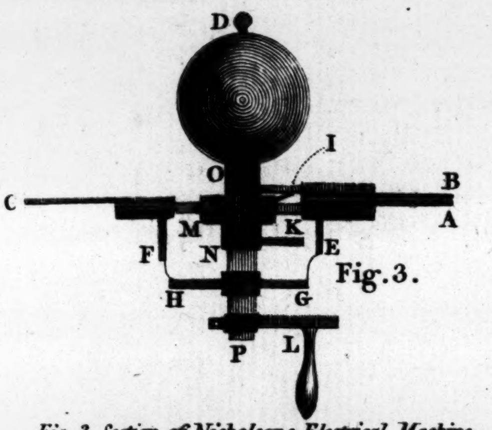

Fig.3.

Fig.3. Section of Nicholsons Electrical Machine.

Fig.4. Lanes Electrical Machine.

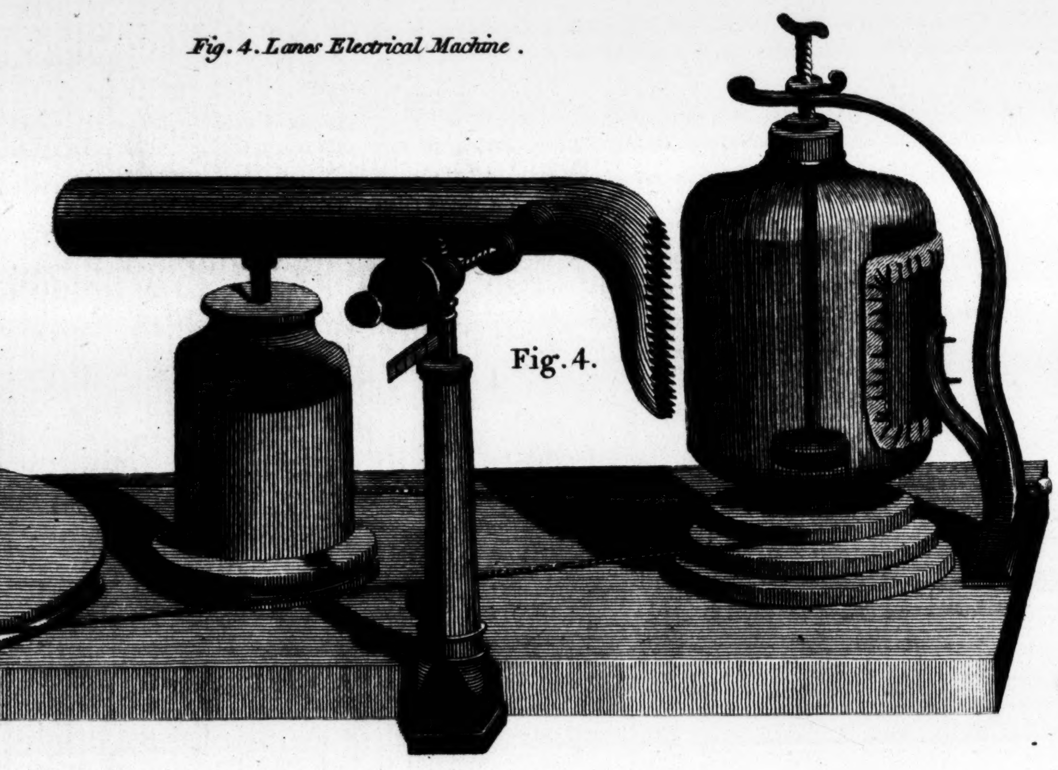

Fig.4.

Adams's Medical Electrical Machine Electrometer and Bottle.

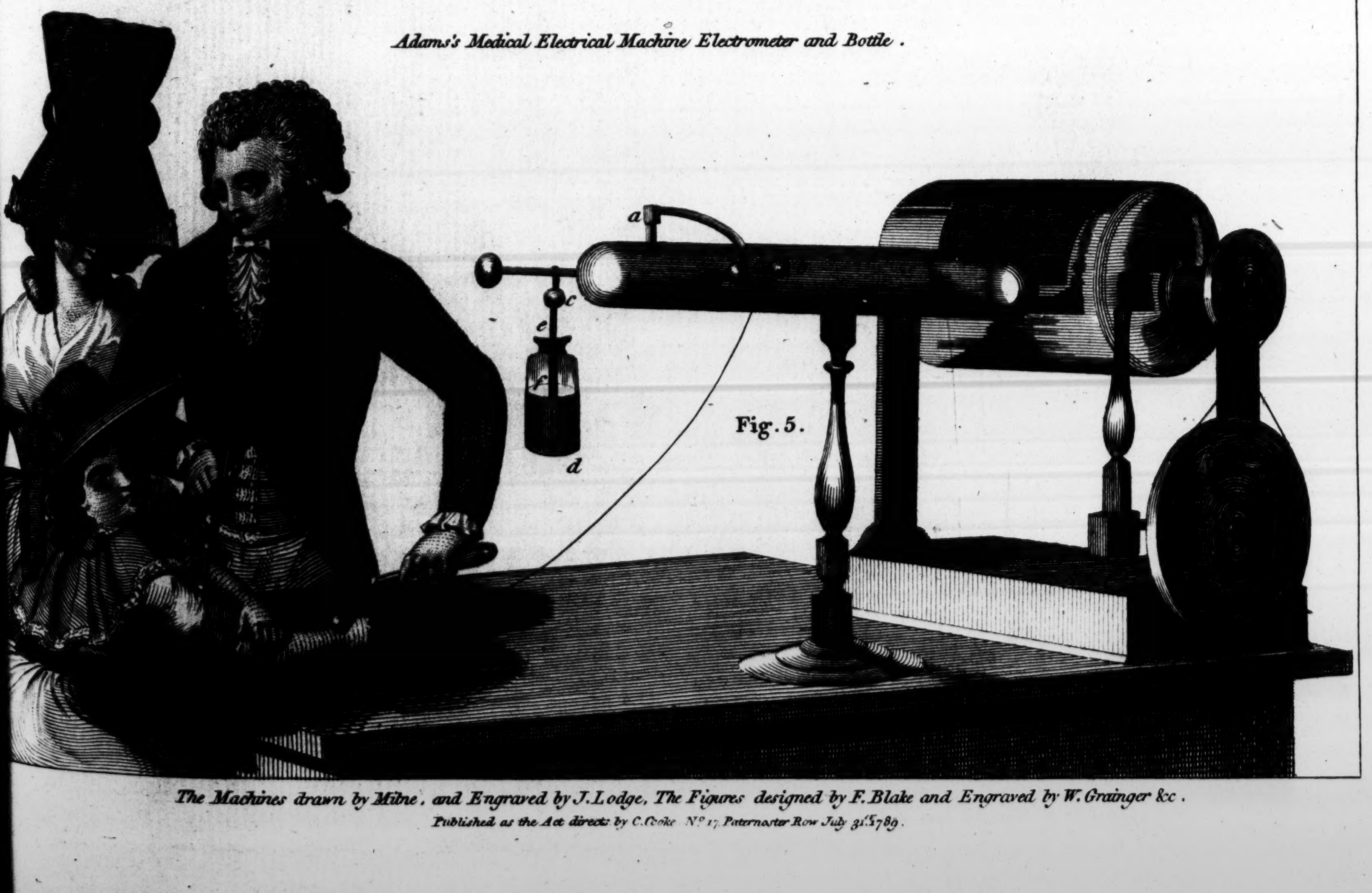

Fig.5.

The Machines drawn by Milne, and Engraved by J. Lodge, The Figures designed by F. Blake and Engraved by W. Grainger &c.
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ate increaſe of velocity in the cylinder, augments the momentum of the electric fluid, and produces a greater quantity of it in the ſame time, and thus prevents its being abſorbed by the cuſhion. And further, when the machine is fixed to a table, the poſition of the lower multiplying wheel is more advantageous to the operator, giving him a greater power over the cylinder and fatiguing him leſs; it may alſo be turned with the right hand, which cannot be done conveniently with the other. It may be proper to remark, that thoſe with a ſimple winch are cheaper than thoſe with a multiplying wheel.

Fig. 1 and 5. ABC repreſent the bottom board of the machine. D and E, the two perpendicular ſupports, which ſuſtain or carry the glaſs cylinder FGHI.

The axis of the cap K paſſes through the ſupport D; on the extremity of this axis either a ſimple winch is fitted, as in *fig.* 1, or a pulley, as in *fig.* 5.

The axis of the other cap runs in a ſmall hole which is made in the top of the ſupport E.

OP is the glaſs pillar to which the cuſhion is fixed, T a braſs ſcrew at the bottom of this pillar, which is to regulate the preſſure of the cuſhion againſt the cylinder. This adjuſting ſcrew is peculiarly advantageous. By it the operator is enabled to leſſen or increaſe gradually the preſſure of the cuſhion, which it effects in a much neater manner than it is poſſible to do when the inſulating pillar is fixed on a ſliding-board, a method that diſgraces the maker.

On the top of the pillar OP is a conductor, which is connected with the cuſhion, which is called the negative conductor. In this figure the conductor is ſuppoſed to be fixed cloſe to the cuſhion, and to lie parallel to the glaſs cylinder. In *fig.* 1, it is brought forwards, or placed too near the handle, in order that more of it may be in ſight as at RS.

Q, *Fig.* 1, repreſents the poſitive prime conductor, or that which takes the electric fluid immediately from the cylinder, R the glaſs pillar by which it is ſupported and inſulated, and S a wooden foot or baſe for the glaſs pillar. In *fig.* 1. this conductor is placed in a direction parallel (which is the beſt poſition) to the glaſs cylinder; it may be placed in any poſition occaſionally, as is moſt convenient to the operator. In general, electrical machines are ſold with a ſingle conductor; though there are many experiments where two are convenient, and from ſome improvements lately made in the apparatus, they are rendered exceeding proper for experimental inquiries.

A DESCRIPTION OF AN INSTRUMENT WHICH, BY THE TURNING OF A WINCH, PRODUCES THE TWO STATES OF ELECTRICITY WITHOUT FRICTION OR COMMUNICATION WITH THE EARTH.

By Mr. WILLIAM NICHOLSON.

From the PHILOSOPHICAL TRANSACTIONS.

Read at the ROYAL SOCIETY, June 5, 1788.

TO SIR JOSEPH BANKS, BART. P. R. S.

SIR,

THE following account of the inſtrument I had the honour to ſhew to yourſelf and other philoſophical friends, in the month of March laſt, will, I hope, appear ſufficiently intereſting to be communicated to the learned ſociety, over which you ſo worthily preſide.

Plate I. *fig.* 2. repreſents the apparatus ſupported on a glaſs pillar 6½ inches long. It conſiſts of the following parts. Two fixed plates of braſs, A and C, are ſeparately inſulated and diſpoſed in the ſame plane, ſo that a revolving plate B may paſs very near them, without touching. Each of theſe plates is two inches in diameter; and they have adjuſting pieces behind, which ſerve to place them accurately in the required poſition. D is a braſs ball, likewiſe of two inches diameter, fixed on the extremity of an axis that carries the plate B. Beſides the more eſſential purpoſe this ball is intended to anſwer, it is ſo loaded within on one ſide, that it ſerves as counterpoiſe to the revolving plate, and enables the axis to remain at reſt in any poſition. The other parts may be diſtinctly ſeen in *fig.* 3. The ſhaded parts repreſent metal and the white repreſent varniſhed glaſs. ON is a braſs axis, paſſing through the piece M, which laſt ſuſtains the plates A and C. At one extremity is the ball D already mentioned; and the other is prolonged by the addition of a glaſs ſtick, which ſuſtains the handle L and the piece GH ſeparately inſulted. E, F, are pins riſing out of the fixed plates A and C, at unequal diſtances from the axis. The croſs-piece GH, and the piece K, lie in one plane, and have their ends armed with ſmall pieces of harpſichord-wire, that they may perfectly touch the pins EF in certain points of the revolution. There is likewiſe a pin I, in the piece M, which intercepts a ſmall wire proceeding from the revolving plate B.

The touching wires are ſo adjuſted, by bending, that when the revolving plate B is immediately oppoſite the fixed plate A, the croſs-piece GH connects the two fixed plates, at the ſame time that the wire and pin at I, form a communication between the revolving plate and the ball. On the other hand, when the revolving plate is immediately oppoſite the fixed plate C, the ball becomes connected with this laſt plate, by the touching of the piece K againſt F; the two plates, A and B, having then no connection with any part of the apparatus. In every other poſition the three plates and the ball will be perfectly unconnected with each other.

Mr. Cavallo's diſcovery, ſo well explained in the laſt Bakerian Lecture, that the minute differences of electrization in bodies, whether occaſioned by art or nature, cannot be completely deſtroyed in any definite time, may be applied to explain the action of the preſent inſtrument. When the plates A and B are oppoſite each other, the two fixed plates A and C may be conſidered as one maſs; and the revolving plate B, together with the ball D, will conſtitute another maſs. All the experiments yet made concur to prove, that theſe two maſſes will not poſſeſs the ſame electric ſtate; but that, with reſpect to each other, their electricities will be plus and minus. Theſe ſtates would be ſimple and without any compenſation, if the maſſes were remote from each other; but as that is not the caſe, a part of the redundant electricity will take the form of a charge in the oppoſed plates A and B. From other experiments I find that the effect of the compenſation on plates oppoſed to each other, at the diſtance of one-fortieth part of an inch, is ſuch that they require, to produce a given intenſity, at leaſt one hundred times the quantity of electricity that would have produced it in either, ſingly and apart. The redundant electricities in the maſſes under conſideration will therefore be unequally diſtributed: the plate A will have about ninety-nine parts, and the plate C one; and, for the ſame reaſon, the revolving plate B will have ninety-nine parts of the oppoſite electricity, and the ball D one. The rotation, by deſtroying the contacts, preſerves this unequal diſtribution, and carries B from A to C, at the ſame time that the tail K connects the ball with the plate C. In this ſituation, the electricity in B acts upon that in C, and produces the contrary ſtate, by virtue of the communication between C and the ball; which laſt muſt therefore acquire an electricity of the ſame kind with that of the revolving plate. But the rotation again deſtroys the contact, and reſtores B to its firſt ſituation oppoſite A. Here, if we attend to the effect of the whole revolution, we ſhall find that the electric ſtates of the reſpective maſſes have been greatly increaſed: for the ninety-nine parts in A and in B remain, and the one part of electricity in C has been increaſed ſo as nearly to compenſate ninety-nine parts of the oppoſite electricity in the revolving plate B, while the communication produced an equal mutation in the electricity of the ball. A ſecond rotation will, of courſe, produce a proportional augmentation of theſe encreated quantities; and a continuance of turning will ſoon bring the intenſities to their maximum, which is limited by an exploſion between the plates.

If one of the parts be connected with an electrometer, more eſpecially that of Bennet, theſe effects will be very clearly ſeen. The ſpark is uſually produced by a number of turns between eleven and twenty; and the electrometer is ſenſibly acted upon by ſtill fewer. When one of the parts is occaſionally connected with the earth, or when the adjuſtment of the plates is altered, there are ſome variations in the effects, not difficult to be reduced to the general principles, but ſufficiently curious to excite the meditations of perſons the moſt experienced in this branch of natural philoſophy. An attention to brevity, however, renders it neceſſary to forbear enlarging upon them.

If the ball be connected with the lower part of Bennet's electrometer, and the plate A with the upper part, and any weak electricity be communicated to the electrometer, while the poſition of the apparatus is ſuch that the croſs-piece GH touches the two pins; a very few turns will render it perceptible. But here, as well as in the common doubler, the effect is rendered uncertain by the condition, the communicated electricity muſt be ſtrong enough to deſtroy and predominate over any other electricity the plates may poſſeſs. I ſcarcely need obſerve, that if this difficulty ſhould hereafter be removed, the inſtrument will have great advantages as a multiplier of electricity in the facility of its uſe, the very ſpeedy manner of its operation, and the unequivocal nature of its reſults.

I have the honour to be, &c.

W. NICHOLSON.

It is with great pleaſure, that we acquaint our readers, that they will find a further and full illuſtration of the Doubler, *Fig.* 2 and 3, Plate I. and of the electrometer, in a work that is preparing for the preſs, and will ſhortly be publiſhed, by the Rev. Mr. *Bennet*, F. R. S. entitled "New Experiments on Electricity;" and we are happy in having an opportunity of informing the lovers of this ſcience, that they will find a great variety of new, important and pleaſing experiments; and more ſo, that we have ſelected in our apparatus, inſtruments that will probably throw much new light on this intereſting branch of natural philoſophy.

LANE'S ELECTRICAL MACHINE, *Fig.* 4.

A, the cylinder; it is moved by means of a pulley, at the lower end of the axis, and a wheel B, which lies parallel to the table and revolves four times for every ſingle revolution of the wheel. The conductor C is finiſhed with points to collect the fire, and it is ſcrewed to the wire of a coated jar D, which ſtands in a ſocket between the cylinder and the wheel.

The electrometer applied to this machine conſiſts of braſs work, G, the lower parts of which is incloſed in the pillar F, made of wood, baked, and boiled in linced oil, and bored cylindrically about two thirds of its length; the braſs work is fixed to the pillar by the ſcrew H, moveable in the grove I, ſo that it may be raiſed higher or lower as the height of the jar, D, requires. Through the braſs work is made to paſs a ſteel ſcrew, L, the diſtance of whoſe threads is about one twenty fourth of an inch; to the end of which, and oppoſite to K, a poliſhed hemiſpherical piece of braſs fixed to the prime conductor, is fixed a well poliſhed ball of braſs, M. To this ſcrew is annexed a circular plate, O, divided into twelve equal parts, and in every revolution of this ſcrew, pointing to the diviſions of the ſcale N, each of which diviſion is equal to each turn of the ſcrew. The uſe of this electrometer is to diſcharge a jar, D, or any battery connected with the prime conductor, without a diſcharging rod; and to give ſhocks ſucceſſively of the ſame degree of ſtrength; and on this account it is particularly adapted for medical purpoſes. If a perſon holds a wire faſtened to the ſcrew H in one hand, and another wire fixed to E, a loop of braſs wire paſſing from the frame of the machine to a tin plate, on which the phial D, ſtands, he will perceive no ſhock when K and M are in contact; and the degree of exploſion, as well as the quantity of electricity decumulated in the phial, will be regulated by the diſtance of K and M from each other.

Fig. 5. Mr. Adams's Medical Electrical Machine, with the electrometer and bottle; *a b*, the electrometer; *c d*, the leyden bottle ſuſpended at a ſmall diſtance from it; a glaſs tube, *e f*, is fixed in this bottle.

It has been found more convenient, to ſeparate the electrometer from the bottle, and apply it to the conductor as in this figure. Where *a b*, repreſent the electrometer, *c d*, the leyden bottle, ſuſpended at a ſmall diſtance from it; a glaſs tube, *e f*, is fixed in this bottle, a ſmall part of the lower end of which is coated; two wires paſs through the ball C on the top of this tube, one of which goes down to the bottom of the exterior bottle, and touches its internal coating, the other only goes to the coating of the tube; theſe wires may be removed at pleaſure. The bottle is to be ſuſpended to the conductor by the ring, and a chain or wire to be fixed to the hook *d*, at the bottom.

We have not been ſo copious in our deſcription of the other parts of this machine as of *fig.* 1, it being nearly ſimilar, excepting the two wheels by which the cylinder is put in motion. This difference of the multiplying wheel is to be preferred as it excites more electric fluid and is leſs fatiguing to the operator.

Directions for Keeping Machines in Order.

Before the electrical machine is put in motion, examine thoſe parts which are liable to wear either from the friction of one ſurface againſt another, or to be injured by the dirt, that may inſinuate itſelf between the rubbing ſurfaces: ſuch as the axes which work in the wooden ſupports D E.

If any grating or diſagreeable noiſe is heard, the place from whence it proceeds muſt be diſcovered, wiped clean, and rubbed over with a ſmall quantity of tallow; a little ſweet oil or tallow ſhould alſo be occaſionally applied to the axis of the cylinder.

The ſcrews that belong to the frame ſhould be examined, and if they are looſe, they ſhould be tightened.

The different working parts of the machine having been looked into, and put in order, the glaſs cylinder, and the pillars which ſupport the cuſhion and conductor, ſhould be carefully wiped, to free them from the moiſture which glaſs attracts from the air, being particularly attentive to leave no moiſture on the ends of the cylinder, as any damp on theſe parts carries off the electric fluid, and leſſens the force of the machine.

Glaſs pillars have been ſometimes uſed to ſupport the cylinder, but they can be of no uſe, unleſs the foregoing circumſtance is conſtantly attended to; and if that is obſerved, they are ſuperfluous.

Take care that no duſt, looſe threads, or filaments adhere to the cylinder, its frame, the conductors, or their inſulating pillars; becauſe theſe will gradually diſſipate the electric fluid, and prevent the machine from acting powerfully.

Rub the glaſs cylinder firſt with a clean, coarſe, dry, warm cloth, or piece of waſh leather, and then with a piece of dry, warm, ſoft ſilk; do the ſame to all the glaſs inſulating pillars of the machine and apparatus; theſe pillars muſt be rubbed more lightly than the cylinder, becauſe they are varniſhed.

A hot iron may in ſome caſes be placed on the foot of the conductor, to evaporate the moiſture which would otherwiſe injure the experiments.

Before the machine be uſed, the cylinder ſhould be firſt wiped very clean with a ſoft linen cloth, that is dry, clean, and warm; and afterwards with a clean hot flannel, or an old ſilk handkerchief; this done, if the winch be turned, when the prime conductor, and other inſtruments, are removed from the electrical machine, and the knuckle be held at a little diſtance from the ſurface of the cylinder, it will be ſoon perceived that the electric fluid comes like a wind from the cylinder to the knuckle, and, if the motion be a little continued, ſparks, and crackling will ſoon follow. This indicates that the machine is in good order, and the electrician may proceed to perform his experiments. But if, when the winch is turned for ſome time, no wind is felt upon the knuckle, then the fault is, very likely, in the rubber.

Having thus fully deſcribed the electrical machines, we ſhall ſubjoin an account of the conſtruction of the conductors. When the conductor is of a moderate ſize, it is uſual to make it of hollow braſs; but when it is very large, then, on account of the price of the materials, it is made of paſteboard, covered with tin foil, or gilt paper. The conductor is generally made cylindrical; but let the form be what it will, it ſhould always be made perfectly free from points, or ſharp edges; and if holes are to be made in it, which on many accounts are very convenient, they ſhould be well rounded, and made perfectly ſmooth.

It has been conſtantly obſerved, that the larger the prime conductor is, the longer, and denſer ſpark can be drawn from it; and the reaſon of this is, that the quantity of electricity, diſcharged in a ſpark, is nearly proportional to the ſize of the conductor; on this account the prime conductor is now made much larger, than what was formely uſed. Its ſize, however, may be ſo large, that the diſſipation of the electricity from its ſurface, may be greater than what the electric can ſupply; in which caſe ſo large a conductor would be nothing more than an unwieldy, and diſagreeable incumbrance.

Beſides the electrical machine, the electrician ſhould be provided with glaſs tubes of different ſizes, a pretty large ſtick of ſealing wax, or a glaſs tube covered with ſealing wax, for the negative electricity. He ſhould at leaſt not be without a glaſs tube about three feet long, and one inch and a half in diameter. This tube ſhould be cloſed at one end, and at the other end ſhould have fixed a braſs cap with a ſtop cock, which is uſeful in caſe it ſhould be required to condenſe or rarify the air within the tube.

The beſt rubber for a tube of ſmooth glaſs is the rough ſide of black oiled ſilk, eſpecially when it has ſome amalgam rubbed upon it; but the beſt rubber for a rough glaſs tube, is a ſtick of baked wood, ſealing wax, or ſulphur.

Practical Method of exciting the Machines ſo as to produce a large Quantity of Electric Fluid.

On this ſubject we ſhall introduce the methods laid down by Mr. Adams, in his eſſay on electricity, page 34, &c.

In order to find out an effectual mode of exciting powerfully an electrical machine, it is neceſſary to frame ſome idea of the mechaniſm by which the cylinder extracts the electric fluid from the cuſhion, and thoſe bodies that are connected with it; I have, therefore, ſubjoined thoſe conjectures on which I have worked, and by which I have been able to excite, in the moſt powerful manner, the machines which have paſſed through my hands.

It appears to me, that the reſiſtance of the air is leſſened, or a kind of vacuum is produced, where the cuſhion is in cloſe contact with the cylinder; that the electric matter, agreeable to the law obſerved by all other elaſtic fluids, is preſſed towards that part where it finds leaſt reſiſtance; the ſame inſtant, therefore, that the cylinder is ſeparated from the cuſhion, the fire iſſues forth in abundance, becauſe the reſiſtance made to it by the action of the atmoſphere is leſſened at that part; a further circumſtance is alſo to be taken into this hypotheſis, namely, the effect which ariſes from the deſtruction of the attraction or coheſion between the cylinder and cuſhion. The more perfect the continuity is made, and the quicker the ſolution of it, the greater is the quantity which will proceed from the cuſhion. But as the fluid in this ſituation will enter with avidity every conducting ſubſtance that is near it, if any amalgam lies above that part of the cuſhion or rubber which is in contact with the cylinder, it will abſorb and carry back part of the electric fire to the reſervoir from whence it was extracted.

If theſe conjectures be true, to excite an electrical machine effectually, we muſt 1ſt, Find out thoſe parts of the cuſhion which are preſſed by the glaſs cylinder. 2d, Apply the amalgam only to thoſe parts. 3d, Make the line of contact between the cylinder and cuſhions as perfect as poſſible and 4th, Prevent the fire that is collected from eſcaping.

" About the year 1782, I applied a looſe flap of leather to the front of the cuſhion; the amalgam was ſpread over the whole of the flap; the cuſhion was then put in its place, and the looſe flap of leather doubled down, or rather turned in, more or leſs, till by ſucceſſive experiments that ſituation was diſcovered which produced the greateſt effect; for, by this means, the quantity of amalgam acting againſt the cylinder was leſſened, and the true line of contact in ſome meaſure aſcertained. Hence I was naturally led to contract the breadth of the cuſhion, and afterwards to place it in ſuch a manner that it might be eaſily raiſed or lowered.

" To find the line of contact formed between the cylinder and cuſhion, place a line of whiting, which has been previouſly diſſolved in ſpirits of wine, on the cylinder; on turning this round, the whiting is depoſited on the cuſhion, and marks thoſe parts of it which bear or rub againſt the cylinder. The amalgam is to be put only on thoſe parts, which are thus marked by the whiting; this line may alſo be aſcertained, by obſerving the parts of the cuſhion which gather the duſt from the cylinder, and laying the amalgam only on thoſe parts.

" The line of contact being found, and the amalgam placed on it, the cylinder is to be rubbed with a piece of leather which is covered with amalgam, which will render the contact between the cylinder and cuſhion more perfect, becauſe it fills the ſmaller pores of glaſs with amalgam, and depoſits the ſuperfluous particles on the cuſhion: it is alſo probable that the amalgam, thus depoſited on the ſurface of the glaſs, forms a continued ſeries of conducting particles, which carry the fire to the prime conductor, and will conſequently, under certain circumſtances, carry it back again to the cuſhion. When the cylinder is rubbed with the amalgamated leather, that part of the oil, or black ſilk, which lies above the cuſhion, is to be turned back, and if, by accident, any particles of amalgam ſtick to it, they muſt be wiped off carefully. If the machine has not been uſed for ſome time, it will be proper to place it for a few minutes, before a fire, and to take off the cuſhion and dry the ſilk thereof.

"If the electricity of the cylinder grows leſs powerful, it is eaſily renewed by turning back the ſilk which lies over it, and then rubbing the cylinder with the amalgamated leather, or by occaſionally altering the preſſure of the adjuſting ſcrew.

"A very ſmall quantity of tallow placed over the amalgam, is obſerved to give more force to the electric powers of the cylinder; the ſame end is anſwered by rubbing the cylinder with a coarſe cloth that has been greaſed a little, and afterwards wiping the cylinder with a clean cloth.

"When the cylinder is put into good action, a number of circular lines of fire will iſſue from the cuſhion; preſent a row of metallic points towards theſe, and they will diſappear. This ſhews, the conducting ſubſtance collects the electric fluid before it can take thoſe appearances, or be diſſipated into the air.

"Hence we learn, that to prevent a loſs of the electric fluid which his excited, we muſt prevent the air from acting on the fluid, which is put in motion by the excitation; becauſe the air not only reſiſts the emiſſion of the fluid, but alſo diſſipates what is collected on account of the conducting ſubſtances, which are continually floating in it.

"Theſe ends are effectually anſwered by letting a non-conducting ſubſtance, as a piece of black or oiled ſilk, proceed from the line or contact to the collecting points of the prime conductor, and placing theſe points within its atmoſphere. The ſtreams of fire, which proceed from the cuſhion over the cylinder, ſhew whether the cuſhion bears uniformly againſt the cylinder; for they are moſt copious and denſe at thoſe parts where the preſſure is greateſt, but are uniformly denſe, when the preſſure is equable.

"When the zinc amalgam is uſed, the ſilk will ſometimes adſo ſtrongly to the cylinder as to render it very difficult to turn; to obviate this, wipe the ſilk perfectly clean, and then rub it over with a very ſmall quantity of aurum muſivum, or a little whiting. The operator ought not to think his machine in good order till it pours forth the fire in great abundance, and ſtrong denſe ſparks are obtained in quick ſucceſſion from the conductor. When the conductor is removed, the fire ſhould ſparkle round the cylinder, and throw out many beautiful bruſhes of light.

"Two kinds of amalgam are much in requeſt at preſent. One is made of quickſilver five parts, zinc one part, which are melted together with a ſmall quantity of bees wax: the other is the aurum muſivum of the ſhops. I find it difficult, after many trials, to ſay which of theſe act the beſt. To make the amalgam adhere cloſely to the ſilk, it is neceſſary to greaſe it, wipe off the ſuperfluous greaſe, and then ſpread the amalgam."

Apparatus neceſſary to accumulate, retain, and employ Electricity.

The inſtruments neceſſary for the accumulation of electricity, are coated electrics, among which, glaſs coated with conductors obtains the principal place; on account of its ſtrength it may be formed into any ſhape, and it will receive a very great charge. The form of the glaſs is immaterial with reſpect to the charge it will contain; its thickneſs only is to be conſidered, for the thinner it is, the higher charge it is capable of receiving; but it is at the ſame time more ſubject to be broken by the force of electric attraction; for this reaſon, therefore, a thin coated jar or plate may be uſed very well by itſelf, and it is very convenient for many experiments; but when large batteries are to be conſtructed, then it is neceſſary to uſe glaſs a little thicker, and care ſhould be taken to have them perfectly well annealed. If a battery is required of no very great power, as containing about eight or nine ſquare feet of coated glaſs, we recommend the uſe of common pint, or half-pint phials, ſuch as apothecaries uſe. They may be eaſily coated with tin-foil, ſheet-lead, or gilt-paper on the outſide, and braſs-filings on the inſide; they occupy a ſmall ſpace, and, on account of their thinneſs, hold a very good charge. But when a large battery is required, then theſe phials cannot be uſed, for they break very eaſily; and for that purpoſe cylindrical glaſs jars, of about fifteen inches high, and four or five inches in diameter, are the moſt convenient. One large jar anſwers better than ſeveral ſmall ones, becauſe the diſſipation of the electric fluid over the uncoated part is not ſo conſiderable in the former as in the latter caſe. But then, if a large jar breaks, the loſs is much more conſiderable.

When glaſs plates or jars, having a ſufficient large opening, are to be coated, the beſt method is to coat them with tin-foil on both ſides, which may be fixed upon the glaſs with varniſh, gum-water, bees-wax, &c.; but in caſe the jars have not an aperture large enough to admit the tin-foil, and an inſtrument to adapt it to the ſurface of the glaſs, then braſs filings, ſuch as are ſold by the pin-makers, may be advantageouſly uſed, and they may be ſtuck with gum-water, bees-wax, &c. but not with varniſh, for this is apt to be ſet on fire by the diſcharge. Care muſt be taken that the coatings do not come very near the mouth of the jar, for that will cauſe the jar to diſcharge itſelf. If the coating is about two inches below the top, it will in general do very well: but there are ſome kinds of glaſs, eſpecially tinged glaſs, that, when coated and charged, have the property of diſcharging themſelves more eaſily than others, even when the coating is five or ſix inches below the edge. There is another ſort of glaſs, like that of which Florence flaſks are made, which, on account of ſome unvitrified particles in its ſubſtance, is not capable of holding the leaſt charge; on theſe accounts, therefore, whenever a great number of jars are to be choſen for a large battery, it is adviſeable to try ſome of them firſt, ſo that their quality and power may be aſcertained.

Electricians have often endeavoured to find ſome other electric, which might anſwer better than glaſs for this purpoſe, but we do not find that any remarkable diſcovery has been made relating to this point.

When a jar, a battery, or in general a coated electric, is to be diſcharged, the operator ſhould be provided with an inſtrument called the diſcharging rod, which conſiſts of a metal rod ſometimes ſtraight, but more commonly bended in the form of a C: they are made alſo of two joints, ſo as to open like a kind of compaſſes, as in *fig.* 25, Plate II. This rod is furniſhed with metal knobs at its extremities, and has a non-conducting handle, generally of glaſs or baked wood, faſtened to its middle. When the operator is to uſe this inſtrument, he holds it by the handle, and, touching one of the coated ſides of the charged electric with one knob, and approaching the other knob to the other coated ſide, or ſome conducting ſubſtance communicating with it, he completes the communication between the two ſides, and diſcharges the electric.

Apparatus to meaſure the Quantity, and aſcertain the Quality of Electricity.

They are commonly called electrometers; and are of four ſorts, 1ſt, the ſingle thread, 2d. the cork, or pith balls, 3d. the quadrant, and 4th. the diſcharging electrometer. The ſecond ſort of electrometer, i. e. the corkballs electrometer, was invented by Mr. Canton: the diſcharging electrometer was invented by Mr. Lane; See *Fig.* 4, Plate I. and another, on a different principle, by Mr. Kinnerſley: and the quadrant electrometer, which is of lateſt invention, is a contrivance of Mr. Henly. See *fig.* 14. A particular deſcription of this improved electrometer, will be found in other parts of the Syſtem.

Beſides the apparatus above deſcribed, there are ſeveral other inſtruments uſeful for various experiments, but theſe will be deſcribed occaſionally. The electrician however, ought to have by him not only a ſingle coated jar, a ſingle diſcharging rod, or in ſhort, only what is neceſſary to perform the common experiments; but he ſhould provide himſelf with ſeveral plates of glaſs, with jars of different ſizes, with a variety of different inſtruments of every kind, and even tools for conſtructing them; in order that he may readily make ſuch new experiments, as his curioſity may induce him to try, or that may be publiſhed by other ingenious perſons, who are purſuing their reſearches in this branch of philoſophy.

Practical Rules neceſſary to be obſerved by young Practitioners.

It often happens that young electricians are at a loſs to aſſign the reaſon, why ſome experiments do not ſucceed as deſcribed in the Syſtem on Electricity. Sometimes they are in poſſeſſion of very good inſtruments, but, by reaſon of ſome circumſtance or other unattended to, they are quite uſeleſs in their hands. This indeed cannot be remedied by nothing but practice, and it is by long uſe, that the electrician, as well as the practitioner in any art or ſcience, becomes ſo good an operator, as to uſe his inſtruments to the beſt advantage. A few rules are however very neceſſary, to guide him in his operations; and although theſe alone are inſufficient to make a perſon a complete practical electrician; yet, when accompanied with the actual management of the apparatus, they facilitate the uſe of it, and render the performance of the experiments more accurate and expeditious.

The firſt thing that the young electrician ſhould obſerve, is, the preſervation, and care, of his inſtruments. The electrical machine, the coated jars, and in ſhort every part of the electrical apparatus, ſhould be kept clean, and as free as poſſible from duſt, and moiſture. When the weather is clear, and the air dry, eſpecially in clear and froſty weather, the electrical machine will always work well. But when the weather is very hot, the electrical machine is not ſo powerful; nor in damp weather, except it be brought into a warm room; and the cylinder, the ſtands, the jars, &c. be made thoroughly dry.

If ſeveral jars are connected together, among which there is one that is apt to diſcharge itſelf very ſoon, then the other jars will alſo ſoon be diſcharged with that; although they may be capable of holding a very great charge by themſelves. The electrician muſt be cautious leſt, by ſome circumſtance not adverted to, the ſhock ſhould paſs through any part of his body; for an unexpected ſhock, though not very ſtrong, may occaſion ſeveral diſagreeable accidents. In making the diſcharge, care muſt be taken that the diſcharging rod be not placed on the thinneſt part of the glaſs, for that may cauſe the burſting of the jar.

When large batteries are diſcharged, jars will be often found broken in it, which burſt at the time of the diſcharge. To remedy this inconvenience, Mr. Nairne ſays he has found a very effectual method; which is, never to diſcharge the battery through a good conductor, except the circuit be at leaſt five feet long. Mr. Nairne adds, that ever ſince he made uſe of this precaution, he has diſcharged a very large battery near a hundred times, without ever breaking a ſingle jar, whereas before he was continually breaking them. But here it muſt be conſidered, that the length of the circuit weakens the force of the ſhock proportionably; the higheſt degree of which is in many experiments required.

"When a coated phial is cracked, either by a ſpontaneous diſcharge, or by any other accident, I remove the outſide coating from the fractured part, and then make it moderately hot by holding it to the flame of a candle, and whilſt it remains hot I apply burning ſealing wax to the part, ſo as to cover the fracture entirely; taking care that the thickneſs of the wax is rather more than the thickneſs of the glaſs. Laſtly, I cover all the ſealing wax, and alſo part of the ſurface of the glaſs beyond it, with a compoſition made with four parts of bees-wax, one of roſin, one of turpentine, and a very little oil of olives; which compoſition I ſpread upon a piece of oiled ſilk, and apply it in the manner of a plaiſter. With this method I have repaired ſeveral broken phials ſo effectually, that after being frequently charged, they were at laſt broken by a ſpontaneous diſcharge, but in a different part of the glaſs.

"Here it is proper to remark, that when jars, or glaſs in general, that is coated for the purpoſe of charging and diſcharging, is in any manner covered with cement or ſealing wax, it breaks more eaſily by a ſpontaneous diſcharge; and it is very remarkable that the fracture generally lies on the limits of the cement.

"It is adviſeable, when a jar, and eſpecially a battery, has been diſcharged, not to touch its wires with the hand, before the diſchaging-rod be applied to its ſides a ſecond, and even a third time; as there generally remains a reſiduum of the charge. This reſiduum is in great meaſure occaſioned by the electricity, that, when the jar is charging, ſpreads itſelf over the uncoated part of the glaſs near the coating, which will not be diſcharged at firſt, but gradually returns to the coating after the diſcharge, which is ſometimes very conſiderable.

"When any experiment is to be performed, which requires but a ſmall part of the apparatus, the remaining part of it ſhould be placed at a diſtance from the machine, the prime conductor, and even from the table, if that is not very large. Candles, particularly, ſhould be placed at a conſiderable diſtance from the prime conductor, for the effluvia of their flames carry off much of the electric fluid.

"Laſtly, the young electrician ſhould be cautioned not to depend on firſt appearances in electricity. A new phenomenon may juſtly excite his curioſity; it is laudable to remark it, and to perſue the hint; but at the ſame time even the doubtful aſſertion of a new fact ſhould never be made, till after a number of ſimilar and concurring experiments. Electricity is a ſcience that often deceives the ſenſes, and the moſt experienced electrician frequently finds himſelf miſtaken in things, which perhaps he may have before conſidered as the moſt certain."

SECT. II.

PHILOSOPHICAL AND ENTERTAINING EXPERMENTS.

Article I.

The Properties of Electric Attraction and Repulſion illuſtrated by Experiments on Light Bodies

Natural philoſophers were originally incited to conſider the nature of electricity from its ſtrong attractive and repulſive powers. The phænomena exhibited by thoſe myſterious properties are ſo various and ſo pleaſing, that they were led, as by enchantment, to purſue the ſubject; and have been richly rewarded by the diſcoveries, which are both intereſting and important.

The powers of genius have been exerted with induſtrious ardour to inveſtigate the cauſes of thoſe properties; but they are ſtill involved in deep obſcurity, and we are ſtill totally ignorant of that mechaniſm by which light bodies, when electrified, approach to or recede from each other.

To enter into a diſcuſſion of the difficulties which perplex this ſubject, would lead us too far from the deſign of this Syſtem; we ſhall, therefore, proceed to ſtate thoſe general properties, or modes of action, which are obſerved in electric attraction and repulſion, and then deſcribe the experiments from which thoſe properties have been deduced, or by which they are illuſtrated.

1. The electric fluid, when in action, diſpoſes or places light bodies in ſuch manner as will beſt facilitate its tranſmiſſion through them, with the greateſt velocity; and this in proportion to the gravity of the body, its conducting power, and the ſtate of the air. 2. Bodies that are electrified poſitively repel each other. 3. Bodies electrified negatively repel each other. 4. Bodies electrified by contrary powers attract each other ſtrongly. 5. Bodies that are electrified, attract thoſe ſubſtances which are not electrified. 6. Thoſe ſubſtances that are brought within the influence of electrified bodies, become poſſeſſed of a contrary electricity; or electrified ſubſtances, without parting with their own electricity, act upon other bodies in their neighbourhood, producing in them an electricity which is contrary to their own; or bodies which are immerged in an electric atmoſphere always become poſſeſſed of an electricity contrary to that of the body in whoſe atmoſphere they are immerged.

The experiments deſcribed in this article are ſimple, eaſily performed, and certain in their reſults; and, though they may at firſt ſight appear to be trifling, yet, on an attentive examination, they will be found of conſiderable importance, as they afford a clue to inveſtigate and explain a variety of electric phænomena, and exhibit, in a ſtrong point of view, ſome of the contrary effects of negative and poſitive electricity.

Theſe experiments may all be made with a ſmall and portable apparatus; conſiſting generally of two braſs tubes, each of theſe is ſupported on a glaſs pillar, which ſcrews into a wooden foot; a pair of ſmall pith balls ſuſpended on linen threads, fit upon each tube by means of a ſmall braſs ring; theſe tubes, with a piece of ſealing-wax or a glaſs tube, are ſufficient to illuſtrate the greater part of the experiments in this article, as well as ſome of the principal phænomena in electricity. The apparatus will be rendered more complete, when it conſiſts of four braſs tubes with their ſtands. Mr. Wilſon, in a maſterly tract on this ſubject, entitled, "A ſhort view of Electricity," has, with a ſimilar apparatus, explained and illuſtrated all its general principles.

Electrified Balls.

Experiment 1. Touch a pair of inſulated pith balls with an excited glaſs tube, they will become electrified, and will ſeparate from each other; the balls are electrified poſitively, and are therefore attracted by excited wax, and repelled by excited glaſs.

As thoſe light ſubſtances, which poſſeſs the ſame electric power, repel each other; we can eaſily diſcover whether they are electrified poſitively or negatively, by preſenting an excited ſtick of ſealing-wax or glaſs to them. If they are attracted by the glaſs, they are negatively, if repelled by it they are poſitively electrified; on the contrary, if repelled by the excited wax, they are negative, if attracted, poſitive.

In aſcertaining the nature of the electric powers, we muſt avoid bringing the bodies to be tried near each other ſuddenly; or one with a ſtrong electricity near another which is weakly ſo, as it may render the experiment doubtful by attracting and not repelling the light body.

Hold an excited glaſs tube over a braſs tube, but at ſome diſtance from it, part of the natural quantity of electricity contained in the braſs tube will be driven into the pith balls that are annexed to it, by the excited glaſs, the balls will diverge with poſitive electricity; remove the excited glaſs, the balls will then return to their natural ſtate, and cloſe. If the excited glaſs continues in its place, the balls will continue to be repelled; for the excited electric will always continue to ſeparate the powers of electricity, or in other words to force a quantity from the ſurface of the tube; and will alſo prevent its return, ſo long as it continues of the ſame force, and acts at the ſame diſtance.

The nearer the excited electric is brought, the greater is the effect. The ſphere of action of an excited electric has been diſtinguiſhed into two parts, one termed the *ſphere of influence*, in which the balls will ſeparate, but cloſe when the electric is removed; the other is called the *ſphere of communication*, in this the force acquired by the balls remains after the excited electric is removed.

The electrified Cork-ball Electrometer.

Experiment 2. When the machine is in order, and the prime conductor is ſet ſo that the points of the collector are about half an inch from the ſurface of the cylinder, fix at the end of the prime conductor the knobbed rod Plate I. *fig.* 5. and hang on it the electrometer with the cork-balls. The balls will now touch one another, the threads hanging perpendicularly, and parallel to each other. But if the cylinder of the machine be whirled by turning the winch E, then the cork-balls will repel one another, and more, or leſs, according as the electricity is more or leſs powerful. In this experiment, the glaſs cylinder extracting the electric fluid from the rubber, throws it upon the pointed wires of the collector, and in conſequence upon the prime conductor, and the electrometer; which are all connected together; and as bodies overcharged with electric fluid will always repel each other, ſo the cork-balls muſt repel each other. If the electrometer be hung to a prime conductor negatively electrified, i. e. connected with the inſulated rubber of the machine, the cork-balls will alſo repel each other; for bodies, undercharged, will repel each other, as well as bodies overcharged with electric fluid.

If, in this ſtate of repulſion, the prime conductor is touched with ſome conducting ſubſtance not inſulated, the cork-balls will immediately come together; for the electric fluid ſuperinduced upon the prime conductor, and the electrometer communicating with it, will be carried away to the ground by that conducting

Plate 2

Electrical Apparatus, – See System of Electricity.

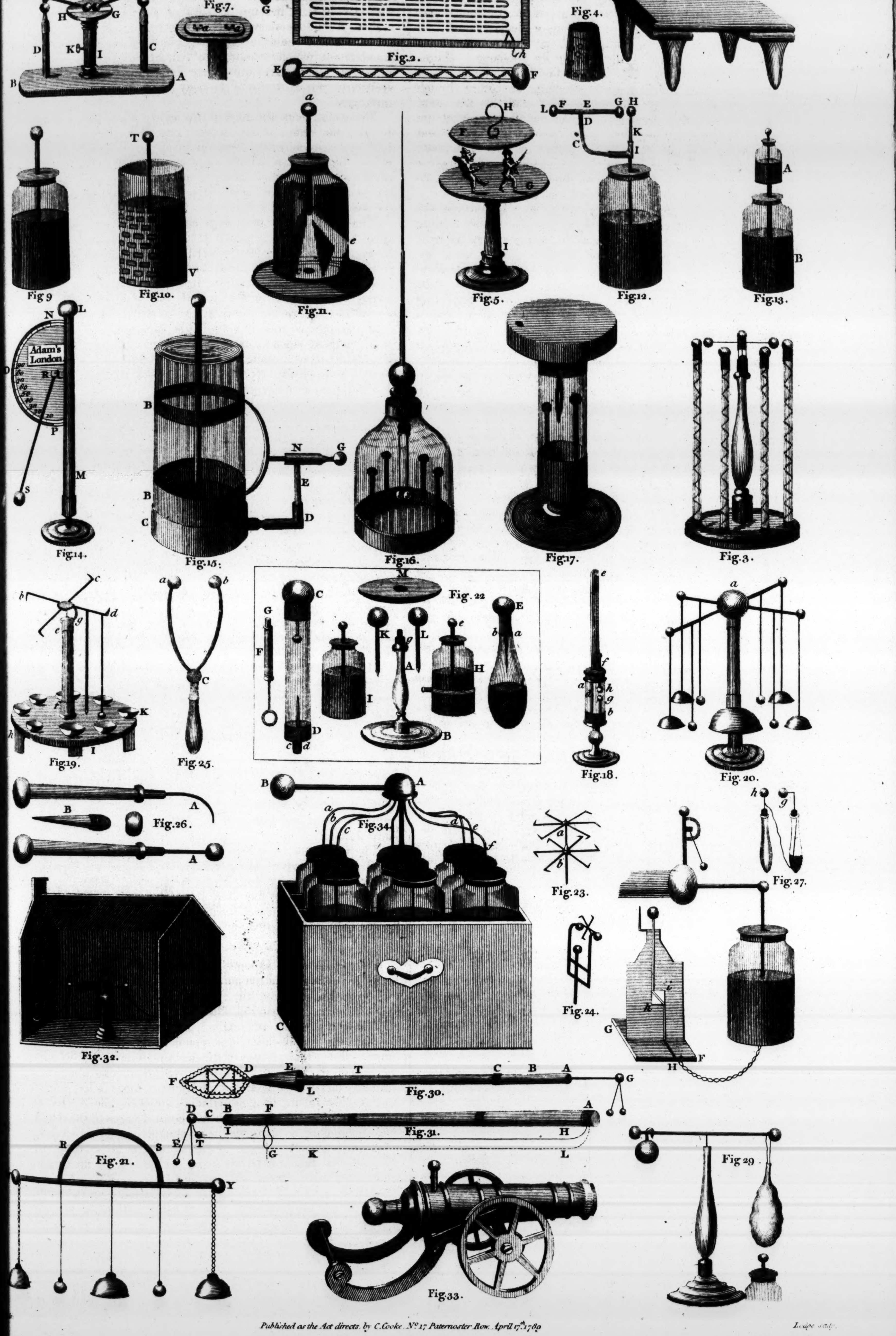

Fig.6.
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Fig 9
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Fig 29
Fig.33.

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MUSEUM

body; ſo that in this caſe the prime conductor can never be overcharged; nor can it be undercharged, if connected with the rubber; for its deficiency of fluid is ſupplied through that conducting body, with which it has been touched. But if, inſtead of the conducting ſubſtance, the prime conductor is touched with an electric, as for inſtance a ſtick of ſealing-wax, a piece of glaſs, &c. then the cork-balls will continue to repel each other; becauſe the electric fluid cannot be conducted through that electric: hence we have an eaſy method of determining what bodies are conductors, and what electrics. This method in groſs will do very well; but when the conducting power of fluids or ſome other bodies, and the degree of that power, is to be aſcertained, then recourſe muſt be had to other means, more nice and accurate.

This electrical repulſion is alſo ſhewn by the quadrant electrometer, with a large downy feather, or the like; for if theſe be connected with the prime conductor, and the winch be turned, the electrometer will raiſe its index, and the feather, by the divergency of its down, will appear ſwelled in a beautiful manner. Excited glaſs held over the middle of the tube, forces ſome part of the natural quantity of electricity into the balls that are ſuſpended, and ſome part out at the two ends into the air. During this experiment, the balls are repelled by glaſs, and are therefore in a poſitive ſtate; but, after the excited glaſs is removed, they in a very little time change to a negative ſtate, becauſe part of the natural quantity had eſcaped from the pointed ends into the air, while the glaſs was held over the tube; but, when the glaſs is removed, the over-charge in the balls will of courſe return, and diffuſe itſelf equally in the tube, but as this is not ſufficient to ballance the loſs ſuſtained, the tube, thread, and balls muſt be in a negative ſtate. It may be inferred from this experiment, that whenever the electric fluid in any body becomes ſuddenly more denſe in any one part, the fluid in the neighbouring parts will be more rare, and vice verſa. Theſe alternate changes of rarity and denſity muſt, from the nature of an elaſtic fluid, continue to oſcillate many times backwards and forwards before the fluid can be at reſt; though, when theſe motions are weakened to a certain degree they are imperceptible to the obſerver. Moſt of the preceding experiments may be had with cylinders of wood or glaſs inſtead of braſs. When glaſs is uſed it muſt be kept dry and not diſturbed by friction. It is not improbable that the attractive and repulſive motions of electrified bodies are owing to the alternate condenſation and dilatation of the electric fluid on the ſurface of theſe bodies, as they are naturally carried where they meet with the leaſt reſiſtance. That there is a vibratory motion, or ſtruggle, between the electric fluid, when in action, and the air, is evident from that ſenſation which is felt when a ſtrongly excited electric is brought near any part of the human body; and is ſuch as would be occaſioned by a ſpider's web drawn lightly along the ſkin. This circumſtance is rendered more clear by an experiment made by Dr. Prieſtley, in order to diſcover whether electricity was concerned in the freezing of water. He placed two diſhes with water in the open air in the time of a ſevere froſt, one of them he kept ſtrongly electrified, and could obſerve no difference in the time when it began to freeze, or in the thickneſs of the ice when it had been frozen ſome time; but he obſerved, on each ſide of the electrified wire, the ſame dancing vapour which is ſeen near the ſurface of the earth in a hot day, or at any time near a body ſtrongly heated.

Strong Attraction and Repulſion between electrified Silk Stockings.

Experiment 3. The following curious obſervations were made by Mr. Symmer. He had been accuſtomed to wear two pair of ſilk ſtockings, a black and a white; when theſe were pulled off both together no ſigns of electricity appeared; but, on pulling off the black ones from the white, he heard a ſnapping or cracking noiſe, and in the dark perceived ſparks between them. To produce this and the following appearances in great perfection, it was only neceſſary to draw his hand ſeveral times backward and forward over his leg with the ſtockings upon it.

When the ſtockings were ſeparated and held at a diſtance from each other, both of them appeared to be highly excited; the white ſtocking poſitively, the black negatively. While they were kept at a diſtance from each other, both of them appeared inflated to ſuch a degree that they exhibited the intire ſhape of the leg. When two black or two white ſtockings are held in one hand, they repel one another with conſiderable force. When a white and a black ſtocking are preſented to each other, they are mutually attracted, and ruſh together, if permitted, with great violence. As they approach, the inflation gradually ſubſides, and their attraction of foreign objects diminiſhes, but their attraction of one another increaſes; when they actually meet, they become flat and joined cloſe together, like ſo many folds of ſilk; when ſeparated again, their electric virtue does not ſeem to be in the leaſt impaired for having once met. The ſame appearances will be exhibited by them for a conſiderable time. When the experiment was made with two black ſtockings in one hand, and two white ones in the other, they were thrown into a ſtrange agitation, owing to the attraction between thoſe of different colours, and the repulſion between thoſe of the ſame colour. This mixture of attractions and repulſions made the ſtockings catch at each other at greater diſtances than otherwiſe they would have done, and afforded a very curious ſpectacle.

When the ſtockings were ſuffered to meet, they ſtuck together with conſiderable force; at firſt Mr. Symmer found they required from one to twelve ounces to ſeparate them. Another time they raiſed 17 ounces. Getting the black ſtockings new dyed, and the white ones waſhed, and whitened in the fumes of new ſulphur, and then putting them one within the other, with the rough ſides together they required three pounds three ounces to ſeparate them. When the white ſtocking was put within the black one, ſo that the outſide of the white was contiguous to the inſide of the black, they raiſed nine pounds, wanting a few ounces; when the two rough ſurfaces were together, they raiſed fifteen pounds, one penny weight and a half. The Rev. Mr. Lyons has made many curious experiments on the attraction of ribbons; their coheſion; &c. See Lyon's Experiments and Obſervations on Electricity.

The Electrical Jack.

Experiment 4. This is an invention of Dr. Franklin's, and turns with conſiderable force, it may be uſed for the purpoſes of a common jack. A ſmall upright ſhaft of wood paſſes at right angles through a thin round board of about 12 inches diameter, and turns on a ſharp point of iron fixed in the lower end, while a ſtrong wire in the upper end, paſſing through a ſmall hole in a thin braſs plate, keeps the ſhaft truly vertical. About 30 radii, of equal length, made of ſaſh-glaſs cut into narrow ſlips, iſſue horizontally from the circumference of the board, the ends moſt diſtant from the centre being about four inches apart. On the end of every one a braſs thimble is fixed If now the wire of a bottle electrified in the common way be brought near the circumference of this wheel, it will attract the neareſt thimble, and ſo put the wheel in motion. That thimble, in paſſing by, receives a ſpark; and thereby being electrified, is repelled, and ſo driven forwards; while a ſecond, being attracted, approaches the wire, receives a ſpark, and is driven after the firſt; and ſo on, till the wheel has gone once round; when the thimbles before electrified approaching the wire, inſtead of being attracted, as they were at firſt, are repelled, and the motion preſently ceaſes. But if another bottle which had been charged through the coating, or otherwiſe negatively electrified, is placed near the ſame wheel, its wire will attract the thimble repelled by the firſt, and thereby double the force that carries the wheel round. The wheel therefore moves very ſwiftly, turning round 12 or 15 times in a minute, and with ſuch force, that a large fowl ſpitted on the upper ſhaft may be roaſted by means of it.

Dancing Figures.

Experiment 5. Suſpend the ſmall metal plate F, *fig.* 5, to the conductor by the hook H; place the ſtand I, directly under it, and the large plate G on the top of the ſtand; the upper part of the ſtand I, is moveable, ſo that the diſtance of the two plates from each other may be occaſionally varied. Lay ſmall paper images, or any other light ſubſtances, on the under plate, then put the machine in action, and the light bodies will be attracted and repelled by each plate, and move from one plate to the other with conſiderable velocity.

The light bodies placed on the under plate become poſſeſſed of an electricity which is contrary to that of the upper plate, and are therefore attracted by it, and acquire the ſame electricity with it; they are then repelled, and part with this electricity to the ſtand, and are again in a proper ſtate to be attracted by the upper plate. That theſe bodies cannot be attracted by the upper plate, till they have acquired a power contrary to it, or till the equilibrium of the fluid in them is diſturbed, will be evident from the following experiment. Remove the under plate and ſtand; hold in its ſtead, by one corner, a pane of glaſs, which has previouſly been made very clean and dry; now, as glaſs does not tranſmit electricity, no contrariety in the electric ſtates of the conductor and the light ſubſtances can be occaſioned, and therefore no attraction or repulſion is obſerved. If a finger is preſented to the under ſide of the glaſs plate, the light bodies will be attracted and repelled: the cauſe of this will be ſeen when the nature of the Leyden phial is explained.

Mr. Eeles, (Philoſophical Eſſays, preface, page 25,) ſpeaking of this alternate attraction and repulſion, ſays, they may be agreeably varied, by wetting firſt the head of the paper images, and when theſe are dry, wetting the feet.

"When you dry the head of one of thoſe images, the power thown out from the conductor, cannot enter the image with the ſame facility with which the contrary power from the table enters at the feet, which are not ſo dry; this will therefore aſcend to the upper plate and remain there. Reverſe the experiment; dry the feet and wet the head, and the images will fix themſelves to the lower plate. If the image retains ſo much more of the attracted power as will ballance againſt its weight, than there is of the contrary power which proceeds from the conductor, the image will be ſuſpended between the two plates.

"This may be effected by making the head of the image broad and round, which does not admit the power coming out ſo readily as the feet, being ſharp, admit the power going in; a minute alteration will make the images dance, or remain fixed to one of the plates. In this experiment the figures will ſometimes move one upon another, or exhibit different poſtures, ſo as to afford a pleaſing ſpectacle to an obſerving company.

The Electrified Bells.

Experiment 6. *Fig.* 21 repreſents a ſmall ſet of bells, which are cauſed to ring by the powers of attraction and repulſion; the two exterior ones are connected to the wire VY, by a braſs chain; the middle bell and the clappers are ſuſpended on ſilk.

Hang the bells on the conductor by the hook RS, let the chain from the middle bell touch the table, turn the cylinder, and the clappers will fly continually from bell to bell, as long as the electricity continues.

The braſs chain, which connects the two exterior bells to the conductor, conveys the electric fluid to them, which attracts the clappers; theſe, when they have received the electric fluid, are repelled by the exterior bell, and attracted by the middle one, on which they depoſit their electricity; they are then again attracted and repelled by the outer bells. Hold up, by a ſilk thread, the chain, which proceeds from the middle bell, and the ringing will ceaſe, becauſe it cannot convey the electric fluid communicated by the clappers to the ground.

Fig. 20 repreſents a more elegant form of mounting the bells. When this is uſed, the knob *a* ſhould communicate with the conductor.

Fig. 19 repreſents another kind. In this the clapper is ſuſpended from the fly *b c d*, the axis of the fly reſts in a ſmall hole on the top of the glaſs pillar *e f*, the upper part of the axis moves freely in, and is ſupported by a hole in the braſs piece *g*. Bells of different tones are placed round the board *h* I K. Remove the prime conductor, and place this apparatus in it's ſtead near the cylinder; when this is in action, it will cauſe the fly to turn round, the clapper will ſtrike each bell in rotation, and thus produce a pleaſing and harmonious ſound.

The Dancing Balls.

Experiment 7. Put a pointed wire into one of the holes which are at the end of the conductor, hold a glaſs tumbler over the point, then electrify the conductor, and turn the tumbler round, that the whole interior ſurface may receive the fluid from the point; place a few pith balls on the table, and cover them with this glaſs tumbler, the balls will immediately begin to leap up and down as if they were animated, and will continue to move for a long time. See *fig.* 4. This experiment may be agreeably varied with two tumblers. Electrify the inſide of one poſitively, of the other negatively; put the balls in one tumbler, and then bring the mouths of both in contact, the balls will paſs from one to the other, till the contrariety between them is deſtroyed.

The flying Feather, or ſhuttle Cock.

Experiment 8. The phenomena of electric attraction and repulſion may be repreſented alſo with a glaſs tube, or a charged bottle, and ſome of them in a manner more ſatisfactory than with the machine. Take a glaſs tube (whether ſmooth, or rough, is not material), and after having rubbed it, let a ſmall light feather be let out of your fingers at a diſtance of about eight or nine inches from it. This feather will be immediately attracted by the tube, and will ſtick very cloſe to its ſurface for about two or three ſeconds, and ſometimes longer; after which time it will be repelled, and if the tube be kept under it, the feather will continue floating in the air at a conſiderable diſtance from the tube, without coming near it again, except it firſt touches ſome conducting ſubſtance; and if you manage the tube dexterouſly, you may drive the feather through the air of a room at your pleaſure. The reaſon of this experiment is obvious; for when the feather is electrified, it cannot approach the tube again, except it firſt touches ſome conducting body, becauſe it cannot part with its electricity when floating in the air, and therefore cannot acquire a contrary electricity: conſequently it muſt remain in a ſtate incapable of being again attracted by the excited tube. If it be aſked, why, when the feather is at firſt attracted by the tube, it ſticks for ſo conſiderable a time to its ſurface before it is repelled? the anſwer is, that the feather being an electric, requireth ſome time before it acquires any conſiderable quantity of electricity.

There is a remarkable circumſtance attending this experiment, which is, that if the feather be kept at a diſtance from the tube by the force of electric repulſion, it always preſents the ſame part towards the tube: you may move the excited tube about the feather very ſwiftly, and yet the ſame ſide of the feather will always be preſented to the tube. The reaſon of this phenomenon is, that equilibrium of the electric fluid in the parts of the feather, being once diſturbed, cannot eaſily be reſtored; becauſe the feather is an electric, or at leaſt a very bad conductor. When the feather has acquired a quantity of electricity from the tube, it is plain, that by the action of the excited tube, that ſuperinduced electricity will be in the greateſt part forced on that ſide of the feather which happens to be at firſt the fartheſt from the tube; hence that part will always afterward be repelled the fartheſt. This experiment may be agreeably varied in the following manner: A perſon may hold in his hand an excited tube of ſmooth glaſs, and another perſon may hold an excited rough glaſs tube, a ſtick of ſealing-wax, or in ſhort another electric negatively electrified, at about one foot and a half diſtance from the ſmooth glaſs tube: a feather now may be let go between theſe two differently excited electrics, and it will leap alternately from one electric to the other; and the two perſons will ſeem to drive a ſhuttle-cock from one to the other, by the force of electricity.

To diſtinguiſh the Quality of Electricity in electrified Bodies.

Experiment 9. Before we proceed further, it is neceſſary that we ſhould deſcribe ſome practical method of diſtinguiſhing the quality of the electricity in an electrified body, which is abſolutely neceſſary for the right performance of the enſuing experiments. To do this, different methods may be followed, which however are all founded, either upon the electric attraction, and repulſion, or upon the different appearances of the electric light. To find out the quality of electricity by the different appearances of its light, is a very convenient, and ſure method; but the phenomena of attraction and repulſion, afford one much more general, and eaſy; for ſometimes the quantity of electricity to be obſerved is ſo very ſmall, that it will give no light, though it may be ſtill capable of attracting or repelling. The general method to prove whether the electricity of a body, electrified either by excitation, or communication, is negative, or poſitive, is to bring it pretty near to an electrified electrometer D or C, *fig.* 36, and obſerve whether the body attracts or repels it; for if the electrometer is electrified poſitively, and the electrified body repels it, then you may conclude that the body is alſo electrified poſitively; becauſe bodies, poſſeſſed of the ſame kind of electricity, repel each other; but if the body preſented attracts the electrometer, then it muſt be electrified negatively, becauſe there is no electric attraction between bodies, unleſs they are differently electrified; and as the electrometer is known to be electrified poſitively, the body is conſequently electrified negatively.

The following preciſe method may lead to determine the quality of the electricity of an electrified body.

Firſt, electrify one of the electrometers C, *fig.* 36, either poſitively, or negatively, at pleaſure: touch it, for inſtance, with an excited glaſs tube, ſo that its balls may repel, and ſtand about two inches diſtant from one another; then touch the other electrometer C with the electrified body, that you deſire to examine, ſo that it may be poſſeſſed of the ſame degree of electricity: laſtly, take either of the two electrometers by the top of the glaſs handle *a*, diſengage it from the arm of the ſtand, and bring it near the other electrometer; if then the balls of one electrometer repel thoſe of the other, you may conclude that they are poſſeſſed of the ſame kind of electricity; but if they attract each other, you may conclude that they were electrified with contrary electricities; and as you know the electricity of that electrometer, which was firſt electrified, you will alſo know the electricity of the other electrometer, i. e. of the electrified body, with which it was touched.

The above experiment may be alſo made with the ſingle-thread electrometers; ſuch as are ſuſpended at the end of *fig.* 30. for if they are brought near to one another, when their feathers are electrified, they will, if poſſeſſed of the ſame electricity, repel, or if poſſeſſed of contrary electricities, attract each other. To account for any of the phænomena of electric attraction and repulſion, is very difficult, but more ſo to ſhew why bodies, which are electrified with the ſame power, repel each other, particularly thoſe which are negatively electrified. Philoſophers have invented various ſolutions of this difficulty; Cavallo's, which he has introduced in his treatiſe Part 110, is eſteemed the beſt.

From ſeveral experiments of Beccaria's, it appears, that, if the air is thoroughly exhauſted from a glaſs receiver, the attraction and repulſion of electrified light bodies within the receiver grow languid, and ſoon ceaſe altogether. This is confined by an experiment of Mr. Cavallo's. A pith ball electrometer was ſuſpended within a receiver of an air pump, by it's braſs cap; this was then electrified; the balls diverged a little when the air was only rarified 100 times: when it was rarified 300 times, the repulſion was ſcarce diſcernable; when the rarifaction was greater, they did not diverge at all; and that, whether a ſmall or large quantity of electricity was communicated to the cap. Phil. Tranſ. vol. 73, p. 452.

ARTICLE II.

EXPERIMENTS ON ELECTRIC LIGHT.

The following experiments require to be made in the dark; for although the electric light, in ſeveral circumſtances, may be ſeen in the day light, yet its appearance in this manner is very confuſed; and, that the electrician might form a better idea of its different appearances, it is abſolutely neceſſary to perform ſuch experiments in a darkened room.

The Star and Pencil of electric Light.

Experiment 1. When the electrical machine is in good order, and the prime conductor is ſituated with the collector ſufficiently near the glaſs cylinder (which ſituation we ſhall call hereafter its proper place) turn the winch, and you will ſee a lucid ſtar at each of the points of the collector. This ſtar is the conſtant appearance of the electric fluid that is entering a point. At the ſame time, you will ſee a ſtrong light proceeding from the rubber, and ſpreading itſelf over the ſurface of the cylinder; and, if the excitation of the cylinder is very powerful, denſe ſtreams of fire will proceed from the rubber, and, darting round almoſt half the circumference of the cylinder, will reach the points of the collector. If the prime conductor is removed, the denſe ſtreams of fire will go quite round the cylinder; reaching from one ſide of the rubber to the other. By obſerving on which ſide of the cylinder thoſe ſtreams are moſt copious, it may be eaſily determined which ſide of the rubber preſſes more or leſs upon the cylinder, or is better covered with amalgam, or, in ſhort, which ſide is the moſt or leaſt fit for the excitation of the glaſs. If the chain of the rubber is taken off, and a pointed body (as for inſtance, the point of a needle or a pin) is preſented to the back of the rubber, at the diſtance of about two inches, a lucid pencil of rays will appear to proceed from the point preſented, and diverge towards the rubber. This pencil is the conſtant appearance of the electric fluid iſſuing from a point; and in fact, it now comes out of the point, in order to ſupply the rubber, which is conſtantly exhauſted by the cylinder in motion. If another pointed body be preſented to the prime conductor, it will appear illuminated with a ſtar; but if a pointed wire, or other pointed conducting body, be connected with the prime conductor, it will throw out a pencil of rays; for, the prime conductor being overcharged, the fluid departing from it muſt, agreeably to the law, form a pencil on that point from which it flies off, and a ſtar on that point which it enters.

Imitations of the Planetary Motions.

EXPERIMENT 2. From the prime conductor ſuſpend ſix concentric hoops of metal, at diſtances from each other; under them, on a ſtand, place a metal plate at the diſtance of about half an inch. Then place upon the plate within each hoop, and near to it, a round glaſs bubble blown very light; theſe bubbles and the diſtances between the hoops ſhould correſpond to the different diameters of the planets and thoſe of their orbits; but as that cannot be on account of the vaſt diſproportion between them, it muſt ſuffice here to make a difference that bears ſome relation to them. Now, the hoops being electrified, the bubbles placed upon the plate, near the hoops, will be immediately attracted by them, and they will continue to move round the hoops as long as the electrification continues. If the electricity is very ſtrong, the bubbles will frequently be driven off from the hoops, and make a variety of ſurpriſing motions round their axis, and running hither and thither on the plate, after which they will come back to the hoops, and run round them as before. If the room is darkened, all the glaſs balls will appear beautifully illuminated.

To illuminate Wood.

EXPERIMENT 3. Take a ſpark through a ball of box-wood, and it will appear of a beautiful crimſon, or rather a fine ſcarlet colour; or the ſhock may be paſſed through pieces of wood of different thickneſſes and denſity, which will afford a very ample field for obſervation and experiment.

The illuminated ſpiral Tube.

EXPERIMENT 4. E F, *fig.* 2, is a glaſs tube, round which, at ſmall but equal diſtances from each other, pieces of tin foil are paſted in a ſpiral form, (hence it is called the ſpiral tube) from end to end; this tube is incloſed in a larger one, fitted with braſs caps at each end, which are connected with the tin-foil of the inner tube. Hold one end in the hand, and apply the other near enough to the prime conductor to take ſparks from it, a beautiful and lucid ſpot will then be ſeen at each ſeparation of the tin-foil; theſe multiply, as it were, the ſpark taken from the conductor; for if there was no break in the tin-foil, the electric fire would paſs off unperceived.

Fig. 3. repreſents ſeveral ſpiral tubes, placed round a board; a glaſs pillar is fixed to the board, and on this pillar is cemented a metal cap, carrying a ſmall ſteel point; a braſs wire, furniſhed with a ball at each end, and nicely ballanced, is placed on this point; place the middle of this wire under a ball proceeding from the conductor, ſo that it may receive a continued ſpark from the ball, then give the wire a rotative motion, and the balls in revolving will give a ſpark to each ball of the ſpiral tube, which will be communicated from thence to the board; forming, from the brilliancy of the light and its rapid motion, a very pleaſing experiment. All theſe experiments on the interrupted ſpark may be pleaſingly and beautifully varied, and the ſpark made to appear of different colours, at the pleaſure of the operator.

The luminous Word.

EXPERIMENT 5. This experiment is exactly on the ſame principles as the foregoing. The word is formed by the ſmall ſeparations made in the tin-foil, which is paſted on a piece of glaſs that is fixed in a frame of baked wood, as repreſented in *fig.* 1. To make the experiment, hold the frame in the hand, and preſent the ball G to the conductor, the ſpark received on this will be communicated to the tin-foil, and follow it in all its windings, till it arrives at the hook *h*, and is conveyed from thence to the ground by a chain: the lucid appearance at each break exhibits a word in characters of fire.

To illuminate a Decanter of Water.

EXPERIMENT 6. Connect one end of a chain with the outſide of a charged jar, let the other end lie on the table, place the end of another piece of chain at about one quarter of an inch diſtance from the former, then ſet a decanter of water on theſe ſeparated ends, and, on making the diſcharge through the chain, the water will appear perfectly and beautifully luminous.

Do not theſe experiments indicate, that there is a ſubtle medium both in electric and non-electric bodies, that renders them tranſparent, when it is put in motion?

Drawing Sparks.

EXPERIMENT 7. Let the prime conductor be ſituated in its proper place, and electrify it by working the machine; then bring a metallic rod with a round knob at each end, or the knuckle of a finger, within a proper diſtance of the prime conductor, and a ſpark will be ſeen between that and the knuckle, or knobbed wire. The longer and ſtronger ſpark is drawn from that end of the prime conductor which is fartheſt from the cylinder, or rather from the end of the knobbed rod, fixed at its end, *fig.* 5, Plate I.

The reaſon of this is, becauſe that end of the prime conductor is leſs influenced by the atmoſphere of the excited cylinder.

This park (which has the ſame appearance, whether drawn from a prime conductor poſitively, or negatively electrified) appears like a long line of fire; it often darts bruſhes of light ſideways, in every direction, reaching from the conductor to the oppoſed body; and often (particularly when the ſpark is long, and different conducting ſubſtances are near the line of its direction) it will have the appearance of being bended to ſharp angles in different places, exactly reſembling a flaſh of lightning. Notwithſtanding, however, this extended appearance, which is imputed to the quick paſſage of the luminous matter, the electric fluid paſſing from one body to another in a ſpark, is reaſonably thought to proceed in a ſeparate, and nearly globular body.

The direction of the ſpark often deceives the moſt experienced electrician, it ſeeming ſometimes to proceed from one place, and at other times, under the ſame circumſtances, to proceed from the oppoſite. When the prime conductor is electrified poſitively, the ſpark muſt certainly proceed from it, and go to the body preſented; and when the prime conductor is electrified negatively, the ſpark muſt proceed from the body preſented, and go to the conductor. This, however, we learn by reaſoning from other experiments; for the real direction of the ſpark in the above experiment, is much more rapid in its motion than to admit its form, much leſs its direction, to be perceived by our eyes.

The electric Light flaſhing between two metallic Plates.

EXPERIMENT 8. Let two perſons, one ſtanding upon an inſulated ſtool, and communicating with the prime conductor, and another ſtanding upon the floor, each hold in one of his hands a metal plate, in ſuch a manner, that the plates may ſtand back to back in a parallel ſituation, and about two inches aſunder. Let the winch of the machine be turned, and you will ſee the flaſhes of light between the two plates ſo denſe and frequent, that you may eaſily diſtinguiſh any thing in the room. By this experiment, the electric light is exhibited in a very copious and beautiful manner, and it bears a ſtriking reſemblance to lightning.

To fire inflammable Spirits.

EXPERIMENT 9. The power of the electric ſpark to ſet fire to inflammable ſpirits, may be exhibited by ſeveral different methods; but more eaſily thus: hang to the prime conductor a ſhort rod, having a ſmall knob at its end, then pour ſome ſpirit of wine, a little warmed, into a metal ſpoon; hold the ſpoon by the handle, and place it in ſuch manner, that the ſmall knob on the rod may be about one inch above the ſurface of the ſpirit. In this ſituation, if, by turning the winch, a ſpark be made to come from the knob, it will ſet the ſpirit on fire. This experiment happens in the very ſame, whether the conductor is electrified poſitively or negatively, i. e. whether the ſpark be made to come from the conductor, or from the ſpoon; it being only in conſequence of the rapid motion of the ſpark that the ſpirits are kindled. It will be perhaps ſcarce neceſſary to remark, that the more inflammable the ſpirits are, the more proper they will be for this experiment, as a ſmaller ſpark will be ſufficient to inflame them; therefore rectified ſpirit of wine is better than common proof ſpirit, and æther better than either.

This experiment may be varied different ways, and may be rendered very agreeable to a company of ſpectators. A perſon, for inſtance, ſtanding upon an electric ſtool, and communicating with the prime conductor, may hold the ſpoon with the ſpirits in his hand, and another perſon, ſtanding upon the floor, may ſet the ſpirits on fire, by bringing his finger within a ſmall diſtance of it. Inſtead of his finger, he may fire the ſpirits with a piece of ice; when the experiment will ſeem much more ſurprizing. If the ſpoon is held by the perſon ſtanding upon the floor, and the inſulated perſon brings ſome conducting ſubſtance over the ſurface of the ſpirit, the experiment ſucceeds as well.

Let an electrified perſon, ſtanding on an inſulated ſtool, hold the ſpirits. Let another perſon, ſtanding alſo on an inſulated ſtool, hold in his hand an iron poker, one end of which is made red hot, he may then apply the hot end to the ſpirits, and even immerge it in them without firing them. But if he put one foot on the floor, he may ſet the ſpirits on fire with either end. The ſpirits cannot be kindled by the inſulated perſon, becauſe, as the electric cannot eſcape through him to the earth, he is incapable of drawing a ſpark ſufficiently ſtrong to inflame them, and hot iron will ſeldom or ever ſet ſpirits on fire. If oil of turpentine is ſet on fire in a veſſel which is placed on the conductor, and the ſmoak is received on a plate, held by a perſon ſtanding on an inſulated ſtool, he will be electrified thereby, and enabled to fire ſpirits of wine, &c. If the inſulated perſon holds a braſs wire at the top of the flame of burning ſpirits of wine, which is connected with the conductor, he will alſo become electrified. Hence we find, that either ſmoke or flame conducts the electrical fluid.

“ Mr. Winckler ſays, that oil, pitch, and ſealing-wax, might be lighted by electric ſparks, provided thoſe ſubſtances were firſt heated to a degree next to kindling. To theſe it muſt be added, that Mr. Gralath fired the ſmoke of a candle juſt blown out, and lighted it again; and that Mr. Boze fired gunpowder, melting it in a ſpoon, and firſt the vapour that roſe from it.”

The artificial Bolonian Stone illuminated by the Electric Light.

EXPERIMENT 10. The moſt curious experiment to ſhew the penetrability of the electric light, is made with the real, or with the artificial Bolonian ſtone, which is procured more eaſily, and was invented by the late Mr. J. Canton. This phoſphorus is a calcareous ſubſtance, generally uſed in the form of a powder, which has the property of appearing lucid, when brought into the dark after having been expoſed to the light. The method of making this phoſphorus is as follows: “ Calcine ſome common oyſter-ſhells” (if they are old, and half calcined by time, ſuch as are commonly found upon the ſea-ſhore, they are, as Mr. W. Canton obſerves, ſo much the better) “ by keeping them in a good coal-fire for half an hour; let the pureſt part of the calx be pulverized, and ſifted; mix with three parts of this powder one part of the flowers of ſulphur; let this mixture be rammed into a crucible of about an inch and a half in depth, till it be almoſt full; and let it be placed in the middle of the fire, where it muſt be kept red-hot for one hour at leaſt, and then ſet it by to cool; when cold, turn it out of the crucible, and cutting or breaking it to pieces, ſcrape off, upon trial, the brighteſt parts; which, if good phoſphorus, will be a white powder, and may be preſerved by keeping it in a dry phial with a ground ſtopple.” If this phoſphorus, whether in the phial or not, be kept in the dark, it will give no light, but if expoſed to the light, either of the day, or of any thing elſe, and afterwards brought into a dark place, it will then appear lucid for a conſiderable time. For farther properties of this phoſphorus, ſee the Phil. Tranſ. Vol. 58.

Take ſome of this powder, and, by means of ſpirit of wine, or æther, ſtick it all over the inſide of a clear glaſs phial, and ſtop it with a glaſs ſtopper, or a cork and ſealing-wax. If this phial be kept in a darkened room (which for this experiment muſt be very dark) it will give no light: but let two or three ſtrong ſparks be drawn from the prime conductor, when the phial is kept at about two inches diſtance from the ſparks, ſo that it may be expoſed to that light, and this phial will receive that light, and afterwards will appear illuminated for a conſiderable time.

This powder may be ſtruck upon a board by the means of the white of an egg, ſo as to repreſent figures of planets, letters, or any thing elſe, at the pleaſure of the operator, and theſe figures may be illuminated in the dark, in the ſame manner as the above-deſcribed phial. A beautiful method to expreſs geometrical figures with the above phoſphorus, is to bend ſmall glaſs tubes, of about the tenth part of an inch diameter, in the ſhape of the figure deſired, and then to fill them with the phoſphorus-powder. Theſe may be illuminated in the manner deſcribed, and they are not ſo ſubject to be ſpoiled, as the figures repreſented upon the board frequently are. The beſt method of illuminating this phoſphorus, and was that Mr. W. Canton generally uſed, is to diſcharge a ſmall electric jar near it. Paper, after being made dry and rather hot, marble, oyſter ſhells, and the moſt calcareous ſubſtances, eſpecially when burned to lime, have the property of being illuminated by the light given by the diſcharge of a jar, though not ſo much as the above-mentioned phoſphorus.

Take ſome of the powder of Canton's phoſphorus, and by means of a little ſpirit of wine, ſtick it all over the inſide of a clean glaſs phial, then ſtop the bottle, and keep it from the light. To illuminate this phoſphorus, draw ſeveral ſtrong ſparks from the conductor, keeping the phial about two or three inches from the ſparks, ſo that it may be expoſed to their light; the phial will afterwards appear luminous, and remain ſo for a conſiderable time.

A curious Method of ſhewing the Penetrability of electric Light.

EXPERIMENT 11. Let the extremities of two wires, one of which proceeds from the outſide of a charged jar, and another from one branch of the diſcharging rod, be laid on a table at about one tenth part of an inch diſtance of each other; then put the thumb juſt upon that interruption, preſſing it flat down. This done, bring the diſcharged rod in contact with the knob of the jar, and on making the diſcharge, the ſpark which neceſſarily happens under the thumb will illuminate it in ſuch a manner, that the bone, and the principal blood veſſels, may be eaſily diſcovered in it. In this experiment the operator needs not be afraid of receiving a ſhock; for the diſcharge of the jar paſſes from wire to wire, and only affects the thumb with a ſort of tremor, which is far from being painful.

The electrified Capillary Syphon.

EXPERIMENT 12. Let a ſmall bucket of metal, full of water, be ſuſpended from the prime conductor, and put in it a glaſs ſyphon of ſo narrow an extremity, as the water will juſt drop from it. If in this diſpoſition of the apparatus the winch of the machine be turned, the water, which, when not electrified, only dropt from the extremity of the ſyphon, will now run in a full ſtream, which will even be ſubdivided into other ſmaller ſtreams; and if the experiment be made in the dark, it will appear beautifully illuminated.

The Aurora Borealis.

EXPERIMENT 13. Take a phial nearly of the ſhape and ſize of a Florence flaſk; fix a ſtop-cock or a valve to its neck, and exhauſt it of air as much as poſſible with a good air-pump. If this glaſs is rubbed in the common manner uſed to excite electrics, it will appear luminous within, being full of a flaſhing light, which plainly reſembles the aurora borealis, or northern light. This phial may alſo be made luminous by holding it by either end, and bringing the other end to the prime conductor; in this caſe all the cavity of the glaſs will inſtantly appear full of flaſhing light, which remains in it for a conſiderable time after it has been removed from the prime conductor. Inſtead of the above-deſcribed glaſs veſſel, a glaſs tube, exhauſted of air and hermetically ſealed, may be uſed, and perhaps with better advantage. The moſt remarkable circumſtance of this experiment is, that if the phial or tube, after it has been removed from the prime conductor (and even ſeveral hours after its flaſhing light hath ceaſed to appear) be graſped with the hand, ſtrong flaſhes of light will immediately appear within the glaſs, which often reach from one of its ends to the other.

ARTICLE III.

EXPERIMENTS ON THE LEYDEN PHIAL.

The experiments upon the Leyden phial are ſome of the moſt intereſting in electricity: they excited the attention of the philoſopher to this ſubject more than any other experiment, and are ſtill viewed with wonder and ſurprize. The phænomena attending this very extraordinary experiment ſeemed totally inexplicable, till they were elucidated by the ingenious theory of Dr. Franklin; which, in a plain and clear manner, accounts for moſt of the difficulties which attend this intricate branch of electricity; and accommodates itſelf ſo eaſily and ſatisfactorily to a variety of appearances, as to make us almoſt loſe ſight of the objections againſt it.

Charging and diſcharging the Leyden Phial.

EXPERIMENT 1. Place the braſs ball of a coated jar in contact with the prime conductor while the outſide communicates with the table, turn the cylinder, and the bottle will in a little time be charged, or modify the electric fluid in a peculiar manner. To diſcharge the jar, or reſtore it to its natural ſtate, bring one end of a conducting ſubſtance in contact with the outſide coating, and let the other be brought near the knob of the jar which communicates with the inſide coating, a ſtrong exploſion will take place, the electric light will be viſible, and the report very loud. Charge the Leyden bottle, then touch the outſide coating with one hand, and the knob with the other, the bottle will be diſcharged, and a ſudden peculiar ſenſation will be perceived, that is called the electric ſhock. The ſhock, when it is taken in this manner, generally affects the wriſts, elbows, and breaſt; when the ſhock is ſtrong, it reſembles an univerſal blow. This peculiar ſenſation is probably owing to the two-fold and inſtantaneous action of the electric fluid, which enters and goes out of the body, and the various parts through which it paſſes, at one and the ſame inſtant. It has been alſo obſerved, that nature has appointed a certain modification of the electric fluid in all terreſtrial bodies, which we violate in our experiments: when this violation is ſmall, the powers of nature operate in a gentle manner to rectify the diſorder we have introduced; but when the deviation is conſiderable, the natural powers reſtore the original conſtitution with extreme violence.

If ſeveral perſons join hands, and the firſt touches the outſide of a charged jar, and the laſt the knob, the bottle will be diſcharged, and they will all feel the ſhock at the ſame inſtant; but the greater the number of perſons that join hands to take a ſhock, the weaker it is. The force of the ſhock is in proportion to the quantity of coated ſurfaces, the thinneſs of the glaſs, and the power of the machine; or, the effect of the Leyden phial is increaſed, in proportion as we deſtroy the equilibrium on the ſurfaces. A given quantity of electricity, impelled through our body with a given force, produces a weaker ſenſation than twice that quantity impelled with half that force, and conſequently the ſtrength of the ſhock depends rather more on the quantity of fluid, which paſſes through our body, than on the force with which it is impelled. Yet the force of an exploſion ſeems to depend more on the degree to which the fluid is compreſſed, than on the quantity; hence a ſmall phial fully charged, will act nearly as ſtrong as a larger jar which is half charged.

If a charged jar is coated very high, it will diſcharge itſelf before it has received near the charge it would take if the coating was lower. If it is coated very low, this part of the ſurface may be charged very high, but a conſiderable part of the glaſs is not charged at all. When a jar is charged very high, it will often explode or diſcharge itſelf over the glaſs from one coated ſurface to the other; or, if the glaſs is thin, it will make a hole through it, and ſwell the coating on both ſides, the glaſs in the hole will be pulverized, and very often a variety of fiſſures will proceed from it in various directions. A Leyden jar very often recovers its electricity, in a ſmall degree, after a diſcharge has been made; this ſecond exploſion is called the reſiduum of a charge.

To avoid receiving the electric ſhock, be careful never to touch the top and bottom of the jar at the ſame time, and never to enter a circuit formed between the inſide and outſide of a jar; for the effect of the Leyden phial depends entirely on the reciprocal action of the two ſurfaces, and does not take place, when either is touched ſeparately. By attending to this obſervation, jars of any ſize may be handled with ſafety. Indeed, the human frame makes ſo little reſiſtance to the free paſſage of this ſubtle agent, that no other inconvenience will attend a ſhock from a common ſized charged jar, than a tranſient diſagreeable ſenſation.

Touch the knob of a charged jar, no ſhock will enſue; but the finger, or part that touches the ball of the jar, will be affected with a ſharp ſenſation, as if it had been pricked with a needle. The diſcharge is ſilent and without an exploſion, when the communication between the two ſides of the jar is made by imperfect conductors. A charged phial ſet upon electric ſubſtances, may be taken hold of without danger, either by the coating or the wire; a ſmall ſpark only will proceed from either.

Combined Apparatus.

The apparatus repreſented *fig.* 22, will be found exceedingly convenient for making a variety of experiments on the Leyden phial. We have endeavoured to combine the parts of it in ſuch manner, as to render the apparatus extenſively uſeful, without being complicated. A is an inſulated pillar of glaſs, which is ſcrewed to the wooden foot B: all the different parts of the apparatus may be ſcrewed alternately on this pillar. C is an exhauſted tube of glaſs, furniſhed at each end with braſs caps: at the end D is a valve, properly ſecured under the braſs plate; a braſs wire, with a ball, projects from the upper cap; a pointed wire proceeds from the bottom plate; this tube is called the luminous conductor. The flaſk, repreſented at E, is called the Leyden vacuum. It is furniſhed with a valve under the ball E; this ball unſcrews, in order to come more readily at the valve; a wire, with a blunt end, projects a little below the neck of the flaſk; the bottom of the flaſk is coated with tin foil: a female ſcrew is cemented to the bottom, in order to ſcrew it on the pillar A.

F is a ſyringe to exhauſt the air occaſionally, either from the luminous conductor, or the Leyden vacuum. To do this, unſcrew the ball of the Leyden vacuum, or the plate of the luminous conductor, and then ſcrew the ſyringe in the place of either of theſe pieces, being careful that the bottom of the female ſcrew G bears cloſe againſt the leather which covers the ſhoulders *a b*, and *c d*, then work the ſyringe, and in a few minutes the glaſſes will be ſufficiently exhauſted. H and I are two Leyden bottles, each of which has a female ſcrew fitted to the bottom, in order that they may be conveniently ſcrewed on the pillar A. The bottle H is furniſhed with a belt, that it may be ſcrewed ſideways on the pillar A. K and L are two ſmall wires, which are to ſcrew occaſionally into either the ball E, the knobs *e* or *f*, the cap *c*, or the ſocket *g*, on the top of the pillar: the balls may be unſcrewed from theſe wires, which will then exhibit a blunt point. M is a wooden table to be ſcrewed on the glaſs pillar occaſionally.

The Leyden Vacuum.

Experiment 2. *Fig.* 22. of Plate 2. repreſents a ſmall phial E, *b a*, coated on the outſide about three inches up the ſides with tin-foil; at the top of the neck of this phial, a braſs cap is cemented, having a hole with a valve, and from the cap a wire proceeds a few inches within the phial, terminating in a blunt point. When this phial is exhauſted of air, a braſs ball is ſcrewed upon the braſs cap, ſo as to defend the valve, and prevent any air from getting into the exhauſted glaſs. This phial exhibits clearly the direction of the electric fluid, both in charging and diſcharging; for if it be held by its bottom, and its braſs knob be preſented to the prime conductor poſitively electrified, you will ſee that the electric fluid cauſeth the pencil of rays to proceed from the wire within the phial, and if its diſcharged, a ſtar will appear in the place of the pencil. But if the phial is held by the braſs cap, and its bottom be touched with the prime conductor, then the point of the wire, on its inſide, will appear illuminated with a ſtar when charging, and with a pencil when diſcharging. If it be preſented to a prime conductor electrified negatively, all theſe appearances, both in charging and diſcharging, will be reverſed. The ſame experiment is beautifully diverſified by means of the luminous conductor, C D, *fig* 22.

The courſe of the Electric Fluid in the Diſcharger rendered viſible by the Star and Pencil.

Experiment 3. *Fig.* 15, is an electric jar, B B the tin-foil coating, C a ſtand which ſupports the jar, D a ſocket of metal which carries the glaſs rod E; a curved metallic wire, pointed at each end, is fixed to the end of the rod G, which rod is moveable at pleaſure in a ſpring tube N, that tube being fixed by a ſocket upon the top of the glaſs rod E, the charging wire communicates with the different diviſions of the inſide coating of the jar by horizontal wires. Place the jar as uſual, and put the machine in action, a ſmall luminous ſpark will appear upon the upper point of the wire F, (a plain indication that the point is then receiving electricity from the upper ring of the coating on the outſide of the jar) a fine ſtream or pencil of rays will at the ſame time fly off, beautifully diverging from the lower point of the wire E upon the bottom ring of the coating on the jar; when theſe appearances ceaſe, which they will as ſoon as the jar is charged, let a pointed wire be preſented towards the prime conductor, this will ſoon diſcharge the jar ſilently, during which, the lower point will be illuminated with a ſmall ſpark, while the upper point of the wire will throw off a pencil of rays, diverging towards the upper ring of the coating.

The Magic Picture.

Experiment 4. This is a contrivance of Mr. Kinnerſley; and more calculated to give ſurpriſe, than any other experiment. It is made in the following manner: having a large mezzotinto, with a frame and glaſs, (ſuppoſe of the king), take out the print, and cut a pannel out of it near two inches diſtant from the frame all round. If the cut be through the picture, it is nothing the worſe. With thin paſte, or gum water, fix the board that is cut off on the inſide of the glaſs, preſſing it ſmooth and cloſe; then fill up the vacancy, by gilding the braſs well with leaf gold or braſs. Gild likewiſe the inner edge of the back of the frame all round, except the top part, and form a communication between that gilding and the gilding behind the glaſs; then put in the board, and that ſide is finiſhed. Turn up the glaſs, and gild the foreſide exactly over the back gilding; and when it is dry, cover it, by paſting on the pannel of the picture that has been cut out; obſerving to bring the correſpondent parts of the board and picture together, by which the picture will appear of a piece as at firſt; only part is behind the glaſs, and part before. Laſtly, hold the picture horizontally by the top, and place a little moveable gilt crown on the king's head. If now the picture is moderately electrified, and another perſon take hold of the frame with one hand, ſo that his fingers touch its inſide gilding, and with the other endeavour to take off the crown, he will receive a terrible blow, and fail in the attempt. The operator, who holds the picture by the upper end, where the inſide of the frame is not gilt, to prevent its falling, feels nothing of the ſhock; and may touch the face of the picture without danger, which he pretends to be a teſt of his loyalty.

Imitation of Rain and Snow.

Experiment 5. Put a quantity of braſs duſt into a coated jar, and when it is charged invert it, and throw ſome of the duſt out, which will be ſpread in an equable and uniform manner on any flat ſurface, and fall juſt like rain or ſnow. May it not be queſtioned, ſays an ingenious writer, whether water, falling from the higheſt region of the clouded atmoſphere, would not meet the earth in much larger drops, or in cataracts, if the coaleſcing power of the drops was not counteracted by their electric atmoſpheres.

Illuminated Jar.

Experiment 6. TV. *Fig.* 10 repreſents a bottle, whoſe exterior coating is formed of ſmall pieces of tin-foil, placed at a little diſtance from each other. Charge this bottle in the uſual manner, and ſtrong ſparks of electricity will paſs from one ſpot of tin-foil to the other, in a variety of directions; the ſeparation of the tin-foil making the paſſage of the fluid from the outſide to the table viſible. Diſcharge this bottle, by bringing a pointed wire gradually near the knob, and the uncoated part of the glaſs between the ſpots will be pleaſingly illuminated, and the noiſe will reſemble that of ſmall fired crackers. If the jar is diſcharged ſuddenly, the whole outſide ſurface appears illuminated. To produce theſe appearances, the glaſs muſt be very dry.

Diſcharges of the double Jar.

Experiment 7. *Fig.* 13 repreſents two Leyden phials, placed one over the other. Various experiments may be made with this double bottle, which are very pleaſing, and elucidate clearly the received theory. Bring the outſide coating of the bottle A in contact with the prime conductor, and turn the machine till the bottle is charged, then place one ball of the diſcharging rod upon the coating of B, and with the other touch the knob of the jar A, which will cauſe an exploſion. Now place one ball of the diſcharger on the knob of A, and bring the other ball to its coating, and you have a ſecond diſcharge. Again, apply one ball of the diſcharger on the coating of B, and carry the other to the coating of A, and it will produce a third exploſion. A fourth is obtained by applying the diſcharger from the coating of A to its knob. The outer coating of the upper jar communicating with the inſide of the under one, conveys the fluid from the conductor to the large jar, which is therefore charged poſitively; the upper jar does not charge, becauſe the inſide cannot part with any of it's electric fluid: but when a communication is formed from the outſide of A to the inſide of B, part of the fire on the inſide of A will be conveyed to the negative coating of B, and the jar will be diſcharged. The ſecond exploſion is occaſioned by the diſcharge of the jar A: but as the outſide of this communicates, by conducting ſubſtances, with the poſitive inſide of the jar B, if the ball of the diſcharging rod remains a ſmall time after the diſcharge on the knob of A, part of the fire of the inſide of A will eſcape, and be replaced by an equal quantity on the outſide from the jar B, by which means A is charged a ſecond time; the diſcharge of this produces the third, and of B the fourth exploſion.

To make the electric Spark viſible in Water.

EXPERIMENT 8. Fill a glaſs tube, of about half an inch diameter, and ſix inches long, with water, and to each extremity of the tube adapt a cork, which may confine the water; through each cork inſert a blunt wire, ſo that the extremities of the wires within the tube may be very near one another; laſtly, connect one of theſe wires with the coating of a ſmall charged phial, and touch the other wire with the knob of it; by which means the ſhock will paſs through the wires, and cauſe a vivid ſpark to appear between their extremities within the tube. In performing this experiment care muſt be taken, that the charge be exceedingly weak, otherwiſe the tube will burſt.

To fire Gun-powder.

EXPERIMENT 9. Make a ſmall cartridge of paper, and fill it with gun-powder, or elſe fill the tube of a quill with it; inſert two wires, one at each extremity, ſo that their ends within the quill, or cartridge, may be about one fifth of an inch from one another; this done, ſend the charge of a phial through the wires, and the ſpark between their extremities, that are within the cartridge, or quill, will ſet fire to the gun-powder. If the gun-powder be mixed with ſteel filings, it will take fire more readily, and with a ſmall ſhock.

To light a Candle by the Diſcharge of a Jar.

EXPERIMENT 10. Take a wire of the ſize of a common knitting-needle, and by means of a ſmall flexible wire or a chain, let one end of it communicate with the outſide of a jar, that at leaſt contains about ten inches of coated ſurface. To the other end of the thick wire ſome cotton muſt be twiſted, but very looſely, ſo as to form a head round, and to conceal the extremity of the wire entirely. This head of cotton muſt be rolled in powder of lycopodium, or, which anſwers better, in powder of roſin; by which means a good deal of the powder will ſtick to the cotton: this done, the jar is charged, and then the head of cotton, &c. is brought towards its knob rather quickly, ſo as to cauſe the jar to diſcharge through the cotton, by which means the cotton will be inſtantly ſet on fire, and will laſt long enough to light a candle thereby. This is a very pleaſing experiment, contrived by Dr. Ingenhouze.

To ſtrike Metals into Glaſs.

EXPERIMENT 11. Take two ſlips of common window-glaſs about three inches long, and half an inch wide; put a ſmall ſlip of gold, ſilver, or braſs leaf, between them, and tie them together, or elſe preſs them together between the boards of the preſs H, belonging to the univerſal diſcharger, *fig.* 6. Plate II. leaving a little of the metallic leaf, and the force of the exploſion will drive part of the metal into ſo cloſe a contact with the glaſs, that it cannot be wiped off, or even be affected by the common menſtrua, which otherwiſe would diſſolve it. In this experiment the glaſſes are often ſhattered to pieces; but whether they are broken or not, the indelible metallic tinge will always be found in ſeveral places, and ſometimes through the whole length of both glaſſes.

ARTICLE IV.

EXPERIMENTS WITH THE ELECTRICAL BATTERY.

The force of accumulated electricity, great as it appears by the experiments performed with a ſingle coated jar, is very ſmall when compared with that which is produced by a number of jars connected together; and if the effects of a ſingle jar are ſurpriſing, the prodigious force of a large battery is certainly aſtoniſhing. To obſerve that the metals, even the moſt purified platina, which reſiſts the greateſt efforts of chymic fire, are actually, and almoſt inſtantaneouſly rendered red-hot, and fuſed; to ſee animals deſtroyed; and to hear the loud report of a large electric battery, are things that always produce a kind of terror in the mind of an attentive obſerver. Experiments of this kind ſhould be conducted with great caution, and the operator ought to be attentive, not only to the buſineſs in hand, but alſo to the perſons who may happen to be near him, prohibiting their touching, or even coming too near any part of the apparatus; for if a miſtake in performing other experiments may be diſagreeable, thoſe in the diſcharge of a large battery may be attended with worſe conſequences. When a battery is to be charged, inſtead of a large prime conductor, a ſmall one is much more convenient; for, in this caſe, the diſſipation of the electricity is not ſo conſiderable. The quadrant-electrometer, *Fig.* 14. Plate II. which ſhews the height of the charge in the battery, may be fixed either upon the prime conductor, or upon the battery: in which latter caſe, it ſhould be placed upon a rod proceeding from the wires of the jars, and if the battery be very large, it ſhould be elevated two or three feet above them.

The index of the electrometer in charging a large battery will ſeldom riſe ſo high as 90°, becauſe the machine cannot charge a battery ſo high in proportion, as a ſingle jar. Its limit is often about 60° or 70°, more or leſs in proportion to the ſize of the battery, and the force of the machine. To increaſe the force of the electric exploſion, ſeveral Leyden phials are connected together in a box; this collection is termed an electrical battery. *Fig.* 34, repreſents one of the moſt approved form. The bottom of the box is covered with tin foil, to connect the exterior coatings; the inſide coatings of the jars are connected by the wires *b*, *c*, *d*, *e*, *f*, *g*, which meet in the large ball A; C is a hook at the bottom of the box, by which any ſubſtance may be connected with the outſide coating of the jars; a ball B proceeds from the inſide, by which the circuit may be conveniently completed. The following precautions are neceſſary to be attended to by thoſe who make uſe of an electrical battery. To keep the top and uncoated parts of the jars dry and free from duſt, and after the exploſion to connect a wire from the hook to the ball, which ſhould be left there till the battery is to be charged again, which will totally obviate the inconveniencies that have occaſionally happened from the reſiduum of a charge. If one jar in a battery is broke, it is impoſſible to charge the reſt till the broken jar is removed. A cracked jar may be made to receive a charge, by taking away the external and internal coatings which were over the crack, ſo as to leave a ſpace of about one fourth of an inch between the crack and remaining tin-foil. To prevent the jars of a large battery breaking at the time of the exploſion, it has been recommended not to diſcharge a battery through a good conductor, except the circuit is at leaſt five feet long; but what is gained on one hand by this method, is loſt on the other, for, by lengthening the circuit, the force of the ſhock is weakened proportionably. We have been informed, that it is very difficult to break by an exploſion the jars which are made of green glaſs, fabricated at Newcaſtle, but have had no opportunity to make any experiments on this glaſs ourſelves. The force of a battery may be conſiderably increaſed by concentrating the ſpark from the exploſion, which is effected by cauſing it to paſs through ſmall circuits of non-conducting ſubſtances. By this means the reſiſting medium, through which the ſpark is to paſs, may be ſo prepared as to augment its power. If the ſpark is made to paſs through a hole in a plate of glaſs, one twelfth or one ſixth part of an inch in diameter, it will be leſs diſſipated, more compact and powerful. If the part round the hole is wetted with a little water, the ſpark, by converting this into vapour, may be conveyed to a greater diſtance, with an increaſe of rapidity, attended with a louder noiſe than common. Mr. Morgan, by attending to theſe and ſome other circumſtances, has melted wires, &c. with ſmall bottles. We hope he will be induced to communicate this, as well as the reſt of his important diſcoveries, to the public.

Extraordinary Power of the Electric Battery.

EXPERIMENT 1. Let a quire of paper be ſuſpended by a line in the manner of a pendulum from any convenient altitude, ſo that its plane may be vertical. Let the largeſt charge from a battery be cauſed to paſs through it, while quieſcent in an horizontal direction perpendicular to the plane, the rods of communication not touching the paper; the phænomena are; firſt, the aperture cauſed by perforation, the leaves being protruded both ways from the middle: ſecond, not the ſmalleſt motion is communicated to the paper from the force of the diſcharge. A quire of the thickeſt and ſtrongeſt paper was made uſe of for this experiment, the height from which it was ſuſpended ſixteen feet. It is an extraordinary appearance on the hypotheſis of a ſingle electric fluid, that a force ſufficient to penetrate a ſolid ſubſtance of great tenacity and coheſive force, ſhould not communicate the ſmalleſt motion to the paper, when a breath of air would cauſe ſome ſenſible vibration in it. But this difficulty is not unanſwerable: for a velocity may be aſſigned, with which a body impinges againſt and paſſes through a pendulum of any given weight and reſiſting force, ſo that a ſmaller angular velocity ſhall be communicated to it, than any that ſhall be propoſed, and we know no limit to the velocity of the electric power or powers. But the other phenomenon, i. e. the oppoſite direction in which the leaves are protruded, tends very much to ſtrengthen the opinion of two oppoſite currents: perhaps either of thoſe phænomena, conſidered ſimply, may admit of an eaſy ſolution from the hypotheſis of a ſingle power; when they are taken both together, it ſeems more difficult to reconcile this hypotheſis with matter of fact.

If pieces of cork or any light bodies be placed near the exploſion of a jar or battery, they will be moved out of their place in all directions from the centre of the exploſion; and the greater the force of the exploſion, ſo much greater will the diſtance be to which they are removed. It is not ſurpriſing, therefore, that heavy bodies ſhould be removed to conſiderable diſtances by a ſtrong flaſh of lightning. Dr. Prieſtley apprehends, that this ſpecies of lateral force is produced by the exploſion of the air from the place through which the electric diſcharge paſſes.

To melt Wires.

EXPERIMENT 2. Connect with the hook, communicating with the outſide coating of a battery, containing at leaſt thirty ſquare feet of coated ſurface, a wire, that is one fiftieth part of an inch thick, and about two feet long; the other end of it muſt be faſtened to one end of the diſcharging rod; this done, charge the battery, and then by bringing the diſcharging rod near its wire, ſend the exploſion through the ſmall wire, which by this means will be made red-hot, and melted, ſo as to fall upon the floor in different glowing pieces. When a wire is melted in this manner, ſparks are frequently ſeen at a conſiderable diſtance from it, which are red-hot particles of the metal, that by the violence of the exploſion are ſcattered in all directions. If the force of the battery is very great, the wire will be intirely diſperſed by the exploſion, ſo that none of it can be afterwards found.

To make Globules of Metals.

EXPERIMENT 3. Take a very ſlender wire, and put it in a glaſs tube, about one quarter of an inch in diameter; then ſend the charge of a battery through it, and the wire will be melted, and reduced into globules of different ſizes, which are found ſticking on the inſide ſurface of the glaſs tube, and they may be eaſily ſeparated from it at pleaſure: theſe, upon examination, will all be found hollow, and are little more than a mere ſcoria of metal. It muſt be obſerved, in making this experiment, that the charge of the battery muſt neither be too high nor too weak; for in the former caſe, the wire will be reduced into pieces exceedingly ſmall, or rather exploded in ſmoke; and in the latter caſe, it will be imperfectly fuſed, ſo that its pieces will be large and irregular.

The Imitation of an Earthquake.

EXPERIMENT 4. The appearance of the earthquake, as repreſented with the exploſion of a battery, is occaſioned by the concuſſion given to ſeveral ſubſtances by the exploſion paſſing over their ſurfaces. To give a repreſentation of the impreſſion made upon houſes by the earthquake, ſmall ſticks, cards, or the like, may be placed upon the ſurface of the body over which the exploſion is to be tranſmitted, ſo as to ſtand very light. Theſe ſticks, &c. will never fail to be ſhook, and often to be thrown down by the exploſion. It is remarkable, that an exploſion will not paſs over the ſame length of ſurface of all bodies, though they are equally good conductors. Water, ice, wet wood, raw fleſh, and moſt of the animal fluids, are the beſt to make this remarkable experiment; to do which, nothing more is required than to inſert part of the ſurface of the ſaid ſubſtances into the circuit of the two ſides of a battery; a chain, for inſtance, communicating with the outſide, may be placed ſo as nearly to touch the ſurface of a quantity of water, and at about eight or nine inches diſtant from another chain, ſituated alſo very near the ſurface of the water, and communicating with one end of the diſcharging rod. If the ends of the chains touch the water, the experiment will happen in the ſame manner.

The report, in this experiment, is much louder than when the exploſion paſſes through the air only. The concuſſion given to the water, by the exploſion paſſing over its ſurface, is not only ſuperficial, but affects its whole body; and if the hand is kept deep under its ſurface whilſt the exploſion paſſes over it, the concuſſion may be very ſenſibly felt.

The ſpark, that in this experiment paſſes over the ſurface of the water, ſeems to bear a great reſemblance to the balls of fire that have ſometimes been ſeen over the ſurface of the ſea or land in time of an earthquake; and hence it ſeems very probable, that thoſe balls of fire are electrical phænomena.

ARTICLE V.

EXPERIMENTS ON THE INFLUENCE OF POINTS, AND THE USEFULNESS OF POINTED METALLIC CONDUCTORS, TO DEFEND BUILDINGS FROM THE EFFECTS OF LIGHTNING.

The reader, in the courſe of this Syſtem, muſt have obſerved in ſeveral of the experiments already deſcribed, the remarkable property that points have, both of throwing off and receiving ſilently the electric fluid; but in this article we ſhall deſcribe a few curious experiments of this kind, by which the influence of points, in reſpect to electricity, may be better underſtood, and which may, in a more particular manner, demonſtrate the utility of metallic conductors to houſes, or piles of building, in order to preſerve them from the damage often occaſioned by a ſtroke of lightning; which is one of the greateſt benefits that mankind has received from the ſcience of electricity.

Thunder Houſe.

EXPERIMENT 1. *Fig.* 35 repreſents the gable end of a houſe, fixed vertically on a board F G; a ſquare hole is made in the gable and at *h i*, into which a piece of wood is fitted; a wire is inſerted in the diagonal of this little piece; two wires are alſo fitted to the gable end; the lower end of one wire terminating at the upper corner of the ſquare hole: the top of the other wire is fixed to its lower corner; the braſs ball on the wire may be taken off, in order that the pointed end may be taken occaſionally expoſed to receive the exploſion. Place a jar with its knob in contact with the conductor, connect the bottom of the jar with the hook H, then charge the jar, and bring the ball under the conductor, and the jar will be diſcharged by an exploſion from the conductor to the ball of the houſe. The wires and chain being all in connection, the fire will be conveyed to the outſide of the jar, without affecting the houſe; but if the ſquare piece of wood is placed ſo that the wires are not connected, but the communication cut off, the electric fluid, in paſſing to the outſide of the bottle, will throw out the little piece of wood to a conſiderable diſtance, by the lateral force of the exploſion. See *Fig.* 35.

Unſcrew the ball, and let the point which is underneath be preſented to the conductor, and then you will not be able to charge the jar; for the ſharp point gradually draws the fire from the conductor, and conveys it to the coating on the outſide of the jar. The prime conductor is ſuppoſed to repreſent a thunder cloud diſcharging its contents on a weather-cock, or any other metal, at the top of a building. From this experiment many have inferred, that if there is a connection of metal to conduct the electric fluid down to the earth, the building will receive no damage; but where the connection is imperfect, it will ſtrike from one part to another, and thus endanger the whole building.

To diſcharge a Jar ſilently.

EXPERIMENT 2. When a large jar is fully charged, which would give a terrible ſhock, put one of your hands in contact with its outſide coating: with the other hold a ſharp-pointed needle, and, keeping the point directed towards the knob of the jar, proceed gradually near it, until the point of the kneedle touches the knob. This operation diſcharges the jar entirely, and you will either receive no ſhock at all, or ſo ſmall a one as can hardly be perceived. The point of the kneedle, therefore, has ſilently and gradually drawn all the ſuperfluous fluid from the inſide ſurface of the electric jar.

Powder Houſe.

EXPERIMENT 3. *Fig.* 32 is a perſpective view of the powder houſe; the ſide of the roof next the eye being omitted, that the inſide may be more conveniently ſeen. The front of this model is fitted up like the thunder houſe, and is uſed in the ſame manner; the ſides of the houſe, the back, and fore-front, are joined to the bottom by hinges; the roof is divided into two parts, which are alſo faſtened by hinges to the ſides; the building is kept together by a ridge on the roof; when the roof is blown up, it will fall down with the ſides, the back, and the fore-front. To uſe this model, fill the ſmall tube *a* with gun-powder, and ram the wire *c* a ſmall way in the tube, then connect the hook *e* with the bottom of a large jar or battery; when the jar is charged, form a communication from the hook *d* to the top of the jar; the diſcharge will fire the powder, and the exploſion of the gun-powder will throw off the roof, and the ſides, the fore and back fronts will then all fall down.

EXPERIMENT 4. Mr. Henly ſuſpended by a ſilk ſtring, from one end of a wooden bar, which turned freely in an horizontal direction upon the point of a needle, a large bullock's bladder, gilded with leaf copper; the bladder was ballanced by a weight at the other end of the arm; (ſee *fig.* 29;) he gave a ſtrong ſpark from the knob of a charged phial to the bladder; he then preſented towards it a braſs ball, two inches in diameter, and obſerved that the bladder would come towards it at that diſtance of three inches; and when it got within an inch, would throw off it's electricity in a full ſpark. He then gave it another ſpark, and preſented a pointed wire towards the bladder, which never approached to the point, nor ever gave any ſpark, the electricity being carried off.

The Electric Fly.

EXPERIMENT 5. Fix a pointed wire in the hole on the upper ſide of the conductor, then place the center of the braſs croſs *b*, *fig.* 23, upon the point, the ends of which croſs are all bent one way; electrify the conductor, and the croſs will turn upon its center with great rapidity. If the room be darkened, a circle of light will be formed by the electric fluid on the points of the wires. The re-action of the air on the diverging cone of electric matter, gives the retrograde motion to the points of the wire. The fly turns round in the ſame direction, whether it is electrified negatively or poſitively; though it will not move in vacuo, unleſs the finger, or ſome other conductor, is applied to the glaſs receiver oppoſite to one of the points, it will then begin to move, and continue to do ſo briſkly till the glaſs is charged.

Fig. 24 repreſents a ſmall crane, which will move from the ſame cauſe as the foregoing, and raiſe a ſmall weight. Several flyers may be made to turn at the ſame time, and many other pleaſing experiments may be contrived on the ſame principle; or, the flyers may be placed one above another, as in *fig.* 23, diminiſhing gradually in ſize, and forming when electrified a luminous cone; the circles of light will be more brilliant, if the ends of the wires are covered with a thin coating of greaſe, ſealing-wax, or ſulphur.

Various Objects put in Motion by electrified Points.

EXPERIMENT 6. If ſmall boats or little ſwans, &c. are made of cork or light wood, they may be attracted, and made to ſwim in any direction, by applying a finger towards them; a fine needle ſtuck into the end of the boats, in the manner of a bowſprit, will cauſe them to be repelled from the hand held over it, and they may be ſteered by it, ſtern foremoſt, to what point of the compaſs you pleaſe. The boats might have the addition of ſails to them, and might then be made to move briſkly before an electrical gale, from the point of a wire held in the hand. The operator in theſe tricks would certainly be looked upon as a magician, if the electrical machine is kept out of ſight. But a more ſtriking ſight, would be a number of theſe boats, with each of them a twirling fly, about an inch in length, fixt to the top of the maſt; the hand held over them would ſet them all in motion: in the dark, they would appear as ſo many rings of fire, moving in various courſes, and following the hand in any direction.

When a few young perſons have nothing elſe to do, they might very innocently amuſe themſelves, by making a repreſentation of a kind of ſea-engagement between theſe boats. Suppoſing each of them large enough to hold a ſmall coated phial without ſinking, theſe phials may be charged, ſome of them poſitively on the inſide, others negatively; they may then be placed at the bow of the boat, with the wire ball and uncoated part of the phial projecting over; a ſmall braſs chain ſhould be made to touch the outward coating of the phial, and the other end brought over the ſtern of the boat, and hang ſo as to touch the water. The boats being then put into a trough of water, and pretty highly charged, they will ſoon be in motion; thoſe that are electrified alike, will repel each other; and thoſe poſſeſſed of a contrary electricity, will be attracted, till the balls of the two phials approach pretty near together; they will then diſcharge their contents with a loud exploſion, and the boats will afterwards ſheer from each other. Becket's Eſſay on Electricity, p. 36.

When the electric fluid percolates a wooden point, the ſtream or cone, which iſſues from it, ſeems diluted, and ſomething ſimilar to the purple electric light, which is obtained in vacuo. The action of the electric fluid on the air, by an electrified point, produces a ſenſible aura, or wind of ſufficient force, as is ſeen above, to put light bodies in motion, or diſturb the flame of a candle, and occaſion an undulation in the fluids: the action of the fluid is ſo modified by points, as to produce an agreeable ſenſation, reſembling a gentle breathing: this ſenſation may be rendered more or leſs ſtimulating, by the reſiſtance the fluid meets with in its action on our bodies, an effect which is productive of great advantages in medical electricity.

ARTICLE VI.

EXPERIMENTS AND OBSERVATIONS ON ATMOSPHERICAL ELECTRICITY, BY MR. CAVALLO.

Theſe were principally made with an electrical kite, which will collect electricity from the air at any time. The power of this inſtrument reſides in the ſtring. The beſt method of making the ſtring is by twiſting two threads of common twine with one of that copper thread which is uſed for trimming: a ſchoolboy's kite with this ſtring anſwers the purpoſe as well as any other. When a kite conſtructed in this manner was raiſed, Mr. Cavallo ſays he always obſerved the ſtring to give ſigns of electricity, except once; the weather was warm, and the wind ſo weak, that the kite was raiſed with difficulty, and could hardly be kept up for a few minutes: afterwards, when the wind increaſed, he obtained as uſual a ſtrong poſitive electricity. If this kite was raiſed at a time when there was any probability of danger from the great quantity of electricity, Mr. Cavallo connected one end of a chain with the ſtring, and let the other end fall on the ground, and placed himſelf alſo on an inſulating ſtool. Except the kite is raiſed in a thunder-ſtorm, there is no great danger that the operator will receive a ſhock. Although he raiſed his kite hundreds of times without any precaution whatever, he ſeldom received even a few ſlight ſhocks in the arms. But it is not adviſeable to raiſe it while ſtormy clouds are over head. This is alſo leſs neceſſary, as the electricity of the atmoſphere may then be eaſily obſerved by other means.

When the kite was raiſed, he often introduced the ſtring through a window into a room of the houſe, and faſtened it by a ſtrong ſilk lace to a heavy chair in the room. A ſmall prime conductor, which, by means of a ſmall wire, is connected with the ſtring of the kite; a quadrant electrometer is fixed upon an inſulating ſtand, and placed near the prime conductor; a glaſs tube about 18 inches long, a ball and a wire of braſs, are fixed to a glaſs tube. This ſmall inſtrument is uſeful to determine the quality of the electricity, when it is not ſafe to come near the ſtring. This is effected by touching the ſtring with the wire, which takes a ſufficient quantity from it to aſcertain thereby the quality of the electricity, either by the attraction and repulſion of light balls, or the appearances of the electric light: or it may be aſcertained by a Leyden phial, which will retain a charge for a conſiderable time; and then the kite need not be kept up any longer than is neceſſary to charge the phial, by which the quality will be ſhewn even at ſome days diſtance.

If a charged phial is carefully kept from any of thoſe means by which it is known to be diſcharged, it will retain its charge for a long time. On this principle the above-mentioned phial is conſtructed; the bottle is coated in the uſual manner; the uncoated part of the glaſs is covered with wax, or elſe well varniſhed; a glaſs tube, which is open at both ends, is cemented into the neck of this phial, having a piece of tin foil connected with its loweſt extremity, which touches the inſide non-electric coating. A glaſs handle is fixed to the ball on the wire which paſſes into a glaſs tube; the wire is of a proper length to touch the tin-foil which is at the bottom of the tube. Charge this bottle in the uſual manner, and then take out the wire from the glaſs tube by means of the glaſs handle. This may be done without diſcharging the phial; and, as the fire cannot now eſcape eaſily, the charge of a phial may be preſerved for many weeks.

Fig. 31 repreſents a very ſimple inſtrument (contrived by Mr. Cavallo) for making experiments on the electricity of the atmoſphere, and which, on ſeveral accounts, appears to be the beſt for the purpoſe. A B is a common jointed fiſhing rod, without the laſt or ſmalleſt joint: from the extremity of this rod proceeds a ſmall glaſs tube C, covered with ſealing wax, a cork D is fixed at the end of it, from which an electrometer with pith balls is ſuſpended. HGI is a piece of twine faſtened to the other extremity of the rod, and ſupported at G by a ſmall ſtring F G. At the end of the twine T a pin is faſtened, which, when puſhed into the cork D, renders the electrometer E uninſulated. When the electricity of the atmoſphere is obſerved with this inſtrument, thruſt the pin T into the cork D, and hold the rod by the lower end A; place it out of a window at the upper part of the houſe, raiſing the end of the rod with the electrometer, ſo as to make an angle of 50 or 60 degrees with the horizon. Keep the inſtrument in this ſituation for a few ſeconds, then pull the twine at H, and the pin will be diſengaged from the cork D; which operation cauſes the ſtring to drop in the dotted ſituation KL, and leaves the electrometer inſulated, and electrified with an electricity contrary to that of the atmoſphere. This being done, you may draw the electrometer into the room, and examine the quality of the electricity, without obſtruction either from wind or darkneſs.

Fig. 30 is an electrometer for rain, contrived by Mr. Cavallo. ABCT is a ſtrong glaſs tube, about two feet and a half long, having a tin funnel DE cemented to its extremity, which funnel defends part of the tube from the rain. The outſide ſurface of the tube from A to B is covered with ſealing-wax, and ſo is the part of it which is covered by the funnel. FD is a piece of cane, round which braſs wires are twiſted in different directions, ſo as to catch the rain eaſily, and at the ſame time to make no reſiſtance to the wind. This piece of cane is fixed into the tube, and a ſmall wire proceeding from it goes through the tube, and communicates with the ſtrong wire AG, which is thurſt into a piece of cork, faſtened to the end A of the tube. The end G of the wire AG is formed into a ring, from which a ſenſible pith ball electrometer is to be ſuſpended. This inſtrument is faſtened to the ſide of a window frame, where it is ſupported by ſtrong braſs hooks at CB; which part of the tube is covered with a ſilk lace, in order to adapt it better to the hooks. The part FL is out of the window, with the end F elevated a little above the horizon. The remaining part of the inſtrument comes through a hole in one of the lights in the ſaſh, within the room, and no more of it touches the ſide of the window than the part CB. When it rains, eſpecially in paſſing ſhowers, this inſtrument is frequently electrified; and by the divergence of the electrometer, the quantity and quality of the rain may be obſerved without any danger of a miſtake. With this inſtrument, in rainy weather, Mr. Cavallo has been able to charge a ſmall coated phial at the wire AG. It ſhould be fixed in ſuch a manner, that it may be eaſily taken off from the window, and replaced again, as occaſion requires; as it will be neceſſary to clean it often, particularly when a ſhower of rain is approaching.

Mr. De Sauſſure's Atmoſpherical Electrometer, with Experiments to illuſtrate its Effects.

The electrometer *fig.* 16, Plate 2, is nearly the ſame as that of Mr. Cavallo's; it may be uſed inſtead of the condenſer of M. Volta, by only placing it on a piece of oiled ſilk, ſomewhat larger than the baſe of the inſtrument; but in this caſe, it is the baſe, and not the top of the inſtrument, which muſt be brought into contact with the ſubſtance whoſe electricity is to be explored. The following are the moſt material circumſtances in which they differ; firſt, the fine wires, by which the balls are ſuſpended, ſhould not be long enough to reach the tinfoil which is paſted on the inſide of the glaſs, becauſe the electricity, when ſtrong, will cauſe them to touch this tinfoil twice conſecutively, and thus deprive them in a moment of their electricity. To prevent this defect, and yet give them a ſufficient degree of motion, it is neceſſary to uſe larger glaſſes than thoſe that are generally applied to Mr. Cavallo's Electrometer; two or three inches diameter will be found to anſwer the purpoſe very well. But as it is neceſſary to carry off the electricity which may be communicated to the inſide of the glaſs, and thus be confounded with that which belongs to thoſe ſubſtances that are under examination; four pieces of tinfoil ſhould be paſted on the inſide of the glaſs; the balls ſhould not be more than 1-20th of an inch diameter, ſuſpended by ſilver wire moving freely in holes nicely rounded. The bottom of the electrometer ſhould be of metal: for this renders it more eaſy to deprive them of any acquired electricity, by touching the bottom and top at the ſame time.

In order to collect a great quantity of electricity from the air, the electrometer is furniſhed with a pointed wire 15 inches, or two feet long, which unſcrews in three or four pieces, to render the inſtrument more portable; ſee *fig*. 16. When it rains or ſnows, a ſmall parapluie, is to be ſcrewed on the top of the inſtrument, as by this its inſulation is preſerved, notwithſtanding the rain. This inſtrument indicates not only the electricity of fogs, but that alſo of ſerene weather, and enables us to diſcover the kind of electricity which reigns in the atmoſphere; and to a certain degree, to form an eſtimate of its quantity, and that under two different points of view, the degree of intenſity, and the diſtance from the earth at which it firſt begins to be ſenſible.

Mr. Abraham Bennett's Atmoſpherical Electrometer with Experiments to illuſtrate its Effects.

Fig. 17, repreſents an improvement of the atmoſpherical electrometer, by Mr. Abraham Bennett, of Wirkſworth, Derbyſhire; it was tranſmitted to us by a very ingenious friend. The principal advantage of this little inſtrument, is the delicacy of the materials of which it is compoſed.

It conſiſts of two ſlips of leaf gold, which are paſted to the ſides of a peg, which fits into a ſmall tube, in the under ſide of the cap. The cap, or cover, is flat, in order that plates, books, or other articles, on which experiments are to be made, may be placed upon it. It has alſo a rim to keep off the rain, and maintain the inſulation, when it is uſed in the open air. There is a ſmall tube on one ſide of the cap, to fix wire or any other occaſional ſubſtance to; the pieces of leaf gold are about 3 inches long, and 1-5th of an inch broad. The cover may be taken off at pleaſure, to repair any accident happening to the leaf gold. The glaſs prevents the leaf gold from being agitated; two pieces of tinfoil are faſtened on oppoſite ſides of the internal ſurface of the glaſs, to prevent the glaſs from being charged, and thus interfering with the repulſion of the electrometer; therefore the cover ſhould be ſo turned, that the leaf gold may ſtrike againſt the tin-foil. The following experiment ſhews the great ſenſibility of this little inſtrument.

The ſenſibility of this inſtrument may be increaſed, by placing a candle upon the cap; by this means a cloud of chalk, which would but juſt open the leaf gold before, will cauſe them to ſtrike the ſides for a long time together, and the electricity is now communicated ſo ſtrong, that the leaves will be repelled by a ſtick of excited wax at 10 or 12 inches diſtance. A cloud of chalk made in one room will electrify this inſtrument, brought from another room, and at a conſiderable diſtance. Excited ſealing-wax will often make the leaf gold ſtrike the ſides of the glaſs more than 12 times; when the ſealing-wax recedes, it will ſtrike it again, nearly the ſame number of times; but if the approach is quicker than the receſſion, the number of times will ſometimes be greater. The quantity of electricity neceſſary to cauſe a repulſion of the leaf gold is ſo ſmall, that the ſharpeſt points or edges do not draw it off, unleſs they are brought into contact with it: hence it is unneceſſary to avoid points or edges in the conſtruction of this inſtrument. In ſome experiments, a candle may be connected at the ſame time by a wire with the upper part of the electrometer; and they increaſe the advantages to be obtained from it. When this apparatus is uſed, the operator muſt touch the metallic handle, and the electricity will enter by the candle, between the cap and upper plate; this being lifted up, the inſtrument will exhibit the electricity.

Of the Electric Properties of the Torpedo, Gymnotus Electricus, and Silurus Electricus.

The electric power, by the ancients obſerved only in amber, and perhaps in the tourmalin, was in proceſs of time found to be produced by glaſs, ſulphur, reſins, ſilk, and divers other bodies. It has been within theſe forty years that its great influence has been diſcovered in the atmoſphere; and not yet twenty five years ſince that power has been obſerved even in the animal kingdom. Three fiſhes have hitherto been diſcovered to have the ſingular property of giving ſhocks analogous to thoſe of artificial electricity, namely, the *torpedo*, the *gymnotus electricus*, and the *ſilurus electricus*.

The ancients indeed were acquainted with this wonderful property of the firſt, and probably of the laſt of thoſe animals, and it was from the property of giving that ſhock, benumbing ſenſation, or *torpor*, that they called the firſt *torpedo*; but they were utterly ignorant of the cauſe of it. Two diſtinguiſhed writers of the laſt century endeavoured to explain this property upon mechanical laws, but their ingenuity was inſufficient to anſwer for the phenomenon. The principal diſcoveries, relating to the identity of the abovementioned property of thoſe fiſhes and the electric ſhock, were made by John Walſh, Eſq. F. R. S. to whoſe ingenuity we are indebted for the demonſtration of the power of the torpedo agreeing with the electric ſhock in all the points of compariſon in which it could be examined; and alſo for almoſt all the other diſcoveries which were ſince made relating to animal electricity. The three animals which, whilſt alive, are poſſeſſed of an electric power, are belonging to three different orders of fiſh; and the few particulars, which they ſeem to have in common, are the power of giving the ſhock; an organ in their body, now called the electric organ, which is employed by the animals for the exertion of that power; a ſmooth ſkin without ſcales; and ſome ſpots here and there on the ſurface of their bodies.

1. *Torpedo.*

The torpedo, which belongs to the order of rays, is a flat fiſh, very ſeldom twenty inches in length, weighing not above a few pounds when full grown, and pretty common in various parts of the ſea-coaſt of Europe. The electric organs of this animal are two in number, and placed one on each ſide of the cranium and gills, reaching from thence to the ſemicircular cartilages of each great fin, and extending longitudinally from the anterior extremity of the animal to the tranſverſe cartilage which divides the thorax from the abdomen.

The magnitude and the number of the electric nerves beſtowed on organs, in proportion to their ſize, muſt on reflection appear as extraordinary as the phenomena they afford. Nerves are given to parts either for ſenſation or for action. Now if we except the more important ſenſes of ſeeing, hearing, ſmelling, and taſting, which do not belong to the electric organs, there is no part, even of the moſt perfect animal, which, in proportion to its ſize, is ſo liberally ſupplied with nerves; nor do the nerves ſeem neceſſary for any ſenſation which can be ſuppoſed to belong to the electric organs; and, with reſpect to action, there is no part of any animal, with which we are acquainted, however ſtrong and conſtant its natural actions may be, which has ſo great a proportion of nerves.

Thus far with the anatomical deſcription of the animal; we ſhall now proceed to deſcribe its wonderful electric properties. The above-deſcribed electric organs ſeem to be the only parts employed to produce the ſhock; the reſt of the animal appearing to be only the conductor of that ſhock, as parts adjacent to the electric organs; and in fact, by artificial electricity, it has been found that the animal is a conductor of the electric fluid. The two great lateral fins which bound the electric organs laterally, are the beſt conductors.

If the torpedo, whilſt ſtanding in water or out of the water, but not inſulated, be touched with one hand, it generally communicates a trembling motion or ſlight ſhock to the hand, but this ſenſation is only felt in the fingers of that hand. If the torpedo be touched with both hands at the ſame time, one hand being applied to its under, and the other to its upper ſurface, a ſhock in that caſe will be received, which is exactly like that occaſioned by the Leyden phial. When the hands touch the fiſh on the oppoſite ſurfaces, and juſt over the electric organs, then the ſhock is the ſtrongeſt; but if the hands are placed in other parts of the oppoſite ſurfaces, the ſhocks are ſomewhat weaker, and no ſhock at all felt when the hands are both placed upon the electric organs of the ſame ſurface; which ſhews that the upper and lower ſurfaces of the electric organs are in oppoſite ſtates of electricity, anſwering to the *plus* and *minus* ſides of a Leyden phial. When the fiſh is touched by both hands on the ſame ſurface, and the hands are not placed exactly on the electric organs, a ſhock though weak is ſtill received, but in that caſe the oppoſite power of the other ſurface of the animal ſeems to be conducted over the ſkin.

The ſhock given by the torpedo when the air is about four times as ſtrong as when in water; and when the animal is touched on both ſurfaces by the ſame hand, the thumb being applied to one ſurface, and the middle finger to the oppoſite ſurface, the ſhock is felt much ſtronger than when the circuit is formed by both hands. Sometimes the torpedo gives the ſhock ſo quickly one after the other as ſcarcely to elapſe two ſeconds between them; and when, inſtead of a ſtrong determined ſtroke, it communicates only a torpor, that ſenſation is juſtly attributed to the ſucceſſive and quick diſcharge of many conſecutive ſmall ſhocks. It is very ſingular, that the torpedo, even when inſulated, ſhould be capable of giving a great many ſhocks to perſons likewiſe inſulated. This power of the torpedo is conducted by the ſame ſubſtances which conduct electricity, and is interrupted by the ſame ſubſtances which are not conductors of electricity: hence if the animal, inſtead of being touched immediately with the hands, be touched by non-electrics, as wire, two wet cords, or other conductors of electricity, held in the hands of the experimenter, the ſhock will alſo be communicated through them. The circuit may alſo be formed by ſeveral perſons joining hands, and the ſhock will be felt by them all at the ſame time. When the animal is in water, if the hands are put in water, a ſhock will alſo be felt, which will be ſtronger if one of the hands be brought quite into contact with the fiſh, whilſt the other hand is kept in the water at a diſtance from it. In ſhort, the ſhock of this animal is conducted by the ſame conductors which conduct that of a Leyden phial. This ſhock of the torpedo may be alſo be conducted by ſeveral circuits at once, and the circuit may be conſiderably extended; but the ſhock is always weakened by lengthening or multiplying the circuit

The ſhock of the torpedo cannot paſs through the leaſt interruption of continuity in the conductors which form the circuit; ſo that it will not be conducted by a chain, nor will it paſs through the air from one conductor to the other, when the diſtance between them is leſs than the two hundredth part of an inch; conſequently no ſpark has ever been obſerved to accompany it. No electric attraction or repulſion could be ever obſerved to be produced by the torpedo, nor, indeed, by any of the electric fiſhes; though ſeveral experiments have been purpoſely made with them. Theſe ſhocks of the torpedo ſeem to depend on the will of the animal; for each effort is accompanied with a depreſſion of his eyes, by which even his attempts to give it to non-conductors may be obſerved. It is not known whether both electric organs muſt always act together, or only one of them may be occaſionally put in action by the will of the animal. All theſe effects of the torpedo may be imitated by means of a large electric battery weakly charged, and furniſhed with Mr. Lane's Electrometer, *fig.* 4, Plate I, the balls of which muſt be put exceedingly near, or almoſt in contact with each other. But the properties of the gymnotus electricus, which we are going to deſcribe next, will throw more light on thoſe of the torpedo, and will ſhew much more evidently their analogy with the power of the electric fluid diſperſed through a vaſt ſurface of coated electric ſubſtance. "But," ſays Mr. Walſh, "after the diſcovery that a large area of rare electricity would imitate the effect of the torpedo, it may be inquired, where is this large area to be found in the animal? We here approach to that veil of nature, which man cannot remove. This, however, we know, that from infinite diviſion of parts infinite ſurface may ariſe, and even our groſs optics tell us, that thoſe ſingular organs, ſo often mentioned, conſiſt, like our electric batteries, of many veſſels, call them cylinders or hexagonal priſms, whoſe ſuperficies taken together furniſh a conſiderable area."

2. *The Gymnotus Electricus.*

The gymnotus electricus has been frequently called electrical eel, on account of its ſuperficial reſemblance to the common eel; though, when accurately examined, it is found to have none of the ſpecific properties of that animal. The gymnotus is found pretty frequently in the great rivers of South America. Its uſual length is about three feet; but it has been ſaid ſome of them have been ſo large, as to be able to ſtrike a man dead with the ſhock of their electric organs. A few of theſe animals were brought to England about ten years ago, which, as far as we know, were the firſt of the kind brought to Europe. They had been catched in Surinam river, a great way above where the ſalt-water reaches. It was with thoſe identical fiſhes that Mr. Walſh made many diſcoveries relating to their electrical properties, and the experiments which ſhew thoſe properties were publicly exhibited in London, during ſeveral months. The ſubject of animal electricity was conſiderably advanced by the diſcovery of the ſpark, with which the ſhock of the gymnotus was attended; for, notwithſtanding the previous diſcoveries relating to the torpedo, and the actual poſſibility of imitating the effects of that animal's extraordinary power by means of a large battery weakly charged with artificial electricity, yet the ſcrupulous philoſophers ſtill ſuſpected that the power of the torpedo might be ſomething different from electricity, ſince the two principal characteriſtics of electricity, namely the ſpark and the attraction, had never been diſcovered in the torpedo; and at the ſame time it was difficult to conceive the manner in which the electric fluid might be generated, accumulated, and diſcharged in an animal, which, at leaſt in its uſual ſtate of exiſtence, is a conductor of electricity, and is ſurrounded by a fluid which is likewiſe a conductor of that power. This indeed ſtill remains a profound ſecret; and it is difficult to ſay, whether any future experiments will ever diſcloſe it. But the ſpark having been diſcovered with the gymnotus, the analogy between its power and electricity is rendered conſiderably more evident, and it would be ſcepticiſm to doubt, of the property of the torpedo being derived from the ſame cauſe as that of the gymnotus. In order to proceed regularly, we ſhall now begin with the deſcription of the animal, and ſhall then enumerate its electric properties, in a very conciſe manner.

A gymnotus of three feet length, is generally between ten and fourteen inches in circumference, about the thickeſt part of its body. The electric power of this animal being much greater than that of the torpedo, its electric organs are accordingly a great deal larger, and indeed that part of its body which contains moſt of the animal parts, or the parts common to the ſame order of fiſhes, is conſiderably ſmaller than that which is ſubſervient to the electric power; though the latter muſt naturally derive nouriſhment and action from the former.

This animal has two pair of electric organs, one pair being larger than the other, and occupying moſt of the longitudinal parts of the body. They are divided from each other by peculiar membranes. "The ſtructure of theſe organs is extremely ſimple and regular, conſiſting of two parts, viz. flat partitions or ſepta, and croſs diviſions between them. The outer edges of theſe ſepta appear externally in parallel lines nearly in the direction of the longitudinal axis of the body. Theſe ſepta are thin membranes placed nearly parallel to one another: their lengths are nearly in the direction of the long axis, and their breadth is nearly the ſemidiameter of the body of the animal. They are of different lengths, ſome being as long as the whole organ. The nerves which go to the electric organs of the gymnotus, as well as of the torpedo, are much larger than thoſe which ſupply any other part of the body. The electric organs of the gymnotus are ſupplied with nerves from the ſpinal marrow, and they come out in pairs between the vertebræ of the ſpine.

The gymnotus poſſeſſes all the electric properties of the torpedo, but in a ſuperior degree. His ſhock is conducted by the conductors of electricity, and interrupted by the non-conductors of the electric fluid. Hence the ſhock is communicated through water, without the immediate contact of the animal, or through any other proper circuit; but the ſtronger ſhock is received by touching the animal when out of the water; and the beſt way to receive ſtrong ſhocks, is to apply one hand towards the tail, and the other towards the head of the animal. In this manner ſhocks have been felt not only in the arms, but even very forcibly in the breaſt. If the animal be touched only with one hand, then a kind of tremor is felt only in that hand, which though ſtronger, is quite analogous to the ſenſation communicated by the torpedo when touched in the like manner. The gymnotus's power of giving ſhocks is alſo depending on the will of the animal, ſo that ſometimes he gives very ſtrong ſhocks, and at other times very weak ones, but he gives the ſtrongeſt ſhocks when provoked by being frequently and roughly touched.

When ſmall fiſhes are put into the water wherein the gymnotus is kept, they are generally ſtunned or killed by a ſhock, and then they are ſwallowed, if the animal is hungry. The fiſhes which are ſtunned by the gymnotus may often be recovered by being ſpeedily removed into another veſſel of water. The ſtrongeſt ſhocks of the gymnotus will paſs a very ſhort interruption of continuity in the circuit. Thus they will be conducted by a chain, eſpecially when it is not very long, and is ſtretched, ſo as to bring its links into better contact. When the interruption is formed by the inciſion made by a pen-knife on a ſlip of tin-foil that is paſted on glaſs, and that ſlip is put into the circuit, the ſhock in paſſing through that interruption will ſhew a ſmall but vivid ſpark, plainly diſtinguiſhable in a dark room. Several other particulars, not only concurring to prove the above-mentioned property, but otherwiſe intereſting, were aſcertained by Mr. Walſh; but for theſe we muſt wait till that ingenious gentleman will favour the public with a particular account of his reſearches.

3. *The Silurus Electricus.*

This is the third fiſh which is known to have the power of giving the ſhock; it is found in the rivers of Africa, but we have a very imperfect account of its properties. Meſſrs. Adanſon and Forſkal, make a ſhort mention of it, and Mr. Brouſſonet deſcribes it, under the French name of *le Trembleur*, in the Hiſt. de l'Academie Royale des Sciences, for the year 1782. This animal belongs to the order which the naturaliſts call *ſilurus*; hence it is commonly called *ſilurus electricus*. Some of thoſe fiſhes have been ſeen even above twenty inches long. The ſilurus electricus is oblong, ſmooth, and without ſcales; being rather large, and flattened towards its anterior part. The colour of the body is greyiſh, and towards the tail it has ſome blackiſh ſpots.

The electric organ ſeems to be towards the tail, where the ſkin is thicker than on the reſt of the body, and a whitiſh fibrous ſubſtance, which is probably the electric organ, has been diſtinguiſhed under it. It is ſaid that the ſilurus electricus has the property of giving a ſhock or benumbing ſenſation like the torpedo, and that this ſhock is communicated through ſubſtances that are conductors of electricity; but no other particular about it is known with any conſiderable degree of certainty. An inquiſitive mind will immediately enquire, for what purpoſe has nature furniſhed thoſe animals with ſo ſingular a property? But the preſent knowledge of the ſubject ſeems to furniſh no other anſwer, except, that they are endowed with the power of giving the ſhock for the ſake of ſecuring their prey, by which they muſt ſubſiſt, and perhaps of repelling larger animals, which might otherwiſe annoy them. The ancients conſidered the ſhocks given by the torpedo as capable of curing various diſorders; and a modern philoſopher will hardly heſitate to believe their aſſertions, after that electricity has been found to be a remedy for many diſeaſes.

As Medical Electricity relates rather to the cure of diſorders than the explanation or elucidation of its ſeveral properties; and as I never practiſed Electricity medicinally, have reſigned it to the gentleman who is engaged to compoſe the Syſtem of Medicine, a taſk to which, from the nature of his profeſſion and his knowledge of the ſubject, he is far more competent than I am.

In forming this Syſtem, I have made ſeveral extracts from Mr. Cavallo's *learned and ingenious Treatiſe, but more particularly from Mr.* Adams's Practical Eſſay, *and acknowledge myſelf indebted to that work for the principal part of the entertaining experiments I have ſelected. I wiſhed to introduce many more from the ſame valuable collection; but as they would have far exceeded the œconomy of our plan, I have been under the neceſſity of omitting them.*

Thoſe who are inclined to enter more fully into an inveſtigation of the ſcience, I ſhall refer to Cavallo *and* Adams. *With reſpect to the apparatus uſed in performing the various experiments, the reader may ſelect ſuch as he thinks will beſt anſwer his purpoſe from Mr.* Adams's Catalogue, *affixed to No.* 66, *of this Work, with the price annexed to each article. As to the ſeveral uſes and applications of the Apparatus, Mr.* Adams *will moſt readily communicate any information that may be required.*

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ELECTUARY, in pharmacy, a form of medicine, compoſed of powders and other ingredients, incorporated with ſome conſerve, honey, or ſyrup; to be divided into doſes, like boluſes, when taken.

ELEEMOSYNÆ is uſed for the poſſeſſions belonging to churches. See ALMS.

ELEEMOSYNARIUS, in our old writers, is uſed for the almoner, or peculiar officer who received the eleemoſynary rents and gifts, and diſtributed them to pious and charitable uſes. There was ſuch an officer in all religious houſes. The biſhops alſo uſed to have their almoners, as now the king has. Linn. Provinc. Lib. i. tit. 12. See alſo Du-Cange, Gloſſ. Lat.

ELEEMOSYNARY *Corporations*. See CORPORATIONS.

ELEGANCE, ELEGANCY, from *eligo, I chuſe*, denotes a manner of doing, or ſaying things politely, agreeably, and with choice. With choice, ſo as to riſe above the common manners; politely, ſo as to ſtrike people of delicate taſte; and agreeably, ſo as to diffuſe a reliſh which gratifies every body.

ELEGANCE, in oratory, is one of the three parts of general elocution, and reſpects the purity and perſpicuity of the language. By the former a diſcourſe is rendered correct, and by the latter intelligible; and both extend to the ſelection of ſingle words, as well as to their conſtruction in ſentences. See Treatiſe on the Art of ORATORY.

Poetical elegancies, *elegantiæ poeticæ*, are of ſervice to ſcholars in making their verſes; by being too regular in the grammatical conſtruction, we loſe certain licences, wherein the elegance of language conſiſts. Elegance, though irregular, is better than regularity without elegance. The elegance of a painting is not founded on the correctneſs of the deſign, as appears in Raphael, and the antique. It is moſt felt in works otherwiſe careleſs and inaccurate; as in Correggio, where, in ſpite of all the defects as to juſtneſs of deſign, there is an elegance even in the manner of the deſign itſelf, as well as in the turn of the attitudes, &c. The elegance of a deſign is a manner which embelliſhes and heightens objects, either as to their form, or colour, or both; without deſtroying or perverting the truth.

ELEGIAC, in ancient poetry, ſomething that belongs to elegy. Elegiac verſes, Ελεγοι, are alternately hexameter, and pentameter. Quintilian eſteems Tibullus the chief of the elegiac poets; but the younger Pliny gives the preference to Propertius. They have each of them reaſon on their ſide; and one might make a third choice, as juſt as either of them. See ELEGY.

ELEGY, Ελεγεια, a mournful, and plaintive kind of poem. Voſſius, after Didymus, derives the term from ἒ, ἒ, λεγειν, *to ſay alas!* The firſt inventor of the elegy is not known: ſome ſay it was one Theocles of Naxus, or, according to others, of Eretria, who, in the heat of his phrenſy, firſt produced this kind of compoſition. But there is no wonder that we are at this time in the dark as to the matter; Horace aſſures us it was a point not ſettled among the grammarians, even in his time, who the author was.

> *Quis tamen exiguos* elegos *emiſerit auctor,*
> *Grammatici certant, & adhuc ſub judice lis eſt.*

The chief writers of elegy among the Greeks, are Callimachus, Parthenius, and Euphorion; and among the Latins, Ovid, Catullus, Tibullus, and Propertius. The Flemiſh have diſtinguiſhed themſelves among the moderns for this kind of Latin verſe. The elegies of Bidermann, Grotius, and eſpecially Sedronius and Vallius, ſeem worthy of the pureſt antiquity. The counteſs de la Suze has diſtinguiſhed herſelf for elegies in the French tongue. In the Engliſh, we have nothing conſiderable of the elegiac kind, but what we have in Milton. The Engliſh and French elegies are chiefly in Alexandrine verſes. In proceſs of time, elegy degenerated from its original intention; and not only matters of grief, but alſo joy, wiſhes, prayers, expoſtulations, reproaches, and almoſt every ſubject, were admitted into elegy. The office of elegy is well delivered by M. Boileau.

> *La plaintive elegie en long habits de deuil,*
> *Sçait, les cheveux epars, gemir ſur un cercueil:*
> *Elle peint des aimans la joye, & la triſteſſe;*
> *Flate, menace, irrite, appaiſe une maîtreſſe.*
>
> In mourning weeds ſad elegy appears,
> Her hair diſhevell'd, and her eyes in tears:
> Her theme, the lover's joys, but more his pains;
> By turns ſhe ſighs, ſooths, threatens, and complains.

The diction of elegy ought to be eaſy, perſpicuous, expreſſive of the manners, tender, and pathetic; not oppreſſed with ſentences, points, &c. No apoſtrophes are allowed; and the ſenſe ought to be generally cloſed in every diſtich, or two lines; at leaſt, in Latin compoſitions.

ELEMENTARY, ſomething that relates to the principles or elements of bodies. The elements of a body are alſo called the elementary principles thereof.

ELEMENT, a term uſed by philoſophers to denote the original component parts of bodies, or thoſe into which they are ultimately reſolveable. Some of the ancients repreſented the elements as corruptible, and ſome as incorruptible. Thoſe who maintained the incorruptibility of the elements, ſuppoſed them to be atoms, i. e. bodies which could not be divided, or broke into pieces. Of this opinion were Democritus, Epicurus, &c. Among thoſe who held the elements to be corruptible, ſome reckoned there was but one, and ſome that there were ſeveral elements. Heraclitus held fire, Anaximenes air, Thales Mileſius water, and Heſiod earth, to be the only element. The Peripatetics contended for four elements, fire, air, earth, and water. Some of theſe philoſophers conſidered only the ſenſible properties of bodies, ſuch as pellucidity and opacity, to be elements. Of this number Ariſtotle himſelf is ſaid to have been. For, conſidering the four principal qualities that fall under the ſenſe of touch, he made four elements: the firſt, cold and dry; the ſecond, cold and moiſt; the third, hot and moiſt; and the fourth, hot and dry. To give names to theſe elements, he inquired in what things theſe qualities were found chiefly to prevail. Accordingly, taking earth to be the coldeſt, and at the ſame time the drieſt, of all things, he called the firſt element earth. Water being the coldeſt and moiſteſt of all things, he called his ſecond element water; and imagining air to be the hotteſt and moiſteſt of all things, he called his third element air. Laſtly, fire being the hotteſt and drieſt of all things, he called his fourth element fire.

Succeeding philoſophers have differed greatly in their opinions; ſome adopting the Epicurean or atomical hypotheſis, and ſome the Ariſtotelian. It is, however, eaſy to ſee, that the queſtion concerning elements can never be ſolved. If we embrace the atomical ſyſtem, we muſt be conſcious that we know not what an atom is. We can have no idea of a body that doth not conſiſt of parts, and conſequently which cannot be made leſs than it is. If we adopt the notion of infinite diviſibility, or, which is much the ſame, of the Ariſtotelian qualities, we ſhall find ourſelves equally embarraſſed. Some have imagined that there are two diſtinct elements, which they call the celeſtial and terreſtrial matter. Both theſe they conſider as made up of atoms; but they ſuppoſe the atoms of the firſt to be active, and of the ſecond paſſive. It is difficult, however, to maintain this hypotheſis without allowing one kind of atoms to be animated. Certain it is, that we ſee one part of matter in many caſes acting upon, and giving motion to, another; but whether the matter which is paſſive in one caſe doth not become active in another, is a thing not eaſy to be determined. The utmoſt that can be ſaid upon the ſubject ſeems to be, that as long as matter is ſubject to our eye-ſight and other ſenſes, we can talk intelligibly about it; but when its parts become too ſmall to be obſerved by them, we are then totally in the dark.

ELEMENTS, in chymiſtry, are the principles, or component parts, of natural bodies, into which they are reſolveable by fire, &c. The effect of chymiſtry is, to analyſe or reſolve bodies into their elements. The chymical elements, are divided into active and paſſive. The chymiſts are ſomewhat divided as to their elements. The elements of foſſils are, 1. Mercury, as the baſe. 2. Sulphur, as the coagulator, or binder. 3. Salt. 4. Earth. The elements of metals are ſulphur and mercury alone; mercury as the baſe, or matter, and ſulphur as the binder or cement. The elements of foſſil ſalts are an acid ſpirit, and inſipid earth. The elements of earths are an oil, a little acid ſalt, and a calx. The elements of ſulphurs are an acid ſpirit, an oil, and an earthy or metallic matter. See Syſtem of CHYMISTRY, Part I. Sect. I. and II.

ELEMENTS are uſed, figuratively, for the grounds and principles of arts and ſciences. Thus we ſay, letters are the elements of ſpeech: he does not know the firſt elements of grammar. The elements of mathematics have been delivered by ſeveral authors in their courſes, ſyſtems, &c. The elements of Euclid are the firſt and beſt ſyſtem of geometry. We have abundance of editions, and comments on the fifteen books of Euclid's Elements.

ELEMENTS, in the higher geometry, are the infinitely ſmall parts, or differentials, of a right line, curve, ſurface, or ſolid. See Syſtem of GEOMETRY.

ELEMENTS, in aſtronomy, are thoſe principles deduced from aſtronomical obſervations and calculations, and thoſe fundamental numbers, which are employed in the conſtruction of tables of the planetary motions. Thus, the elements of the theory of the ſun, or rather of the earth, are his motion and eccentricity, and the motion of the aphelia. The elements of the theory of the moon are its mean motion, that of its node and apogee, its eccentricity, the inclination of its orbit to the plane of the ecliptic, &c. See Syſtem of ASTRONOMY, Sect. VII.

ELEPHANT, the Engliſh name of the genus elephas, in the Linnæan ſyſtem. For a deſcription of the different ſpecies of this genus, ſee ELEPHAS. For the claſſification, ſee MAMMALIA.

ELEPHANT *Beetle*, the Engliſh name of a ſpecies of the genus Scarabæus, in the Linnæan ſyſtem. For a deſcription of the different ſpecies of this genus, ſee SCARABÆUS. For the claſſification, ſee Syſtem of ENTOMOLOGY.

American ELEPHANT; an animal only known in a foſſile ſtate, and that but partially, from the teeth, ſome of the jaw bones, the thigh bones, and vertebræ, found with many others five or ſix feet beneath the ſurface on the banks of the Ohio. But theſe bones differ in ſeveral reſpects from thoſe of the elephant. As yet the living animal has evaded our ſearch. Mr. Pennant thinks it "more than probable, that it ſtill exiſts in ſome of thoſe remote parts of the vaſt new continent unpenetrated yet by Europeans. Providence maintains and continues every created ſpecies; and we have as much aſſurance that no race of animals will any more ceaſe while the earth remaineth, than *ſeed time and harveſt, cold and heat, ſummer and winter, day or night.*"

Knights of the ELEPHANT, an order of knighthood in Denmark, conferred upon none but perſons of the firſt quality and merit. It is alſo called the order of St. Mary. Its inſtitution is ſaid to have been owing to a gentleman among the Daniſh croiſes having killed an elephant, in an expedition againſt the Saracens, in 1184; in memory of which, king Canutus inſtituted this order, the badge of which is a towered elephant, with an image of the holy virgin encircled with rays, and hung on a watered ſky-coloured ribbon, like the George in England.

ELEPHANTIASIS, in medicine, a kind of leproſy, called alſo *lepra arabum*, in contradiſtinction to the *lepra græcorum*, which is another diſeaſe. The elephantiaſis is thus denominated, becauſe thoſe ſeized therewith have their arms and legs big, ſwollen, and tumorous; the ſkin bloated, yet rough to the touch, and all wrinkled and rugoſe like the ſkin of an elephant. The elephantiaſis is a diſeaſe unknown in our parts of the world, at leaſt in theſe days.

ELEPHANTINE, ſomething that relates to or partakes of the qualities of elephants. The term is chiefly applied to certain books of the ancient Romans, wherein were recorded the tranſactions of the emperors, and the proceedings, acts, &c. of the ſenate. They are ſuppoſed to have been ſo called, as being made of ivory; though ſome will have them to have been written on the inteſtines of elephants.

ELEPHAS, or the ELEPHANT, a genus of quadrupeds belonging to the order of bruta. The characters are theſe: the elephant has no ſore-teeth in either jaw, and the dog-teeth are very long: the proboſcis, or trunk, is long, and capable of laying hold of any thing; and the body is ſomewhat naked.

The elephant is the largeſt of all land-animals. From the front to the origin of the tail he is generally about 16 feet long, from the end of the trunk 25 feet, and about 14 feet high. The circumference of the neck is 17 feet, and the circumference of the body at the groſſeſt part 25 feet 10 inches; the tail is about 6 feet long, and 2½ in circumference. The circumference of the legs is about 6 feet. The trunk is, properly ſpeaking, the noſe extended, and terminated by a couple of noſtrils. But, beſides ſerving as an organ of ſmell, the trunk performs all the functions of a ſtrong and dexterous arm. The trunk of an elephant is about 8 feet long, 5½ feet in circumference near the mouth, and one foot and a half near the extremity: it is a pipe of an irregular conical figure, and widened at the end.

The elephant can move the trunk in all directions; he can extend or ſhorten it at pleaſure, without altering the diameters of the two canals within. At the extremity of the trunk there is a concave protuberance, in the bottom of which are the two paſſages of the noſtrils. The inferior part of the protuberance is thicker than the ſides, and the ſuperior part is ſtretched out like a finger about five inches long; which, together with the edges of the whole extremity of the trunk, takes on different figures according to the neceſſities of the animal. It is by this organ that the animal lays hold of food, or other ſubſtances; which he manages with as much dexterity as a man does his hand, taking up grains of corn, or the ſmalleſt piles of graſs, and conveying them to his mouth. When he drinks, he thruſts his trunk into the water, and fills it by drawing in his breath, and exhauſting the air: when the trunk is thus filled with water, he can either throw it out to a great diſtance, or drink it by putting the end of the trunk in his mouth. The two large tuſks, which ſome call the horns of the elephant, are of a yellowiſh colour, and extremely hard. The bony ſubſtance of which they are compoſed is known by the name of ivory, and much uſed in different branches of manufacture. The female has two dugs, one on each ſide of the breaſt. The parts of generation are ſmall in proportion to thoſe of other animals. The penis reſembles that of a horſe. The female organ is ſituated near the middle of the belly, more than two feet diſtant from the uſual ſituation in other quadrupeds: when they copulate, the female lies down on her back.

Elephants, even in a ſavage ſtate, are peaceable and gentle creatures. They never uſe their weapons but in defence of themſelves or companions. Their ſocial diſpoſitions are ſo ſtrong, that they are ſeldom found alone, but march always in large troops: the oldeſt and moſt experienced lead the van; the younger, or lame ones, keep in the middle; and thoſe of a ſecond rate, as to age, walk in the rear. The females carry their young on their tuſks, embracing them at the ſame time with their trunk. They ſeldom march in this regular order but when they reckon the journey dangerous, ſuch as an expedition to cultivated lands, where they expect to meet with reſiſtance. On other occaſions they are leſs cautious; ſome of them falling behind or ſeparating from the reſt, but ſeldom ſo far as to be without the reach of aſſiſtance by alarming and aſſembling their companions. It is only theſe wanderers that the hunters dare attack: for it would require a whole army to aſſail a troop of them; and even an army would be unable to conquer them without loſing a number of lives. It is dangerous to offer them the leaſt injury: for they run ſtraight upon the offender; and, although the weight of their body be great, their ſteps are ſo large, that they eaſily outrun the ſwifteſt man, whom they either pierce with their tuſks, or ſeize with their trunk, dart him in the air like a ſtone, and then trample him under their feet. But they never attack any perſon, unleſs when provoked. However, as they are extremely ſenſible and delicate with regard to injuries, it is always prudent to keep out of their way. Travellers who frequent theſe countries kindle large fires, and beat drums during the night, in order to prevent their approach. After being once attacked by men, or falling into any ambuſh, they are ſaid never to forget the injury, but ſearch for every opportunity of getting revenge. As they are endowed perhaps with a more exquiſite ſenſation of ſmell than any other animal, owing to the great extent of their noſe, they can ſcent a man at a very great diſtance, and trace him by his footſteps.

The ordinary food of elephants is roots, herbs, leaves, the tender branches of trees, fruits, and grains: but they abhor fleſh or fiſh. When any of them diſcovers a fine paſture, he immediately calls and invites his companions to come and eat with him. As they devour a large quantity of food in a ſhort time, they are always ſhifting their paſture; when they meet with cultivated grounds, they make a prodigious deſolation and deſtroy more plants by their feet than they uſe for nouriſhment; which laſt is very conſiderable, amounting to 150 pounds of herbage every day: by this means, as they conſtantly graze in large troops, they lay waſte whole fields in an hour. The Indians and negroes employ every art to prevent them from viſiting their cultivated lands, making great noiſes, and burning large fires round their fields. However, theſe precautions are not always ſufficient to prevent the elephants from viſiting them. They chaſe away the domeſtic animals, put the men to flight, and ſometimes even throw down their limber huts. Elephants are hardly ſuſceptible of fear; the only things which can ſurpriſe them, or ſtop their courſe, are artificial fires, ſuch as ſquibs, crackers, &c. the effects of which are ſo ſudden and ſo quickly repeated, that the elephants frequently turn back; and when one runs, all the reſt inſtantly follow his example.

Although the ſocial diſpoſition in the elephant be exceeding ſtrong; yet whenever the females come in ſeaſon, it immediately gives place to the ſtronger and more intereſting paſſion of love. They obſerve the greateſt delicacy in their amours, abhorring nothing ſo much as to be ſeen by their companions. The troop divide themſelves into couples, ſteal off into the moſt ſecret places of the foreſt, and then give way to all the impulſes of nature, which are lively and laſting in proportion to the long period of abſtinence; for the female goes with young two years, and it is only once in three years that the ſeaſon of love returns. They bring forth but one at a time; which as ſoon as it comes into the world, is as large as a wild boar, and is furniſhed with teeth; however, the large tuſks do not make their appearance till ſome time after, and at the age of ſix months they are ſeveral inches long. Elephants of this age are as large as an ox, when in a natural ſtate. But it is incredible how they degenerate when inſlaved and under the management of men. Their diſguſt and chagrin for the loſs of liberty ſeems never to depart from their minds. In this ſtate, though they feel, at the proper ſeaſons, the ſtrongeſt deſires for the ſex, no art can allure them to copulate: but the natural paſſion, reſtrained by an exceſs of modeſty, burſts out into ſuch violent fits of fury and reſentment, that the ſtrongeſt chains are hardly ſufficient to command them. This is a ſtriking difference betwixt the elephant and moſt other tamed animals. It is only the individual that we can enſlave; the ſpecies, in ſpite of all our endeavours, ſtill retain their original freedom and independence.

The manner of taking and taming elephants, therefore merits our attention. In foreſts and ſuch places as are frequented by elephants, the Indians chooſe a ſpot and incloſe it with ſtrong palliſades. The guide then makes the female proceed towards the artificial incloſure, repeating her cries from time to time as ſhe goes along. She enters into the incloſure, the male follows her, and the Indians immediately ſhut the port behind him. He no ſooner diſcovers the hunters, and that he is incloſed, than his paſſion for the ſex is converted into rage and fury. The hunters entangle him with ſtrong ropes; they fetter his legs and trunk; they bring two or three tame elephants in order to pacify and reconcile him to his condition. In a word, they reduce him to obedience in a few days, by a proper application of torture and careſſes. There are many other methods of catching elephants. Inſtead of making large incloſures with palliſades, like the kings of Siam, and other monarchs, the poor Indians content themſelves with a very ſimple apparatus: they dig deep pits in the roads frequented by elephants, covering them over with branches of trees, turf, &c. When an elephant falls into one of theſe pits, he is unable to get out again. The elephant, when tamed, is the moſt friendly and obedient of all animals; he is entirely attached to the perſon who feeds and takes care of him. In a ſhort time he underſtands ſigns, and the ſound of his maſter's voice. He diſtinguiſhes the language of paſſion, of command, of ſatisfaction; and acts accordingly. He receives his orders with attention, and executes them with prudence and alacrity, but without precipitation. He eaſily learns to bow his knees and lower his body, for the convenience of thoſe who mount him. He careſſes his friends with his trunk. He lifts burdens with his trunk, and aſſiſts thoſe who are loading him in laying them on his back. He delights in ſhining harneſs and trappings. When yoked in a cart or waggon, he pulls equally and cheerfully, unleſs he be abuſed by injudicious chaſtiſements. His guide is generally mounted on his neck, with a ſmall rod of iron ſharp at the point in his hand; he directs his motion by pricking him on the ears and head; but, for the moſt part, a word is ſufficient.

A tame elephant will do more labour than ſix horſes: but then he requires a proportional quantity of food. They are the principal beaſts of burden in many parts of Africa and the Eaſt Indies. They carry ſacks and bundles of all kinds on their neck, back, and tuſks. They never loſe or damage any thing committed to their care; they will ſtand on the edge of a river, take bundles off their necks and tuſks, lay them carefully in a boat wherever they are deſired, and try with their trunk whether they are properly ſituated; if they be loaded with caſks, they go in queſt of ſtones to prop them and prevent them from rolling. The elephant is not only the moſt tractable, but the moſt intelligent, of animals; ſenſible of benefits, reſentful of injuries, and endowed even with a ſenſe of glory. In Delli, an elephant paſſing along the ſtreets, put his trunk into a taylor's ſhop, where ſeveral people were at work; one of them pricked the end with his needle: the beaſt paſſed on: but in the next dirty puddle filled his trunk with water, returned to the ſhop, and ſpurting every drop among the people who had offended him, ſpoilt their work. At the Cape of Good-Hope, it is cuſtomary to kill thoſe animals, for the ſake of their teeth, by the chace. Three horſemen, well-mounted and armed with lances, attack the elephant alternately, each relieving the other as they ſee their companion preſſed, till the beaſt is ſubdued. Three Dutchmen (brothers), who had made large fortunes by this buſineſs, determined to retire to Europe, and enjoy the fruits of their labours; but reſolved, before they went, to have a laſt chaſe by way of amuſement; they met with their game, and began the attack in the uſual manner; but unfortunately one of their horſes fell down and flung it's rider; the enraged animal inſtantly ſeized the unhappy man with its trunk, flung him up to a vaſt height in the air, and received him on one of it's tuſks; then turning towards the two other brethren, as if it were with an aſpect of revenge and inſult, held out to them the impaled wretch wreathing on the bloody tooth.

From the earlieſt accounts in hiſtory, the eaſtern nations have employed elephants in war; Alexander the Great was the firſt European who ever mounted an elephant. He carried a number of them into Greece, which Pyrrhus employed ſome years after againſt the Romans at the battle of Tarentum. Both the Greeks and Romans ſoon learnt to get the better of theſe monſtrous animals: they opened their ranks and allowed them to paſs through; neither did they attempt to hurt them, but threw darts, &c. at their guides. Now that fire arms are the principal inſtruments of war, elephants, who are terrified at the noiſe and flame, inſtead of being uſeful, would only tend to embarraſs and confuſe an army. However, in Cochin and other parts of Malabar, as alſo in Tonquin, Siam, and Pegu, where fire arms are little underſtood, they are ſtill uſed in battle. The guide ſits aſtride upon the neck, and the combatants ſit or ſtand upon the other parts of the body.

When the elephant is properly managed, he lives very long even in a ſtate of ſlavery and labour. That ſome have lived in this ſtate 130 years, is pretty well authenticated. In a natural ſtate, they often exceed 200 years, and propagate their ſpecies till they are 120: it is 30 years before they come to their full growth. The elephant inhabits India, and ſome of its greater iſlands, Cochin China, and ſome of the provinces of China. It abounds in the ſouthern parts of Africa, from the river Senegal to the Cape; and from thence as high as Ethiopia on the other ſide. They are found in the greateſt numbers in the interior parts, where there are vaſt foreſts, near the ſides of rivers. They are not at preſent domeſticated in Africa, but only in the more civilized parts of Aſia. They are much more numerous in Africa. In ſome parts they ſwarm ſo, that the Negroes are obliged to make their habitations under ground for fear of them. They are killed and eaten by the natives, and the trunk is ſaid to be a delicious morſel. All the teeth are brought from Africa: they are frequently picked up in the woods; ſo that it is uncertain whether they are ſhed teeth, or thoſe of dead animals. The African teeth which come from Moſambique, are 10 feet long; thoſe of Malabar only three or four; the largeſt in Aſia are thoſe of Cochin China, which even exceed the ſize of the elephants of Moſambique. The ſkin is thick, and, when dreſſed, proof againſt a muſket ball. The fleſh, the gall, the ſkin, and the bones, are ſaid to be uſed medicinally by the Chineſe.

ELEVATION, the altitude or height of any thing. See ALTITUDE. The word is formed from *elevare*, to raiſe or lift up.

Elevation, in architecture, denotes a draught or deſcription of the principal face or ſide of a building called alſo its upright or orthography.

Elevation, in the Romiſh religion, is applied to that part of the maſs wherein the prieſt hoiſts or raiſes the hoſt, with the cup above his head, for the people to adore it, after having firſt conſecrated and adored it himſelf.

ELEVATOR, **Elevatorium**, in ſurgery, an inſtrument uſed to raiſe up bones, as thoſe in fractures of the ſkull, when beaten or cruſhed in with blows, or the like. See Syſtem of SURGERY.

Elevator, in anatomy, is a name common to ſeveral muſcles, which do the office of raiſing or lifting up the parts they belong to, of equal import with the attollens and levator. See Syſtem of ANATOMY, Part III. Sect. IX.

ELEUSINIA, in antiquity, the myſteries of the goddeſs Ceres, or the religious ceremonies performed to her honour; thus called from Eleuſis, a maratime town of the Athenians, wherein was a temple of that goddeſs, famous for the celebration of theſe myſteries. See CEREALIA.

ELIGIBILITY, in the Romiſh canon law. A bull of eligibility is a bull granted by the pope, to certain perſons, to qualify them to be choſen, or inveſted with an office, or dignity, whereof they were before incapable, by reaſon of want of age, birth, or the like. The word is formed of the Latin *eligere, to chuſe*; whence the word *eligibilitas*, &c. In ſeveral churches in Germany, a perſon, who is not of the chapter, cannot be elected biſhop, without a bull of eligibility.

ELIQUATION, in chymiſtry, an operation by which a more fuſible ſubſtance is ſeparated from one that is leſs ſo, by means of a heat ſufficiently intenſe to melt the former, but not the latter. Thus an allay of copper and lead may be ſeparated by a heat capable of melting the latter, but not the former.

ELISION, in grammar, the cutting off, or ſuppreſſing a vowel at the end of a word, for the ſake of ſound or meaſure. Eliſions, excepting in poetry, are but little known in Engliſh; in Latin, French, &c. they are frequent, and conſiſt moſtly in ſuppreſſions of the final *a*, *e*, and *i*: as in *Phillida amo ante alias. Si ad vitulum ſpectes*, &c. In wrigting, eliſions are often marked by an apoſtraphe; as *egon' quem quæram?* for *egone*. *Emin' ego te?* for *emine*. *Veniſtin'* for *veniſtine*, &c. *Cett' eſperance*, for *cette*; *l'homme*, for *le homme*. In the pronounciation we make frequent eliſions, but do not mark them in writing: thus we write *riſque it*, but pronounce *riſq' it*. So the French pronounce *un' ame*, but write *une ame*. In effect, they never mark any eliſions but at the end of the monoſyllables *je*, *ne*, *le*, *te*, *ce*, *que*, and *la*. They never elide in the *o*, nor *u*, nor *i*, but in the conjunction *ſi*, before *il*; nor *a*, but in *la*. In poetry, the ſyllable where there is a vowel elided, is never reckoned; and great care is taken to avoid the claſhing of ſyllables where there is no eliſion, this making what they call a *hiatus* or *chaſm*.

ELIXATION, in pharmacy, &c. the infuſing, ſeething, or boiling of any medicine in a proper liquor, gently, and for a conſiderable time; amounting to what, in the dreſſiing of meat, we call ſtewing. The word is formed from the Latin *lixare, to boil*, or *boil in water*.

ELIXIR, in medicine, a compound tincture extracted from many efficacious ingredients. Hence the difference between a tincture and an elixir ſeems to be this, that a tincture is drawn from one ingredient, ſometimes with an addition of another to open it, and to diſpoſe it to yield to the menſtruum; whereas an elixir is a tincture extracted from ſeveral ingredients at the ſame time.

ELK is a wild beaſt, found in the foreſts of Muſcovy, Sweden, and Pruſſia; but more abundantly in Canada, and moſt parts of North America. It is about the ſize and figure of a mule, only its ſnout bigger, its tail ſhorter, its feet cloven; and that it bears a large ramage, or horn, like that of a deer. That anatomized, in the Royal Academy of Sciences, was five feet ſeven inches long. Its hair is brown, about the length of that of a goat; and being very elaſtic, is uſed for matraſſes; its ears nine inches long, and four broad; and its tail not above two inches; its neck ſhort and thick; its ſkin ſtrong and hard, though thin; ſo that, according to Linnæus, it will turn a muſket-ball: its fleſh very delicate, eſpecially that of the female.

The hunting of the elk, is one of the principal and moſt agreeable employments of the ſavages of Canada, Acadia, &c. They chooſe a time when the ſnow is on the ground, in which the beaſt is apt to ſink and ſtick. When they have killed enough with their fire arms to feaſt for ſeveral days, they flay them, and ſend the ſkins to the manufacturers, who dreſs them in oil, like the buffalo ſkin.

ELL, *ulna*, a meaſure, which obtains, under different denominations, in moſt countries. The ell is the ſtandard, or meaſure, whereby cloths, ſtuffs, linens, ſilks, &c. are uſually meaſured, or eſtimated, anſwering, in good meaſure, to the yard of England, the canna of Italy, the vara of Spain, the palm of Sicily, &c.

ELLIPSIS, in geometry, one of the conic ſections, commonly called an oval. The word is formed from the Greek, ελλειψις, *deficiency*, a denomination which the ancient Greek geometricians gave this figure, becauſe among other properties this is one, that the ſquares of the ordinates are leſs than, or defective of, the rectangles under the parameters and abſciſſes. See Syſtem of GEOMETRY.

Ellipsis, in grammar and rhetoric, is a verbal figure, or a figure of ſyntax, wherein ſomething is ſuppreſſed, or left out, in a diſcourſe, and ſuppoſed or underſtood; or, it is a defect or omiſſion of ſome part of a ſentence, which muſt be ſupplied in order to render the conſtruction complete.

ELLIPTIC, or Elliptical, ſomething that belongs to an ellipſis.

Elliptic compaſſes, an inſtrument made uſually in braſs, for the drawing any ellipſis or oval, by one revolution of an index.

Elliptic *Dial*, is an inſtrument uſually of braſs, with a joint or fold together, and the gnomon to fall flat, for the ſake of the pocket. By it are found the meridian, hour of the day, riſing and ſetting of the ſun, &c. See Dial.

ELM, in botany, the Engliſh name of the genus ulmus. See Ulmus.

ELOCUTION. See Treatiſe on the Art of Oratory.

ELOGY, a praiſe or panegyric beſtowed on any perſon or thing, in conſideration of its merit. The beauty of elogy conſiſts in an expreſſive brevity. Eulogiums ſhould not have ſo much as one epithet, properly ſo called, nor two words ſynonymous: they ſhould ſtrictly adhere to truth; for extravagant and improbable elogies rather leſſen the character of the perſon or thing they would extol.

ELOHI, Eloi, or Elohim, in Scripture, one of the names of God. But it is to be obſerved, that angels, princes, great men, judges, and even falſe gods, are ſometimes called by this name.

ELONGATION, in aſtronomy, the digreſſion, or receſs of a planet from the ſun, with reſpect to an eye placed on our earth. See Syſtem of Astronomy, Sect. IX.

ELOPEMENT, in law, is when a married woman, of her own accord, departs from her huſband, and dwells with an adulterer; for which, without voluntary reconcilement to the huſband, ſhe ſhall loſe her dowry; nor ſhall the huſband, in ſuch caſe, be compelled to allow her any alimony. The word is formed from the Belgic, *Ee, matrimony*, and *loopen, to run away*. However, mere advertiſing a wife in the gazette, or other public papers, is not a legal notice to perſons in general not to truſt her; though a perſonal notice given by the huſband to particular perſons is ſaid to be good. An action lies, and large damages are uſually given, againſt a perſon for carrying away, and detaining another man's wife.

ELOQUENCE, the art of ſpeaking or writing well; ſo as to move and perſuade. See Treatiſe on the Art of Oratory.

ELUDING, the act of evading, or rendering a thing vain, and of no effect; a dextrous getting clear, or eſcaping out of an affair, difficulty, embarraſſment, or the like. We ſay, to elude a propoſition, &c.

ELUTRIATION, in metallurgy, is the ſeparating the lighter matters from the mixed ores of metal, by means of great quantities of fair water. Solid bodies not diſſoluble in water, are, by this operation, ſeparated from each other by water very well ſtirred, ſo that the lighter and finer parts are carried away with the water, and the heavier and more ſolid remain at the bottom of the veſſels.

ELYSIUM, Ελυσιος, in the ancient theology, or rather mythology, a place in the inferi, i. e, in the lower world; furniſhed with fields, meads, agreeable woods, groves, ſhades, rivers, &c. whither the ſouls of good people were ſuppoſed to go after this life. Orpheus, Hercules, and Æneas, are ſuppoſed to have deſcended into elyſium, in their life time, and to have returned again. Virgil, lib. vi. ver. 638, &c. Tibullus, lib. i. eleg. 3. gives us fine deſcriptions of the elyſian fields. Virgil oppoſes elyſium to tartara; which was the place where the wicked underwent their puniſhment.

ELYTROIDES, Ελυτροειδης, in anatomy, one of the proper coats, or tunics of the teſticles. The word is formed of the Greek ελυτρον, *vagina*, a *ſheath*, and ειδος, *form*.

EMANATION, the act of flowing, or proceeding, from ſome ſource or origin. Such is the emanation of light from the ſun; or that effluvia from odorous, &c. bodies; of wiſdom from God, &c. The word is formed of the Latin *e, out of*, and *manare, to flow* or *ſtream*.

Emanation is alſo uſed for the thing that proceeds, as well as the act of proceeding. The power given a judge is an emanation from the regal power; the reaſonable ſoul is an emanation from the divinity.

EMANCIPATION, in the Roman law, the ſetting free a ſon from the ſubjection of his father; ſo that whatever moveables he acquires belong in property to him, and not to his father, as before emancipation. Emancipation puts the ſon in a capacity of managing his own affairs, and of marrying without his father's conſent, though a minor. Emancipation differs from manumiſſion, as the latter was the act of a maſter in favour of a ſlave, whereas the former was that of a father in favour of his ſon.

EMASCULATION, the act of taking from a male thoſe parts which are characteriſtic of his ſex. See Castration.

EMAUX *de l' Eſcu*, in heraldry, the metals and colours of a ſhield, or ſcutcheon.

EMBALMING, is the opening a dead body, taking out the inteſtines, and filling the place with odoriferous and deſiccative drugs and ſpices, to prevent its putrifying. The Egyptians excelled all other nations in the art of preſerving bodies from corruption; for ſome that they have embalmed upwards of 2000 years ago, remain whole to this day, and are often brought into other countries as great curioſities. Their manner of embalming was thus: they ſcooped the brains with an iron ſcoop, out at the noſtrils, and threw in medicaments to fill up the vacuum: they alſo took out the entrails, and, having filled the body with myrrh, caſſia, and other ſpices, except frankincenſe, proper to dry up the humours, they pickled it in nitre, where it lay ſoaking for 70 days. The body was then wrapped up in bandages of fine linen, and gums, to make it ſtick like glue; and ſo was delivered to the kindred of the deceaſed, entire in all its features, the very hairs of the eyelids being preſerved. They uſed to keep the bodies of their anceſtors, thus embalmed, in little houſes magnificently adorned, and took great pleaſure in beholding them, alive as it were, without any change in their ſize, features, or complexion. The Egyptians alſo embalmed birds, &c. The prices for embalming were different; the higheſt was a talent, the next 29 minæ, and ſo decreaſing to a very ſmall matter: but they who had not wherewithal to anſwer this expence, contented themſelves with infuſing, by means of a ſyringe, through the fundament, a certain liquor extracted from the cedar; and, leaving it there, wrapped up the body in ſalt of nitre: the oil thus preyed upon the inteſtines, ſo that when they took it out, the inteſtines came away with it, dried, and not in the leaſt putrified: the body being encloſed in nitre, grew dry, and nothing remained beſides the ſkull glued upon the bones.

The method of embalming uſed by the modern Egyptians, according to Maillet, is to waſh the body ſeveral times with roſe-water, which, he elſewhere obſerves, is more fragrant in that country than with us; they afterwards perfume it with incenſe, aloes, and a quantity of other odours, of which they are by no means ſparing; and then they bury the body in a winding ſheet, made partly of ſilk and partly of cotton, and moiſtened, as is ſuppoſed, with ſome ſweet ſcented water or liquid perfume, though Maillet uſes only the term moiſtened; this they cover with another cloth of unmixed cotton, to which they add one of the richeſt ſuits of clothes of the deceaſed. The expence, he ſays, on theſe occaſions, is very great, though nothing like what the genuine embalming coſt in former times.

EMBARGO, in commerce, an arreſt on ſhips or merchandiſe, by public authority; or a prohibition of ſtate, commonly on foreign ſhips, in time of war, to prevent their going out port, ſometimes to prevent their coming in, and ſometimes both, for a limited time. The king may lay embargoes on ſhips, or employ thoſe of his ſubjects, in time of danger, for the ſervice and defence of the nation: but they muſt not be for the private advantage of a particular trader, or company; and therefore a warrant to ſtay a ſingle ſhip is no legal embargo. No inference can be made from embargoes which are only in war time; and are a prohibition by advice of council, and not at proſecution of parties. If goods be laden on board, and after an embargo or reſtraint from the prince or ſtate comes forth, and then the maſter of the ſhip breaks ground, or endeavours to ſail, if any damage accrues, he muſt be reſponſible for the ſame; the reaſon is, becauſe his freight is due, and muſt be paid, even though the goods be ſeized as contraband.

EMBASSY, *legatio*, a miſſion from one ſovereign prince, or ſtate, to another, of ſome able experienced perſon, to negotiate ſome affair in quality of ambaſſador.

EMBATTLED, a term in heraldry, when the outer line of any ordinary is notched in a manner repreſenting the battlements of a wall or caſtle.

EMBER *Weeks*, are thoſe wherein the ember or embering days fall. In the laws of king Alfred, and thoſe of Canute, thoſe days are called *ymbren*, that is, *circular days*, from whence the word was probably corrupted into *ember days*. By the canoniſts they are called *quatuor anni tempora*, the four cardinal ſeaſons, on which the circle of the year turns; and hence Henſhaw takes the word to have been formed, viz. by corruption, from *temper*, or *tempora*. The ember days are the Wedneſday, Friday, and Saturday, after Quadrageſima Sunday, or the firſt Sunday in Lent, after Whitſunday, after Holyrood day in September, and after St. Lucy's day in December; which four times anſwer well enough to the four quarters of the year, ſpring, ſummer, autumn, and winter. Theſe ember weeks are now chiefly taken notice of on account of the ordination of prieſts and deacons; becauſe the canon appoints the Sundays next ſucceeding the ember weeks for the ſolemn times of ordination; though the biſhops, if they pleaſe, may ordain on any Sunday or holiday.

EMBERIZA, or Bunting, in ornithology, the 70th genus of birds, belonging to the ſixth order, according to Linnæus. Latham, in his improved arrangement, makes it the 35th genus, and of the order of Paſſerine.

EMBLEM, Εμβλημα, a kind of painted ænigma, which, repreſenting ſome obvious hiſtory, with reflections underneath, inſtructs us in ſome moral truth, or other matter of knowledge. The word is pure Greek, formed of the verb εμβαλλειν, *to caſt in, to inſert*. The emblem is ſomewhat plainer, and more obvious, than the ænigma. Gale defines emblem an ingenious picture, repreſenting one thing to the eye, and another to the underſtanding. With us, emblem ordinarily ſignifies no more than a painting, *baſſo relievo*, or other repreſentation, intended to hold forth ſome moral or political inſtruction. What diſtinguiſhes an emblem from a device is, that the words of an emblem have a full, complete ſenſe of themſelves; nay, all the ſenſe and ſignification which they have together with the figure. But there is yet a farther difference between emblem and device; for a device is a ſymbol appropriated to ſome particular perſon, or that expreſſes ſomething which concerns him particularly; whereas an emblem is a ſymbol that regards all the world alike. Theſe differences will be more apparent from comparing the emblem above quoted with the device of a candle lighted; and the words *juvando conſumor, I waſte myſelf in doing good.* According to lord Bacon, emblems are of uſe in the art of memory, as ſenſible objects ſtrike the mind ſtronger than what is intellectual. Thus, it is eaſier to retain the image of a ſportſman hunting a hare, of an apothecary ranging his boxes, an orator making a ſpeech, a boy repeating verſes, or a player acting his part, than the correſponding notions of invention, diſpoſition, elocution, memory, and action. Works abr. vol. i. p. 136. vol. ii. p. 475. and vol. iii. p. 106.

EMBOSSING, or Imbossing, the act of forming, or faſhioning works in relievo, whether they be caſt, or moulded, or cut with the chiſſel, &c. Emboſſing is one great part of ſculpture; being that which has to do with figures raiſed, or prominent from the plane, or ground; the other part, which makes figures, &c. that are indented, or cut in below the ground, is called engraving. See Engraving.

EMBROCATION, Εμβροχη, formed from βρεχω, *irrigo, I ſprinkle*, or *moiſten*, in pharmacy, denotes the application of remedies, as oils, ſpirits, decoctions, and other liquids, by ſprinkling, or even rubbing them on the part affected: this is alſo called irrigation. Embrocations are only a kind of lotions; they are uſed to remove obſtructions, and to relieve pains, numbneſs, and palſies. The pumping uſed in natural baths is properly an embrocation.

EMBROIDERY, a work in gold, or ſilver, or ſilk thread, wrought by the needle upon cloth, ſtuffs, or muſlin, into various figures. In embroidering ſtuffs, the work is performed in a kind of loom; becauſe the more the piece is ſtretched, the eaſier it is worked. As to muſlin, they ſpread it upon a pattern ready deſigned; and ſometimes, before it is ſtretched upon the pattern, it is ſtarched, to make it more eaſy to handle. Embroidery on the loom is leſs tedious than the other, in which, while they work flowers, all the threads of the muſlin, both lengthwiſe and breadthwiſe, muſt be continually counted; but, on the other hand, this laſt is much richer in points, and ſuſceptible of greater variety. Cloths too much milled are ſcarce ſuſceptible of this ornament, and in effect we ſeldom ſee them embroidered. The thinneſt muſlins are left for this purpoſe; and they are embroidered to the greateſt perfection in Saxony: in other parts of Europe, however, they embroider very prettily, and eſpecially in France.

There are ſeveral kinds of embroidery: as, 1. Embroidery on the ſtamp; where the figures are raiſed and rounded, having cotton or parchment put under them to ſupport them. 2. Low embroidery; where the gold and ſilver lie low upon the ſketch, and are ſtitched with ſilk of the ſame colour. 3. Guimped embroidery: this is performed either in gold or ſilver; they firſt make a ſketch upon the cloth, then put on cut vellum, and afterwards ſow on the gold and ſilver with ſilk thread: in this kind of embroidery they often put gold and ſilver cord, tinſel, and ſpangles. 4. Embroidery on both ſides; that which appears on both ſides of the ſtuff. 5. Plain embroidery; where the figures are flat and even, without cords, ſpangles, or other ornaments.

By ſtat. 22. Geo. II. c. 36. no foreign embroidery, or gold and ſilver brocade, ſhall be imported, upon pain of being forfeited and burnt, and penalty of 100l. for each piece. No perſon ſhall ſell, or expoſe to ſale, any foreign embroidery, gold or ſilver thread, lace, fringe, brocade, or make up the ſame into any garment, on pain of having it forfeited and burnt, and penalty of 100l. All ſuch embroidery, &c. ſhall be ſeized and burnt; and the mercer, &c. in whoſe cuſtody it was found, ſhall forfeit 100l.

EMBRYO, in phyſiology, the firſt rudiments of an animal in the womb, before the ſeveral members are diſtinctly formed; after which period it is denominated a fetus. See Generation, and Fetus.

Embryo is alſo uſed by naturaliſts to expreſs the grain, or ſeed of a plant; ſometimes the germ, or firſt ſprout appearing out of the ſeed; becauſe the whole future plant is ſuppoſed to be contained therein. Juſt as the whole chick is ſuppoſed contained in the cicatricula, or treddle of an egg.

Embryo *Worms*. It is a matter of no ſmall curioſity, to obſerve the arrangement of the multitudes of the embryo-worms, as they are lodged in the bodies of the viviparous two winged flies. An accurate diſſection of one of theſe little animals, ſhews very plainly the parts where the embryo-worms are incloſed. This diſſection is eaſily made with a pair of fine pointed ſciſſars, taking off the whole upper ſhell of the body from the lower; and that part which covers the belly may be turned back upon the corcelet, without diſturbing the internal parts by the operation; and the form and arrangement of the parts which contain the embryo-worms in theſe, will be found very different from that of thoſe which contain the eggs in the common flies. Baker on the Microſcope, p. 115. 416. 417. 428. 430.

EMERALD, a genus of precious ſtone, very green and tranſparent; and, as to hardneſs, the next after the ruby. The word is formed from the French *eſmeraude*, and that from the Latin *ſmaragdus*, which ſignifies the ſame. Others derive it from the Italian *ſmeraldo*, or the Arabic *zomorrad*. Our jewellers diſtinguiſh emeralds into two kinds; the oriental, and occidental. The emeralds of the Eaſt Indies are evidently finer than thoſe of any other part of the world; but our jewellers, ſeldom meeting with theſe, call the American emeralds the oriental; and uſually ſell chryſtal, accidentally tinged with green, under the name of the occidental emerald; theſe being alſo the moſt common, there has grown an opinion among the lapidaries, that the emerald is no harder than the cryſtal; becauſe what they take to be emeralds, are in general only cryſtals. The genuine emerald, in its moſt perfect ſtate, is perhaps the moſt beautiful of all the gems; it is found of various ſizes, but uſually ſmall; a great number of them are met with of about the ſixteenth part of an inch in diameter, and they are found from this to the ſize of a walnut. The emerald is of different figures like the diamond and many of the other gems; being ſometimes found in a roundiſh or pebble-like form, but much more frequently in a columnar one, reſembling common cryſtal: the pebble-emeralds are always the hardeſt and brighteſt, but are ſeldom found exceeding the ſize of a pea; the cryſtalliform ones grow ſeveral together, and are often larger; the pebble-kind are found looſe in the earths of mountains, and ſands of rivers: the columnar are found uſually bedded in, or adhering to, a white, opake, and coarſe cryſtalline maſs, and ſometimes to the jaſper or the praſius. The oriental emerald is of the hardneſs of the ſapphire and ruby, and is ſecond only to the diamond in luſtre and brightneſs: the American is of the hardneſs of the garnet: and the European ſomewhat ſofter than that, yet conſiderably harder than cryſtal; it loſes its colour in the fire, and becomes undiſtinguiſhable from the white ſapphire. The oriental emeralds are very ſcarce, and at preſent found only in the kingdom of Cambay. Very few of them have of late been imported into Europe, inſomuch that it has been ſuppoſed there were no oriental emeralds; but, lately, ſome few have been brought from Cambay into Italy, that greatly excel the American ones. The American, being what our jewellers call *oriental emeralds*, are found principally about Peru; and the European are principally from Sileſia.

Emerald, or Emeraud, in heraldry, is uſed in lieu of vert, or green, in blazoning the arms of dukes, earls, &c.

EMERSION, in phyſics, the riſing of any ſolid above the ſurface of a fluid ſpecifically heavier than itſelf, into which it had been violently immerged, or thurſt.

Emersion, in aſtronomy, is when the ſun, moon, or other planet, begins to re-appear, after its having been eclipſed, or hid by the interpoſition of the moon, earth, or other body: The difference of longitude is ſometimes found by obſerving the immerſions and emerſions of the firſt of Jupiter's ſatellites. See Syſtem of Astronomy, Sect. VIII.

EMERY, a ſort of metallic ſtone, found in ſeveral mines of metals; but chiefly in thoſe of iron, being properly an iron ore. We uſually diſtinguiſh three kinds of emery; the Spaniſh, red, and commom emery. The firſt is found in the gold mines of Peru, and other provinces of the Spaniſh America; it is judged a kind of ore of that rich metal; being ſtreaked with little veins, and ſpecks of gold. The red emery is found in copper mines; the little we have of it comes from Sweden and Denmark. The common emery is taken out of iron mines; and is almoſt the only ſort uſed among us. The conſumption hereof is very conſiderable among the armourers, cutlers, lockſmiths, glaziers, lapidaries, maſons, &c. ſome of whom uſe it to poliſh and burniſh iron, and ſteel works; others, to cut and ſcollop glaſs, marble, and precious ſtones.

EMETIC, from εμεω, *I vomit*, in medicine, a remedy that excites vomiting; or that purges the ſtomach by the mouth. See Syſtem of Medicine.

EMINENCE, in geography, a little hillock, or aſcent, above the level of the adjoining champain. Eminence is alſo a title of honour given to cardinals. The grand maſter of Malta is likewiſe addreſſed under the quality of *eminence*.

EMINENTLY, is uſed in contradiſtinction to formally, and in the ſame ſenſe with virtually, viz. to denote that a thing poſſeſſes, or contains, any other in a more perfect or higher manner than is required to a formal poſſeſſion thereof.

EMIR, a title of dignity among the Turks, ſignifying a prince. This title was firſt given to the Caliphs; but when they aſſumed the title of Sultans, that of emir remained to their children; as that of Cæſar among the Romans. At length the title came to be attributed to all who were judged to deſcend from Mahomet by his daughter Fatimah, and who wear the green turban inſtead of the white. The Turks make an obſervation, that the emirs, before the fortieth year, are men of the greateſt gravity, learning, and wiſdom; but after this, if they are not great fools, they diſcover ſome ſigns of levity and ſtupidity. This is interpreted by the Turks as a ſort of divine impulſe in token of their birth and ſanctity. The Turks alſo call the vizirs, baſhaws, or governors of provinces, by this name.

EMISSARY, in a political ſenſe, a perſon employed by another to ſound the opinions of people, ſpread certain reports, or act as a ſpy over other people's actions.

Emissary *Veſſels*, in anatomy, the ſame with thoſe more commonly called excretory.

EMISSION, in medicine, a term uſed chiefly to denote the ejaculation of the ſemen, or ſeed, in the act of coition. See Coition and Generation.

EMMENAGOGUES, εμμηναγωγα, in medicine, ſuch remedies as promote the menſes. See Syſtem of Medicine.

EMOLLIENTS, in medicine and pharmacy, are ſuch remedies as ſheath and ſoften the aſperity of the humours, and relax and ſupple the ſolids at the ſame time.

EMOLUMENT, is properly applied to the profits ariſing daily from an office or employ. The word is formed of the Latin, *emolumentum*, which, according to ſome, primarily ſignifies the profits redounding to the miller from his mill; of *molo, molere, to grind*.

EMOTION *and* **Passion**, in the human mind. An internal motion or agitation of the mind, when it paſſeth away without deſire, is denominated *an emotion*: when deſire follows, the motion or agitation is denominated *a paſſion*. A fine face, for example, raiſeth in me a pleaſant feeling: if that feeling vaniſh without producing any effect, it is in proper language an *emotion*; but if the feeling, by reiterated views of the object, becomes ſufficiently ſtrong to occaſion deſire, it loſes its name of emotion, and acquires that of *paſſion*. The ſame holds in all the other paſſions. The painful feeling raiſed in a ſpectator by a ſlight injury done to a ſtranger, being accompanied with no deſire of revenge, is termed an emotion; but that injury raiſeth in the ſtranger a ſtronger emotion, which being accompanied with deſire of revenge, is a paſſion. External expreſſions of diſtreſs produce in the ſpectator a painful feeling, which being ſometimes ſo ſlight as to paſs away without any effect, is an emotion; but if the feeling be ſo ſtrong as to prompt deſire of affording relief, it is a paſſion, and is termed *pity*. Envy is emulation in exceſs: if the exaltation of a competitor be barely diſagreeable, the painful feeling is an emotion; if it produce deſire to depreſs him, it is a paſſion. See Passion.

EMPALEMENT, or **Impalement**, a cruel kind of puniſhment, whereby a ſharp pale or ſtake is thruſt up the fundament, and through the body. We find mention of empaling in Juvenal. It was frequently practiſed in the time of Nero, and continues to be ſo in Turkey.

EMPANELLING, or **Impanelling**, in law, ſignifies the writing and entering into a parchment ſchedule, or roll of paper, by the ſheriff, the names of a jury ſummoned by him to appear for the performance of ſuch public ſervice as juries are employed in.

EMPERESS, **Empress**, *Imperatrix*, the feminine of emperor, applied either to an emperor's wife, or to a woman who rules ſingly over an empire, with all the authority of an emperor; as the empreſs of Ruſſia. See Emperor, Queen, &c.

EMPEROR, a title of honour among the ancient Romans, conferred on a general that had been victorious; and now made to ſignify a ſovereign prince, or ſupreme ruler of an empire. The title of emperor adds nothing to the rights of ſovereignty; it only gives pre-eminence above other ſovereigns. The emperors, however, pretend, that the imperial dignity is more eminent than the regal. It is diſputed whether emperors have the power of diſpoſing of the regal title. However this may be, they have ſometimes taken upon them to erect kingdoms: thus it is that Bohemia, Pruſſia, and Poland, are ſaid to have been raiſed to that dignity. In the eaſt, the title of emperor is more frequent than with us; thus the ſovereign princes of China, Mogul, &c. are called emperors. In the weſt, the title has been a long time reſtrained to the emperors of Germany. The firſt who bore it was Charlemagne, who was crowned by Pope Leo III. in 800. And it is to be obſerved, that there was not a foot of land or territory annexed to the emperor's title. In the year 1723, the Czar of Muſcovy aſſumed the title of emperor of all the Ruſſias. The kings of France were alſo called emperors, when they reigned with their ſons, whom they aſſociated in the crown: thus Hugh Capet was called emperor, and his ſon Robert king. The kings of England were anciently ſtyled emperors, as appears from a charter of king Edgar. The emperor of Germany is a limited monarch in regard to the empire, though he is an abſolute ſovereign in moſt of his hereditary dominions. The late emperors of the Auſtrian family, having hereditary dominions, enumerated all of them in their title. Charles VI. was ſtyled emperor of the Romans, always auguſt, king of Bohemia and Hungary, archduke of Auſtria, &c. The emperor creates dukes, marquiſſes, and other noblemen; and he appoints moſt of the officers, civil and military, in the empire: he is elected by the nine electors; and he ſummons the general diet of the empire.

EMPHASIS, in rhetoric, a force, ſtreſs, or energy, in expreſſion, action, geſture, or the like, which performs the ſame office in ſentences as the accent does in words. The word is Greek, εμφασις, which ſignifies the ſame.

The neceſſity of obſerving propriety of *emphaſis* is ſo great that the true meaning of words cannot be conveyed without it. *Emphaſis* is of two kinds, ſimple, or complex. The former ſerves to point out the plain meaning of any propoſition; the latter alſo marks ſome affection or emotion of the mind, by the uſe of which a diſcourſe receives life and ſpirit, and is rendered capable of producing the nobleſt effects. See Sheridan's Lectures on Elocution, lect. 11.

EMPIRE, **Imperium**, in political geography, a large extent of land, under the juriſdiction or government of an emperor. See Emperor. The moſt ancient empire we read of is that of the Aſſyrians, which was ſubverted through the effeminacy of Sardanapalus; the Perſian empire was deſtroyed through the bad conduct of Darius Codomannus; the Grecian empire, by its being diſmembered among the captains of Alexander the Great; and the Roman empire, through the ill management of the laſt emperors of Rome.

Antiquaries diſtinguiſh between the medals of the upper, and lower, or bas, empire. The curious only value thoſe of the upper empire, which commences with Cæſar, or Auguſtus, and ends in the year of Chriſt 260.

The lower empire comprehends near 1200 years, reckoning as low as the deſtruction of Conſtantinople in 1453. They uſually diſtinguiſh two ages, or periods, of the lower empire: the firſt beginning where the upper ends, viz. with Aurelian, and ending with Anaſtaſius, including 200 years; the ſecond beginning with Anaſtaſius, and ending with the Palæologi, which includes 1000 years.

Empire, or *The Empire*, uſed abſolutely, and without any addition, ſignifies the empire of Germany; called alſo, in juridical acts and laws, The holy Roman empire. Authors are at a loſs under what form of government to range the empire: ſome will have it a monarchical ſtate, by reaſon all the members thereof are forced to aſk the inveſtiture of their ſtates of the emperor, and to take an oath of fidelity to him. Others will have it an ariſtocratic ſtate, by reaſon the emperor cannot determine any thing without the concurrence of the princes: and, laſtly, others will have the empire to be a monarcho-ariſtocratic ſtate.

EMPIRIC, an appellation given to thoſe phyſicians who conduct themſelves wholly by their own experience, without ſtudying phyſic in a regular way. Some even uſe the term, in a ſtill worſe ſenſe, for a quack who preſcribes at random, without being at all acquainted with the principles of the art.

EMPLASTER, popularly called plaſter, a medicine of a ſtiff, glutinous conſiſtence, compoſed of divers ingredients, ſpread on leather, or linen, and applied externally.

EMPYEMA, in medicine, a collection of pus, or purulent matter, in the cavity of the breaſt, diſcharged thither upon the burſting of ſome abſceſs or ulcer in the lungs, or membranes that incloſe the breaſt; or formed from that inſpiſſated ſerum, which Dr. Hunter obſerves is found in large quantities in the cavities of the breaſt, belly, &c. Lond. Med. Obſ. &c. vol. ii. p. 61.

FMPYREUMA, Εμπυρευμα, in chymiſtry, &c. a ſmell or taſte of burning; a quality, or change in bodies that have been burnt, or much ſcorched with fire, ſenſible to the taſte and ſmell. The word is formed of the Greek, εμπυρευειν, *to inflame, kindle*.

EMULATION, is a generous ardour kindled by the brave examples of others, which impels us to imitate, to rival, and, if poſſible to excel them. This paſſion involves in it eſteem of the perſon whoſe attainments or conduct we emulate, of the qualities and actions in which we emulate him; and a deſire of reſemblance, together with a joy ſpringing from the hope of ſucceſs. The word comes originally from the Greek αμιλλα, *diſpute, conteſt*; whence the Latin, *æmulus*, and thence our *emulation*. Plato obſerves of emulation, that it is the daughter of envy; if ſo, there is a great difference between the mother and the offspring; the one is a virtue, and the other a vice. Emulation admires great actions, and ſtrives to imitate them; envy refuſes them the praiſes that are their due; emulation is generous, and only thinks of ſurpaſſing a rival; envy is low, and only ſeeks to leſſen him. Perhaps, therefore, it would be more juſt to ſuppoſe emulation the daughter of admiration: admiration ever, is a principal ingredient in the compoſition of it.

EMULGENT, in anatomy, an epithet beſtowed on thoſe arteries which bring the blood to the kidneys, and thoſe veins which carry back what is ſuperfluous to the cava. See Syſtem of Anatomy, Part IV. Sect. I.

EMULSION, from *emulgere, to milk*, in medicine, a ſoft liquid remedy, of a colour and conſiſtence reſembling milk.

ENALLAGE, in grammar, is when one word is ſubſtituted for another of the ſame part of ſpeech: A ſubſtantive for an adjective, as *exercitus victor*, for *victorioſus*; *ſcelus*, for *ſceleſtus*: a primitive for a derivative, as *Dardana arma*, for *Dardania*: An active for a paſſive, as *nox humida cœlo præcipitat*, for *precipitatur*, &c.

ENAMEL, in general, is a vitrified matter betwixt the parts of which is diſperſed ſome unvitrified matter: hence enamel ought to have all the properties of glaſs except tranſparency.

Enamels have for their baſis a pure cryſtal glaſs or frit, ground up with a fine calx of lead and tin prepared for the purpoſe, with the addition uſually of white ſalt of tartar. Theſe ingredients baked together, are the matter of all enamels, which are made by adding colours of this or that kind in powder to this matter, and melting or incorporating them together in a furnace.

For white enamel, Neri (*De Arte Vitriar*) directs only mangeneſe to be added to the matter which conſtitutes the baſis. For azure, zaffer mixed with calx of braſs. For green, calx of braſs with ſcales of iron, or with crocus martis. For black, zaffer with manganeſe, or with crocus martis: or manganeſe with tartar. For red, manganeſe with calx of copper and red tartar. Eor purple, manganeſe with calx of braſs. For yellow, tartar and manganeſe. And for violet-coloured enamel, manganeſe with thrice-calcined braſs.

In making theſe enamels, the following general cautions are neceſſary to be obſerved. 1. That the pots muſt be glazed with white glaſs, and muſt be ſuch as will bear the fire. 2. That the matter of enamels muſt be very nicely mixed with the colours. 3. When the enamel is good, and the colour well incorporated, it muſt be taken from the fire with a pair of tongs. 4. The general way of making the coloured enamel is this: powder, ſift, and grind, all the colours very nicely, and firſt mix them with one another, and then with the common matter of enamels; then ſet them in pots in a furnace; and when they are well mixed and incorporated, caſt them into water; and when dry, ſet them in a furnace again to melt; and when melted, take a proof of it. If too deep-coloured, add more of the common matter of enamels; and if too pale, add more of the colours. Enamels are uſed either in counterfeiting or imitating precious ſtones, in painting in enamel; or by enamellers, jewellers, and goldſmiths, in gold, ſilver, and other metals. The two firſt kinds are uſually prepared by the workmen themſelves, who are employed in theſe arts. That uſed by jewellers, &c. is brought to us chiefly from Venice or Holland, in little cakes of different ſizes, commonly about four inches diameter, having the mark of the maker ſtruck upon it with a puncheon. It pays the pound 1 s. $7\frac{41}{100}$d. on importation, and draws back 1 s. $5\frac{70}{100}$d. at the rate of 4s. per pound.

Painting in ENAMEL, is a method of painting with enamels, or metalline colours, ground, reduced to powder, and uſed like other colours with a pencil; then fuſed, baked again, and vitrified by force of fire. The art of painting in enamel, or at leaſt of giving colours to glaſs, whence this method of painting was derived, is very ancient, and appears to have been firſt practiſed on earthen veſſels, or potters ware. As early as in the age of Porſenna, king of Tuſcany, we hear of beautiful vaſes made in his territories, enamelled with various figures, though far ſhort of thoſe afterwards made at Faenza, and Caſtel Durante, in the duchy of Urbino, in the time of Raphael and Michael Angelo. There are ſtill ſome of thoſe vaſes extant in the cabinets of antiquaries; in all which, the deſign, or drawing of the figures, is much better than the colouring; for they were at that time only acquainted with two colours, viz. black and white, either for earthen or metal works, excepting a faint kind of carnation for the faces and other parts.

The preſent Method of painting in ENAMEL. This is performed on plates of gold or ſilver, and moſt commonly of copper, enamelled with the white enamel; whereon they paint with colours which are melted in the fire, where they take a brightneſs and luſtre like that of glaſs. This painting is the moſt prized of all for its peculiar brightneſs and vivacity, which is very permanent, the force of its colours not being effaced or ſullied with time as in other painting, and continuing always as freſh as when it came out of the workmens hands. It is uſual in miniature; it being the more difficult the larger it is, by reaſon of certain accidents it is liable to in the operation. Enamelling ſhould only be practiſed on plates of gold, the other metals being leſs pure: copper, for inſtance, ſcales with the application, and yields fumes; and ſilver turns the yellow white. Nor muſt the plate be made flat; for in ſuch caſe, the enamel cracks; to avoid which, they uſually forge them a little round or oval and not too thick. The plate being well and evenly forged, they uſually begin the operation by laying on a couch of white enamel (as we obſerved above) on both ſide, which prevents the metal from ſwelling and bliſtering; and this firſt layer ſerves for the ground of all the other colours. The plate being thus prepared they begin at firſt by drawing out exactly the ſubject to be painted with red vitriol, mixed with oil of ſpike, marking all parts of the deſign very lightly with a ſmall pencil. After this, the colours (which are to be before ground with water in a mortar of agate extremely fine, and mixed with oil of ſpike ſomewhat thick) are to be laid on, obſerving the mixtures and colours that agree to the different parts of the ſubject; for which it is neceſſary to underſtand painting in miniature. But here the workman muſt be very cautious of the good or bad qualities of the oil of ſpike he employs to mix his colours with, for it is very ſubject to adulterations. See OIL.

Great care muſt likewiſe be taken, that the leaſt duſt imaginable come not to your colours while you are either painting or grinding them; for the leaſt ſpeck, when it is worked up with it, and when the work comes to be put into the reverberatory to be red hot, will leave a hole, and ſo deface the work.

When the colours are all laid, the painting muſt be gently dried over a ſlow fire to evaporate the oil, and the colours afterwards melted to incorporate them with the enamel, making the plate red hot in a fire like what the enamellers uſe. Afterwards that part of the painting muſt be paſſed over again which the fire hath any thing effaced, ſtrengthening the ſhades and colours, and committing it again to the fire, obſerving the ſame method as before, which is to be repeated till the work be finiſhed.

ENAMELLING, the art of laying enamel upon metals, as gold, ſilver, copper, &c. and of melting it at the fire, or of making divers curious works in it at a lamp. It ſignifies alſo to paint in enamel.

ENARTHROSIS, Εναρθρωσις, a ſpecies of diarthroſis. Such is that of the huckle bone, &c. See Syſtem of ANATOMY, Part I. Sect. XII.

ENCAMPMENT, in the military. See CAMP.

ENCANTHIS, in ſurgery, denotes a tumor of the caruncula lachrymalis, in the great canthus, or angel of the eye. The word is Greek, εγκανθις, formed of the prepoſition εν and κανθος, *corner of the eye.*

ENCEPPE, in heraldry, denotes chained, or girt round the middle; as is uſual with monkeys, &c.

ENCHANTMENT, of *in*, and *canto*, *I ſing*, denotes certain words and ceremonies uſed by magicians in the practice of their pretended and deluding art; thus called, becauſe the *formulæ* of their *enchantment* were generally compoſed in verſe, and deſigned to be ſung. See MAGIC.

ENCHASING, INCHASING, or CHASING, the art of enriching and beautifying gold, ſilver, and other metal-works, by ſome deſign or figures repreſented thereon, in low relievo. Chaſing is only practiſed on hollow, thin works; as watch caſes, cane-heads, tweezer caſes, or the like. It is performed by punching or driving out the metal to form the figures from within ſide, ſo as to ſtand out prominent from the plane or ſurface of the metal. In order to this, they have a great number of fine ſteel blocks, or puncheons, of divers ſizes; and the deſign being drawn on the ſurface of the metal, they apply the inſide upon the heads or tips of theſe blocks, directly under the lines or parts of the figures. Then, with a fine hammer, ſtriking on the metal ſuſtained by the block, the metal yields, and the block makes an indenture or cavity on the inſide; correſpondent to which, there is a prominence on the outſide, which is to ſtand for part of the figure. Thus the workman proceeds to chaſe and finiſh all the parts, by ſucceſſive applications of the block and hammer to the ſeveral parts of the deſign. And it is ſurpriſing, with what beauty and juſtneſs, by this ſimple piece of mechaniſm, the artiſts in this kind will repreſent foliages, groteſques, animals, hiſtories, &c.

ENCLITICA, in grammar, particles which are ſo cloſely united with other words, as to ſeem part of them as in *virumque*, &c. There are three enclitic particles in Latin, viz. *que*, *ne*, *ve*.

ENCOPE, of εν and κοπτω, *I cut*, in ſurgery, an inciſion of any part; as in a gangrene, &c.

ENCOUNTERS, in military language, a combat between two perſons; and the term is alſo more generally applied to attacks or battles between ſmall or large armies.

ENCYCLOPÆDIA, the circle or chain of arts and ſciences. The word is compounded of the prepoſition εν, *in*, κυκλος, *circle*, and παιδεια, *ſcience*, *doctrine*, *diſcipline*, *learning*; the root being παις, *child*, *infant*. The Greeks uſed the term for the knowledge of the ſeven liberal arts, and the poſſeſſion of all the ſciences. *Orbis ille doctrinæ, quem Græci* εγκυκλοπαιδειαν *vocant*, ſays Quintillian. It is ſometimes alſo written, κυκλοπαιδεια, *cyclopædia*. Vitruvius, in the preface to his ſixth book, calls it, *encyclios diſciplina*. See CYCLOPÆDIA.

ENDEMIC *Diſeaſe*, of εν and δεμος, *people*, that which affects many people together in the ſame country, as proceeding from ſome cauſe peculiar to the country where it reigns.

ENDENTED, DENTED, or INDENTED, in heraldry. See INDENTED. Endented, is alſo applied to a feſs or pale, and other triangular pieces, when divided alternately between two different colours. Coupé, or endented with or and azure.

ENDIVE, or SUCCORY, *cithorium*, in botany, a genus of the polygamia equalis order, belonging to the ſyngeneſia claſs of plants. The curled endive is now much cultivated in the Engliſh gardens, being one of the principal ingredients in the ſallads of autumn and winter; for which purpoſe it is continued as long as the ſeaſon will permit.

ENDORSE, in heraldry, an ordinary, containing the eighth part of a pale. See Syſtem of HERALDRY, Plate IV.

ENDORSEMENT, of *in* and *dorſum*, *back*, is particularly uſed in commerce, for a writing on the back of a bill of exchange by the proprietor or bearer, either thereby to transfer it to ſome other, or to render it payable to the order of ſome other, or elſe to ſerve for an acquittance or receipt. The endorſement is only the name of the proprietor, or endorſer. Note, when the endorſement of a bill of exchange is to render it payable to another, it is called an order.

ENDORSING, or INDORSING, in law, implies the writing on the back ſide of a deed, inſtrument, &c. Something relating to the matters contained therein.

ENDOWMENT, or INDOWMENT, the giving or aſſigning of a dower to a woman. The word is alſo uſed figuratively, for the ſetting forth or ſevering a ſufficient portion for a vicar, towards his perpetual maintenance, when the benefice is appropriated; whence ſuch a vicarage is called a vicarage endowed.

ENERGETICAL *Bodies* or *Particles*, are ſuch as are eminently active, and which produce manifeſt operations of various natures, according to the various circumſtances, and motions of ſuch bodies or particles.

ENERGY, an uncommon force or ſtrength in a diſcourſe, a ſentence, or a word. See EMPHASIS. The word is Greek ενεργεια, formed of the prepoſition εν, and εργον, *work, labour*.

ENERVATING, the act of deſtroying the force, uſe, or office of the nerves, either by cutting them, by weakening them with debauchery, or by ſome other violence. Exceſs of wine, and other ſtrong, hot, ſpirituous liquors, enervate or weaken the nerves. When they would render a horſe uſeleſs, they enervate him, or cut his nerves.

ENFANS *Perdus*, a French phraſe, uſed in war to ſignify the ſoldiers who march at the head of a body of forces appointed to ſuſtain them, in order to begin an attack, make an aſſault, or force a poſt. The word literally imports loſt children, on account of the imminent danger they are expoſed to. In Engliſh, they are called the forlorn, or forlorn hope. At preſent, the grenadiers uſually begin ſuch attacks.

ENFILADE, in war, is applied to thoſe trenches, and other lines, which are ranged in a right line, and ſo may be ſcoured or ſwept by the cannon lengthways, or in the direction of the line, and rendered almoſt defenceleſs. Care muſt be taken that the lines be not enfiled, or enfiladed; on the contrary, the covert line muſt be enfiladed, that the enemy may be driven out of it. The laſt boyau, or gut of the trenches, is ſubject to be enfiladed, that is, to be ſcoured according to its length. A battery *d'enfilade*, is that where the cannon ſweep a right line. A poſt, or command *d'enfilade*, is a height from which one may ſweep a whole line at once.

ENFILED, in heraldry, when the head of a man or beaſt is placed on the blade of a ſword; the ſword is ſaid to be enfiled with a head, &c.

ENFRANCHISEMENT, the incorporating any man into a ſociety or body politic. Thus, he that by charter is made denizen of England, is ſaid to be enfranchiſed. The like is underſtood of a perſon made a citizen of London, or other city or corporate town; becauſe he is thereby made partaker of the liberties appertaining to the corporation whereof he is enfranchiſed.

ENGAGEMENT, in a naval ſenſe, denotes a particular or general battle at ſea, or an action of hoſtility between ſingle ſhips, or or detachments, or ſquadrons of men of war. See NAVAL TACTICS.

ENGAGEMENT, in Engliſh hiſtory, was the obligation impoſed by Oliver Cromwell required to be ſigned by every member of the firſt parliament in 1654, aſſembled by his authority, after he was declared protector, viz. I *A. B.* do hereby freely promiſe and engage myſelf to be true and faithful to the Lord protector, and to the commomwealth of England, Scotland, and Ireland, and ſhall not (according to the tenure of the indenture whereby I am returned to ſerve in this preſent parliament) propoſe or give any conſent to alter the government, as it is ſettled in one ſingle perſon and a parliament. Many, who refuſed to ſign this engagement, were excluded from the houſe.

ENGENDERING, or INGENDERING, the act of begetting or producing the kind, by way of generation. The term is likewiſe applied to other productions of nature; thus, meteors are ſaid to be engendered in the middle region of the air. Crude fruits engender worms. The ancients believed, that inſects were engendered of putrefaction.

ENGINE, in mechanics, a compound machine, conſiſting of ſeveral ſimple ones, as wheels, ſcrews, levers, or the like, combined together, in order to lift, caſt, or ſuſtain a weight, or produce ſome other conſiderable effect, ſo as to ſave either time or force. The word is formed of the French, *engine*; of the Latin, *ingenium, wit*; becauſe of the ingenuity required in the contrivance of engines, to augment the effect of moving powers. See Syſtem of MECHANICS, Plate II.

ENGINEER, in the military art, an able expert man, who, by a perfect knowledge in mathematics, delineates upon paper, or marks upon the ground, all ſorts of forts, and other works proper for offence and defence. He ſhould underſtand the art of fortification, ſo as to be able, not only to diſcover the defects of a place, but to find a remedy proper for them; as alſo how to make an attack upon, as well as to defend the place. Engineers are extremely neceſſary for theſe purpoſes; wherefore it is requiſite, that, beſides being ingenious, they ſhould be brave in proportion. When at a ſiege the engineers have narrowly ſurveyed the place, they are to make their report to the general, by acquainting him which part they judge the weakeſt, and where approaches may be made with moſt ſucceſs. Their buſineſs is alſo to delineate the lines of circumvallation and contravallation, taking all the advantages of the ground; to mark out the trenches, places of arms, batteries and lodgments, taking care that none of their works be flanked or diſcovered from the place. After making a faithful report to the general of what is a doing, the engineers are to demand a ſufficient number of workmen and utenſils, and whatever elſe is neceſſary.

ENGLANTE, in heraldry, a French term for an oak tree, when bearing acorns.

ENGLISH, in a general ſenſe, ſomething that relates to the country, or people of England. We ſay the Engliſh crown, Engliſh copperas, Engliſh names, Engliſh money, Engliſh meaſures, Engliſh weights, &c.

ENGLISH, or the ENGLISH *Tongue*, the language ſpoken by the people of England, and, with ſome variation, by thoſe of Scotland, as well as part of Ireland, and the reſt of the Britiſh dominions. The ancient language of Britain is generally allowed to have been the ſame with the Gaulic, or French; this iſland, in all probability, having been firſt peopled from Gallia, as both Cæſar and Tacitus affirm, and prove by many ſtrong and concluſive arguments, as by their religion, manners, cuſtoms, and the nearneſs of their ſituation. But now we have very ſmall remains of the ancient Britiſh tongue, except in Wales, Cornwall, the iſlands and Highlands of Scotland, part of Ireland, and ſome provinces of France; which will not appear ſtrange, when what follows is conſidered. Julius Cæſar, ſome time before the birth of our Saviour, made a deſcent upon Britain, though he may be ſaid rather to have diſcovered than conquered it; but, about the year of Chriſt 45, in the time of Claudius, Aulus Plautius was ſent over with ſome Roman forces, by whom two kings of the Britons, Togodumnus and Caractacus were both overcome in battle; whereupon a Roman colony was planted at Malden in Eſſex, and the ſouthern parts of the iſland were reduced to the form of a Roman province; after that, the iſland was conquered as far north as the friths of Dunbarton and Edinburgh, by Agricola, in the time of Domitian; whereupon a great number of the Britons, in the conquered part of the iſland, retired to the weſt part called Wales, carrying their language with them. The greateſt part of Britain being thus become a Roman province, the Roman legions, who reſided in Britain for above 200 years, undoubtedly diſſeminated the Latin tongue; and the people being afterwards governed by laws written in Latin, muſt neceſſarily make a mixture of languages. This ſeems to have been the firſt mutation the language of Britain ſuffered. Thus the Britiſh tongue continued, for ſome time, mixed with the provincial Latin, till, the Roman legions being called home, the Scots and Picts took the opportunity to attack and harraſs England: upon which, K. Vortigern, about the year 440, called the Saxons to his aſſiſtance; who came over with ſeveral of their neighbours, and having repulſed the Scots and Picts, were rewarded for their ſervices with the iſle of Thanet, and the whole county of Kent; but growing too powerful, and not being contented with their allotment, diſpoſſeſſed the inhabitants of all the country on this ſide of the Severn: thus the Britiſh tongue was in a great meaſure deſtroyed, and the Saxon introduced in its ſtead. What the Saxon tongue was long before the conqueſt, about the year 700, we may obſerve in the moſt ancient manuſcript of that language, which is a gloſs on the Evangeliſts, by biſhop Edfrid, in which the three firſt articles of the Lord's prayer run thus:

"Uren fader thic arth in heofnas, ſic gehalgud thin noma, ſo cymeth thin ric. Sic thin willa ſue is heofnas, and in eortho, &c." In the beginning of the ninth century the Danes invaded England; and getting a footing in the northern and eaſtern parts of the country, their power gradually increaſed, and they became ſole maſters of it in about 200 years. By this means the ancient Britiſh obtained a tincture of the Daniſh language; but their government being of no long continuance, did not make ſo great an alteration in the Anglo-Saxon, as the next revolution, when the whole land, A. D. 1067, was ſubdued by William the conqueror, duke of Normandy in France; for the Normans, as a monument of their conqueſt, endeavoured to make their language as generally received as their commands, and thereby rendered the Britiſh language an entire medley. About the year 900, the Lord's prayer, in the ancient Anglo-Saxon, ran thus:

"Thue ur fader the eart on heofenum, ſi thin nama gehalgod; cume thin rice ſi thin willa on eorthan ſwa, ſwo on heofenum, &c." About the year 1160, under Henry II. it was rendered thus by pope Adrian, an Engliſhman, in rhyme:

"Ure fader in heaven rich,
"Thy name be halyed ever lich,
"Thou bring us thy michell bliſſe:
"Als hit in heaven y doe,
"Evar in yearth beene it alſo, &c."

Dr. Hicks gives us an extroardinary ſpecimen of the Engliſh, as ſpoken in the year 1385, upon the very ſubject of the Engliſh tongue. "As it is knowe how meny maner peple beeth in this lond; ther beeth alſo ſo many dyvers longages and tonges. Notheleſs Walſchemen and Scots that beeth nought medled with other nation, holdeth wel nyh hir firſte longage and ſpeche; but yif the Scottes, that were ſometime confederate and woned with the Picts, drawe ſomewhat after hir ſpeche; but the Flemynges, that woneth on the weſt ſide of Wales, haveth loſt her ſtrange ſpech, and ſpeketh Sexonliche now. Alſo Engliſhemen, they had from the bygynnynge thre maner ſpeche; northerne, ſoutherne, and middel ſpeche in the middel of the lond, as they come of thre maner of peple of Germania: notheleſs by commyxtion and mellynge firſt with Danes, and afterwards with Normans, in meny the contrary longage is apayred (*corrupted*.)

"This apayrynge of the burth of the tunge is bycauſe of tweie things; oon is for children in ſcole agenſt the uſuage and maner of all other nations, beeth compelled for to leve hire own longage, and for to conſtrue hir leſſons and here thynges in French, and ſo they haveth ſethe Normans come firſt into Engelond. Alſo gentlemen children beeth taught to ſpeke Frenſche, from the tyme that they beeth roked in here cradel, and kunneth ſpeke and play with a childe's broche; and uplondiſſche men will lykne hymſelf to gentilmen, and fondeth with great beſyneſſe for to ſpeak Frenſche to be told of. Hit ſeemeth a great wonder how Engliſhemen and her own longage and tonge is ſo dyverſe of ſown in this oon iland; and the longage of Normandie is comlynge of another lond, and hath oon maner ſoun amonge alle men that ſpeketh hit arigt in Engelond. Alſo of the aforeſaid Saxon tonge that is deled (*divided*) a three, and is abide ſcarceliche with fewe uplondiſſche men, is greet wonder. For men of the eſt, with men of the weſt, is, as it were, undir the ſame partie of hevene accordeth more in ſowynge of ſpeche, than men of the north with men of the ſouth. Therefore it is that Mercii, that beeth men of myddel Engelond, as it were, parteners of the endes, underſtondeth bettre the ſide longes northerne and ſoutherne, than northerne and ſoutherne underſtondeth either other. All the longage of the Northumbers and ſpechialiche at York, is ſo ſcharp, ſlitting and frotynge, and unſchape, that we ſoutherne men may that longage unnethe underſtonde, &c.

In the year 1537, the Lord's prayer was printed as follows: " O oure father which arte in heven, hallowed be thy name: let thy kingdome come, thy will be fulfilled as well in earth as it is in heven; geve us this daye in dayly bred, &c." Where it may be obſerved, that the diction is brought almoſt to the preſent ſtandard, the chief variations being only in the orthography. By theſe inſtances, and many others that might be given, it appears, that the Engliſh Saxon language, of which the Normans deſpoiled us in a great meaſure, had its beauties, was ſignificant and emphatical, and preferable to what they impoſed on us. " Great, verily, (ſays Camden), was the glory of onr tongue before the Norman conqueſt, in this, that the old Engliſh could expreſs moſt aptly, all the conceptions of the mind in their own tongue, without borrowing from any." Of this he gives ſeveral examples.

Having thus ſhewn how the ancient Britiſh language was in a manner extirpated by the Romans, Danes, and Saxons, and ſucceeded by the Saxon,and after that the Saxon blended with the Norman French, we ſhall now mention two other cauſes of change in the language. The firſt of theſe is owing to the Britons having been a long time a trading nation, whereby offices dignities, names of wares, and terms of traffic are introduced, which we take with the wares from the perſons of whom we have them and form them anew, according to the genius of our own tongue; and beſides this change in the language, ariſing from commerce, Britain's having been a conſiderable time ſubject to the ſee of Rome, in eccleſiaſtical affairs, muſt unavoidably have introduced ſome Italian words among us. Secondly, As to the particular properties of a language, our tongue has undergone no ſmall mutation, or rather has received no ſmall improvement upon that account: for, as to the Greek and Latin, the learned have together with the arts and ſciences now rendered familiar among us, introduced abundance; nay, almoſt all the terms of art in the mathematics, philoſophy, phyſic, and anatomy; and we have entertained many more from the Latin, French, &c. for the ſake of neatneſs and elegancy: ſo that, at this day, our language, which, about 1800 years ago, was the ancient Britiſh, or Welſh, &c. is now a mixture of Saxon, Teutonic, Dutch, Daniſh, Norman, and modern French, embelliſhed with the Greek and Latin. Yet this, in our opinion, is ſo far from being a diſadvantage to the Engliſh tongue as now ſpoken, (for all languages have undergone changes, and do continually participate with each other), that has ſo enriched it as now to become the moſt copious, ſignificant, fluent, courteous, and maſculine language in Europe, if not in the world.

ENGOULANT, in heraldry, ſwallowing, as applied to ſerpents, &c.

ENGRAFTING, GRAFTING, or GRAFFING, in gardening, the art, or act of inſerting, or fixing, a cyon, ſhoot, or bud of one tree, into the ſtock of another; in order to correct, and improve its fruit. See Treatiſe on GARDENING.

ENGRAILED, or INGRAILND, in heraldry (from the French *grêle, hail*) is when a thing is preſented with its edges ragged, or notched, ſemicircularly, as if broken by ſomething falling on it.

ENGRAVING, the art of cutting metals and precious ſtones, and repreſenting thereon figures, letters, or whatever device, or deſign, the artiſt fancies. Engraving, properly a branch of ſculpture, is divided into ſeveral other branches, according to the matter whereon it is employed, and the manner of performing it. For the rudeſt branch, that of engraving on wood, ſee *Cutting in* WOOD.

ENGRAVING *on Copper*, the making, correſpondently ſome delineated figure or deſign, ſuch concave lines on a ſmooth ſurface of copper, either by cutting or corroſion, as render it capable, when charged properly with any coloured fluid, of imparting by compreſſion an exact repreſentation of the figure or deſign to paper or parchment.

Whether we conſider the art of engraving, with regard to the utility and pleaſure it affords, or the difficulty that attends its execution, we cannot but confeſs, that on every account it deſerves a diſtinguiſhed rank among the polite arts. It is by means of this art that the cabinets of the curious are adorned with the portraits of the greateſt men of all ages and all nations; that their memories, their moſt remarkable and moſt glorious actions, are tranſmitted to the lateſt poſterity. It is by this art alſo, that the paintings of the greateſt maſters are multiplied to a boundleſs number; and that the lovers of the polite arts, diffuſed over the face of the whole earth, are enabled to enjoy thoſe beauties which their diſtant ſituations ſeemed to have for ever debarred them; and perſons of moderate fortunes are hereby enabled to become poſſeſſed of all the ſpirit, and all the poetry, that are contained in thoſe miracles of art, which ſeemed to have been reſerved for the temples of Italy, or, the cabinets of princes. When we reflect, moreover, that the engraver, beſide the beauties of poetic compoſition, and the artful ordinance of deſign, is to expreſs, merely by the means of light and ſhade, all the various tints of colours and clair obſcure; to give a relief to each figure, and a truth to each object; that he is now to paint a ſky ſerene and bright, and then loaded with dark clouds; now the pure tranquil ſtream, and then the foaming, raging ſea; that here he is to expreſs the character of the man, ſtrongly marked in his countenance, and there the minuteſt ornament of his dreſs; in a word, that he is to repreſent all, even the moſt difficult objects in nature; we cannot ſufficiently admire the vaſt improvements in this art, and that degree of perfection to which it is at this day arrived.

The invention of this art is ſaid to be owing to chance. In the 15th century, a goldſmith of Florence, who was in much eſteem with pope Innocent X. having placed a ſheet of oiled paper under a plate of ſilver that was engraved, and on which, by accident, he had laid a heavy weight, was much ſurpriſed to find, a few days after, a complete impreſſion of the plate upon the paper. This he communicated to ſome able painters, his cotemporaries; who profiting by that example, laid the firſt foundation of the art of engraving: which Raphael in Italy, and Albert Durer in Germany, greatly improved; and which the Italian, French, and Flemiſh maſters, ſuch as Michal Angelo, Edinlinck, Rembrandt, &c. and lately ſome of the Britiſh artiſts, have ſucceſſively carried to the higheſt degree of excellence.

The method by which engraving is performed, by the graver or tool alone, is in common language the only kind called ſtroke engraving; that by corroſion with aqua fortis, which is generally called etching: and by entirely covering the ſurface of a copper plate with a dark ground, in ſuch a manner, that the whole may produce the effect of black in an impreſſion; and then ſcraping or burniſhing away part of the dark colour, ſo as to cauſe the remainder to have the effect of a painting, which laſt kind is called ſcraping in mezzotinto. Of late the methods of producing effects upon copper have been ſo various, that it would be endleſs to deſcribe them. But there are two methods very much in preſent practice, the firſt is ſtippling, which is performed by dots on the copper, and by this means worked up in ſuch a manner, as to have ſomething of the appearance of a mezzotinto; but infinitely preferable, as it will afford a ſofter, and yet more ſpirited effect. The other method is by aquatinta, which we have deſcribed under that article.

Engraving with the tool was the kind originally practiſed, and it is yet retained for many purpoſes. For though etching be more eaſy, and other advantages attend it; yet where great regularity and exactneſs of the ſtroke or lines are required, the working with the graver is much more effectual: on which account it is more ſuitable to the preciſion neceſſary in the execution of portraits; as there every thing the moſt minute muſt be made out and expreſſed, according to the original ſubject, without any licenſe to the fancy of the deſigner in deviating from it or varying the effect either by that maſterly negligence and ſimplicity in ſome parts, or thoſe bold ſallies of the imagination and hand in others, which give ſpirit and force to hiſtory-painting.

The principal inſtruments uſed in engraving with the tool, are gravers, ſcrapers, a burniſher, an oil-ſtone, and a cuſhion for bearing the plates. Gravers are made in ſeveral forms with reſpect to the points, ſome being ſquare, others lozenge; the ſquare graver for cutting board, and the lozenge for more delicate deep and fine ſtrokes. The dry point, or needle, which has been of late much uſed in engraving, is a tool like an etching point, which being drawn hard on the copper, cuts a ſtroke, and raiſes a burr; the burr is ſcraped off, and there remains a ſtroke more ſoft and delicate than can be produced in any other way.

The burniſher is uſed to aſſiſt in the engraving on ſome occaſions, as well as to poliſh the plates. The principal application of it in engraving, beſides its uſe in poliſhing the plates, is to take out any ſcratches, or accidental defacings, that may happen to the plates during the engraving; or to leſſen the effect of any parts that may be too ſtrongly marked in the work, and require to be taken down. A cuſhion, as it is called, is likewiſe generally uſed for ſupporting the plate in ſuch a manner, that it may be turned every way with eaſe. It is a bag of leather filled with ſand, which ſhould be of the ſize that will beſt ſuit the plates it is intended to bear. They are round, and about nine inches over, and three inches in thickneſs.

In making circular or other curve lines, hold your hand and graver ſteadily; and as you work, turn your plate upon the cuſhion againſt your graver, otherwiſe it will be impoſſible for you to make any circular or curved lines with that neatneſs and command of hand you by this means may. After part of the work is engraved, it is neceſſary to ſcrape it with the ſcraper, or graver, paſſed in the moſt level direction over the plate to take off the roughneſs formed by the cutting of the graver; but great care muſt be taken not to incline the edge of the ſcraper or tool uſed, in ſuch a manner that it may take the leaſt hold of the copper, as it would otherwiſe produce falſe ſtrokes or ſcratches in the engraving: and that engraved work may be rendered more viſible, it may afterwards be rubbed over with a roll of felt dipped in oil.

It is very neceſſary for thoſe, who learn to engrave in perfection, to endeavour, by frequent trials, to acquire the habit of making ſuch ſtrokes both ſtraight and curving, by lightning or ſinking the graver with the hand, according to the occaſion. If, after finiſhing the deſign, any ſcratches appear, or any part of the engraving be falſely executed, ſuch ſcratches, or faulty parts, muſt be taken out by the burniſher, and further poliſhed, if neceſſary, by the above-mentioned roll.

Engraving *on Precious Stones*, is the repreſenting of figures, or devices, in relievo or indented, on divers kinds of hard poliſhed ſtones. The art of engraving on precious ſtones is one of thoſe wherein the ancients excelled; there being divers antique agates, cornelians, and onyxes, which ſurpaſs any thing of that kind the moderns have produced. Pyrgoteles among the Greeks, and Dioſcorides under the firſt emperors of Rome, are the moſt eminent engravers we read of: the former was ſo eſteemed by Alexander, that he forbade any body elſe to engrave his head; Auguſtus's head, engraven by the latter, was deemed ſo beautiful, that the ſucceeding emperors choſe it for their ſeal. All the polite arts having been buried under the ruins of the Roman empire, the art of engraving on ſtones met with the ſame fate. It was retrieved in Italy at the beginning of the 15th century, when one John of Florence, and after him Dominic of Milan, perfomed works of this kind no way to be deſpiſed. From that time, ſuch ſculptures became common enough in Europe, and particularly in Germany, whence great numbers were ſent into other countries: but they came ſhort of the beauty of thoſe of the ancients, eſpecially thoſe on precious ſtones; for, as to thoſe on cryſtal, the Germans, and, after their example, the French, &c. have ſucceeded well enough. In this branch of engraving, they make uſe either of the diamond, or of emery.

The diamond, which is the hardeſt of all ſtones, is only cut by itſelf, or with its own matter. The firſt thing to be done in this branch of engraving, is to cement two rough diamonds to the ends of two ſticks big enough to hold them ſteady in the hand, and to rub or grind them againſt each other till they be brought to the form deſired. The duſt or powder that is rubbed off ſerves afterwards to poliſh them, which is performed with a kind of mill that turns a wheel of ſoft iron. The diamond is fixed in a braſs diſh; and, thus applied to the wheel, is covered with diamond-duſt, mixed up with oil of olives; and when the diamond is to be cut facet-wiſe, they apply firſt one face, then another, to the wheel. Rubies, ſapphires, and topazes, are cut and formed the ſame way on a copper wheel, and poliſhed with tripoli diluted in water. As to agates, amethyſts, emeralds, hyacinths, granates, rubies, and others of the ſofter ſtones, they are cut on a leaden wheel, moiſtened with emery and water, and poliſhed with tripoli on a pewter wheel. Lapis-lazuli, opal, &c. are poliſhed on a wooden wheel. To faſhion and engrave vaſes of agate, cryſtal, lapis-lazuli, or the like, they make uſe of a kind of lathe, like that uſed by pewterers to hold the veſſels, which are to be wrought with proper tools: that of the engraver generally holds the tools, which are turned by a wheel; and the veſſel is held to them to be cut and engraved, either in relievo or otherwiſe; the tools being moiſtened from time to time with diamond-duſt and oil, or at leaſt emery and water. To engrave figures or devices on any of theſe ſtones, when poliſhed, ſuch as ſeals, &c. they uſe a little iron wheel, the ends of whoſe axis are received within two pieces of iron, placed upright, as in the turner's lathe; and to be brought cloſer, or ſet further apart at pleaſure: at one end of the axis are fitted the proper tools, being kept tight by a ſcrew. Laſtly, The wheel is turned by the fort, and the ſtone applied by the hand to the tool, and is ſhifted and conducted as occaſion requires. The tools are generally of iron, and ſometimes of braſs; their form is various, but it generally bears ſome reſemblance to chiſels, gouges, &c. Some have ſmall round heads, like buttons, others like ferrels, to take the pieces out, and others flat, &c. When the ſtone has been engraven, it is poliſhed on wheels of hair-bruſhes and tripoli.

Engraving *on Steel* is chiefly employed in cutting ſeals, punches, matrices, and dyes proper for ſtriking coins, medals, and counters. The method of engraving with the inſtruments, &c. is the ſame for coins as for medals and counters: all the difference conſiſts in their greater or leſs relievo; the relievo of coins being much leſs conſiderably than that of medals, and that of counters, ſtill leſs than that of coins.

Engravers in ſteel commonly begin with punches, which are in relievo, and ſerve for making the creux, or cavities, of the matrices and dyes: though ſometimes they begin with the creux, or hollowneſs; but then it is only when the intended work is to be cut very ſhallow. The firſt thing done, is that of deſigning the figures; the next is the moulding them in wax, of the ſize and depth they are to lie, and from this wax the punch is engraven. When the punch is finiſhed, they give it a very high temper, that it may the better bear the blows of the hammer with which it is ſtruck to give the impreſſion to the matrix. The ſteel is made hot to ſoften it, that it may the more readily take the impreſſion of the punch; and after ſtriking the punch on it, in this ſtate, they proceed to touch up or finiſh the ſtrokes and lines, where by reaſon of their fineneſs or the too great relievo they are any thing defective, with ſteel gravers of different kinds, chiſels, flatters, &c. being the principal inſtruments uſed in graving on ſteel. The figure being thus finiſhed, they proceed to engrave the reſt of the medal, as the mouldings of the border, the engrailed ring, letters, &c. with little ſteel punches well tempered, and very ſharp.

ENGROSSING, the writing a deed over fair, and in proper legible characters. Among lawyers it more particularly means the copying of any writing fair upon parchment, or ſtamped paper.

Engrossing, in commerce, ſignifies the buying up any commodity in the groſs, or foreſtalling the market.

ENGUICHE, in heraldry, is ſaid of the great mouth of a hunting horn, when its rim is of a different colour from that of the horn itſelf.

ENHANCED, in heraldry, placed high in the field.

ENIGMA. See Ænigma.

ENMANCHE, in heraldry, is when a chief has two lines drawn from the middle of the upper edge, to the ſides, the depth of half the chief; the two lines including an obtuſe angel, whoſe vertex is the centre of the top of the chief.

ENNEAGON, in geometry, a figure of nine angles, and nine ſides. The word is formed of εννεα, *nine*; and γωνια, *angle*.

ENNEANDRIA, in botany, the ninth claſs of plants; in the Linnæan Syſtem. The word is derived from the Greek εννεα, *nine*, and ανηρ, *male*. This claſs comprehends three orders; viz. the monogynia, the trigynia, and hexagynia. See Syſtem of Botany, Sect. V. and Plate IV.

ENORMOUS, ſomething exceſſive, or monſtrous, eſpecially of bulk. The coluſſus of Rhodes was of an enormous ſtature.

ENSEMBLE, a French term, ſometimes uſed in our language, literally ſignifying *together*, or *one with another*; being formed from the Latin, *in*, and *ſimul*. In architecture, we ſay, the *enſemble*, or *tout enſemble* of a building; meaning the work or compoſition, conſidered together, and not in parts; and ſometimes alſo the relative proportion of the parts to the whole. Alſo thoſe pieces of building make a fine *enſemble*.

To judge well of a ſtatue, or other work of ſculpture, one muſt firſt examine whether the *enſemble* be good. The *tout enſemble* of a painting, is that harmony which reſults from the diſtribution of the ſeveral objects or figures whereof the whole is compoſed. This picture is good, taking the parts ſeparately; but the *tout enſemble* is bad.

ENSIFORM *Leaf*, in botany. See Syſtem of Botany, Plate I. *fig*. 56.

ENSIGN, in the military art, a banner or colours under which ſoldiers are ranged, according to the different companies or parties they belong to. See Flag, Colours, Standard, &c.

Ensign is alſo the officer that carries the colours, being the loweſt commiſſioned officer in a company of foot, ſubordinate to the captain and lieutenant. It is a very honourable and proper poſt for a young gentleman at his firſt coming into the army: he is to carry the colours both in aſſault, day of battle, &c. and ſhould not quit them but with his life; he is always to carry them himſelf on his left ſhoulder: only on a march he may have them carried by a ſoldier. If the enſign is killed, the captain is to carry the colours in his ſtead.

Naval Ensign, a large ſtandard or banner hoiſted on a long pole erected over the poop, and called the *enſign ſtaff*. The enſign is uſed to diſtinguiſh the ſhips of different nations from each other, as alſo to characteriſe the different ſquadrons of the navy. The Britiſh enſign in ſhips of war is known by a double croſs, viz. that of St. George and St. Andrew, formed upon a field which is either red, white, or blue.

ENTABLATURE, in architecture, is that part of an order of column which is over the capital, comprehending the architrave, frize, and corniche. See Syſtem of Architecture, on the Orders of Architecture in general, and Plate VI.

ENTAIL, in law, ſignifies fee tail, or fee entailed, that is, abridged, curtailed, or limited to certain conditions.

ENTEROLOGY, from εντερον, *inteſtinum*, a gut, and λογος, *ſermo*, diſcourſe) is properly a treatiſe on the bowels. Though the word is generally underſtood to include the contents of three cavities, head, breaſt, and all the viſcera or belly.

ENTHYMEME, in logic and rhetoric, an argument conſiſting only of two propoſitions, an antecedent, and a conſequent deduced from it.

ENTITY, in the ſchool philoſophy, a phyſical ens, or being, conſidered according to what it is in its natural capacity.

ENTOMOLOGY, the ſcience of inſects, or that part of zoology which treats of inſects.

SYSTEM OF ENTOMOLOGY.

PART. I.

INTRODUCTION.

THIS ſcience, although it is only a ſmall part of zoology, yet in the number of individuals and ſpecies it exceeds all the other parts united; inſects are the moſt numerous tribe of animals though leaſt in ſize, and notwithſtanding the extreme minuteneſs, admirable ſkill and perfect mechaniſm which pervade the whole, the omnipotence and omniſcience of the great Creator is manifeſtly diſplayed, and that divine rule and order which regulate all his works are equally apparent in the moſt minute as in the largeſt of his creatures. Inſects therefore aſſuredly claim a proper degree of attention: the effects produced by them are inimitable by art, and oftentimes ſo great and incomprehenſible as to exceed the bounds of human reaſon: but notwithſtanding their univerſality, their variety and the exceſſive beauty of ſome particular ſpecies, and that thirſt for novelty inherent in man, the ſtudy of theſe minute animals has never been cultivated with that ardor and ſucceſs which has fallen to the ſhare of botany. This probably aroſe from the many difficulties attending it; the minuteneſs of their form and the ſingularity of their transformations, together with the idea which formerly prevailed, that their generation was equivocal, and their production inconſtant, ſpontaneouſly iſſuing without law or order, in immenſe varieties from the putrified remains of animals and other ſubſtances. However ridiculous and abſurd ſuch an opinion may now appear, it was almoſt univerſally credited, till the valuable and numerous experiments of Harvey and Rhedi enlightened the ſubject; and clearly and fully demonſtrated that every living thing was produced from an egg. There were indeed other reaſons that operated powerfully againſt this ſtudy, viz. the difficulty of aſcertaining what an inſect was, and the terror that many people have for particular ſpecies: again, a man was looked upon with contempt who employed himſelf in thoſe purſuits, and often ſtigmatized with the opprobrious epithets of fool or madman, for thus, as it was called, miſpending his time, though in exploring the works of that Being from whom our own exiſtence is derived.

With a view to render this ſtudy more eaſy, and a deſire to make it more general, it is our intention to elucidate it, firſt by giving a ſhort liſt of the authors who have diſtinguiſhed themſelves in this branch of knowledge, then to add ſome obſervations on the ſexes, food, modes of living, uſes, deſtructive properties and metamorphoſes of inſects, with conciſe directions for catching and preſerving them; alſo a complete definition of an inſect, and a ſcientific deſcription of its component parts; and conclude with a clear and comprehenſive view of that admirable ſyſtem laid down by Linnæus.

HISTORY.

Among the ancients, Ariſtotle and Pliny did not neglect the contemplation of inſects; but Ariſtotle, rich as he is in remarks on their general œconomy has deſcribed but very few of the ſpecies to which he refers, an omiſſion which we cannot ſufficiently lament, and Pliny's obſervations are not numerous. In ſhort, little was effected till the beginning of the 17th century, when Mouffet's Inſectorum ſive minimorum animalium theatrum was printed in London 1634; this work appears to have been only finiſhed by Mouffet, it having been begun in 1550, by Edward Wootton, continued by Conrad Geſner, and enriched by Thomas Penny; it is embelliſhed with wooden cuts. Aldrovand, who publiſhed in 1638, and Jonſton in 1653, were mere compilers, and added nothing new to this ſtock of knowledge. To theſe ſucceeded many figures of inſects uſed as embelliſhments to paintings of flowers, which led the artiſts as it were imperceptibly to apply themſelves to this ſtudy; in this liſt we find the names of Robert, Hoefnagel, Goedart, Merian, Schvartz, Albin, &c. Rhedi in 1668 and 1684 publiſhed his valuable works. The invention of microſcopes opened a new field totally unknown to the ancients, and among the labourers in this extenſive field we ſee the valuable names of Lewenhoek, Joblot, Hook, Needham, Malphigi, Swammerdam, Lyonet, De Geer, Baker, and the two Adams's, father and ſon, beſides many others. But in this liſt Swammerdam appears to have ſurpaſſed all his predeceſſors, and to have gained infinite fame; he was the firſt who inveſtigated the internal ſtructure of inſects, at which he acquired ſuch a preciſion and dexterity, that he could diſplay and demonſtrate the moſt minute parts of theſe ſmall animals with clearneſs and accuracy. Lyonet's work on the Larva of the Phalæna Coſſus, is beyond praiſe; and it is ſincerely to be wiſhed that his ſecond work on the Pupa of the ſame inſect, which it is ſaid was finiſhed before his death, may not long be with-held from the public. Reaumur made a rapid progreſs, not only in the anatomy but alſo in the œconomy and habits of inſects, purſuing them with unwearied attention through their ſeveral ſtates and changes. The illuſtrious Swede Baron Charles De Geer, trod in the ſame path, and excelled all that had gone before him, not only adding to the diſcoveries of Lewenhoek, but extending the anatomical reſearches of Swammerdam, uniting with theſe the objects of inveſtigation propoſed by Reaumur; and above all, digeſted the catalogue of inſects into claſſes and orders. The ſpace allotted us in this work will prevent our doing ample juſtice to the merits of all the writers on this exhauſtleſs ſubject; but we cannot paſs over the excellent work of our countryman Liſter, on Engliſh ſpiders, which to this day remains unequalled, nor the copious obſervations of that ſuperlative genius Ray, a man of inexhauſtible induſtry and perſeverance. The ſyſtematic writers are Linnæus, De Geer, Scopoli, Shultzer, Geoffroy, Gronovius, Schæffer, Fabricius, &c. and of theſe Linnæus ranks the higheſt; it was he who firſt reduced the genera and families of inſects into order in the Syſtema Naturæ, publiſhed in 1735 and 1740; and although his ſyſtem was the firſt, it yet ſtands unrivalled for clearneſs and perſpicuity. We muſt now content ourſelves with giving a bare liſt of many admirable works, ſome of which are lately publiſhed, and do honor to the ſcience, ſuch as Bonnet, Friſch, Seba, Ehret, Admiral, Wilkes, Brunnich, Leche, Leſſer, Roeſel, Drury, Harris, Sepp, Knoch, Forſter, Ernſt, Cramer, Voet, Stoll, Fueſly, Fabricius, Schrank, cum multis aliis: together with a number of elegant diſſertations of Linnæus and his pupils, publiſhed in the Amœnitates Academicæ, many of which are tranſlated by Stillingfleet, Brand and Curtis; and to theſe we would recommend our readers as affording much valuable information.

SEXES OF INSECTS, AND THE PROPAGATION OF THEIR SPECIES.

In this particular, inſects differ from all other animals, there being not only males and females of each ſpecies, but in many caſes neuters; to diſtinguiſh the ſexes of inſects, requires much ſkill and knowledge, the males in many inſtances differing ſo eſſentially from the females as not even to preſerve a ſimilarity; as in the *Lampyris noctiluca*, or glow worm, and in many ſpecies of moths, where the male is winged and the female apterous. Among the ants the neuters only are without wings. This laſt ſex is confined to thoſe inſects who live in ſocieties, as bees, waſps, ants, &c. where providence has ſo ordained, that being incapable of generation, they perform the whole buſineſs of the community, leaving the males and females to *The Propagation of their Species*; In which we find very ſingular exceptions to thoſe laws which are obſerved in the higher orders of animated beings. We have before obſerved that inſects are produced from an egg laid by the female parent, after an impregnation from the male; but in the Aphides one impregnation or union of the male and female, is ſufficient for five generations; and what is ſtill more worthy of admiration, the ſame ſpecies of Aphis which was viviparous in the ſummer, becomes oviparous in the autumn; it would be impoſſible to note here one thouſandth part of that care and attention, aſtoniſhing ſagacity, or inſtinct, with which inſects are endued for the preſervation of their young; the facts are conſtantly before us, and yet are paſſed by unnoticed and neglected.

FOOD OF INSECTS.

All animal and vegetable ſubſtances ſeem to be allotted by the Creator, for the food of inſects, and the higheſt tree has its inhabitants equally with the loweſt moſs. The root, trunk, leaves, flowers, and fruit, have each its deſtroyer, while many exiſt in the bodies of living animals, and numbers depoſit their eggs in dead and putrid carcaſes, dunghills, ſtagnant waters, &c. all of which afford a proper nouriſhment for the young offspring, even hard and dried wood, and all animal ſubſtances, ſuch as preſerved quadrupeds, birds and inſects, are ſoon deſtroyed without great care; and it is not a ſmall number who live upon other inſects; for there is no claſs of animals ſo voracious or who eat ſo much food in proportion to their ſize as inſects. In many countries they occaſion a famine, and even in our own where we are not ſo liable to their depredations, we are conſtantly exerting ourſelves to preſerve our viands, clothes, and furniture, and even our bodies, from being conſumed or annoyed by them.

MODE OF LIVING.

After giving ſome account of the food of inſects, it may not be improper to give a ſlight ſketch of that admirable proviſion adapted to the preſervation of each individual ſpecies in its infant ſtate; ſome as ſoon as they are hatched form little ſocieties, and live in a web, ſpun round the ſlender branch of a tree, which they enlarge as they increaſe in ſize; others fixed by one end to a ſmall twig ſtand almoſt erect and motionleſs, reſembling a thorn or decayed part, their colour being ſimilar; many by a delicate ſlender thread draw the leaves of a plant cloſe and tight round them, forming a neat cylindric caſe. The phalæna ſarcitella, or cloaths moth, covers itſelf with the fineſt threads of the wool on which it is feeding, enlarging its houſe as it grows bigger; and if you fix it ſucceſſively upon different coloured cloths, it becomes party-coloured like the jacket of an harlequin. The cicada ſpumaria, or froghopper, emits a frothy matter in which it lies concealed, and the larvæ of the phryganeæ, who ſeek their food in the bottom of ponds and rivers, form little ſtrong hollow tubes with ſtones, ſhells, or ſmall particles of wood, which they line with a ſilky ſubſtance, and by that means eſcape falling a prey to many ſpecies of fiſh.

USES OF INSECTS.

Reaſon and obſervation daily teach us that nothing was created in vain, but that every living creature has its uſe, although that uſe may not always come within the ſphere of our capacity, and it is probable that the uſes of numberleſs ſpecies of inſects may never be made known to us; yet we have every reaſon to believe that theſe minute beings are of very conſiderable importance in the grand ſcale of creation, that each of them has its proper buſineſs aſſigned to it in the œconomy and police of nature, whereby they tranſact the greateſt things, and though gradually and ſlowly, yet by their number they effect what would appear to exceed all expectation and belief. It is by their means that a proper proportion and equilibrium are preſerved in vegetables by deſtroying many which are inacceſſible to large animals; happily ſome clear the ſurface of the earth, of impure and ſuperfluous, ſome the air of fœtid and putrid matters, and others muddy and ſtagnating waters of heterogeneous and filthy mixtures. The labours of the ſilk-worm and bee are little attended to in general, becauſe they are frequently before us; but can we without gratitude reflect that in this ſmall iſland 50,000 people are daily maintained by the delicate and curious workmanſhip of one little groveling worm. The medicinal properties of honey, and the numerous uſes to which wax is applied, have made them conſiderable objects of commerce. The meloe veſicatorius, or cantharides of the ſhops, is alſo of ſovereign utility in the hands of the phyſicians; as is the cochineal inſect to the dyer. The labour of another inſect (cynips) produces the gall ſo eſſential in making ink; but this is an exhauſtleſs ſubject; and therefore we ſhall, agreeable to our plan, proceed to their.

DESTRUCTIVE PROPERTIES.

Happily in our climate we are fully exempt from many of the moſt terrible deſtroyers: we are totally unacquainted with the gryllus migratorius, a ſpecies of locuſt, which ſome years ago came in ſuch immenſe numbers out of Tartary as to darken the air, laying waſte almoſt all Europe; the muſca hordei, which is ſaid by Linnæus to deſtroy one fifth part of the corn in the granaries of Sweden amounting annually to 100,000 tons. The phalæna calamitoſa and graminis, in ſome countries lay waſte the meadow lands ſo as to render the hay not worth cutting. The tenthredo pini ſtrips whole plantations of firs of their leaves, and by that means haſtens their death; and ſurely we ought to be peculiarly thankful for our ignorance of the Heſſian fly, that for eleven years paſt has been increaſing in America, totally deſtroying all the wheat. We are indeed much plagued in our cities and large towns, with the cimex lectularius, or bed bug, the common flea, and the louſe which ſwarm in the heads of children; the blatta orientalis is very troubleſome in our kitchens; but the inſect moſt terrible in its effects is the acarus ſiro, which inſinuates itſelf under the cuticle, where it increaſes to an immenſe degree ulcerating and producing a leprous irruption called the itch. Many ſpecies of the tabani, gnats, &c. annoy us in the fields with their pungent bite, as do the conops calcitrans, an inſect much reſembling the common fly in our houſes.

Spiders alſo are very unpleaſant companions in our houſes, although they leſſen the quantity of the houſe fly in the autumn when it covers all our victuals and ſweetmeats in ſuch vaſt numbers; the phalæna granella deſtroys the corn in our granaries, and the eggs of the tenebrio molitor, produce the meal worm in flour. Cheeſe is deſtroyed in quantity by acari, or mites, and the larvæ of the muſca putris; our woollen furniture and cloaths without great care fall a ſacrifice to a ſmall moth, as do our furs to the dermeſtes pellio. Our fruit trees are frequently ſpoiled of their foliage by the larvæ of various moths, and our cabbages totally deſtroyed by the caterpillars of the white butterfly; but were we to enumerate the damage done by each particular ſpecies, it would fill a volume: we ſhall however obſerve that the inſects which deſtroy the turnep in ſome counties and the hop in others, neither of which appear to be properly defined, are the moſt pernicious inſects the farmers in this country have to encounter. Our oxen and cows ſuffer much from the oeſtrus bovinus, which is nouriſhed in their backs, living there the whole winter. The oeſtrus hæmmorhoidalis, or bot, is bred in the inteſtines of horſes to which it enters by the rectum; the oeſtrus ovis leaves its eggs in the noſtrils of ſheep, the maggots of which lodge the whole winter in the cavity of the forehead often occaſioning death. The hippoboſea equina, or foreſt-fly is very troubleſome to horſes, who have alſo a ſpecies of louſe which emaciates them by degrees. Birds are all infeſted with lice, each genus having a peculiar one; our domeſtic poultry, if they rooſt for a conſiderable time in a confined place, ſuffer very much from them, the old ones droop, but the young ones die; pepper is in this caſe the beſt antidote. Crabs are great deſtroyers of fiſh in rivers, lakes, &c. as are the dytiſci in ponds. The oniſcus entomon is a terrible enemy to the herring, and even that enormous animal the whale, is prayed upon by the oniſcus ceti. The inſects which deſtroy other inſects are innumerable, and therefore we muſt paſs them over, with only obſerving that the breeders of bees ſhould be very careful to guard them againſt the phalæna melonella, which eats the honey comb, and from hornets and waſps their moſt deſtructive enemies.

METAMORPHOSES OF INSECTS.

This aſtoniſhing property ſeems peculiar to inſects; for all, except thoſe of the aptera claſs, are continually undergoing ſome transformation; this circumſtance while it increaſes the number of objects, renders the ſtudy of the ſcience more difficult, becauſe the ſame individual in one ſtate bears no reſemblance to itſelf in another ſtate; their firſt change is from the egg to the *larva*, caterpillar or maggot, then into the *pupa*, chryſalis or aurelia, and laſtly into the *imago*, fly, or perfect ſtate. Linnæus was the firſt who applied the term *larva*, which ſignifies maſked, to the firſt ſtate of an inſect, becauſe he thought it fully expreſſed its ſituation, as its true appearance then lay concealed; Swammerdam having demonſtrated that the butterfly with its wings, exiſts in the caterpillar, though its reſemblance is very imperfect. Inſects in this ſtate feed and increaſe in ſize, frequently changing their ſkin: when they are full fed they ſeek out a convenient place, roving ſometimes for days, wherein to make their ſecond change, formerly called chryſalis and aurelia from the elegant ſpots like gold on ſome of the butterflies; now named *pupa*, from the likeneſs they bear to an infant in ſwaddling cloaths. The modes in which this is performed are almoſt as numerous as inſects themſelves, and in this ſtate all, but the hemiptera claſs, take no nouriſhment. After a certain time, which is often accelerated or retarded by the ſeaſons, the inſect breaks its outward covering and burſts forth as it were into new life, in glory and ſplendour; this laſt production is called by the ſame author its *imago* or perfect ſtate; it appears at firſt, moiſt, tender, and its wings rumpled together, in a few minutes it becomes dry, its antennà appear, the wings ſhoot forth, its ſtrength increaſes, and all its beauty and luſtre become apparent; it now undergoes no more transformations, but ſporting in the air ſeeks out its mate; and, after propagating its ſpecies, dies. It is here however worthy of remark, that the ephemeron, gnat, &c. who live through and undergo their two firſt changes in the water, in their laſt or fly ſtate, infallibly loſe their lives if they chance to fall into that element. As the *pupa* of inſects differ much in ſhape, they have been named,

Coarctata, when round, and as it were turned without any reſemblance to the inſect incloſed, as in the diptera.

Obtecta, when it conſiſts of two parts, one of which incloſes the head and thorax, and the other the abdomen.

Incompleta, in this they have wings and feet, but are not capable of moving them, as in the hymenoptera.

Semicompleta, theſe walk or run, but have only rudiments of wings.

Completa, in which they immediately obtain the form of the inſect without undergoing any further change as in the aptera, the flea excepted. The bed bug belongs to this claſs.

The ſpider undergoes frequent transformations, but it is only in the colour of its ſkin; cruſtaceous inſects, as crabs, lobſters, &c. yearly caſt their ſhells, as their growth would otherwiſe be impeded. The ſcolopendri, when young, have fewer feet than when they are full grown.

METHOD OF COLLECTING AND PRESERVING INSECTS.

Thoſe who would wiſh to acquire a good collection of inſects muſt not ſhrink from a little trouble, but be conſtantly on the foot for that purpoſe. Three kinds of net are neceſſary, viz. the forceps net, a hoop net, and a large folding net, made like thoſe uſed for batfowling; all of which ſhould be made of gauze, with the ſtiffening taken out. The firſt will be found convenient for taking the inſects of the hymenoptera claſs, or thoſe armed with ſtings, the ſecond is beſt adapted to water inſects, and the laſt for butterflies and moths, in the handling of which much care is neceſſary, ſo as not to rub off the curious ſcales or feathers with which their wings are covered; they are beſt killed by ſqueezing them with the finger and thumb between the wings while in the net, and then ſticking a pin through the body, by which means they may be immediately placed in the pocket box, which ſhould be made of thin deal, and lined at top and bottom with cork. Butterflies are on the wing during the day in fine weather, and are to be found in various ſituations according to their kinds, many of the moſt beautiful, frequent woods, they may alſo be caught in an evening while aſleep on different plants. Moths in general fly only in the twilight after ſun ſet, and therefore require a keener eye; but the beſt way of having them in perfection is to breed them from the caterpillars, which may be procured by ſpreading a large ſheet under the trees, and beating them with a long pole; they are then to be placed in a ſquare box with canvas ſides like a meat ſafe, the bottom of which ſhould be covered 3 or 4 inches deep with light earth kept tolerably moiſt, care being had to ſupply them with the plants on which they are found, which will keep freſh for ſeveral days if placed in phials of water; when the time of change approaches they leave off eating, and either go into the earth to perfect their change, or ſpin themſelves webs againſt the ſides of the box, wanting no further care nor attention. Many curious inſects may often be found on the ſheet by the foregoing mode of beating; if a ſheet is not at hand, a large piece of paſteboard is a good ſubſtitute, which the collector can hold in one hand while he beats with the other. The pupa of many moths may be found by digging at the roots of trees. Underwoods, particularly thoſe which are cut down every 5 or 7 years, afford the greateſt variety of inſects; but it is neceſſary that the collector ſhould examine putrid bodies, dung of animals, rotten wood, ditches, pools, &c. if he wiſhes to obtain an extenſive knowledge or acquire a large collection, he will alſo find many inſects under ſtones in moiſt and humid places. Bees waſps, &c. are killed by ſpirits of turpentine, and the whole tribe of beetles or cruſtaceous inſects by immerſion in ſcalding water. The collector ſhould always be furniſhed with a pincuſhion, well ſtored with pins of different ſizes and a number of pill boxes, or ſmall phials. To preſerve them properly, it is neceſſary to place them in drawers or boxes lined with cork, and covered with glaſs, which ſhould be made to ſhut as tight as poſſible, and a ſmall compartment or two ſhould be contrived to hold camphire, which is a good preſervative.

DEFINITION OF AN INSECT.

Linnæus has clearly proved that of all animals thoſe only which he has called inſects, are furniſhed with antennæ, that they are deſtitute of bones, but covered with ſkin externally hard, which like a compleat ſuit of armour preſerves them from injury, being of immenſe ſtrength in compariſon to its ſize. All inſects have ſix or more feet, and they reſpire through pores placed on the ſides of their bodies, which are termed ſpiracula; but the antennæ placed on the fore part of the head conſtitute the principal diſtinction. They are jointed and moveable, in which they differ from the horns of all other animals. Before Linnæus pointed out theſe eſſential characters, the crab, which is a true inſect, was claſſed with fiſh, and the hippocampus, a fiſh, was claſſed with inſects. The meduſa, cockle, earth worm, even zoophites, and other claſſes of worms, were likewiſe confounded with them.

SCIENTIFIC DESCRIPTION.

The body of an inſect is divided into a *head*, *trunk*, *abdomen*, and *limbs*. *Caput*, the head, is attached to the trunk by an articulation or joint; it is furniſhed with eyes, antennæ, and in moſt caſes a mouth, but is deſtitute of brains, noſtrils or ears. The eyes are moſtly two in number, without eyelids, and are either ſimple or compound, conſiſting of one or more lenſes, and are the organs of viſion as in other animals. Inſects in general have two antennæ compoſed of an indefinite number of articulations; they differ from the tentacula of the vermes in being cruſtaceous; and are eaſily diſtinguiſhed by their ſituation from the palpi of inſects, which are generally more numerous, and always placed near the mouth. As the antennæ are a very diſtinguiſhing feature in many genera, it will be proper to explain their different forms; they are called

Setaceous, when they gradually taper from the baſe, to the point, like a briſtle.

Filiformes, or thread ſhaped, when of equal thickneſs throughout.

Moniliformes, compoſed of globular joints, reſembling a ſtring of beads.

Enſiformes, ſhaped ſomething like a ſword.

Clavatæ, club ſhaped, when they gradually increaſe in ſize towards the extremity.

Capitatæ, like clavatæ, but the laſt articulation larger and rounder, forming a kind of knob.

Fiſſiles, are capitatæ, but the capitulum or knob is divided longitudinally into 3 or 4 plates, or laminæ.

Perfoliatæ, are alſo like capitatæ, but with the capitulum horizontally divided.

Serratæ, notched like the teeth of a ſaw.

Pectinatæ, like a comb or feather.

Filatæ, ſimple without a lateral hair.

Ariſtatæ, ſuch as have a lateral hair, either naked or furniſhed with leſſer hairs.

Plumatæ, having a lateral feather.

They are termed *breviores*, when ſhorter than the body, *mediocres* when of equal length, and *longiores*, when longer than the body. The *palpi*, or feelers, ſo firſt named by Linnæus, reſemble thread ſhaped, articulated moveable antennæ, from which they differ in being naked, ſhort, and always placed about the mouth: they are moſt commonly four in number, ſometimes ſix, and in a few inſtances only two.

Os, the mouth, is generally placed on the anterior part of the head, extending ſomewhat downwards, ſometimes in the breaſt, and is furniſhed with a roſtrum, or proboſcis, an upper lip, jaws, teeth, tongue and palate; ſome inſects indeed have no mouth.

Maxillæ, the jaws, are two, and ſometimes four in number, placed horizontally, the inner edge of which in ſome inſects is ſerrated, or furniſhed with teeth.

Lingua, the tongue, is either taper and ſpiral, fleſhy, reſembling a proboſcis, or tubular.

Labium ſuperius, the upper lip, is ſituate above the jaws.

Stemmata, or gems, are three bright convex ſpots, or tubercules, placed upon the crown or upper part of the head.

Truncus, the trunk, is that part of the body, ſituate between the head and abdomen, the upper part is called the *thorax*; to the poſterior part of which the ſcutellum, or eſcutcheon, is annexed. This is frequently triangular, and appears to be divided from the thorax at its baſe by an intervening ſuture, and projects between the elytra, from the interior margin of each a piece appears to be cut out for its inſertion. The under part of the trunk, is called the ſternum, or breaſt, and to this part the feet are generally fixed.

Abdomen, this is the hinder part of the inſect, it is diſtinct from the thorax, and contains the ſtomach, inteſtines, and viſcera: it is compoſed of a number of annular ſegments, which are pierced in the ſides with ſpiracula or pores that ſupply the want of lungs, the upper part of the abdomen is called *tergum*, or the back, the under *venter*, or belly, which is terminated by the anus.

Artus, the limbs, are the tail, feet, and in many ſubjects, the wings alſo.

Pedes, the feet, are compoſed of three joints, the firſt of which is generally the thickeſt, and is called *femur*, or thigh; the ſecond, which is commonly of the ſame ſize throughout, is named *tibia*, or leg; and the third, which is divided into leſſer joints, is called *tarſis*, or foot; and theſe are terminated by *ungues*, nails; ſome indeed have a kind of hand, chela, with a moveable thumb; the hinder feet are formed for different movements, as running (curſorii) leaping, (ſaltatorii) ſwimming, (natatorii); thoſe feet which have no claws, are termed *mutici*.

Alæ, wings, are curious inſtruments by which they are enabled to fly; theſe are membraneous and undivided, except in one genus of moths Alucitæ.

Moſt inſects have four wings, but the claſs diptera and the coccus have only two. The wing is divided into its ſuperior and inferior ſurfaces; the anterior part is the thick margin nearly in a line with the head when the wings are extended; the poſterior, the ſlender margin next the anus; the exterior part, is that towards the outer edge; the interior, that next the body; they are called *plicatiles*, when folded up, while the inſect is at reſt, as in the *forficula*; and *planæ* when they are incapable of being folded, as in the papiliones.

Erectæ, ſuch as have their ſuperior ſurfaces brought in contact, when the inſect is at reſt, as in the ephemera, &c.

Patentes, which remain horizontally, as in the phalæna geometra.

Incumbentes, theſe cover horizontally the ſuperior part of the abdomen.

Deflexæ, the outer edges declining towards the ſides, and the inner edges uniting above the abdomen, like the ridge of a houſe.

Reverſæ, is the ſame as deflexæ, with this difference, that the under wings project conſiderably from under the upper ones.

Dentatæ, the edges of theſe are ſerrated or ſcolloped.

Caudatæ, theſe have one or more projections in the hinder wings like tails.

Reticulatæ, when the veins or membranes croſs one another ſo as to reſemble net work.

The colours of the wings are diſtinguiſhed by different names according to their figure, as punctæ, dots; maculæ, ſpots; faſciæ, bands; ſtrigæ, ſtreaks; which are ſlender faſciæ; and lineæ, lines; which are longitudinally extended; ocellus or eye, is a round ſpot containing a leſſer ſpot within it; ſtigma, is a kidney ſhaped ſpot almoſt univerſal in the wings of the phalæna noctua. Stigmata, is another term uſed by Linæus to ſignify the ſpot or anaſtamoſis, in the middle of the wing near the anterior margin, conſpicuous in moſt of the hymenoptera and neuroptera, and alſo in the coleoptera.

Elytron, plural Elytra, are the upper wings, or rather wing caſes, two in number, of a cruſtaceous ſubſtance, extended when the inſect flies, but ſhut when it reſts, forming a longitudinal ſuture down the back, and covering the wings. The elytra are variouſly diſtinguiſhed, and are termed,

Abbreviata, when ſhorter than the abdomen.

Truncata, are alſo ſhorter than the abdomen, but terminate in a right line at their extremity.

Faſtigiata, are of equal or greater length than the abdomen, but terminate in a tranſverſe line.

Serrata, when the exterior margin towards the apex is notched, or ſerrated.

Spinoſa, when the ſurface is covered with ſharp points, or prickles.

Scabra, when the ſurface is rough like a file.

Striata, when marked with ſlender longitudinal furrows.

Porcata, when marked with elevated longitudinal ridges.

Sulcata, when furrowed, or deeply channelled.

Punctuata, when marked with concave, or convex ſpots.

Hemelytra, are ſo called, when the ſuperior wings, or caſes, are harder than the wings, but yet ſofter than the elytra, and are either totally ſo as in the grylli, or partially ſo as in the notonecta, nepa, cimeces, &c. The ſecond order, or hemiptera, contains all the inſects of this claſs.

Halteres poiſers, or balancers, are little heads placed on a pedicle, or foot ſtalk, and are ſituate in the thorax behind and under the wings of the ſixth, or diptera claſs, which have only two wings, and are ſuppoſed to act as balances, to keep the body in equilibrio, when they fly.

Cauda, the tail, differs in different inſects, and is either ſimple or furniſhed with various appendages; it is *Triſeta*, conſiſting of three briſtles in the ephemera, *Furcata*; forked in the podura; *Forcipata*, like pincers in the forficula; *Folioſa*, reſembling a leaf in the blatta and ſome cancri; *Telifera*, armed with a ſting, as in the ſcorpion and panorpa; *Aculeus* is alſo another kind of ſting, concealed within a fine tube, which inſtills a poiſon at the time it wounds, as in the bees, hornets, waſps, &c.

To render the foregoing deſcription more uſeful, and explicit, we have added an explanatory plate.

PART II.

CLASSIFICATION ACCORDING TO THE LINNÆAN SYSTEM.

Linnæus has divided inſects into ſeven orders, ſix of them from the nature and number of their wings, and the ſeventh from their being deſtitute of wings.

The firſt order he has named *Coleoptera*, from κολεὸς, *a ſheath*, and πλεϱὸν, *a wing*; and this order comprehends all that claſs of inſects, called beetles, which have hard cruſtaceous elytra, that ſhut together and cover the wings, forming a longitudinal ſuture down the back. The elytra in moſt inſects cover the abdomen entirely, as in the cock-chaffers; but in others but partially, as in the ear-wig, &c.

Order 2. *Hemiptera*, from ἡμισυ, *half*, and πλεϱὸν, *a wing*. Theſe have their elytra, or upper wings, but half cruſtaceous, and half membranaceous, not forming a longitudinal ſuture, but incumbent on each other.

Order 3. *Lepidoptera*, from λεπὶς, *a ſcale*, and πλερον, *a wing*. Theſe have four membranaceous wings, imbricated or covered with ſcales, like powder or meal.

Order 4. *Neuroptera*, from νεῦρὸν, *a nerve*, and πλερὸν, *a wing*. Theſe have four membranaceous, tranſparent, naked wings, generally reticulated with veins, or nerves; tail unarmed, or without a ſting.

Order 5. *Hymenoptera*, from ομὴν, *a membrane*, and πλερὸν, *a wing*. Theſe have four membranaceous wings, tail armed with a ſting.

Order 6. *Diptera*, from δύω, *two*, and πλερὸν, *a wing*. Two wings only, but finiſhed with halteres or poiſers, inſtead of under wings.

Order 7. *Aptera*, from ἀ, *without*, and πλερὸν, *a wing*. Having no wings, as in the ſpider, &c.

Theſe Orders are ſubdivided by Linnæus, in a table under the title of *Characteres Inſectorum*; but as theſe characters are again repeated as the diſtinguiſhing mark of each genus, it is quite unneceſſary to give them here.

ORDER I. INSECTA COLEOPTERA.

This Order is diſtinguiſhed, by the hard cruſtaceous elytra, which cover and protect the wings, and contains 30 diſtinct genera.

Genus 1. SCARABÆUS, or beetle. The antennæ of which terminate in a kind of club, which is divided longitudinally into plates or laminæ, from 2 to 7 in number, the tibiæ of the firſt pair of legs are armed with ſpines or teeth.

This genus contains three diviſions or families.

1ſt. Thoſe in which the thorax is armed with horns.

2d. Thoſe which have horns on the head only.

3d. Thoſe which have head and thorax, both ſimple or without horns.

Genus 2. LUCANUS, or ſtag beetle; the antennæ of the Lucanus terminate in a club or knob, but differs from the preceding genus in its being compreſſed or flattened on one ſide, which part is divided into ſhort plates or laminæ; ſome of this genus have the antennæ bent in the middle, forming a kind of elbow. The maxillæ or jaws, are ſtrong, advanced before the head, and are armed with teeth.

Genus 3. DERMESTES. Antennæ ending in a perfoliated club or head of an oval form, divided into horizontal plates, which appear to be united together by a ſmall ſtalk paſſing through their center; the three extreme articulations are larger than the others: the thorax is convex, and ſlightly margined: the head is bent inwards, and as it were concealed under the thorax.

Genus 4. PTINUS. Antennæ filiform or thread ſhaped, the exterior articulations longer than the others. The thorax nearly round, with a margin into which the head is received or drawn back.

Genus 5. HISTER. The firſt articulation of the antennæ is compreſſed and curved: the laſt or terminating one appears to be a ſolid knob: the head is drawn within the body, ſo that the jaws, which reſemble a forceps, are only viſible: the elytra are ſhorter than the body, and the fore legs are dentated as in the ſcarabæus.

Genus 6. GYRINUS. Antennæ club formed, ſtiff and ſhorter than the head. It has four eyes, two on the upper, and two on the under ſide the head.

Genus 7. BYRRHUS. Antennæ clubformed, terminating in a capitulum or knob, which is of an oval form, rather flattened, and almoſt ſolid.

Genus 8. SILPHA. Antennæ ſmall at their baſe, and gradually increaſing in thickneſs to their extremity; the elytra have a margin, the head prominent, and the thorax rather flattened, with a margin.

Genus 9. CASSIDA, or tortoiſe beetle. Antennæ nearly of equal thickneſs, but increaſe in ſize towards the extremity. Elytra has a broad margin, the thorax is flat and margined, forming a kind of ſhield for the head, which is entirely concealed under it.

Genus 10. COCCINELLA. Antennæ are ſubclavated, or increaſing a little in thickneſs towards the end, the laſt joint appears as if the end was chopped off. The palpi are club-formed, with the laſt articulation, ſhaped like a heart. The body is hemiſpherical, thorax and elytra margined, abdomen and belly flat.

This genus is ſubdivided into families, from the colour of the elytra, and of the ſpots with which they are adorned.

1. Thoſe with red or yellow elytra, and black ſpots.
2. Thoſe with white ſpots on a red or yellow ground.
3. Thoſe with black elytra and red ſpots.
4. Thoſe with black elytra, and white or yellow ſpots.

Genus 11. CHRYSOMELA. Antennæ moniliformes, or compoſed of little globular articulations, increaſing in ſize towards the extremity. Neither thorax nor elytra have any margin. This genus is divided into five families, viz.

1. Corpore ovato, whoſe bodies are of an oval form; many of which reſemble the coccinellæ.

2. Saltatoriæ, whoſe hinder thighs are much thicker than the other, and are made for leaping.

3. Corpore cylindrico. The bodies of theſe are of a cylindric form.

4. Corpore oblongo, Thorace anguſtiore. In theſe the body is oblong, and the thorax narrower than the abdomen.

5. Elongatæ. Theſe are long and of a ſlender make, and indeed bear little affinity to either of the others.

Genus 12. HISPA. Antennæ fuſiformes, increaſing gradually in ſize from each extremity towards the middle; they are ſituate between the eyes, and are placed ſo near each other at the baſe, that they ſeem to ariſe from one point. The thorax and elytra are generally covered with ſpines.

Genus 13. BRUCHUS. Antennæ filiformes, ſenſim craſſiores, that is of equal ſize, but growing thicker towards the extremity; this was ſurely an overſight in Linnæus, as it is contradictory; the antennæ of the Linnean Bruchi, do gradually increaſe in ſize towards the extremity, the head projects forward ſomething like a roſtrum. The thorax is marginated, and the elytra are ſhorter than the abdomen, and rounded at the apex.

Genus 14. CURCULIO. Antennæ ſubclavatæ, roſtrum inſidentes, or ſubclavated, and ſeated in a roſtrum or proboſcis, which is of a horny ſubſtance; and in ſome ſpecies prominent, in others inflex or bent under the thorax. This genus is divided into the following families.

1. Longiroſtres femoribus ſimplicibus. Roſtrum or beak longer than the thorax, and whoſe thighs are ſimple, without teeth or ſpines.

2. Longiroſtres ſaltatorii femoribus poſticis craſſis. Roſtrum longer than the thorax, hinder thighs large and made for leaping.

3. Longiroſtres femoribus dentatis. Roſtrum longer than the thorax, and the thighs dentated.

4. Breviroſtres femoribus dentatis. Roſtrum ſhorter than the thorax, and the thighs dentated.

3. Breviroſtres femoribus muticis. Roſtrum ſhorter than the thorax, and the thighs ſimple.

Genus 15. ATTELLABUS. The head of the attellabus is broader in the fore part, and tapers gradually from the eyes to the thorax. Antennæ are thicker towards the extremity than at the baſe; ſome of this genus come ſo near the curculiones, as often to be miſtaken for them.

Genus 16. CERAMBYX. Antennæ compoſed of oblong articulations, which gradually diminiſh in ſize towards the extremity. The thorax is either armed with ſpines or gibbous, made uneven by ſmall elevations. The elytra are narrow and of equal breadth throughout. This genus is divided into ſections from the form of its thorax, and that part being armed or not armed with ſpines.

1. Thorace ſpinis lateralibus mobilibus. Thorax armed on each ſide with moveable ſpines.

2. Thorace marginato dentibus lateralibus. Thorax margined, and ſides armed with teeth or ſpines.

3. Thorace rotundato, ſpinis fixis lateralibus mucronato. Thorax round and armed with fixed ſpines.

4. Thorace inermi ſubcylindrico. Thorax nearly cylindrical and unarmed.

5. Thorace inermi ſubrotundo ſive ex globoſo depreſſo. Thorax roundiſh, reſembling a globe flattened on the upper ſide.

Genus 17. LEPTURA. Antennæ briſtle ſhaped, elytra diminiſhing in breadth towards the apex; thorax roundiſh and of a ſlender make.

This genus is divided into two families.

1ſt. Thorace ovato ſivè entrorſum, oblongiuſculo anguſtiore, elytris apice truncatis. Thorax ovate or broader at the apex, than were joined to the head, the elytra cut off in a right line at their extremity.

2d. Thorace ſubgloboſo, nec antice attenuato, elytris, apice obtuſis, nec truncatis. Thorax nearly globular, and elytra obtuſe at the extremities.

Genus 18. NECYDALIS. Antennæ briſtle ſhaped; this genus is divided into two ſections.

1ſt. The elytra-ſhorter than the wings and abdomen, wings not folded under the elytra, as in the forficula.

2d. Elytra as long as the body, but narrower, contracting to a point, or awl ſhaped.

Genus 19. LAMPYRIS. Antennæ of equal thickneſs throughout Elytra, weak and flexible, thorax flat; and ſemiorbicular, ſurrounding and concealing the head. The ſegments of the abdomen, terminate on each ſide in papillæ, or little appendices, which are bent up towards the elytra, and in part cover one another; females in general are apterous.

Genus 20. CANTHARIS. Antennæ ſhaped like a briſtle; thorax margined, and ſhorter than the head. Elytra flexible; ſides of the abdomen, as in the preceding genus; there are two families.

1ſt. Thorace depreſſo, in theſe the thorax is flat and broad.

2d. Thorace teretiuſculo; thorax rounded in the ſides and narrow.

Genus 21. ELATER. Antennæ briſtle ſhaped; this genus is diſtinguiſhed by an elaſtic ſpring, or ſpine, which projects from the hinder extremity of the breaſt, or under ſide of the thorax, by which means the inſect makes a very ſingular leap, different from all other inſects; there is alſo a groove or cavity, ſcooped out of the under ſide of the head, in which the antennæ are lodged.

Genus 22. **CICINDELA.** Antennæ tapering to the extremity, maxillæ, or jaws armed with teeth, and project forwards, the eyes prominent, thorax roundiſh and margined.

Genus 23. **BUPRESTIS.** Antennæ briſtly, and the length of the thorax, the head is half drawn back within the thorax, they are divided into three families.

1ſt, In which the elytra decline towards the ſides, being much elevated at the ſuture, particularly near the baſe.

2d, Elytra ſerrated or armed with ſhort ſpines near their extremity.

3d, Elytra whole and intire.

Genus 24. **DYTISCUS.** Antennæ { ſetaceous, or increaſing in ſize, having a perfoliated capitulum.

They are divided into ſections.

1ſt. Antennæ perfoliated
2d. Antennæ ſetaceous } hinder feet hairy, natatorii, and armed with ſmall claws.

Genus 25. **CARABUS.** Antennæ briſtle ſhaped, thorax in the form of a heart, with the point cut off. The elytra are margined, a conſiderable lamina or knob, fixed at the baſe of the hinder thighs appear conſtant in this genus, and therefore ought to be noticed. Linnæus divides them into two families, merely from their ſize; viz. majores et minores.

Genus 26. **TENEBRIO.** Antennæ moniliform, or like a ſtring of beads, the laſt articulation rounder than the others. Head ſtretched forward, and elytra ſtiff; this genus is divided into families, the firſt containing thoſe which have wings, and the other in which the elytra are united, or without a longitudinal ſuture.

Genus 27. **MELŒ.** Antennæ moniliform, but the laſt joint oval, thorax roundiſh. Elytra ſoft and flexible, head inflected and gibbous. Theſe are divided into two families,

1ſt. With ſhort elytra, and no wings.

2d. Elytra the length of the body, and covering the wings.

Genus 28. **MORDELLA.** Antennæ filiform, and ſerrated. Head deflected or bent under the neck, elytra are curved or incline downwards towards their point, palpi compreſſed, clubbed, and obliquely truncated. A broad lamina is ſeated at the baſe of the abdomen, before the thighs.

Genus 29. **STAPHYLINUS.** Antennæ moniliform, elytra not half the length of the abdomen, wings folded up, and concealed under the elytra. The tail or extremity of the abdomen is ſimple, not being armed as in the following genus, but furniſhed with two oblong veſicles, which the inſect can ſhoot out, or retract at pleaſure.

Genus 30. **FORCICULA,** or Earwig. Antennæ ſetaceous, elytra much ſhorter than the abdomen, the wings are folded and covered by the elytra, the extremity of the abdomen is armed with a kind of forceps.

ORDER II.

INSECTA HEMIPTERA.

The mouth and proboſcis of the inſects which compoſe this order, are inflected or bent inwards, towards the breaſt.

The wings are of a ſubſtance between the cruſtaceous and membranaceous, not ſo hard and ſtrong as the firſt, but more ſo, than the latter; the upper wings are ſemi-coriaceous, and do not meet in a longitudinal ſuture, as in the coleoptera, but have ſome part of their interior margin croſſed, or laid one over another, above the abdomen. This order contains twelve genera.

Genus 31. **BLATTA.** Antennæ briſtle ſhaped, head inflected, elytra and wings extended, ſmooth and ſemi-coriaceous, or of a ſubſtance reſembling vellum. The thorax is flattiſh, orbicular and margined. The feet made for running. The abdomen is terminated by two little appendices, or horns.

Genus 32. **MANTIS.** Antennæ ſetaceous, head unſteady, in conſtant motion, ſlightly attached to the thorax, mouth armed with jaws, and furniſhed with palpi. Wings membranaceous wrapped round the body, the under ones folded. The thorax is narrow, extended to a conſiderable length, and of equal ſize throughout. The firſt pair of feet are compreſſed, armed on the under ſide with teeth like a ſaw, and terminated by a ſingle nail, or crotchet, the four hinder ones are formed for ſlow, rather than quick motion.

Genus 33. **GRYLLUS.** Antennæ in ſome briſtle ſhaped, in others filiform. Head inflected, armed with jaws, and furniſhed with palpi. Wings declined downwards, and wrapped round the ſides of the body; the under ones are folded up, ſo as to be concealed under the elytra, all the feet are armed with two nails or crotchets, the hind ones are formed for leaping. This genus is divided into five families.

1. Acridæ, head conic, longer than the thorax, antennæ ſword ſhaped.

2. Bullæ. Thorax elevated in the middle, antennæ ſhorter than the thorax, and filiform.

3. Achetæ, have two ſetæ or briſtles ſituate above the extremity of the abdomen.

4. Tetigoniæ, the abdomen of the females furniſhed with a tube, through which they depoſit their eggs: antennæ of both ſexes ſetaceous.

5. Locuſtæ, antennæ filiform, abdomen without the tube.

Genus 34. **FULGORA.** The fore part of the head is drawn out, extended and empty, antennæ, placed beneath the eyes of two articulations, whereof the exterior is larger, and of a globular form, the roſtrum is inflected or bent inwards under the body, the feet are formed for walking; in this circumſtance, it differs from the following Genus, with which it was formerly confounded.

Genus 35. **CICADA.** Antennæ briſtle ſhaped, roſtrum bent under the breaſt, four membranaceous wings, declining along the ſides of the body, feet in ſome formed for leaping, in others for walking, or creeping; they are divided into five families.

1ſt. Foliaciæ, thorax compreſſed, membranaceous, and larger than the body.

2d. Cruciatæ, which have the thorax armed on each ſide, with a horn or ſpine.

3d. Maniferæ. Feet not made for leaping.

4th. Ranatræ, feet ſaltatorii, the hinder ones made for leaping.

5th. Deflexæ. Wings wrapped round the ſides of the body.

Genus 36. **NOTONECTA.** Antennæ ſhorter than the thorax, roſtrum inflected, four wings folded croſſwiſe, and coriaceous from the baſe, to their middle hind feet, hairy and formed for ſwimming.

Genus 37. **NEPA.** Antennæ none, roſtrum bent inwards, four wings folded croſſwiſe, anterior parts coriaceous; two fore feet reſemble the claws of a crab; the four others formed for walking. Geoffroy is of opinion, that the fore feet are the antennæ of this inſect.

Genus 38. **CIMEX.** Antennæ longer than the thorax, roſtrum inflected, wings folded croſſwiſe, upper ones coriaceous from the baſe, to the middle, back flat, thorax margined, and feet formed for running; they are divided into eleven families.

1. Apteri, theſe are without wings.

2. Scutellati, in which the ſcutellum or eſcutcheon, is extended ſo far as to cover the abdomen and wings.

3. Coleoptrati. Elytra coriaceous, not becoming membranaceous towards their extremity, as in the other cimices.

4. Membranacei, elytra membranaceous, very much depreſſed, like a leaf.

5. Spinoſi, thorax armed on each ſide, with a ſpine.

6. Rotundati, oval ſhaped, without ſpines on the thorax.

7. Seticornes. Antennæ like a briſtle towards the point.

8. Oblongi, of an oblong figure.

9. Antennæ, ſetaceous, and as long as the body.

10. Spinipedes, thighs armed with ſpines.

11. Lineares, body remarkably long and narrow.

Genus 39. **APHIS.** Antennæ longer than the thorax, roſtrum bent inwards, four erect wings or apterous, feet made for walking, generally two horns or ſpines, at the end of the abdomen.

Genus 40. **CHERMES.** Antennæ longer than the thorax, roſtrum placed under the breaſt, wings declined along the ſides of the abdomen, thorax gibbous, and feet made for leaping.

Genus 41. **COCCUS.** Roſtrum ſituate in the breaſt, hinder part of the abdomen briſtly, males two erect wings, females apterous.

Genus 42. **THRIPS.** Antennæ as long as the thorax, roſtrum obſcure or ſcarce perceptible, body ſlender, and of equal thickneſs, abdomen bent downwards.

ORDER III.

INSECTA LEPIDOPTERA.

The inſects which compoſe this order, are the moſt delicate, elegant and beautiful of all the different genera; they have four wings covered with a farinaceous powder, or a kind of ſcales, diſpoſed in rows, nearly in the ſame manner as tiles are laid upon the roofs of houſes; the various colours that adorn the wings are formed by theſe ſcales, which under a microſcope, appear like an elegant and beautiful carpet; if theſe ſcales are rubbed off, the wings are nothing more than a naked membrane. The mouth is furniſhed with a ſpiral tongue, which they can unfold, and roll up again at pleaſure. Their bodies are hairy. This order is divided into three genera.

Genus 43. **PAPILIO,** or butterfly. Antennæ increaſe in thickneſs towards the extremity, and in general terminate in a kind of capitulum or head. Their wings when ſetting or at reſt, are erect, their extremities meeting, or touching one another above the body. They fly in the day time. This genus is divided into ſections, and are thus diſtinguiſhed.

1. Equites, upper wings longer from the hinder corner or angle, to the anterior extremity, than from the ſame point to their baſe, ſome of theſe have filiform antennæ, in which they reſemble the phalæma, but they ſtill differ in the lightneſs and airineſs of their make; they are further divided, and are called,

Troes, theſe are of a dark, or black colour, with bloody ſpots on their breaſt.

Achivi, the colours of theſe are generally gay, without the bloody ſpots of the Troes, but they have an ocellum, or ſpot, reſembling an eye at the inner corner of the poſterior wings, they are

Simple, of one colour, or variegated, adorned with various colours.

2. Heliconii, wings narrow and intire, oftentimes appearing naked or without ſcales; the upper wings oblong and narrow, the under ones in general ſhorter.

3. Danai, wings intire, but divided into two families.

Candidi, the ground colour of the wings always white.

Feſtivi, wings variegated, or adorned with a variety of colours.

4. Nymphales, wings indented, or ſcolloped; there are two families in this diviſion.

Gemmati, wings adorned with eyes, in ſome only the upper ones, in others, the lower, and in many the whole four.

Phalerati, wings beautifully variegated, but without eyes.

5. Plebeii, theſe are in general ſmall, and are either,

Rurales, ſpots and markings of the wings, often very beautiful but opake, not pellucid or tranſparent.

Urbicoli, ſpots on the wings moſtly tranſparent.

To this diviſion of butterflies, into ſections and families, many objections may be made, as is very juſtly obſerved, by that ingenious and able entomologiſt, the late Mr. Thomas Pattiſon Yeates, in his Inſtitutions of Entomology, which is a tranſlation of Linnæus's Ordines et Genera Inſectorum; he there remarks, that the family of the *Plebeii*, in particular, is very inaccurate, and contains inſects very different from one another, at the ſame time that they reſemble, and have all the characters of ſome or other of the preceding ones; under which many of them might be properly arranged; the remaining *Plebeii*, would compoſe a family very diſtinct from all others, and which might be formed into two ſections, the firſt containing ſmall butterflies, having long and flexible, or weak tails, ſlender bodies and clubbed antennæ, as the *Cupido*, the *Marſyas*, the *Bœticus*, &c. the other diſtinguiſhed by the ſhortneſs, thickneſs, or breadth of their head, thorax, and abdomen, and by the ſhape of their upper wings, which in theſe laſt are pointed at the extremity, and long in proportion to their width, as the *Proteus*, *Phidias*, and others.

The Antennæ in this laſt diviſion, are generally uncinnated, or crooked at their extremity; ſome of them have likewiſe tails, but theſe are very broad and ſtrong, and are always ciliated or edged with a fringe of hairs, as in the *Proteus*, &c.

The bloody ſpots are not always found on the breaſts of the Eq. Trojani, nor is the interior angle of the Achivi always adorned with an eye, ſo that the ſureſt method, is to refer ſuch equites as are of dark or mourning colours, to the family of the *Troes*, and thoſe of gay, lively ones, to that of the *Achivi*.

The under wings of a great many of the Papiliones, placed by Linnæus among his *Heliconii*, are ſlightly indented, and as they are without eyes, they ought, ſtrictly ſpeaking, to be referred to the *Nymphales Phalerati*, but are diſtinguiſhable by the delicacy of their texture, and the ſmoothneſs of their wings, which are leſs covered with ſcales, than thoſe of the laſt mentioned family.

The under wings of the *danai feſtivi*, are likewiſe often indented, but in that caſe, they are generally edged with a kind of fringe, or their margins, eſpecially on the under ſide, ſurrounded by one or more *waved* lines, or rows of white ſpots; thoſe butterflies, therefore, whoſe wings are but *ſlightly* indented, adorned with eyes, and the margins ſurrounded by rows of white ſpots, or *narrow waving* lines, belong rather to this family, than to that of the *nymphales gemmati*.

As butterflies from the elegance of their form, and exceſſive beauty of their colours, have more engaged the attention of the curious than any other claſs of inſects, ſo we find more of them in all collections ſent from foreign parts, many people collect them on account of their ſingular beauty, who have not the leaſt taſte for the ſtudy of inſects in general, and therefore we are totally unacquainted with their food, and manner of living; and this we preſume was what occaſioned Linnæus, to deviate from his general rule, in adapting trivial names to them, in which, in general he has been remarkably happy, and ſucceſsful. The trivial names of his Papiliones diſplay, a fund of ingenuity. The firſt diviſion of the Equites, he has named after the Trojan nobles, giving the name of Priam, who was king of Troy, to the moſt ſplendid; the ſecond diviſion are diſtinguiſhed by the names of the Grecian heroes; further diſtinguiſhing all thoſe elegant ones, whoſe hinder wings reſembled tails, by ſome royal name as Paris, in the firſt diviſion, and Agamemnon in the latter. The ſecond ſection or heliconii, take their names from the muſes.

To the third ſection or danai, he has affixed the names of the ſons and daughters of Danaus, which being again divided, he has confined the names of the daughters to the *candidi*, or white ones, and given to the *feſtivi* or party coloured ones, the names of the ſons of Egyptus.

The fourth ſection or nymphales, are named from various nymphs of antiquity; and the fifth ſection or *Plebeii*, from thoſe men among the antients, whoſe names deſerve to be recorded: by this method, he has in ſome meaſure introduced a knowledge of the antients, and rendered the ſtudy of this ſcience more agreeable.

Genus 44. SPHINX, or hawk moth. Antennæ, in ſhape of a priſm, but thicker in the middle than at the extremities. Wings deflected, the outer margins declining towards the ſides, their flight is ſlow and heavy. They are divided into two families.

1. *Legitimæ* { Wings angulated, anus ſimple not terminated with a tuft of hair.
Wings entire, anus ſimple.
2. Wing entire, anus terminated by a tuft of hair.

2. *Adſcitæ*, differ from the others, in their external appearance, and alſo in their caterpillar.

Genus 45. PHALENA. Moth. Antennæ decreaſing from the baſe to the point. Wings generally deflected when at reſt, fly in the evening, or night; they are divided into two families, as under.

1. *Attaci*. Wings incline downward, and are ſpread open, and have either pectinated antennæ, without a tongue.

Pectinated antennæ
Setaceous antennæ } with a ſpiral tongue

2. *Bombyces*. Wings cover the body, nearly horizontal, antennæ pectinatæ; they are alſo

elingues without the ſpiral tongue { wings reverſed
——depreſſed, back ſmooth
——depreſſed, criſtated on the back

Spirilingues with the ſpiral tongue { wings deflected, back ſmooth
ditto, creſted

3. *Noctuæ*. Wings incumbent, antennæ ſetaceous,
elingues without tongues { back ſmooth
Spirilingues having ſpiral tongues { back creſted

4. *Geometræ*. Wings extended horizontally, when the inſect is at reſt.

Theſe are Antennæ feathered { wings angulated, or
Antennæ briſtle ſhaped { round with entire edges

5. *Tortrices*. Wings obtuſe, the exterior margin is curve and declines towards the ſize of the body; they have ſhort palpi.

6. *Pyralis*. The inner margin of the wings in this ſection lay one over the other, the wings themſelves decline a little towards the body; and in ſhape reſemble a delta or triangle, theſe have large palpi, ſome of which curve upwards, others are ſtrait and extended.

7. *Tiniæ*. Wings wrapped or folded round the body ſo as to give the inſect a cylindric form; forehead ſtretched out or advanced forward.

8. *Alucitæ*. Wings ſplit, or divided into branches almoſt to their baſe.

ORDER IV.

INSECTA NEUROPTERA.

The inſects of this order have four membranaceous, naked wings, reticulated with veins, ſo as to appear like network. Their tail is unarmed or without a ſting, but is frequently furniſhed with appendices like pincers, by which the males are diſtinguiſhed. This order contains 7 genera.

Genus 46. LIBELLULA. Mouth armed with jaws, which are always more than two in number, antennæ ſhorter than the thorax, wings expanded without folds, tail furniſhed with a kind of forceps in the male; they are divided into two ſections.

1ſt. Wings extended horizontally when at reſt.

2d. Wings erect, eyes prominent, and placed at a diſtance from each other.

Genus 47. EPHEMERA. Wings erect, hinder ones ſhorter than the others, mouth deſtitute of teeth and palpi, ſtemmata two in number, large, and ſituate above the eyes; tail furniſhed with appendices reſembling hairs or briſtles; theſe are divided into two families.

1ſt. Cauda triſeta; tail with three briſtles.

2. ——— biſeta ——— two briſtles.

Genus 48. PHRYGANIA. Mouth without teeth, but furniſhed with four palpi. The ſtemmata are three in number. Antennæ longer than the thorax, wings incumbent, under ones folded and concealed, under the upper ones; they are divided into two ſections.

1ſt. Abdomen armed with two truncated ſetæ.

2d. Abdomen ſimple without the ſetæ.

Genus 49. HEMEROBIUS. Mouth armed with teeth, palpi 4, no ſtemmata, wings deflected and not folded; antennæ ſetaceous advanced before the head, and longer than the thorax which is of a convex form.

Genus 50. MYRMELION. Mouth armed with jaws, two teeth, and four long palpi, no ſtemmata; the tail in the male is furniſhed with a kind of forceps, formed of two ſtrait filaments, antennæ club ſhaped, length of the thorax; wings deflected.

Genus 51. PANORPA. Roſtrum horny and cylindrical, two palpi, two ſtemmata; antennæ longer than the thorax, tail in the male furniſhed with a chela or weapon, reſembling the claw of a crab.

Genus 52. RAPHIDIA. Head horny, depreſſed or flattened, mouth armed with two teeth and four palpi; ſtemmata three; wings deflected, antennæ as long as the thorax, the anterior part of which is lengthened out and cylindrical, tail of the female terminated by an appendix reſembling a flexible crooked briſtle.

ORDER V.

INSECTA HYMENOPTERA.

The inſects included in this order have four membranaceous wings; the neuters however in ſome genera, and in others the males and females are deſtitute of wings. The tail, except in the male ſex, is armed with a ſting. This order contains ten genera.

Genus 53. CYNIPS. Mouth armed with jaws, but no proboſcis; ſting ſpiral, and moſtly concealed within the body.

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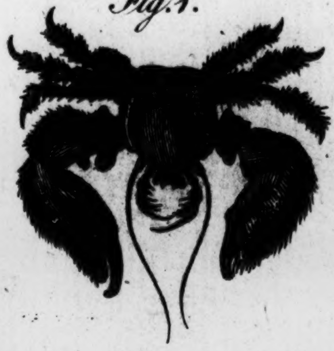
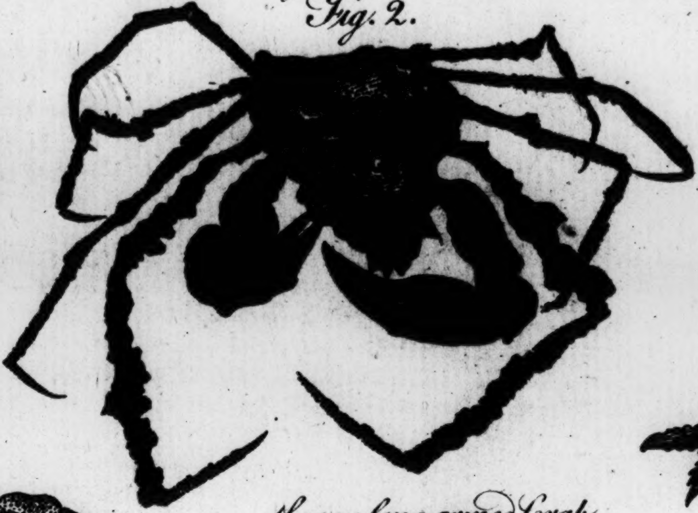
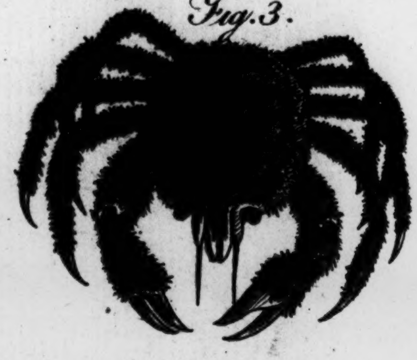
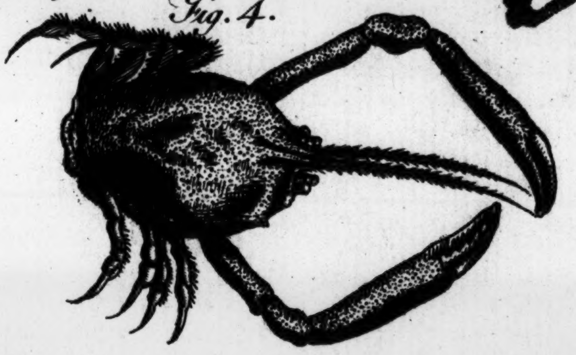
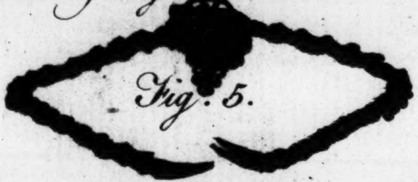
Crustaceous Animals See System of Entomology Order 7.

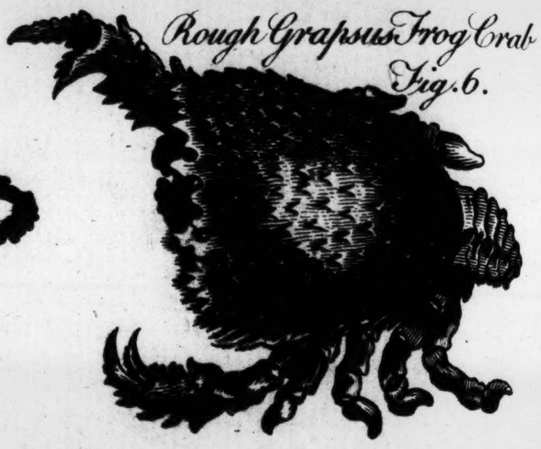

Great Clawed Crab
Fig. 1.

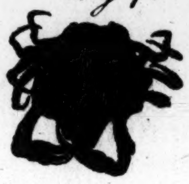

Weymouth Crab
Fig. 2.

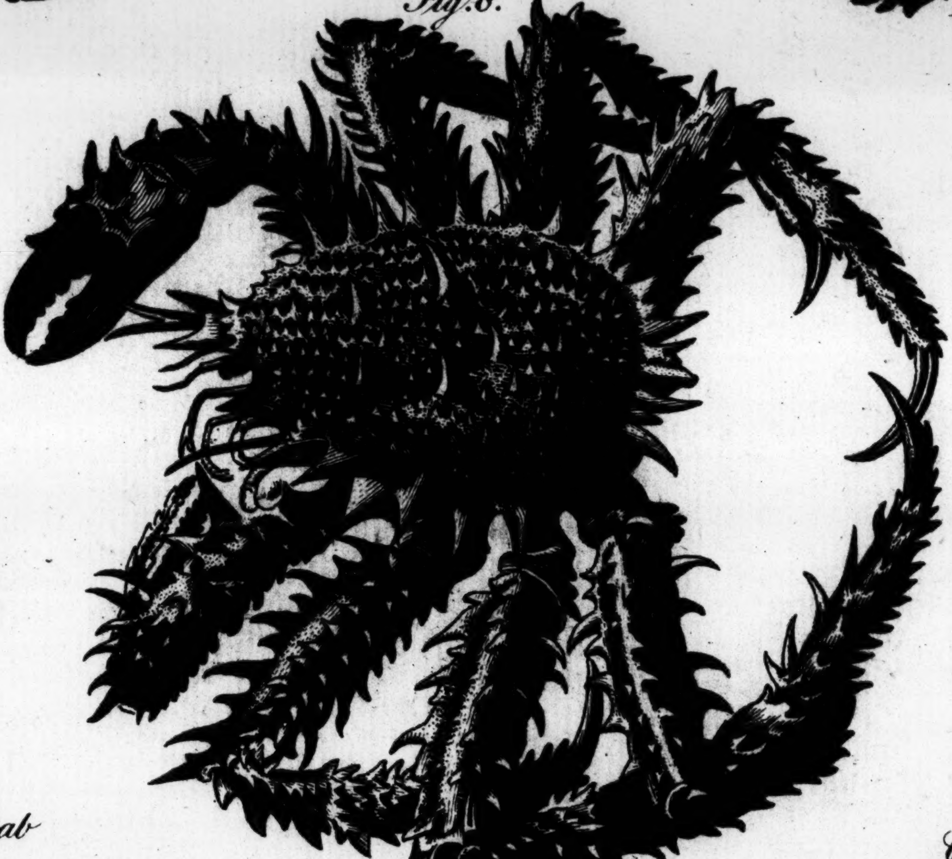

Byssus Spider Crab
Fig. 3.

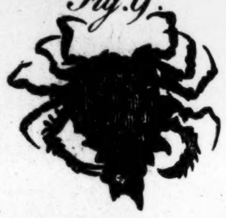

Long Clawed Male Crab
Fig. 4.

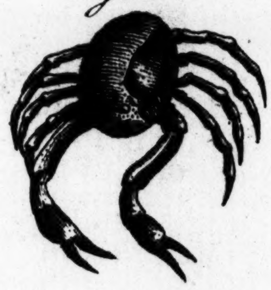

thorny long armed Crab
Fig. 5.

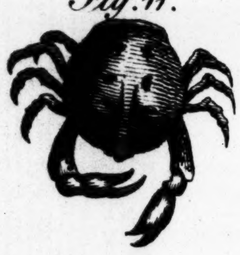

Rough Grapsus Frog Crab
Fig. 6.

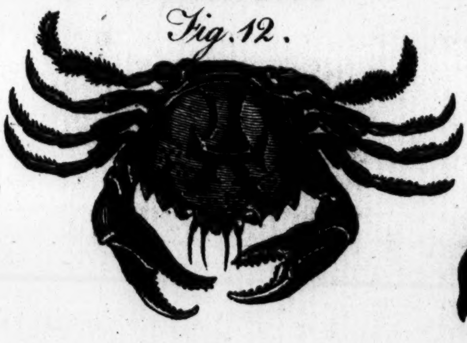

Uneven Crab
Fig. 7.

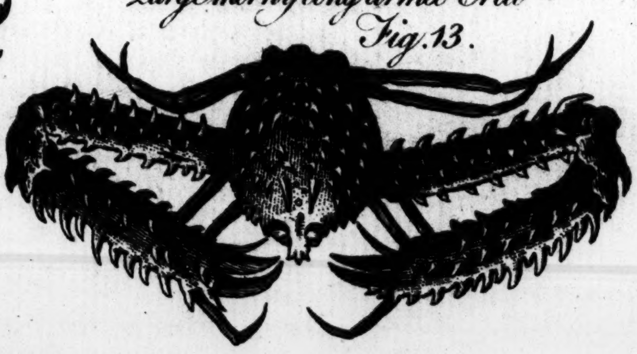

Horrid Crab
Fig. 8.

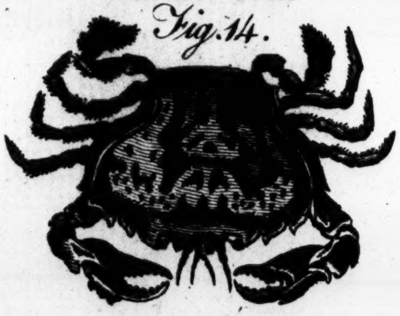

Rough Crab
Fig. 9.

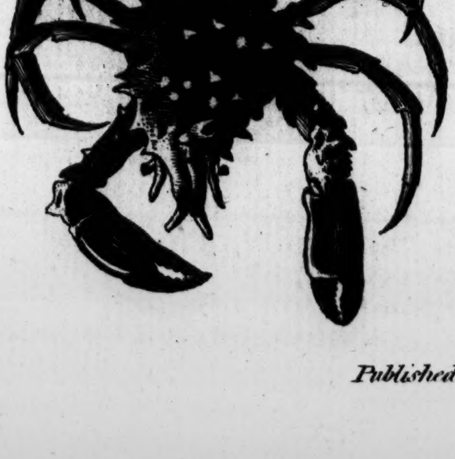

Round Bodied Crab
Fig. 10.

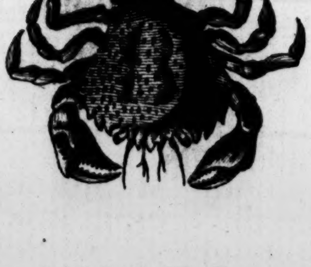

Clotted Crab
Fig. 11.

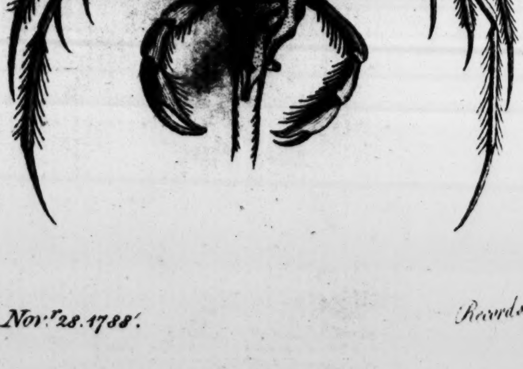

Common Crab
Fig. 12.


Large thorny long armed Crab
Fig. 13.


Cleanser Crab
Fig. 14.


Four forked Crab
Fig. 15.


Broad footed Crab
Fig. 16.


Slender legged Crab
Fig. 17.

Published as the Act directs by C. Cooke No. 17 Paternoster Row Nov.r 28. 1788.

Record sculp.

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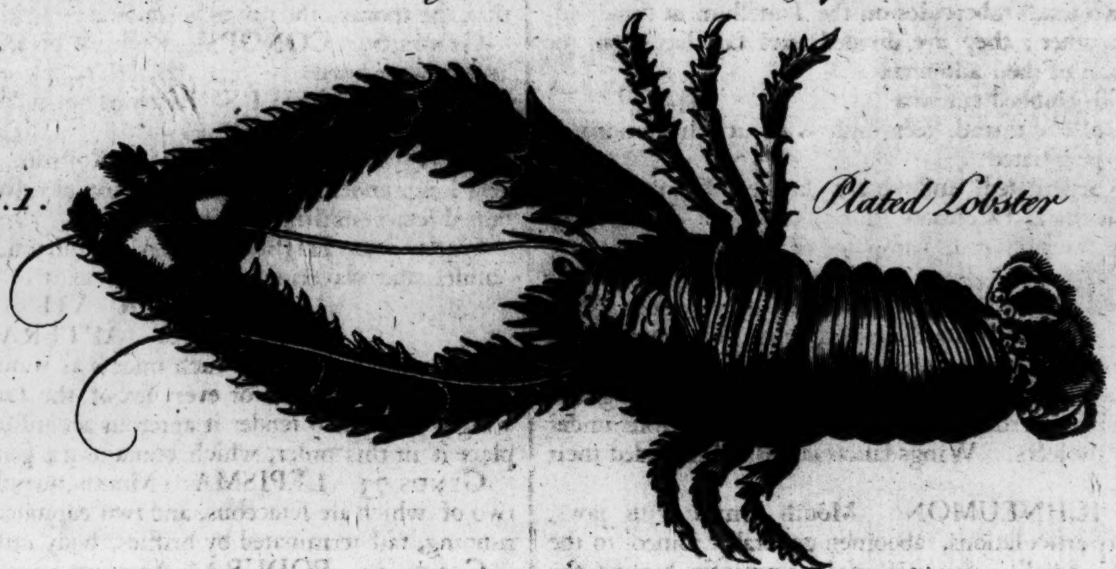
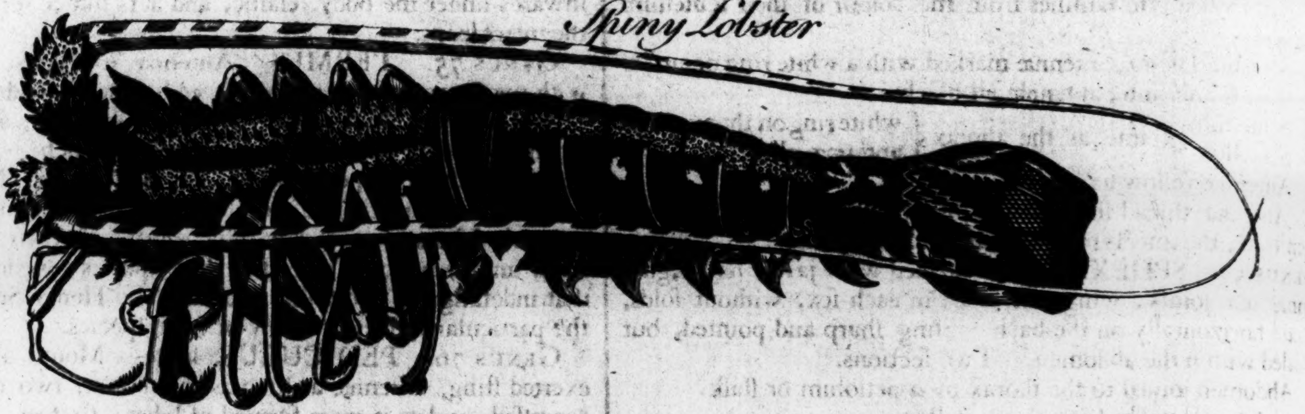
Crustaceous Animals – See System of Entomology, Order 7. Plate

Fig. 1.



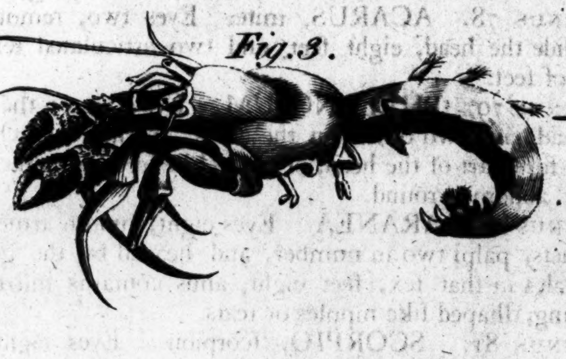
Plated Lobster

Fig. 2.



Spiny Lobster

Fig. 3.



Hermit Lobster

Fig. 4.

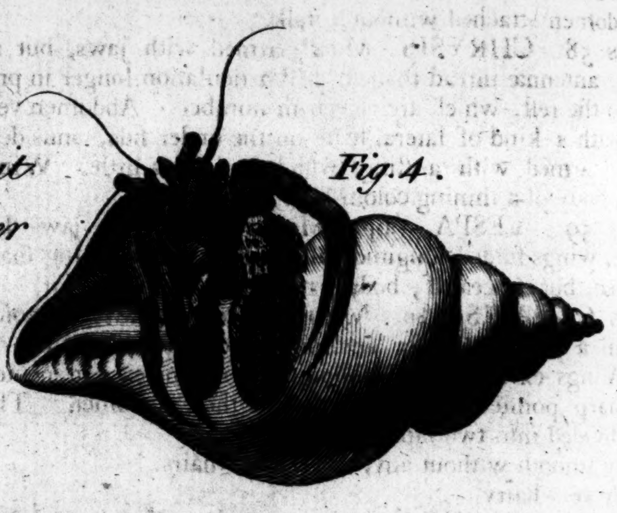
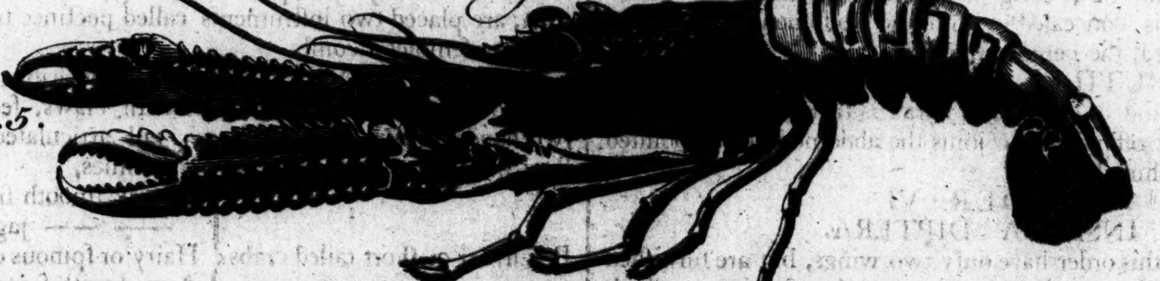
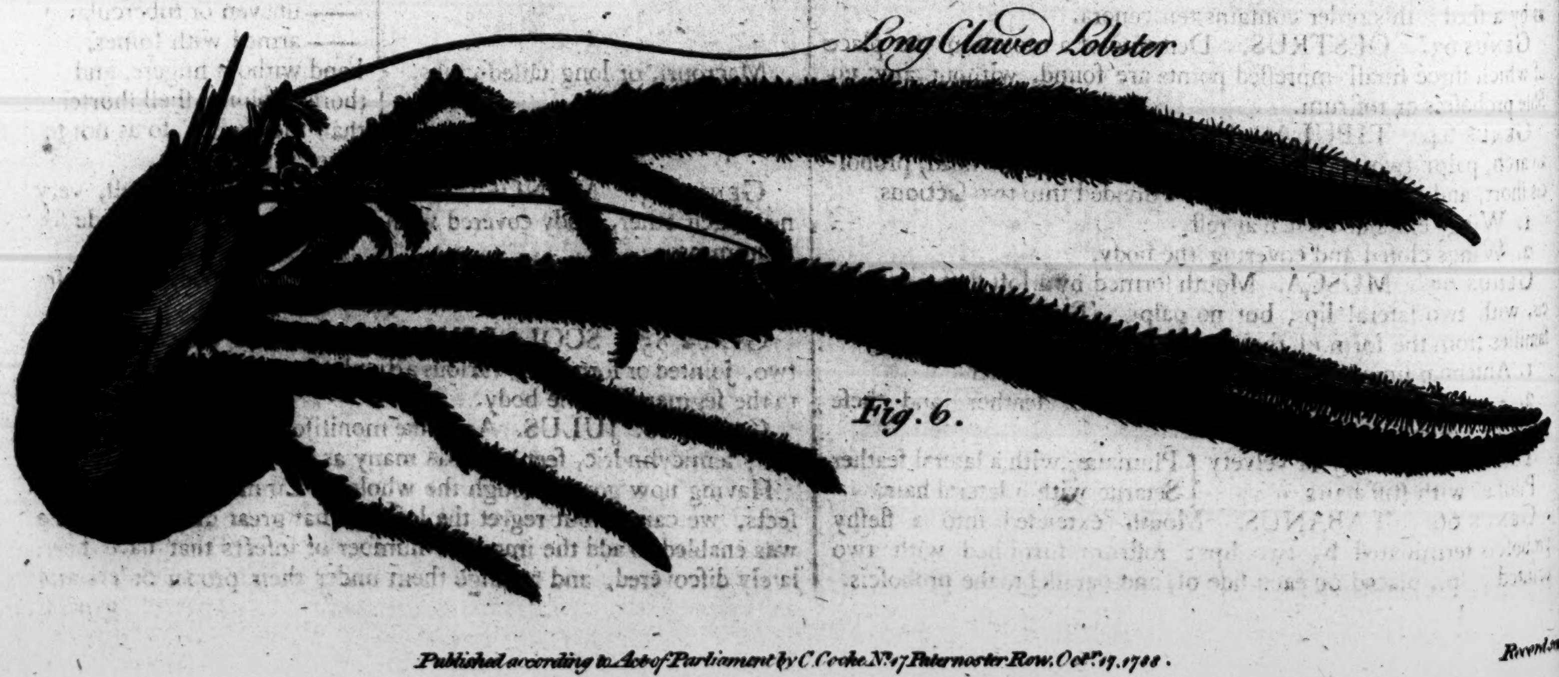


Fig. 5.



Norway Lobster

Fig. 6.



Long Clawed Lobster

Published according to Act of Parliament by C. Cooke No. 17 Paternoster Row, Octr. 17, 1788.

Record sculp

Genus 54. TENTHREDO. Mouth armed with jaws, but no proboſcis, wings extended, and tumid as if ſwelled, or of a bulky conſiſtence, ſting dentated like a ſaw, and compoſed of two laminæ, two ſmall tubercules on the ſcutellum at ſome diſtance from each other; they are divided into families from the different formation of their antennæ.

1ſt. Thoſe with clubbed antennæ.
2d. Antennæ of one thread, ſeemingly without articulations.
3d. Antennæ pectinated.
4th. Antennæ articulated, and nearly clavated, but not ſo diſtinguiſhable as in the firſt ſection.
5th. Antennæ threadſhaped, compoſed of 7 or 8 articulations, beſides the baſe.
6th. Antennæ ſetaceous, compoſed of many articulations.

Genus 55. SIREX. Mouth armed with two ſtrong jaws, palpi two, and truncated, antennæ filiform, and contain upwards of 24 articulations, ſting dentated like a ſaw, projected ſtrong and ſtiff, abdomen ſlender, terminating in a point or ſpine from under which the ſting projects. Wings lanceolated and extended their whole length.

Genus 56. ICHNEUMON. Mouth armed with jaws, antennæ of thirty articulations, abdomen generally joined to the body by a pedicle or ſtalk. Sting exerted or projects beyond the abdomen, and is incloſed in a cylindric ſheath of two valves. They are divided into families from the colour of their ſcutellum and antennæ.

1. Scutellum white, antennæ marked with a white ring or circle.
2. Scutellum white, antennæ all black
3. Scutellum } ſame as the thorax { white ring on the antennæ
4. Scutellum } { antennæ all black
5. Antennæ yellow and briſtly
6. Antennæ thread ſhaped, and often but 10 articulations, abdomen oval; the inſects much ſmaller than the others.

Genus 57. SPHEX. Mouth armed with jaws, no tongue, antennæ ten joints; wings extended in each ſex, without folds, and laid horizontally on the back. Sting ſharp and pointed, but concealed within the abdomen. Two ſections.

1. Abdomen joined to the thorax by a petiolum or ſtalk.
2. Abdomen attached without a ſtalk.

Genus 58. CHRYSIS. Mouth armed with jaws, but no proboſcis, antennæ thread ſhaped, firſt articulation longer in proportion to the reſt, which are eleven in number. Abdomen very convex, with a kind of lateral ſcale on the under ſide, anus dentated, and armed with a ſting, which projects a little. Wings extended, body of a ſhining colour as if gilt.

Genus 59. VESPA, waſp. Mouth armed with jaws but no tongue, wings folded longitudinally in both ſexes. Sting ſharp and pointed, but concealed; body without hair; eyes lunular.

Genus 60. APIS, bee. Mouth armed with jaws, proboſcis incloſed in a bivalve ſheath, and inclined downwards under the body. Wings extended and without folds: females and neuters carry a ſharp pointed ſting concealed in their abdomen. This genus is divided into two families.

1. Body ſmooth without any, or very few hairs.
2. Body very hairy.

Genus 61. FORMICA, emmet, ant, or piſmire, is diſtinguiſhed by a little upright ſcale, which is ſituate between the thorax and abdomen. The ſting with which the females and neuters are armed, is concealed within the abdomen: males and females are winged, the neuters apterous.

Genus 62. MUTILLA. No wings in moſt caſes, body covered with a kind of down. Thorax is truncated, or appears to have a part cut off where it joins the abdomen, ſting pointed and concealed within the body.

ORDER VI.

INSECTA DIPTERA.

The inſects of this order have only two wings, but are furniſhed with a poiſer or ballancer, *halteres*, ſituate under each wing, which is terminated by a capitulum or knob. The baſe in moſt caſes is concealed, or ſecured under a little ſcale, by which it is covered, as by a ſhed: this order contains ten genera.

Genus 63. OESTRUS. Deſtitute of a mouth in the place of which three ſmall impreſſed points are found, without any viſible proboſcis or roſtrum.

Genus 64. TIPULA. Head long, upper jaw formed like an arch, palpi two, curve; and are longer than the head, proboſcis ſhort, and bent inwards; they are divided into two ſections.

1. Wings extended when at reſt.
2. Wings cloſed and covering the body.

Genus 65. MUSCA. Mouth formed by a ſoft fleſhy proboſcis, with two lateral lips, but no palpi. They are divided into families from the form of their antennæ.

1. Antennæ ſimple, without a lateral hair or feather.
2. ——— furniſhed with a lateral hair or feather, and theſe again are either

Tomentoſæ, downy or velvety { Plumatæ, with a lateral feather
Piloſæ, with ſtiff hairs. { Setariæ with a lateral hair.

Genus 66. TABANUS. Mouth extended into a fleſhy proboſcis terminated by two lips; roſtrum furniſhed with two pointed palpi, placed on each ſide of, and parallel to the proboſcis.

Genus 67. CULEX. Mouth formed by a flexible ſheath, encloſing ſetæ, or briſtles pointed like ſtings.

Genus 68. EMPIS. Roſtrum horney, inflexed, bivalve, longer than the thorax, the valves horizontal.

Genus 69. CONOPS. Roſtrum projected, and jointed like an elbow or knee.

Genus 70. ASILUS. Roſtrum horny, projected, bivalve, and extended its whole length.

Genus 71. BOMBYLIUS. Roſtrum porrected, ſetaceous very long, and formed of two horizontal valves, in which are contained ſetaceous ſtings or briſtles.

Genus 72. HIPPOBOSCA. Roſtrum, bivalve, cylindrical, obtuſe, and wavering, or ſhaking, as if ill fitted to the mouth.

ORDER VII.

INSECTA APTERA.

This order contains all ſuch inſects as want wings in either ſex; for the whole ſpecies, or every ſex of the ſame inſect, muſt want wings, in order to render it apterous according to Linnæus, and to place it in this order, which contains 14 genera.

Genus 73. LEPISMA. Mouth furniſhed with four palpi, two of which are ſetaceous, and two capitated, feet 6, formed for running, tail terminated by briſtles, body imbricated with ſcales.

Genus 74. PODURA. Antennæ long and ſetaceous. Eyes two in number, 6 feet, and formed for running. Tail forked, bent inwards under the body, elaſtic, and acts like a ſpring, by which the inſect leaps.

Genus 75. TERMES. Antennæ ſetaceous, mouth armed with two jaws; it has two eyes, and ſix feet, made for running.

We have here followed Linnæus's arrangment, and placed the termites among the apterous inſects, which is certainly an error, as they properly belong to the order Neuroptera, it having in its perfect ſtate, four wings without any ſting. It is probable Linnæus never ſaw thoſe inſects, in their perfect or fly ſtate, and he has only deſcribed three ſpecies: we are indebted to that indefatigable naturaliſt, the late Mr. Henry Smeathman, for the particular hiſtory of many of theſe ſpecies.

Genus 76. PEDICULUS, louſe. Mouth armed with an exerted ſting, antennæ as long as the thorax, two eyes, abdomen depreſſed, and as it were formed of lobes; ſix feet.

Genus 77. PULEX, flea. Antennæ filiform, eyes two, roſtrum bent inwards, ſetaceous and conceals a ſting, abdomen compreſſed or flattened; feet ſix, formed for leaping.

Genus 78. ACARUS, mite. Eyes two, remote, one on each ſide the head, eight feet, and two articulated tentacula, in form of feet.

Genus 79. PHALANGIUM. Eyes two on the ſummit of the head, and two others on the ſides, antennæ which are fixed to the fore part of the head, or made like feet, of which there are eight; abdomen round.

Genus 80. ARANEA. Eyes eight, mouth armed with two crotchets, palpi two in number, and headed by the genitaliæ of the males in that ſex, feet eight, anus contains inſtruments for ſpinning, ſhaped like nipples or teats.

Genus 81. SCORPIO, ſcorpion. Eyes eight, three of which are ſeated on each ſide the thorax, and two on the back, palpi two, cheliform; eight feet, and two claws, which are ſituate on the fore part of the head; tail lengthened out, articulated and terminated by a ſharp crooked ſting; on the breaſt and abdomen, are placed two inſtruments called pectines from their form, which reſembles a comb.

Genus 82. CANCER. Eyes two, moveable, generally placed on a foot ſtalk, palpi two, armed with claws, feet eight, beſides two hands terminated with claws, tail articulated and unarmed; they are divided into the following families,

Brachyuri or ſhort tailed crabs {
Thorax ſmooth ſides entire
—— —— jagged or indented
Hairy or ſpinous on the upper part
Armed with ſpines on the upper part, with ſurface uneven.

Macrouri, or long tailed crabs. {
Thorax ſmooth,
—— uneven or tuberculated,
—— armed with ſpines,
hand without fingers, and thorax oblong, ſhell ſhorter than the thorax, ſo as not to cover it entirely.

Genus 83. MONOCULUS. Eyes fixed in the ſhell, very near each other, body covered with a cruſt or ſhell, feet made for ſwimming.

Genus 84. ONISCUS. Antennæ ſetaceous, body oval, fourteen feet.

Genus 85. SCOLOPENDRA, Antennæ ſetaceous, palpi two, jointed or formed of various articulations, body flat, feet equal to the ſegments of the body.

Genus 86. JULUS. Antennæ moniliform, palpi two, jointed, body ſemicylindric, feet twice as many as the ſegments.

Having now gone through the whole of Linnæus's ſyſtem of inſects, we cannot but regret the loſs of that great man, before he was enabled to add the immenſe number of inſects that have been lately diſcovered, and arrange them under their proper orders and genera. It would be a valuable acquiſition to the entomologiſt, and much facilitate the ſtudy, if ſome perſon properly qualified, would undertake to reduce all the inſects, lately deſcribed by other authors, to the Linnæan ſyſtem; for it is but juſtice to that great author to remark, that notwithſtanding the number of inſects now known, are full three times more than when his laſt edition of the Syſtema Naturæ was publiſhed, we have never yet ſeen an inſect, that we could not readily arrange, under one of his orders; and although ſucceeding authors have amazingly increaſed the number of genera, it will be found on examination that they have in general rather ſubdivided the genera of Linnæus, than framed new ones from inſects that would not with propriety have come under one or other of the eighty-ſix genera we have deſcribed. We do not preſume to ſay, that Linnæus's Syſtem; is free from error, as an artificial one, it cannot be perfect, nor can we expect perfection, till we are enabled to form a natural one, and that time we fear is far diſtant. An increaſe of artificial ſyſtems is ſurely a great obſtacle to the improvement of this ſtudy, and the multiplication of genera muſt inevitably impede our progreſs in this branch of knowledge.

It may however gratify many of our readers, to inform them that the different ſyſtems of Geoffroy, Schæffer, and Scopoli, are collated, and the ſynonymous genera, given by Mr. Yeates, in his inſtitutions of entomology. The Syſtem of Baron Charles De Geer is ingenious, but we think by no means equal to that of Linnæus. The writer to whom entomology is moſt indebted, ſince Linnæus, is Mr. Joſ. Chriſt. Fabricius, who has publiſhed a number of ingenious works upon the ſubject, well worthy the attention of all thoſe who wiſh to become proficients in this ſtudy. For this gentleman in his Mantiſſa Inſectorum, in two volumes, publiſhed in 1787, has deſcribed 7184 inſects, and we are in daily expectation of another Mantiſſa, in which many more will be added; we cannot, however, but lament that a perſon ſo eminently qualified to improve this ſcience, ſhould have ſet about framing a new Syſtem, and increaſing the number of genera. The characteriſtic diſtinctions of this author, are taken from the mouths of inſects; many of which are ſo exceedingly minute, and ſuch numbers of them being dry, hard and damaged before we receive them, that we find it totally impoſſible to define them properly. He has divided them into eight claſſes, and 195 genera. There is alſo another work on inſects, publiſhing at this time in Paris, by a laborious and accurate entomologiſt, Mr. Olivier; but this gentleman, we are alſo ſorry to add, has framed a new Syſtem; although in his great outline, he follows Linnæus, adopting his ſeven orders, but dividing the fourth order or hemiptera, into two diviſions, preſerving the name of hemiptera to the firſt; and to the ſecond, he has given the name of orthoptera; his order hemiptera, is again divided into two ſections, the firſt contains the Linnæan, *Fulgora, Cicadæ, Aphis, Thrips, Chermes and Coccus.* The ſecond ſection includes the *Notonecta, Nepa, Cimex*; the order orthoptera, comprehend the *Blatta, Gryllus, Locuſta, and Mantis.* He alſo arranges his orders different from Linnæus, beginning with order

1. Lepidoptera.
2. Neuroptera.
3. Hymenoptera.
4. Hemiptera.
5. Orthoptera.
6. Coleoptera.
7. Diptera.
8. Aptera.

In his genera he includes all the Linnæan ones, but like Fabricius ſubdivides them, introducing many from the latter author, and adopting others from De Geer, and Geoffroy, to which he has added many new ones, extending the number of Genera to 208, when this work, which is illuſtrated with good figures of all the inſects is finiſhed, it will ſhew the neceſſity of adhering to one Syſtem, as the confuſion of names will prevent the entomologiſt, who ſtudies any particular author, from underſtanding thoſe who purſue a different ſyſtem with themſelves; for inſtance, if we ſpeak to a follower of Fabricius about a moth, which after Linnæus, we call a Pyralis, he will immediately, if unacquainted with Linnæus's Syſtem, ſuppoſe us to mean the Pyralis of Fabricius, which is a tortrix of Linnæus, and ſo on with many others: if therefore it is neceſſary to increaſe the diviſions and arrangements, it is certainly neceſſary to avoid uſing the names of one author, and applying them to a different family, as Fabricius and Olivier have done. The Linnæan, Pyralis and Geometra, they have united under the name of Phalæna, to his Tortrix; they have given that of Pyralis; they have alſo divided his Tineæ, and preſerved his name to the greateſt part of them, and to the remainder, they have given that of Alucitæ, which he had applied to another family, named by them Pterophorus.

Linnæus has been very attentive to the trivial names of his four laſt families of moths, giving the ſame termination to each family, or to each diviſion of a family, in the geometræ; they end in ata, or aria, as the antennæ are either pectinated or ſetaceous; the tortrices all end in ana, the pyralides in lis; the tineæ in ella, and the alucitæ in dactyla; ſo that on receiving a moth from a friend with its name, we could tell by the termination only, in what family to look for it, if we were not ſufficiently acquainted with the ſcience, to know it by its outward appearance, and characteriſtic markings. The great number of theſe ſmall moths, and the difficulty there was in diſcovering their habits and œconomy, induced Linnæus to compliment the admirers and reſearchers into this branch of nature, by naming them after ſuch perſons; and in this he appears to have ſhewn no partiality to particular men or countries, but to have ſelected thoſe, who really deſerved ſuch reſpect: in this inſtance, he alſo diſcriminated between thoſe who only collected and preſerved them, and thoſe who enriched the ſcience, by publiſhing their obſervations and diſcoveries; the firſt will be found only among the tortrices, or thoſe ending in ana, as Burmaniana &c. &c. the latter among the tineæ or thoſe terminating in ella, as De Geerella, &c. &c.

References to the Explanatory Plate.

Fig. 1. A larva or caterpillar of a moth, belonging to the family of geometra; it was from the manner of this larva, drawing itſelf up, and moving like a pair of compaſſes, or, as it were meaſuring its way, that Linnæus gave the name of geometræ to this family; theſe larva reſt in nearly an erect poſture, reſting only on thoſe feet ſituate under the tail.

Fig. 2. Larva of a phalæna bombyx
Fig. 3. Larva of a papilio
Fig. 4. Larva of a ſcarabæus
Fig. 5. Larva of a water inſect
Fig. 6. *a*, *b*, Pupa coarctata—Pupæ of the diptera
Fig. 7. Pupa obtecta, a ſide view } theſe are the pupæ of a
Fig. 8. The ſame pupa front view } moth
Fig. 9. Pupa obtecta. Chryſalis of a butterfly
Fig. 10. *a*, *b*, Pupa incompleta; *a*, a tenthredo; *b*, A phryganea;
Fig. 11. Pupa ſemicompleta. Libellula
Fig. 12. Pupa ſemicompleta. Cimex
Fig. 13. *a*, *b*, *c*, Antennæ ſetaceæ
Fig. 14. *a*, *b*, *c*, Antennæ filiformes
Fig. 15. *a*, *b*, *c*, Antennæ moniliformes
Fig. 16. Antennæ enſiformes
Fig. 17. *a*, *b*, *c*, *d*, *e*, Antennæ clavatæ
Fig. 18. *a*, *b*, Antennæ capitatæ
Fig. 19. *a*, *b*, *c*, Antennæ fiſſiles
Fig. 20. Antennæ perfoliatæ
Fig. 21. Antennæ ſerratæ
Fig. 22. Antennæ pectinatæ
Fig. 23. *a*, *b*, Antennæ ariſtatæ
Fig. 24. Antennæ plumatæ
Fig. 25. Antenna filata
Fig. 26. A, leg; *a*, femur or thigh; *b*, tibia or leg; *c*, tarſis or foot.
Fig. 27. *a*, *b*, Ungues or nails
Fig. 28. Chela or claw — vide nepa
Fig. 29. Chela or claw — vide cancer grangon
Fig. 30. Chela or claw — of a cray fiſh
Fig. 31. Pes curſorius — vide carabus, &c. &c.
Fig. 32. *a*,*b*, Pedes ſaltatorii; vide chryſomelæ, fam. 2 and Gryllus
Fig. 33. *a*, *b*, Pedes natatorii — vide notonecta and dytiſcus
Fig. 34. Pes palmatus — vide gryllus, gryllo-talpa
Fig. 35. Cauda triſeta — vide ephemeron
Fig. 36. Cauda furcata — vide podura
Fig. 37. Cauda forcipata — vide forficula
Fig. 38. Cauda folioſa — vide blatta
Fig. 39. Cauda telifera — vide panorpa & ſcorpion
Fig. 40. Aculeus, or ſting, with its ſheath and feelers, as in the bee
Fig. 42. *a*, Caput, or head; *b*, Palpi, or feelers; *c c*, Antennæ, or horns; *d d*, Oculi, or eyes; *e*, thorax; *f*, Scutellum, or eſcutcheon; *g*, Abdomen and its ſegments; this upper part is called tergum; *h*, Anus; *i i*, Elytra, or wing caſes; *k k*, Alæ, or membranous wings
Fig. 43. *a*, Pectus, or breaſt; *b*, Sternum, or breaſt bone; *c*, Venter, or belly
Fig. 44. *a a*, The anterior margin of the wing; *b b*, The poſterior margin; *cc*, The interior part; *dd*, The exterior margin; *e e*, Tails of the wings; *f*, Oculus, or eye
Fig. 45. } Alæ erectæ
Fig. 46. }
Fig. 47. } Alæ patentes
Fig. 48. }
Fig. 49. } Alæ incumbentes
Fig. 50. }
Fig. 51. Alæ deflexæ. Fig. 52. Alæ reverſæ. Fig. 53. Ala dentata. Fig. 54. Alæ caudatæ. Fig. 55. Ala reticulata. Fig. 56. Ala angulata. Fig. 57. Ala eroſa. Fig. 58. Ala falcata.

The preceding Syſtem of Entomology, was preſented to me by Mr. THOMAS MARSHAM, Secretary to the Linnæan Society. *Thoſe who wiſh to initiate themſelves in this branch of* Natural *Hiſtory, will I am confident find this Syſtem fully anſwer their purpoſe; as it is clear, conciſe, and claſſical. Further to illuſtrate it,* Mr. Marſham *has formed a Plate explanatory of the different Parts of the various Inſects in their reſpective Metamorphoſes. The other Plates of this Claſs of numerous Animals repreſent all the different Genera; and where the Species vary conſiderably, to render the* Syſtem *more complete, ſeveral Species will be given of a Genus, ſimilar to thoſe in* Ornithology. *I hope the Production will conduce to the Entertainment of my Subſcribers, and am happy in an opportunity of thus acknowledging my obligations to the Author for his liberal contribution to the Support of the Work.*

PATER-NOSTER-ROW. C. COOKE.

Plate 1.

Various parts of different Insects which regulate their Classification!
See the conclusion of the System of Entomology.

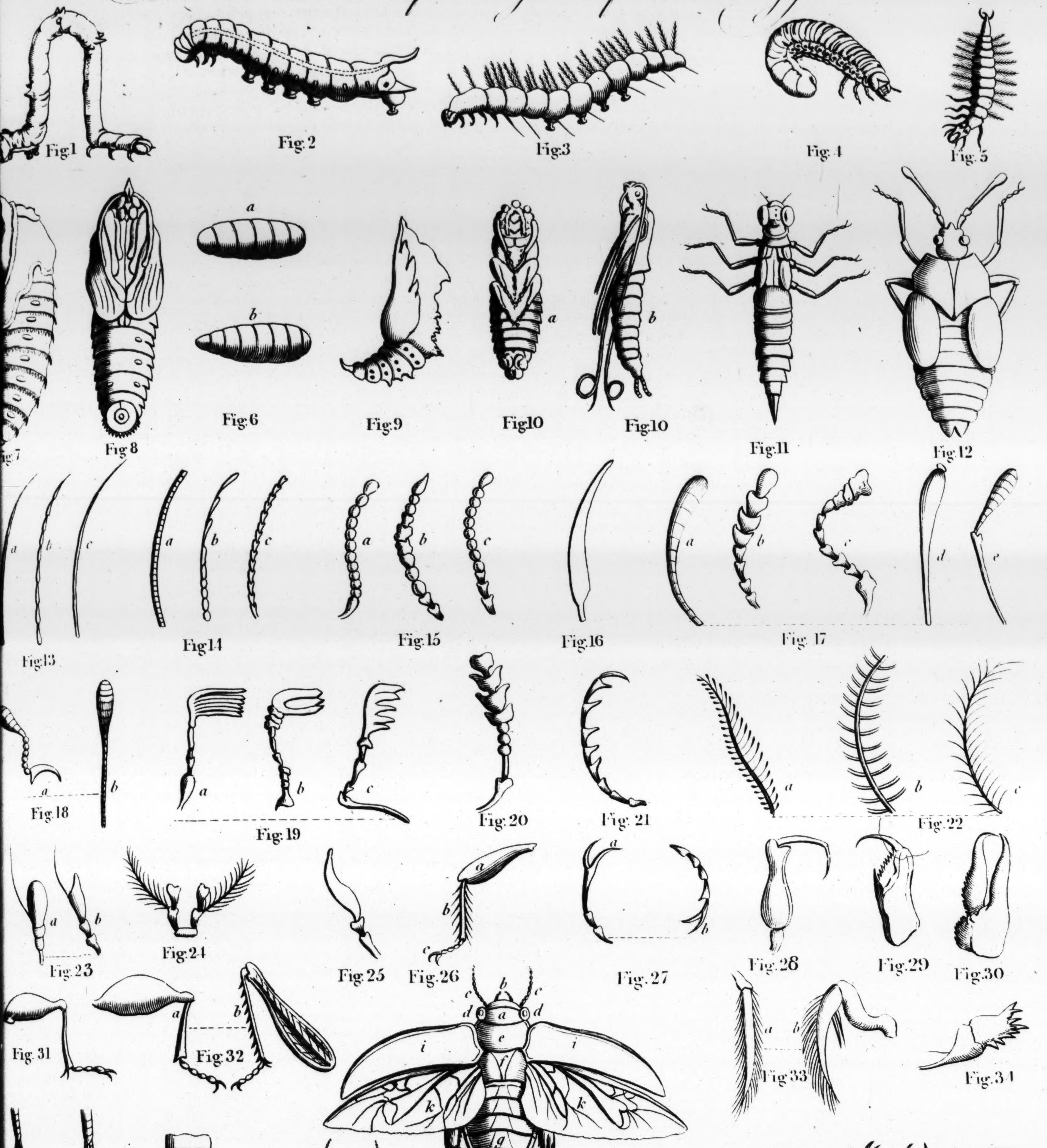


Fig. 1
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Fig. 45
Fig. 46
Fig. 47
Fig. 48
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Fig. 51
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Fig. 53
Fig. 54
Fig. 55
Fig. 56
Fig. 57
Fig. 58

igned by T. Marsham.

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BRITISH 18 MR 63 MUSEUM

ENTOYER, or **Entoire**, in heraldry, is uſed to expreſs a bordure, charged entirely with things without life.

ENTRAILS, the inteſtines or guts of an animal. See Intestines.

Entrails is alſo uſed, in a more extenſive ſenſe, for the viſcera, or all the parts contained in the cavities of the bodies of animals.

ENTRANCE *of Hounds*, a phraſe uſed by our ſportſmen, to expreſs the inſtruction of theſe creatures in the art of hunting. They are ſaid to be entered when they are thoroughly taught this.

Method of entering Hounds.

The time of entering of hounds, is, when they are ſeventeen or eighteen months old; they are then to be taught to take the water and ſwim; they are to be laid abroad in the heat of the day, to enure them to fatigue and exerciſe; and they muſt be frequently led through flocks of ſheep, and warrens, to uſe them to be under command, and to know that they are to run at nothing but what the huntſman orders. They muſt be carefully inſtructed each to know his own name, and to underſtand the voice of the huntſman, and the notes of the horn uſed in hunting; and finally, to uſe their own language in a proper manner.

The beſt time of entering them is about noon; and it ſhould be in a fair warm day; for if they be entered in the morning, they will give out when the heat of the middle of the day comes on. Take the moſt advanced, that the game may not ſtand long before them, and let them be well rewarded when all his over. This ought to be repeated at leaſt once a week, for two months ſucceſſively; by this means they will be ſo fleſhed and ſeaſoned with what game you may enter them at, that they will never afterwards leave off the purſuit. The new hounds ſhould always be entered with the beſt and ſtauncheſt hounds that can be had; and there is not to be one barking dog ſuffered in the field on this occaſion.

Whatever chaſe the hounds are intended for, the hare is the beſt game to enter them at, becauſe in this chace, they will learn all the turns and doubles that they can poſſibly meet within any other kind, and how to come to the hollo. They will learn alſo from this chace, to have a perfect and nice ſcent, and hard feet, by being uſed to highways, beaten paths, and dry hills. The hounds, when firſt entered, muſt have all the advantages given them that can be. When the hare is put up, from her form, it muſt be obſerved which way ſhe went, and the ſcent muſt be left to cool a while, and then they muſt be laid in, and helped as much as can be, by wind, view, hollo, or pricking the paſſage; nor will it be amiſs, for the firſt time to give them a hare tired the ſame morning in her courſe.

Some are of opinion, that the beſt way to enter young hounds, is, to take a live hair, and trail her upon the ground, ſometimes one way, and ſometimes another, and then to draw her off to a convenient diſtance, and hide her, that the dogs, taking ſcent, may follow all the traces through which ſhe was drawn, and at length find her. The huntſman ought very well to underſtand the nature and diſpoſition of his hounds, in finding out the game; for ſome hounds are of that temper, that when they have found the ſcent, they will run forward with it, not making any noiſe, nor ſhew of the tail; others, when they have found a head, will ſhew the game; and ſome, having found the footings of the beaſt, will prick up their ears a little, and either bark, or only wag their ears, or the hinder part of their bodies. This difference of natural diſpoſition, the huntſman is particularly to obſerve in the young and newly entered pack, otherwiſe he will never underſtand them, nor ever be able to hunt them to any credit or advantage.

For entering the hound at hart or buck, he ſhould be in prime caſe, for then he cannot ſtand up, or hold the chaſe ſo long. The foreſt pitched upon ſhould have all the relays at equal diſtances, as nearly as may be; but then the young hounds ſhould always have ſome old ſtaunch ones to enter them, and they ſhould be led to the fartheſt and laſt relay, and the hart or buck ſhould be hunted to them. Being come up, the old hounds ſhould be uncoupled; and when they have found the hart, and well entered the cry, then the young ones are to be uncoupled alſo; and if any of them are found to lag behind, they muſt be whipped and beaten forward.

In whatever place the hart is killed, the neck ſhould be immediately flayed, and the hounds rewarded; for it is beſt always to do this while the fleſh is hot. Another very good method of entering hounds at the buck, is to take one in the toils or nets, and to wound one of his legs, ſo as to diſable him from running either very ſwiftly or very far; then let him looſe, and firſt let a bloodhound trace the creature, then let looſe all the young hounds; and when they have run down the animal, reward them with the neck. Some enter their hounds with a toil; but this is a bad way; for the hart being in this caſe always in ſight, and not able to run an end, makes a great number of doubles and turnings: this is very different from the chaces they are to meet with afterwards; and when they find a hart run in the common way, ſtraight forward, and out of ſight, they will leave the chace, as unlike that by which they were taught.

ENTRY, or **Entrance**, in its general ſenſe, denotes a door, gate, paſſage, &c. through which to enter, or arrive within a place.

Entry, in book-keeping. See Book-keeping, Sect. IV.

Entry is ſometimes alſo uſed to denote a duty or impoſt laid on commodities imported into a ſtate, either by land or ſea. The duties of entry, or importation, are paid according to a tariff ſettled for that purpoſe. Where the duty of entry of any commodity is not fixed by the tariff, it is paid by eſtimation, i. e. in proportion to what ſome other commodity of nearly the ſame quality and value uſes to pay. In making entries inwards, it is uſual for merchants to include all the goods they have on board the ſame ſhip in one bill, though ſometimes there may happen to be upwards of twenty ſeveral kinds; and in caſe the goods are ſhort entered, additional or port entries are now allowed; though formerly the goods ſo entered were forfeited. As to bills of entry outwards, of including goods to be exported, upon delivering them and paying the cuſtoms, you will receive a cocket, which teſtifies your payment thereof, and of all duties for ſuch goods. If ſeveral ſorts of goods are exported at once, of which ſome are free, and others pay cuſtoms, the exporter muſt have two cockets, and therefore muſt make two entries. Entries of goods, on which a draw-back is allowed, muſt likewiſe contain the name of the ſhip in which the goods were imported, the importer's name, and time of entry inwards. The entry being thus made, and an oath taken, that the cuſtoms for theſe goods were paid as the law directs; you muſt carry it to the collector and comptroller, or their deputies; who, after examining their books, will grant a warrant, which muſt be given to the ſurveyor, ſearcher, or land-waiter, that they may certify the quantity of goods; after which the certificate muſt be brought back to the collector and comptroller, or their deputies, and oath made, that the ſaid goods are really ſhipped, and not landed again in any part of Great Britain.

Entry alſo denotes a ſolemn reception, or a ceremony performed by kings, princes, ambaſſadors, legates, &c. upon their firſt entering a city, or their return in triumph from ſome expedition.

Entry, in law, ſignifies the taking poſſeſſion of lands or tenements, in virtue of a title thereto.

Entry is alſo uſed for a writ which grants poſſeſſion of lands or tenements to a perſon, on account of a legal right thereto.

ENTYPOSIS, from εντυποω, *I make an impreſſion*, in anatomy, the articulation of the ſhoulder with the arm.

ENVELOPE, in fortification, denotes a mount of earth ſometimes raiſed in the ditch of a place, and ſometimes beyond it, being either in form of a ſimple parapet, or of a ſmall rampart bordered with a parapet.

ENVELOPED, in heraldry, is where a ſnake entangles himſelf round a beaſt or any other thing.

ENUMERATION, the act of enumerating, or counting. At the time of our Saviour's birth, Auguſtus Cæſar had commanded an enumeration to be made of all the world, or rather of all the people under his empire. Though ſeveral able authors are of opinion, that the cenſus tax, or enumeration mentioned by St. Luke, did not extend to the whole empire, but only to the people of Judæa.

Enumeration, in rhetoric, denotes a part of the peroration, wherein the orator, collecting the ſcattered heads of what has been delivered throughout the whole, makes a brief and artful rehearſal or recapitulation thereof.

ENUNCIATION, a ſimple expreſſion or declaration of a thing, in terms either of affirmation or denial.

ENVOY, a perſon deputed, or ſent purpoſely to negociate ſome particular affair with a foreign prince or republic. Thoſe ſent from the courts of England, and France, &c. to Genoa, the princes of Germany, and other petty princes and ſtates, do not go in quality of ambaſſadors, but of envoys. Add, that thoſe ſent from one great prince or ſtate to another, as from the king of England to the emperor, &c. when the affair they go upon is not very ſolemn and important, have frequently no other character but that of envoys. Envoys are either ordinary or extraordinary. Both kinds are under the protection of the law of nations, and enjoy all the privileges of ambaſſadors, only differing from them in this, that the ſame ceremonies are not performed to them.

ENVY, in ethics, is defined by Mr. Locke, to be an uneaſineſs of mind, occaſioned by the conſideration of a good we diſcover in poſſeſſion of another perſon, whom we deem leſs worthy of it than ourſelves. It is a compoſition of ſorrow and hatred, and ſtands in direct oppoſition to congratulation. Envy, in its nature and effects, is the baſeſt, moſt miſchievous, and moſt tormenting of all paſſions.

Envy, in mythology, is repreſented by the Greek and Roman poets as an infernal divinity, with ſquinting eyes, lean body, pale countenance, diſturbed air, head encompaſſed with ſerpents, &c.

EPACTS, in chronology, the exceſſes of the ſolar month above the lunar ſynodical month; and of the ſolar year above the lunar year of twelve ſynodical months; or of ſeveral ſolar months above as many ſynodical months; and ſeveral ſolar years above as many dozen of ſynodical months. The epacts then, are either annual or menſtrual. Epacts, menſtrual, are the exceſſes of the civil or calendar month above the lunar month. Epacts, annual, are the exceſſes of the ſolar year above the lunar.

EPANALEPSIS, Επαναληψις, called alſo *epanadiploſis*, in rhetoric, the repetition of the ſame word in the beginning of one ſentence, and at the end of another, Thus Virgil,

Ambo florentes ætatibus, Arcades ambo.

EPANODUS, Εϖανοδος, in rhetoric, a repetition of the ſame words in an inverted order; thus,

Nox brevis nimis, ah! nimis brevis nox. Voſſ. Rhet. lib. v. p. 298.

EPAULE, or Espaule, in fortification, the ſhoulder of the baſtion, or the angle made by the face and flank, otherwiſe called the *angle of the epaule.* The word is pure French, and literally ſignifies *ſhoulder.*

EPAULEMENT, in fortification, a ſide-work haſtily thrown up, to cover the cannon or the men. It is made either of earth thrown up, of bags filled with ſand or earth, or of gabions, faſcines, &c. with earth: of which latter ſort the epaulements of the places of arms for the cavalry behind the trenches uſually are.

EPAULETTES, are a kind of ſhoulder-knots choſen for the ſoldiers, which are to be of the colour of the facing, with a narrow yellow or white tape round it, and worſted fringe; thoſe for the officers are made of gold or ſilver lace, with a rich fringe; they are badges of diſtinction worn on one or both ſhoulders. Thoſe of the dragoon-guards, horſe, and dragoons, are worn on the left ſhoulder: the light-dragoons, and officers of grenadiers, have one on each ſhoulder: thoſe of the battalion wear one on the right ſhoulder only, which is to be made of embroidery or lace, with a gold or ſiver fringe. Thoſe of the royal regiment of artillery are to be gold embroidery with gold fringe on ſcarlet cloth, and worn on the right ſhoulder.

EPHEMERA, in medicine, an epithet applied to ſome thing that only laſts a day; particularly to a ſort of fever, which terminates in the compaſs of twenty four hours, called by Galen εΦημερος ϖυρετος, *febris ephemera*, by the Latins, *diaria.* The word, and the following one, *ephemerides*, are formed of the prepoſition επι, *de, of*, and ημερα, *dies, day.*

Ephemera, in the Linnæan ſyſtem of entomology, a diſtinct genus of the neuroptera order. For the deſcription and claſſification, ſee Syſtem of Entomology.

EPHEMERIDES, in aſtronomy, tables calculated by aſtronomers, ſhewing the preſent ſtate of the heavens for every day at noon, that is the places wherein all the planets are found at that time. In England, the nautical almanac, or aſtronomical ephemeris, publiſhed annually by anticipation, under the direction of the commiſſioners of longitude, is the moſt conſiderable.

EPHOD, אפר, derived from אפר, *aphad, to clothe*, a ſacerdotal garment, in uſe among the antient Jews, ſuppoſed to have been a kind of linen alb, or ſurplice, wore by perſons of diſtinction, of various characters. There were two kinds of ephods; the one, common to all who aſſiſted in the temple, being only made of common linen, mentioned in the firſt book of Samuel, ii. 18; the other, peculiar to the high prieſt, mentioned Exod. xxviii. 6. 15. to be made of gold, of blue, and of purple, of ſcarlet, and fine twiſted linen, with cunning work; having two ſhoulder-pieces, with a curious girdle of the ſame matter, whereon were two onyxes, with the names of the children of Iſrael engraved thereon. It is alſo expreſſed in the ſecond book of Samuel, vi. 14. that upon the removal of the ark of the covenant from the houſe of Obed-Edom, David danced for joy, girt with a linen ephod; whence ſome authors have concluded, that the ephod was alſo a regal garment, worn on ſolemn occaſions.

EPHORI, in Grecian antiquity, magiſtrates eſtabliſhed in ancient Sparta to balance the regal power. The authority of the ephori was very great. They ſometimes expelled and even put to death the kings, and aboliſhed or ſuſpended the power of the other magiſtrates, calling them to account at pleaſure. There were five of them, others ſay nine. They preſided in the public ſhews and feſtivals. They were entruſted with the public treaſure; made war and peace; and were ſo abſolute, that Ariſtotle makes their government equal to the prerogative of a monarchy. They were eſtabliſhed by Lycurgus.

EPIC, or Heroic, poem, a poem expreſſed in narration, formed upon a ſtory partly real, and partly feigned; repreſenting, in a ſublime ſtyle, ſome ſignal and fortunate action, diſtinguiſhed by a variety of great events, to form the morals, and affect the mind with the love of heroic virtue.

We may diſtinguiſh three parts of the definition, namely, the matter, the form, and the end. The matter includes the action of the fable, under which are ranged the incidents, epiſodes, characters, morals, and machinery. The form comprehends the way or manner of the narration, whether by the poet himſelf, or by any perſons introduced, whoſe diſcourſes are related: to this branch likewiſe belong the moving of the paſſions, the deſcriptions, diſcourſes, ſentiments, thoughts, ſtyle, and verſification; and beſides theſe, the ſimilies, tropes, figures, and, in ſhort, all the ornaments and decorations of the poem. The end is to improve our morals, and increaſe our virtue.

EPICŒNE, Εϖικοινον, in grammar, a term applied to nouns, which, under the ſame gender and termination, mark, indifferently, two kinds of ſexes. Such, in Latin, is, *aquila*, *veſpertilio*, &c. which ſignify equally a male or female eagle or bat. Grammarians diſtinguiſh between epicœne and common. A noun is ſaid to be common of two kinds, when it may be joined either with a maſculine or a feminine article; and epicœne, when it is always joined to ſome one of the two articles, and yet ſignifies both genders.

EPICUREAN *Philoſophy*, the doctrine or ſyſtem of philoſophy maintained by Epicurus and his followers. His philoſophy conſiſted of three parts; canonical, phyſical, and ethereal. The firſt was about the canons or rules of judging. The cenſure which Tully paſſes upon him for his deſpiſing logic, will hold true only with regard to the logic of the Stoics, which he could not approve of, as being too full of nicety and quirk. Epicurus was not acquainted with the analytical method of diviſion and argumentation, nor was he ſo curious in modes and formation as the Stoics. Soundneſs and ſimplicity of ſenſe, aſſiſted with ſome natural reflections, was all his art. His ſearch after truth proceeded only by the ſenſes; to the evidence of which he gave ſo great a certainty, that he conſidered them as an infallible rule of truth, and termed them the *firſt natural light of mankind.*

In the ſecond part of this philoſophy he laid down atoms, ſpace, and gravity, as the firſt principles of all things; he did not deny the exiſtence of God, but thought it beneath his majeſty to concern himſelf with human affairs; he held him a bleſſed immortal being, having no affairs of his own to take care of, and above meddling with thoſe of others. As to his ethics, he made the ſupreme good of man to conſiſt in pleaſure, and conſequently ſupreme evil in pain. Nature itſelf, ſays he, teaches us this truth; and prompts us from our birth to procure whatever gives us pleaſure, and avoid what gives us pain. To this end he propoſes a remedy againſt the ſharpneſs of pain: this was to divert the mind from it, by turning our whole attention upon the pleaſures we have formerly enjoyed. He held that the wiſe man muſt be happy, as long as he is wiſe: the pain, not depriving him of his wiſdom, cannot deprive him of his happineſs. There is nothing that has a fairer ſhew of honeſty than the moral doctrine of Epicurus. Gaſſendus pretends, that the pleaſure in which this philoſopher has fixed the ſovereign good, was nothing elſe but the higheſt tranquillity of mind in conjunction with the moſt perfect health of body: but Tully, Horace, and Plutarch, as well as almoſt all the fathers of the church, give us a very different repreſentation: indeed the nature of this pleaſure, in which the chief happineſs is ſuppoſed to be ſeated, is a grand problem in the morals of Epicurus. Hence there were two kinds of Epicureans, the rigid and the remiſs; the firſt were thoſe who underſtood Epicurus's notion of pleaſure in the beſt ſenſe, and placed all their happineſs in the pure pleaſures of the mind, reſulting from the practice of virtue: the looſe or remiſs Epicureans, taking the words of that philoſopher in a groſs ſenſe, placed all their happineſs in bodily pleaſures or debauchery.

EPICYCLE, in aſtronomy, a circle, whoſe centre is on the circumference of another circle which bears it, and which for that reaſon is called its deferent. The word is formed of the Greek επι, *upon*, and κυκλος, *circle*, q. d. *a circle on a circle.*

EPICYCLOID, in geometry, denotes a curve generated by the revolution of a point of the periphery of a circle, along the convex or concave part of another circle.

EPIDEMIC, Εϖιδημιος, denotes a general or ſpreading diſorder, as a plague, ariſing from ſome corruption or malignity in the air, which ſeizes great numbers of people in a little time. The word is Greek, formed of εϖι, and δημος, *populus, people*; ſuch diſeaſes running among all kinds of people, of whatever age, ſex, quality, &c. as ariſing from a common or general cauſe. The Latins call them *populares morbi, popular diſeaſes*; in oppoſition to thoſe called *ſporadici*, which are only here and there, as riſing from private or particular cauſes. Epidemic diſeaſes differ from endemial: which imports diſeaſes peculiar to ſome particular country, region, or people; whereas epidemic diſeaſes are ſuch as are peculiar to certain ſeaſons.

EPIDERMIS, in anatomy, the cuticle, or ſcarf-ſkin. The word is formed of the Greek εϖι, *on, over*, and δερμα, *ſkin.*

EPIDIDYMIS, in anatomy, a little round body, on the back of each teſticle; called alſo Paraſtata. See Syſtem of Anatomy, Part III. Sect. II.

EPIGASTRIC *Region*, in anatomy, is a name given to the upper part of the abdomen; reaching from the cartilago xiphoides, almoſt to the navel. See Syſtem of Anatomy, Part V. Sect. I. It is uſually divided into three parts: the ſides, or lateral parts, called hypochondria; and the middle, the epigaſtrium.

EPIGLOTTIS, of εϖι, *upon*, and γλωσσα, or γλωττα, *tongue*, in anatomy, the cover, or lid, of the larynx. The epiglottis is a thin, moveable cartilage, made in form of a leaf of ivy, or a little tongue, and therefore likewiſe called lingula; ſerving to cover the cleft, or rima, of the larynx, called glottis. See Syſtem of Anatomy, Part V. Sect. XVIII.

EPIGRAM, in poetry, a ſhort poem, or compoſition in verſe, treating only of one thing, and ending with ſome point, or lively ingenious thought. The word is formed of επιγραμμα, *inſcription*, of εϖιγραΦειν, *to inſcribe, or write upon.* Epigrams then, originally ſignify inſcriptions, and they derive their origin from thoſe inſcriptions placed by the ancients on their tombs, ſtatues, temples, triumphal arches, &c.

One great beauty of the epigram is, to leave ſomething for the reader to gueſs, or ſupply. Nothing pleaſes the mind ſo much, as to find ſomething in itſelf in the objects preſented it; nor does any thing diſguſt it more than to preclude it from ſhewing and exerciſing a faculty it values itſelf for. The epigram admits of great variety of ſubjects: ſome are made to praiſe, and others to ſatirize, which laſt are much the eaſieſt; ill nature ſerving inſtead of point and wit. The epigram being only a ſingle thought, it would be ridiculous to expreſs it in a great number of verſes; it muſt have its unity like the drama. The comedy has an action for its ſubject, and the epigram a thought.

EPILEPSY, formed of επιλαμβανω, *I ſurpriſe*, or *ſeiſe hold of one*, in medicine, a convulſion, either of the whole body, or ſome of its parts; attended with a deprivation of the ſenſes and underſtanding; and returning from time to time in fits, or paroxyſms. In Engliſh it is uſually called the *falling ſickneſs*, becauſe people fall down when attacked by it. See Syſtem of Medicine.

EPILOGUE, in oratory, the end or concluſion of a diſcourſe, ordinarily containing a recapitulation of the principal matters delivered.

Epilogue, in dramatic poetry, a ſpeech addreſſed to the audience, after the play is over, by one of the principal actors therein; uſually containing ſome reflections on certain incidents in the play, eſpecially thoſe in the part of the perſon that ſpeaks it; and having ſomewhat of pleaſantry, intended to compoſe the paſſions raiſed in the courſe of the repreſention: a practice which is ridiculed by the Spectator; and compared to a merry jigg upon the organ after a good ſermon, to wipe away any impreſſions that might have been made thereby, and ſend the people away juſt as they came.

EPIPHANY, a Chriſtian feſtival, otherwiſe called the *manifeſtation of Chriſt to the Gentiles*, obſerved on the ſixth of January, in honour of the appearance of our Saviour to the three magi, or wiſe men, who came to adore him and bring him preſents. The feaſt of epiphany was not originally a diſtinct feſtival; but made a part of that of the nativity of Chriſt, which being celebrated 12 days, the firſt and laſt of which were high or chief days of ſolemnity, either of theſe might properly be called epiphany, as that word ſignifies the appearance of Chriſt in the world. The word in the original Greek, επιφανια, ſignifies *appearance* or *apparition*; and was applied, as ſome critics will have it, to this feaſt, on account of the ſtar which appeared to the magi. St. Jerom and St. Chryſoſtom take the epiphany for the day of our Saviour's baptiſm, when he was declared to men by the voice, *Hic eſt filius meus dilectus, in quo mihi complacui:* "This is my beloved ſon, in whom I am well pleaſed." And accordingly it is ſtill obſerved by the Cophtæ and Ethiopians in that view. Others contend, that the feaſt of Chriſtmas, or the nativity of our Saviour, was held in divers churches on this day; which had the denomination *epiphany*, or *appearance*, by reaſon of our Saviour's firſt appearance on earth at that time. And it muſt be allowed, that the word is uſed among the ancient Greek fathers, not for the appearance of the ſtar to the magi, but for that of our Saviour to the world: in which ſenſe, St. Paul uſes the word *epiphania*, in his ſecond epiſtle to Timothy, c. i. v. 10.

EPIPHONEMA, Επιφωνημα, *acclamation*, in rhetoric, a ſententious ſort of exclamation, which is frequently added after a narrative, or rehearſal of any thing remarkable; containing uſually a lively, cloſe reflection on the ſubject there ſpoken of, and intended to give it greater force, and render it more affecting to the hearers. Such is that of St. Paul, when after diſcourſing of the rejection of the Jews, and the vocation of the Gentiles, he cries out,

> *O the depth of the wiſdom and knowledge of God!*

Such alſo is that of Lucretius, after relating the ſtory of Agamemnon's ſacrificing his daughter Iphigenia:

> *Tantum religio potuit ſuadere malorum!*

The epiphonema is uſually expreſſive of the milder and more gentle paſſions, and is not ſo vehement and impetuous as exclamation.

EPIPHYSIS, Επιφυσις, in anatomy, a leſſer bone, or bony ſubſtance, adhering, or growing to another, by the intervention of a cartilage. See Syſtem of Anatomy, Part I. Sect. II.

EPILOON, in anatomy, a fattiſh membrane, ſpread over the inteſtines, and entering even into the ſeveral ſinuoſities thereof: called alſo the omentum, and popularly the caul. The word is formed of the Greek Επιπλεειν, *to ſwim upon*, becauſe it ſeems to float on the inteſtines.

EPISCOPACY, the quality of epiſcopal government, or that form of church diſcipline, wherein dioceſan biſhops are eſtabliſhed, diſtinct from, and ſuperior to, prieſts or preſbyters. See Bishop. Epiſcopacy, and preſbytery, have been alternately eſtabliſhed and aboliſhed in Scotland.

EPISCOPAL, ſomething that belongs to a biſhop. The word is formed of the Greek επισκοπος, *overſeer*, derived from επισκοπεω, *inſpicio*, *I inſpect*, or *overlook*. Epiſcopal government, is the government of a dioceſe, wherein one ſingle perſon, legally conſecrated, preſides over the clergy of a whole diſtrict, in quality of head, or ſuperintendent thereof; conferring order, and exerciſing a ſort of juriſdiction. The preſbyterians reject the epiſcopal eſtabliſhment, and condemn the epiſcopal orders as a human inſtitution, the mere reſult of pride and ambition. Among the epiſcopal functions, the principal part is that of holding frequent viſitations of the dioceſe.

EPISCOPALIANS, in church hiſtory, an appellation given to thoſe who prefer the epiſcopal government and diſcipline to all others. By the teſt act, none but Epiſcopalians, or members of the church of England, are qualified for any office, civil or military.

EPISODE, Επεισοδιον, from επι, *upon*, and εισοδος *entry*, is commonly conceived to be a ſeparate incident, ſtory, or action, which an hiſtorian, or poet, inſerts, and connects with his principal action; to furniſh out the work with a greater diverſity of events; though, in ſtrictneſs, all the particular incidents, whereof the action or narration is compoſed, are called epiſodes. Epiſode, in dramatic poetry, was the ſecond part of the ancient tragedy. The origin and uſe of epiſodes is deſcribed by M. Hedelin, and F. Boſſu. Tragedy, in its original, being only a hymn ſung in honour of Bacchus, by ſeveral perſons, who made a kind of chorus, or concert of muſic, with dancing, and the like; to diverſify the repreſentation a little, and divert the audience, they determined at length to divide the ſinging of the chorus into ſeveral parts, and to have ſomething rehearſed in the intervals. At firſt, a ſingle perſon, or actor, was introduced, then two, then more; and what the actors thus rehearſed, or entertained the audience with, being ſomething foreign, or additional to, or beſide, the ſong of the chorus, and no neceſſary part thereof, was called επεισοδιον, *epiſode*. And hence tragedy came to conſiſt of four parts, the *prologue*, *epiſode*, *exode*, and *chorus*. The prologue was all that preceded the firſt entrance of the chorus. The *epiſode*, all that was interpoſed between the ſingings of the chorus. The *exode*, all that was rehearſed after the chorus had done ſinging. And the *chorus*, was the grex, or company, that ſung the hymn.

Episode, in epic poetry. The term epiſode, by being tranſplanted from the ſtage, did not change its nature. All the difference between the tragic and epic epiſodes, is, that the latter are more ample than the former. The ſubject of a poem may be lengthened two ways; either by the poet's making uſe of a great many of his epiſodes; or by his amplifying, and giving a greater extent to every one. By this latter method, chiefly, it is, that the epic poets lengthen their poems much beyond the dramatic.

EPISPASTIC, in medicine, a topical remedy, which being applied to the external parts of the body, attracts the humours to that part.

EPISTLE, denotes the ſame with a miſſive letter; but is now chiefly uſed in ſpeaking of ancient writings, as the epiſtle of St. Paul, epiſtles of Cicero, epiſtles of Pliny, &c.

Epistles *and Goſpels*, in the liturgy of the church of England, are ſelect portions of ſcripture, taken out of the writings of the evangeliſts and apoſtles, and appointed to be read, in the communion-ſervice, on Sundays and holidays. They are thought to have been ſelected by St. Jerom, and by him put into the lectionary. It is certain, they were anciently appropriated to the days whereon we now read them, ſince they are not only of general uſe throughout the weſtern church, but are alſo commented upon in the homilies of ſeveral ancient fathers, which are ſaid to have been preached upon thoſe very days to which theſe portions of ſcripture are now affixed.

The epiſtles and goſpels are placed in an admirable order and method, and bear a ſpecial relation to the ſeveral days whereon they are read. The year is diſtinguiſhed into two parts; the firſt being deſigned to commemorate Chriſt's living among us, the other to inſtruct us to live after his example. The former takes in the whole time from Advent to Trinity-Sunday; the latter, all the Sundays from Trinity to Advent During the firſt of theſe ſeaſons, the epiſtles and goſpels are calculated to raiſe in us a grateful ſenſe of what our Saviour did and ſuffered for us, and ſet before our eyes his nativity, circumciſion, and manifeſtation to the Gentiles; his doctrines, and miracles; his baptiſm, faſting, and temptation; his agony and bloody ſweat; his croſs and paſſion; his death, burial, reſurrection, and aſcenſion; and his miſſion of the Holy Ghoſt. During the ſecond ſeaſon of the year, the epiſtles and goſpels tend to inſtruct us in the true paths of Chriſtianity.

EPISTOLARY, a term uſed in the phraſe epiſtolary ſtile. As the matter of an epiſtle is the ſame with that of converſation, it ſhould not differ in the manner of expreſſion; and therefore, all pomp and ſtudy of language are not only needleſs but very improper: the moſt plain and eaſy way of conveying our thoughts muſt certainly be beſt, as being moſt natural. Purity in the choice of words, and juſtneſs of conſtruction, joined with perſpicuity, are the chief properties of this ſtyle: to which purpoſe Cicero obſerves, that in writing letters we make uſe of common words and expreſſions. And Seneca ſays, I would have my letters be like my diſcourſes, when we either ſit or walk together, unſtudied and eaſy. Ep. 75. ad Lucill. However, as the ſubjects of epiſtles are various, they will neceſſarily acquire ſome variety in the manner of expreſſion. If the ſubject be weighty and momentous, the language ſhould be ſtrong and ſolemn; in things of a lower nature, more free and eaſy; and upon lighter matters, jocoſe and pleaſant. In exhortations, it ought to be lively and vigorous; in conſolations, kind and compaſſionate; and in adviſing, grave and ſerious. In narratives, it ſhould be clear and diſtinct, in requeſts, modeſt; in commendations, friendly, without adulation; in proſperity, chearful; and mournful, in adverſity. In a word the ſtyle ought to be accommodated to the particular nature of the ſubject about which it is converſant. Beſides, the different character of the perſon, to whom the letter is written, requires a little difference in the modes of expreſſion. Superiors ſhould be addreſſed with reſpect; inferiors, with courteſy; and equals, with civility. Old men and young, the grave and facetious, courtiers and philoſophers, friends and ſtrangers, require ſome variety in the mode of addreſs. The epiſtles of Cicero, the ſtyle of which is plain and ſimple, and yet pleaſant and engaging, furniſh a proper model in this reſpect.

EPITAPH, Εϖιταφιον, from *εϖι*, *upon*, and *ταφος*, *ſepulchre*, a monumental inſcription, in honor or memory of a perſon defunct; or an inſcription engraven or cut on a tomb, to mark the time of a perſon's deceaſe, his name, family, and uſually ſome eulogy of his virtues or good qualities.

In epitaphs, the dead perſon is ſometimes introduced by way of proſopopœia, ſpeaking to the living; of which we have a fine inſtance, worthy the Auguſtan age, wherein the dead wife thus beſpeaks her ſurviving huſband.

Immatura peri: ſed tu, felicior, annos
Vive tuos, conjux optime, vive meos

The French have a proverb, *Menteur comme une epitaphe*; *He lies like an epitaph*; an alluſion to the eulogies ordinarily contained therein, which are not always over juſt.

In the anthologies, or collections of epigrams, we have abundance of ſuch epitaphs, ſome of them ludicrous and ſatirical, others grave. For a ſpecimen, we ſhall here add a very beantiful one, compoſed by Mr. Cowley, on himſelf, to be put in a little country houſe, whither he retreated from the court and town to ſpend his laſt days.

Hic, O viator, ſub lare parvulo,
Couleius *hic eſt conditus, hic jacet*
Defunctus humani laboris
Sorte, ſupervacuaque vita;
Non indecora pauperie *nitens*,
Et non inerti nobilis otio,
Vanoque dilectis popello,
Divitiis, animoſus *hoſtis*.
Poſſis ut illum dicere mortuum,
En terra jam nunc quantula *ſufficit?*
Exempta ſit curis, viator,
Terra ſit illa levis, precare.
Hic ſparge flores, *ſparge breves* roſas;
Nam vita gaudet mortua floribus;
Herbiſque odoratis corona
Vatis adhuc cinerem calentem.

EPITALAMIUM, Εϖιθαλαμιον, formed of εϖι and θαλαμος, *bride chamber*, in poetry, a nuptial ſong, or a compoſition, uſually in verſe; on occaſion of a marriage between two perſons of eminence. The topics it chiefly inſiſts on are the praiſes of matrimony, and of the married couple, with the pomp and order of the marriage ſolemnity; it concludes with prayers for their proſperty, their happy offſpring, &c. This kind of poetry is very ancient.

EPITHET, Εϖιθετον, a noun adjective expreſſing ſome quality of a ſubſtantive, to which it is joined. The word is formed of *εϖι*, *upon*, and *θεσις*, *poſitio*, *putting*. As a fruitful vine, a ſtately pile, an echoing vault, &c. Epithets are of great uſe and conveniency among poets and orators, who ſupply in epithets what they want in other requiſites. Card. Perron even blames Homer on the head of epithets, obſerving, that he frequently hooks in epithets without any ſenſe or ſignificancy at all, to help out his meaſures; and that he equips every hero with an epithet, not according to the exigence of the caſe, but the meaſure of the verſe.

EPITHET is alſo uſed for a ſurname, or a perſon's ſecond appellation. Epithets were anciently beſtowed very frankly, either on account of excellencies or defects of the body or mind; kings themſelves were not exempted from them, Hence thoſe epithets ſo frequent in hiſtory, as Edward Long-ſhanks, Richard Cœur de Lion, Edmund Iron-ſide, Richard Crook-back, John Lackland, &c. Nor have the French uſed their kings any better; witneſs their Charles the Simple Louis the Lazy, *feineant* (Ludovicus *nihil faciens*), Pepin the Short, Louis the Stammerer, *le begue*.

EPITOME, an abridgement, or a reduction of the principal matters of a larger book into a little compaſs. See ABRIDGEMENT. The word is Grek, *εϖιτομη*, formed of *εϖιτεμνειν*, *reſecare*, *to retrench*, *abridge*, or *cut off*.

EPLOYE', in heraldry. An *eagle eployé* is what in Engliſh we more uſually call an *eagle diſplayed*, or *a ſpread eagle*.

EPOCHA, in chronology, a term or fixed point of time, whence the ſucceding years are numbered or accounted.

Different epochas obtain in different nations; and no wonder; for there being no aſtronomical conſideration to render one preferable to another, their conſtitution is purely arbitrary. That principally regarded among Chriſtians, is, the epocha of the nativity or incarnation of Jeſus Chriſt; that of the Mahometans, the Hegira: that of the Jews, &c. the creation of the world; that of the ancient Greeks, the Olympiads; that of the Romans, the building of the city; that of the ancient Perſians and Aſſyrians, the Epocha of Nabonaſſar, &c. The doctrine and uſe of epochas is of very great extent in chronology.

EPOCHA *of Chriſt*, or *of our Lord*, is the vulgar epocha throughout Europe, commencing from the ſuppoſed time of our Saviour's nativity, December 25, or rather according to the uſual account, from his circumciſion, that is, from the firſt of January. In effect, the epocha of our Lord ſerves not only for the computation of the years elapſed ſince the epocha commenced, but even of thoſe before it.

The author of the vulgar epocha, or way of computing from Chriſt, is an abbot from Rome, one Dionyſius Exiguus, by nation a Scythian, who flouriſhed under Juſtinian about the year 507, or, according to others, 527, though this Dionyſius borrowed the hint from Pandorus, an Egyptian monk. Till his time, the generality of Chriſtians computed their years either from the building of Rome, or according to the order of the emperors and conſuls, and other ways in uſe with the people among whom they lived. This diverſity occaſioned a great diſtraction between the churches of the Eaſt and Weſt; Dionyſius, to compoſe the ſame, firſt propoſed a new form of the year, with a new general æra, which in a few years time was generally admitted. Dionyſius began his account from the conception or incarnation, by us popularly called Lady day, or the Annunciation; which method obtained in the dominions of Great Britain till the year 1752, before which time the Dionyſian and Engliſh epocha was the ſame; but in that year the Gregorian calendar having been admitted by act of parliament, they now reckon from the firſt of January, as they do in the other countries of Europe, except in the court of Rome, where the epocha of the incarnation ſtill obtains for the date of their bulls.

EPOCHA *of the Creation*, *orbis conditi*, according to the computation of the Jews, called alſo the Jewiſh epocha, is the year of the Julian period 953, anſwering to the year before Chriſt 3761, and commencing on the ſeventh day of October. This epocha is ſtill in uſe among the Jews.

The EPOCHA *of the Creation*, uſed by the Greek hiſtorian, is the year before the Julian period, 787, anſwering to the year before Chriſt 5500.

EPOCHA *of the Hegira*, or *Mahometan* EPOCHA, is the year of the Julian period 5335, anſwering to the year of Chriſt 622. It commences on the 16th of July, the day of Mahomet's flight from Mecca to Medina. This epocha is uſed by the Turks and Arabs, and even all who profeſs the Mahometan faith.

EPODE, Εϖοδος, in lyric poetry, the third or laſt part of the ode; the ancient ode, or ſong, being divided into ſtrophe, antiſtrophe, and epode.

EPOMIS, Εϖωμις, in anatomy, the upper part of the ſhoulder reaching up to the neck. See DELTOIDES.

EPOPOEIA, Εϖοϖοιια, in poetry, the hiſtory, action, or fable, that makes the ſubject of an epic poem. The word is derived from the Greek *εϖος*, *carmen*, *verſe*, and *ϖοιεω*, *facio*, *I make*.

EPSOM *Salt*. What we now meet with, in the ſhops of chymiſts, under this name, is no other than a ſalt made from the bittern, or remaining brine, after the making of common ſalt; but when the world was firſt made acquainted with a purging ſalt, under this name, it was truly what its name expreſſed, being really made from the purging waters of that place. This ſalt is bitter and of a ſtrongly purging quality, and, when ſuffered to ſhoot freely, and its cryſtals at a due diſtance, it always formed them into rectangular priſms, with four parallelogrammic planes; by this, and by divers other properties, it appears evidently different from all other ſalts known at that time. It was ſuppoſed to partake of the nature of alum, and the waters of the place were called aluminous waters; but Dr. Grew has evidently proved the error of that opinion: others ſuppoſed this ſalt the ſame thing with the ſalt of lime, or the nitre of old walls, but this was equally erroneous. The beſt method of taking it was found to be diſſolving it in a proper quantity of its own water; by this means the water was made to work both more quickly and more effectually; and it proved of great ſervice in diſorders of the ſtomach, as want of appetite, and the like; and in colics, diabetes, the ſcurvy, and rheumatiſm, and many other chronic diſeaſes. Phil. Tranſ. N°. 216. p. 76.

Mr. Boulduc has given much the ſame deſcription of the manner of making Epſom ſalt as Mr. Brown had done in Phil. Tranſ. N°. 37. § 10. and N°. 378. § 11. that it is the ſalt which cryſtallizes, after boiling to a due conſiſtence the bittern, which is the liquor remaining in the ſalt-pans, after the ſea-ſalt is ſeparated. See Mem. Acad. Scienc. 1731.

EPSOM *Water*. This is a water eaſily imitated by art, i. e. by only diſſolving half an ounce of Epſom ſalt in a quart of pure water, made ſomewhat briſk or quick by a few drops of ſpirit of vitriol and oil of tartar, ſo as to let the alkali prevail. Shaw's Lectures, p. 90.

EQUABLE *Motion*, is that whereby the moveable body proceeds with the ſame continued velocity; neither accelerated, nor retarded.

EQUAL, a term of relation between two or more things of the ſame magnitude, quantity, or quality. Mathematicians ſpeak of equal lines, angles, figures, circles, ratios, ſolids, &c.

EQUALITY, that agreement between two or more things, whereby they are denominated equal.

Equality, *ratio*, or proportion of, in geometry, is that between two equal numbers, or quantities.

Equality, in algebra, is a compariſon of two quantities, that are equal, both really, and repreſentatively, i. e. which are ſo both in effect and letters. A compariſon of two quantities, equal in effect, but unequal in letters, to render them equal, is called an equation.

EQUANIMITY, in ethics, denotes an even, uniform temper of mind, amidſt all the varieties and revolutions of time and chance. This virtue, together with prudence, forms the character which Horace gives of Ariſtippus:

> *Omnis Ariſtippum decuit color & ſtatus & res.*

EQUATION, or Æquation, in algebra, an expreſſion of the ſame quantity, in two different, that is, diſſimilar, but equal terms or denominations. See Syſtem of Algebra, for definition, Sect. I. for practical illuſtration, Sect. V. VI. and VII.

EQUATOR, or Æquator, in geography, a great circle of the ſphere, equally diſtant from the two poles of the world, or having the ſame poles with thoſe of the world. Such is the circle Æ, *Fig.* 3, 4, Plate II. its poles being N and S. It is called the equator, becauſe when the ſun is in it, the days and nights are equal; whence alſo it is called the the equinoctial; and when drawn on maps and planiſpheres, the equinoctial line, or ſimply, the line. Every point of the equator is a quadrant's diſtance from the poles of the world; whence it follows, that the equator divides the ſphere into two hemiſpheres, in one of which is the northern, and in the other the ſouthern pole.

EQUATOREAL, univerſal, in aſtronomy, is the name of an excellent inſtrument, made by Mr. Adams, an ingenious philoſophical inſtrument maker in London. For a particular deſcription of this inſtrument, ſee Syſtem of Astronomy, ſect. XVI. For the repreſentation of it, ſee Plate I.

EQUERRY, an officer of ſtate, under the maſter of the horſe. There are five equerries who ride abroad with his majeſty; for which purpoſe they attend monthly, one at a time, and are allowed a table. As to the equerries of the crown table, they have this diſtinct appellation, as being employed in mounting, managing, and breaking the ſaddle horſes, for his majeſty's uſe, and holding his ſtirrup.

EQUES *Auratus*, is uſed to ſignify a knight bachelor, called auratus, q. d. gilt, becauſe anciently none but knights might gild or beautify their armour, or other habiliments of war, with gold.

EQUESTRIS, Equestrian, a term chiefly uſed in the phraſe, *equeſtrian ſtatue*, which ſignifies a ſtatue repreſenting a perſon mounted on horſeback. The word is formed of the Latin, *eques, knight, horſeman,* of *equus, horſe.*

EQUESTRIAN *Games, ludi equeſtres,* among the Romans, horſeraces, of which there are five kinds, the prodromus, or plain horſe race, the chariot race, the decurſory race about funeral piles, the *ludi ſemirales*, and the *ludi neptunales*.

Equestrian *Order*, among the Romans, ſignified the order of knights or equites.

EQUIANGULAR, or Æquiangular, in geometry, is applied to figures whoſe angles are all equal.

EQUIDISTANT, or Æquidistant, in geometry, a term of relation between two things which are every where at an equal or the ſame diſtance from each other. Thus, parallel lines are ſaid to be equidiſtant, as they neither approach nor recede.

EQUILATERAL, or Æquilateral, of *æquus, equal,* and *latus, ſide,* is applied to any thing whoſe ſides are all equal. Thus, an equilateral triangle is that whoſe ſides are all of equal length. In an equilateral triangle all the angles are likewiſe equal. All regular poligons and regular bodies are equilateral.

EQUILIBRIUM, or Æquilibrium, in mechanics, a term implying an exact equality of momentum or force between two bodies compared with each other; and this takes place when their directions are equally oppoſite, and their maſſes are reciprocally proportional to the velocities with which they tend to move. A balance is in equilibrio when the two ends are ſo exactly poiſed that neither of them aſcends or deſcends, but both retain their parallel poſition to the horizon. From this circumſtance the word is originally taken, as being a compound of *æquus, equal,* and *libra, balance*; whence we frequently uſe the word balance in lieu thereof.

Equilbrium is alſo uſed figuratively on other occaſions. A painter muſt take care to obſerve the equilibrium of his figures, i. e. diſpoſe them well on their centre of gravity, that they may not ſeem ill-ſupported, or ready to tumble. Thus, e. gr. if one arm be moved forward, the other muſt be proportionally backward to poiſe the figure.

EQUIMULTIPLE, in arithmetic and geometry, is applied to ſimple magnitudes when multiplied equally, i. e. by equal quantities or multipliers. Thus, taking A as many times as B, or multiplying them equally, there will ſtill remain the ſame ratio between the magnitudes thus multiplied as between the primitive magnitudes before multiplication.

EQUINOCTIAL, or Æquinoctial, in aſtronomy, a great and immoveable circle of the ſphere, under which the equator moves in its diurnal motion. The equinoctial, or equinoctial line, is ordinarily confounded with the equator; but there is a difference, the equator being moveable, and the equinoctial immoveable; and the equator being drawn about the convex ſurface of the ſphere, but the equinoctial on the concave ſurface of the magnus orbis. Whenever the ſun, in his progreſs through the ecliptic, comes to this circle, it makes equal days and nights all around the globe; as then riſing due eaſt and ſetting due weſt, which he never does at any other time of the year. And hence the denomination from *æquus* and *nox, night, quia æquat diem nocti.*

Equinoctial *Dial*, is that whoſe plane lies parallel to the equinoctial. See Treatiſe on Dialling, Sect. VI. Article 12.

EQUINOX, or Æquinox, in aſtronomy, the time when the ſun enters one of the equinoctial points. The equinoxes happen when the ſun is in the equinoctial circle; when of conſequence the days are equal to the nights throughout the world, which is the caſe twice a year, viz. about the 20th of March and the 23d of September, the firſt of which is the *vernal*, and the ſecond the *autumnal equinox*.

EQUIPAGE, in the military art, denotes all ſorts of utenſils, artillery, &c. neceſſary for commencing and proſecuting with eaſe and ſucceſs any military operations. Camp and field equipage conſiſts of tents, kitchen furniture, ſaddle-horſes, baggage waggons, bat-horſes, &c.

EQUITY, in a general ſenſe, the virtue of treating all other men according to reaſon and juſtice, or as we would gladly be treated ourſelves when we underſtand aright what is our due.

Equity, in juriſprudence, is defined a correction or qualification of the law, generally made in that part wherein it faileth, or is too ſevere. It likewiſe ſignifies the extenſion of the words of the law to caſes unexpreſſed, yet having the ſame reaſon; ſo that where one thing is enacted by ſtatute, all other things are enacted that are of the like degree. For example, the ſtatute of Glouc. gives action of waſte againſt him that holds lands for life or years; and, by the equity thereof, a man ſhall have action of waſte againſt a tenant that holds but for one year, or one half-year, which is without the words of the act, but within the meaning of it; and the words that enact the one, by equity enact the other. So that equity is of two kinds. The one abridges and takes from the letter of the law: the other enlarges and adds to it; and ſtatutes may be conſtrued according to equity, eſpecially where they give remedy for wrong, or are for expedition of juſtice. Equity ſeems to be the interpoſing law of reaſon, exerciſed by the lord chancellor in extraordinary matters to do equal juſtice, and, by ſupplying the defects of the law, gives remedy in all caſes. See Blackst. Comment. vol. i. 61, 91. vol. iii. 49, 429, 436. vol. iv. 435.

Equity *of Redemption*, on mortgages, is that right which a mortgager has of redeeming his eſtate upon payment of the money borrowed. If where money is due on a mortgage, the mortgagee is deſirous to bar the equity of redemption, he may oblige the mortgager either to pay the money, or be foreclosed of his equity; which is done by proceedings in the court of chancery. But the chancery cannot ſhorten the time of payment of the mortgage money, where it is limited by expreſs covenant, though it may lengthen it; and then upon non-payment, the practice is to foreclose the equity of redemption of the mortgager. 2 Vent. 364.

To foreclose the equity, a bill in chancery is exhibited, to which an anſwer is put in and a decree being obtained, a maſter in chancery is to certify what is due for principal, intereſt, and coſts, which are to be prefixed by the decree, whereupon the premiſes are to be re-conveyed to the mortgager; or, in default of payment, the mortgager is ordered to be foreclosed from all equity of redemption, and to convey the premiſes abſolutely to the mortgagee. By ſtat. 7 Geo. II. cap. 20, after payment or tender by the mortgager of principal, intereſt, and coſts, the mortgagee can maintain no ejectment, but may be compelled to re-aſſign his ſecurities.

EQUIVALENT, an appellation given to things which agree in nature or other circumſtance; as *force, virtue,* &c.

EQUIVOCAL *Terms*, or *Words*, among logicians, are thoſe which have a doubtful or double meaning. According to Mr. Locke, the doubtfulneſs and uncertainty of words has its cauſe more in the ideas themſelves, than in any incapacity of the words to ſignify them; and might be avoided, would people always uſe the ſame term to denote the ſame idea, or collection of ideas: but, adds he, it is hard to find a diſcourſe on any ſubject where this is the caſe; a practice which can only be imputed to folly, or great diſhoneſty.

EQUIVOCATION, *Æquivocatio*, the uſing a term or expreſſion that has a double ſignification. Equivocations are expedients to ſave telling the truth, and yet without telling a falſity.

EQUULEUS, or Eculeus, in antiquity, a kind of rack, or engine of torture, uſed for extorting the truth; at firſt chiefly on ſlaves, but afterwards turned againſt the Chriſtians. The patient's arms and legs being faſtened on the equuleus with cords, he was hoiſted aloft, and extended in ſuch manner that all his bones were diſlocated. In this ſtate, red-hot plates were applied to his body,

body; and he was alſo goaded in the ſides with an iron-forked inſtrument, called ungula. The equuleus was of wood, and had holes at certain diſtances, with a ſcrew, by which the criminal was ſtretched to the third, ſometimes to the fourth or the fifth hole: at intervals, the ſcrew was ſlackened again, by which he had ſome reſpite; but then he was tormented with queſtions. The equuleus in more antient times was conſtructed in the form of a horſe; the criminal was laid on his back, and his arms were turned under the breaſt of the equuleus, his hands were bound and his feet ſtretched out towards his tail. A rope faſtened to the feet was made to paſs over a ſmaller pulley between the hind legs of the equuleus, and made to coil over another larger pulley fixed under the belly by means of a handle, which the executioner turned round till all the bones, &c. were diſlocated. Phil. Tranſ. vol. viii. part iv. p. 32, &c.

EQUUS, the horſe, a genus of quadrupeds belonging to the order of belluæ, in the claſs Mammalia. This genus comprehends the horſe, the aſs, and the zebra; they have ſix erect and parallel fore-teeth in the upper jaw, and ſix ſomewhat prominent ones in the under jaw; the dog teeth are ſolitary, and at a conſiderable diſtance from the reſt; and the feet conſiſt of an undivided hoof. The horſe is a domeſtic animal; and the figure and dimenſions of his body are ſo well known, that a general deſcription is altogether unneceſſary. We ſhall therefore confine ourſelves to the natural hiſtory of this noble animal.

The horſe, in a domeſtic ſtate, is a bold and fiery animal; equally intrepid as his maſter, he faces danger and death with ardour and magnanimity. He delights in the noiſe and tumult of arms, and ſeems to feel the glory of victory: he exults in the chaſe; his eyes ſparkle with emulation in the courſe. But though bold and intrepid, he is docile and tractable: he knows how to govern and check the natural vivacity and fire of his temper. He not only yields to the hand, but ſeems to conſult the inclination of his rider. Conſtantly obedient to the impreſſions he receives, his motions are entirely regulated by the will of his maſter. He in ſome meaſure reſigns his very exiſtence to the pleaſure of man. He delivers up his whole powers; he reſerves nothing; he will rather die than diſobey. Who could endure to ſee a character ſo noble abuſed! who could be guilty of ſuch groſs barbarity!

This character, though natural to the animal, is in ſome meaſure the effect of education. His education commences with the loſs of liberty, and it is finiſhed by conſtraint. The ſlavery of the horſe is ſo ancient and ſo univerſal, that he is but rarely ſeen in a natural ſtate. Several ancient writers talk of wild horſes, and even mention the places where they were to be found. Thoſe of America were originally tranſported from Europe by the Spaniards; for this ſpecies of animals did not exiſt in the new world. The Spaniards carried over a great number of horſes, left them in different iſlands, &c. with a view to propagate that uſeful animal in their colonies. Theſe have multiplied incredibly in the vaſt deſarts of thoſe thinly peopled countries, where they roam at large, without any reſtraint.

The horſe has not only a grandeur in his general appearance, but there is the greateſt ſymmetry and proportion in the different parts of his body. The regularity and proportion of the different parts of the head gives him an air of lightneſs, which is well ſupported by the ſtrength and beauty of his cheſt. He erects his head, as if willing to exalt himſelf above the condition of other quadrupeds: his eyes are open and lively; his ears are handſome, and of a proper height; his mane adorns his neck, and gives him the appearance of ſtrength and boldneſs.

At the age of two years, or two years and a half, the horſe is in a condition to propagate; and the mare, like moſt other females, is ready to receive him ſtill ſooner. But the foals produced by ſuch early embraces are generally ill-made and weakly. The horſe ſhould never be admitted to the mare till he is four or four and a half; this is only meant with regard to draught horſes. Fine horſes ſhould not be admitted to the mare before they be ſix years old; and Spaniſh ſtallions not till ſeven. The mares are generally in ſeaſon from the beginning of March to the end of April; but their chief ardour for the horſe laſts but about 15 or 20 days, and this critical ſeaſon ſhould always be embraced. The ſtallions ought to be ſound, well made, vigorous, and of a good breed. For fine ſaddle-horſes, foreign ſtallions, as Arabians, Turks, Barbs, and Andalouſians, are preferable to all others. Next to theſe, Britiſh ſtallions are the beſt; becauſe they originally ſprang from thoſe above-mentioned, and are very little degenerated. The ſtallions of Italy, and eſpecially the Neapolitans, are very good. The beſt ſtallions for draught or carriage horſes, are thoſe of Naples, Denmark, Holſtein, and Freezeland. The ſtallions for ſaddle horſes ſhould be from 14 to 15 hands high, and for draught horſes at leaſt 15 hands. Neither ought the colour of ſtallions to be over-looked; as a fine black, grey, bay, ſorrel, &c. Beſides theſe external qualities, a ſtallion ought to have courage, tractability, ſpirit, agility, a ſenſible mouth, ſure limbs, &c. Theſe precautions in the choice of a ſtallion are the more neceſſary, becauſe he has been found by experience to communicate to his offspring, almoſt all his good or bad qualities, whether natural or acquired.

The mare contributes leſs to the beauty of her offspring than the ſtallion; but ſhe contributes perhaps more to their conſtitution and ſtature: for theſe reaſons, it is neceſſary that the mares for breed be perfectly ſound, and make good nurſes. For elegant horſes, the Spaniſh and Italian mares are beſt, but, for draught horſes, thoſe of Britain and Normandy are preferable. However, when the ſtallions are good, the mares of any country will produce fine horſes, provided they be well made and of a good breed.

Mares go with young eleven months and ſome days. They bring forth ſtanding; contrary to the courſe of moſt other quadrupeds, who lie during this operation. They continue to bring forth till the age of 16 or 18 years; and both horſes and mares live between 25 and 30 years. Horſes caſt their hair once a year, generally in the ſpring, but ſometimes in the autumn. At this time they are weak, and require to be better fed and taken care of than at any other ſeaſon.

In Perſia, Arabia, and moſt Eaſtern countries, they never geld their horſes, as is done in Europe and China. This operation greatly diminiſhes their ſtrength; courage, and ſpirits; but it makes them good humoured, gentle, and tractable. With regard to the time of performing this operation, the practice of different countries is different: ſome geld their horſes when a year old, and others at 18 months. But the beſt and moſt general practice is to delay the operation till they be two years old at leaſt; becauſe, when the gelding is delayed for two years or more, the animals retain more of the ſtrength and other qualities which naturally belong to the male.

As the utility of horſes ſurpaſſes that of all other domeſtic animals, it may be of uſe to ſubjoin ſome marks by which the age and other properties of horſes may be diſtinguiſhed.

In old horſes, the eye pits are generally deep; but this is only an equivocal mark, being alſo found in young horſes begot by old ſtallions. The moſt certain knowledge of the age is to be obtained from the teeth. Of theſe a horſe has 40; 24 grinders or double teeth, four tuſhes, and 12 fore teeth: mares have no tuſhes, or at leaſt very ſhort ones. It is not from the grinders that we know the age; it is diſcovered firſt by the fore-teeth, and afterwards by the tuſhes. The 12 fore-teeth begin to ſhoot within 12 days after the colt is foaled. Theſe firſt, or foal teeth, are round, ſhort, not very ſolid, and are caſt at different times, to be replaced by others. At the age of two years and a half, the four middle fore-teeth are caſt, two in the upper jaw, and two in the lower. In one year more, four others drop out, one on each ſide of the former, which are already replaced. When he is about four years and a half old, he ſheds four others, and always next to thoſe which have fallen out and been replaced. Theſe four foal teeth are replaced by four others, but are far from growing ſo faſt as thoſe which replaced the eight former, and are called the corner teeth; they replace the four laſt foal-teeth, and by theſe the age of a horſe is diſcovered. They are eaſily known, being the third both above and below, counting from the middle of the jaw. They are hollow, and have a black mark in their cavity. When the horſe is four years and a half old, they are ſcarce viſible above the gum, and the cavity is very ſenſible: at ſix and a half, they begin to fill; and the mark continually diminiſhes and contracts till ſeven or eight years, when the cavity is quite filled up, and the black ſpot effaced. After eight years, theſe teeth ceaſing to afford any knowledge of the age, it is judged of by the tuſhes: which are four teeth adjoining to thoſe laſt mentioned; and, like the grinders, are not preceded by any other teeth. The two in the lower jaw uſually begin to ſhoot at three years and a half, and thoſe of the upper jaw at four; continuing very ſharp-pointed till ſix. At 10, the upper ſeem blunted, worn out, and long, the gum contracting itſelf as its years increaſe; the barer therefore they are, the older is the horſe. From 10 to 13 or 14 years, little can be ſeen to indicate the age; but at that time ſome hairs of the eye brows begin to turn grey. The age of a horſe may be alſo known, though leſs accurately, by the bars in his mouth, which wear away as he advances in years.

When the horſe is without blemiſh, the legs and thighs are clean, the knees ſtraight, the ſkin and ſhank thin, and the back ſinew ſtrong and well braced. The ſinews and the bones ſhould be ſo diſtinct, as to make the legs appear thin and lathy, not full and round. The paſtern joints ſhould never be large and round; nor muſt there be any ſwelling near the coronet. The hocks ſhould be lean and dry, not puffed up with wind. With regard to the hoof, the coronet ſhould be equally thick, and the horn ſhining and greyiſh. A white horn is a ſign of a bad foot, for it will wear out in a ſhort time; and likewiſe when the horn is thin, it is liable to be ſpoiled in ſhoeing, and by travelling hard on ſtony grounds. This is beſt known when the ſhoe is taken off; for then the verge all round the ſole will appear thin, and the horſe will wince at the leaſt touch of the pincers.

A ſtrong foot has the fibres of the hoof very diſtinct running in a direct line from the coronet to the toe, like the grain of wood. In this caſe, care muſt be taken to keep the foot moiſt and pliable. The greateſt inconvenience attending a hard ſtrong foot, is its being ſubject to rifts and fiſſures, which cleave the hoof quite through ſometimes from the coronet down to the bottom.

A narrow heel is likewiſe a defect; and when it is not above two fingers in breadth, the foot is bad. A high heel cauſes a horſe to trip and ſtumble often; and the low one, with long yielding paſterns, is very apt to be worn quite away on a journey. Too large a foot in proportion to the reſt of the body, renders a horſe weak and heavy.

The head of a horſe ſhould be ſmall, and rather lean than fleſhy. The ſhoulders ſhould be pretty long; the withers thin, and enlarge gradually from thence downwards; but ſo as to render his breaſt neither too narrow nor too groſs. A thick-ſhouldered horſe ſoon tires, and trips and ſtumbles every minute; eſpecially if he has a thick large neck at the ſame time. When the breaſt is ſo narrow that the fore-thighs almoſt touch, they are never good for much. A horſe of a middle ſize ſhould have the diſtance of five or ſix inches between his fore-thighs, and there ſhould be leſs diſtance between his feet than his thighs near the ſhoulders when he ſtands upright. The body or carcaſe of a horſe ſhould be of a middling ſize in proportion to his bulk, and the back ſhould ſink a little below the withers; but the other parts ſhould be ſtraight, and no higher behind than before. He ſhould alſo be home-ribbed; but the ſhort ribs ſhould not approach too near the haunches, and then he will have room to fetch his breath. When a horſe's back is ſhort in proportion to his bulk, and yet otherwiſe well limbed, he will hold out a journey, though he will travel ſlow. When he is tall, at the ſame time with very long legs, he is but of little value.

The wind ſhould never be overlooked in the choice of a horſe; and it may eaſily be known by his flanks, if he is broken-winded, when he ſtands quiet in the ſtable; becauſe he always pinches them in with a very ſlow motion, and drops them ſuddenly. A thick-winded horſe fetches his breath often, and ſometimes rattles and wheezes. This may be always diſcovered when he is put to briſk exerciſes. The temper of a horſe ſhould always be obſerved; a vicious horſe generally lays his ears cloſe to his pole, ſhews the whites of his eyes, and looks ſullen and dogged. An angry horſe may be known by his frowning looks; and he generally ſeems to ſtand in a poſture of defence. When he is very vicious, he pays no regard to the groom that feeds him: however, ſome horſes that are ticklish will lay back their ears, and yet be of a good diſpoſition. A fearful horſe is apt to ſtart, and never leaves it off till he is old and uſeleſs. A fretful horſe is very unfit for a journey: and you may diſcover his temper as ſoon as he gets out of the ſtable. A dull, heavy, ſluggiſh horſe may be eaſily known, whatever tricks are uſed to rouſe his ſpirits.

The breed of horſes in Great Britain is as mixed as that of its inhabitants; the frequent introduction of foreign horſes has given us a variety, that no ſingle country can boaſt of; moſt other countries produce only one kind; while ours, by a judicious mixture of the ſeveral ſpecies, by the happy difference of our ſoils, and by our ſuperior ſkill in management, may triumph over the reſt of Europe, in having brought each quality of this noble animal to the higheſt perfection. In the annals of Newmarket, may be found inſtances of horſes that have literally outſtripped the wind, as the celebrated M. Condamine has lately ſhewn in his remarks on thoſe of Great Britain. Childers is an amazing inſtance of rapidity; his ſpeed having been more than once extended equal to 82½ feet in a ſecond, or near a mile in a minute: the ſame horſe has alſo run the round courſe at Newmarket, (which is about 400 yards leſs than four miles) in ſix minutes and 40 ſeconds; in which caſe his fleetneſs is to that of the ſwifteſt barb, as four to three; the former, according to Dr. Maty's computation, covering at every bound a ſpace of ground equal in length to 23 feet royal, the latter only that of 18½ feet royal.

Horſes of this kind derive their origin from Arabia; the ſeat of the pureſt and moſt generous breed. The ſpecies uſed in hunting, is a happy combination of the former with others ſuperior in ſtrength, but inferior in point of ſpeed and lineage; an union of both is neceſſary; for the fatigues of the chace muſt be ſupported by the ſpirit of the one, as well as by the vigour of the other. No country can bring a parallel to the ſtrength and ſize of our horſes deſtined for the draught; or to the activity and ſtrength united of thoſe that form our cavalry. In our capital there are inſtances of ſingle horſes that are able to draw on a plan, for a ſmall ſpace, the weight of three tuns, but could with eaſe, and for a continuance, draw half that weight. The pack horſes of Yorkſhire, employed in conveying the manufactures of that county to the moſt remote parts of the kingdom, uſually carry a burden of 420 pounds; and that indifferently over the higheſt hills of the north, as well as the moſt level roads. But the moſt remarkable proof of the ſtrength of our Britiſh horſes, is to be drawn from that of our mill-horſes; ſome of theſe will carry at one load 13 meaſures, which at a moderate computation of 70 pounds each, will amount to 910; a weight ſuperior to that which the leſſer ſort of camels will bear; this will appear leſs ſurpriſing, as theſe horſes are by degrees accuſtomed to the weight; and the diſtance they travel no greater than to and from the adjacent hamlets.

Our cavalry, in the late campaigns, (when they had opportunity) ſhewed over thoſe of our allies, as well as of the French, a great ſuperiority both of ſtrength and activity; the enemy was broken through by the impetuous charge of our ſquadrons; while the German horſes, from their great weight and inactive make, were unable to ſecond our efforts; though thoſe troops were actuated by the nobleſt ardour. The preſent cavalry of this iſland only ſupports its ancient glory. It was eminent in the earlieſt times: our ſcythed chariots, and the activity and good diſcipline of our horſes, even ſtruck terror into Cæſar's legions; and the Britons, as ſoon as they became civilized enough to coin, took care to repreſent on their money the animal for which they were ſo celebrated. It is now impoſſible to trace out this ſpecies; for thoſe which exiſt among the *indigenæ* of Great Britain, ſuch as the little horſes of Wales and Cornwal, the hobbies of Ireland, and the ſhelties of Scotland, though admirably well adapted to the uſes of thoſe countries, could never have been equal to the work of war: but probably we had even then a larger and ſtronger breed in the more fertile and luxuriant parts of the iſland. Thoſe we employ for that purpoſe, or for the draught, are an offspring of the German or Flemiſh breed, meliorated by our ſoil and a judicious culture. The Engliſh were ever attentive to an exact culture of theſe animals; and in very early times ſet a high value on their breed. The eſteem that our horſes were held in by foreigners ſo long ago as the reign of Athelſtan, may be collected from a law of that monarch, prohibiting their exportation, except they were deſigned as preſents. Theſe muſt have been the native kind, or the prohibition would have been needleſs; for our commerce was at that time too limited to receive improvement from any but the German kind, to which country their own breed could be of no value.

But when our intercourſe with the other parts of Europe was enlarged, we ſoon laid hold of the advantages this gave of improving our breed. Roger de Beleſme, earl of Shrewſbury, is the firſt that is on record; he introduced the Spaniſh ſtallions into his eſtate in Powiſland, from which that part of Wales was for many ages celebrated for a ſwift and generous race of horſes. Giraldus Cambrenſis, who lived in the reign of Henry II. takes notice of it; and Michael Drayton, cotemporary with Shakeſpear, ſings their excellence in the ſixth part of his Polyolbion. This kind was probably deſtined to mount our gallant nobility, or courteous knights for feats of chivalry, in the generous conteſts of the tilt-yard. From theſe ſprung, to ſpeak the language of the times, the flower of courſers, whoſe elegant form added charms to the rider, and whoſe activity and managed dexterity gained him the palm in that field of gallantry and romantic honour.

The increaſe of our inhabitants, and the extent of our manufactures, together with the former neglect of internal navigation to convey thoſe manufactures, multiplied the number of our horſes: an exceſs of wealth, before unknown in theſe iſlands, increaſed the luxury of carriages, and added to the neceſſity of an extraordinary culture of theſe animals: their high reputation abroad has alſo made them a branch of commerce, and proved another cauſe of their vaſt increaſe.

As no kingdom can boaſt of parallel circumſtances, ſo none can vie with us in the number of theſe noble quadrupeds. It would be extremely difficult to gueſs at the exact amount of them, or to form a periodical account of their increaſe: the number ſeems very fluctuating. William Fitz-Stephen relates, that in the reign of king Stephen, London alone poured out 20,000 horſemen in the wars of thoſe times: yet we find, that, in the beginning of queen Elizabeth's reign, the whole kingdom could not ſupply 2000 horſes to form our cavalry: and even in the year 1588, when in the moſt imminent danger from the Spaniſh invaſion, all the cavalry which the nation could then furniſh amounted only to 3000. To account for this difference we muſt imagine, that the number of horſes which took the field in Stephen's reign was no more than an undiſciplined rabble; the few that appeared under the banners of Elizabeth, a corps well formed, and ſuch as might be oppoſed to ſo formidable an enemy as was then expected: but ſuch is their preſent increaſe, that, in the late war, the number employed was 13,575; and ſuch is our improvement in the breed of horſes, that moſt of thoſe which are uſed in our waggons and carriages of different kinds, might be applied to the ſame purpoſe: of thoſe, our capital alone employs near 22,000.

The all-wiſe Creator hath finely limited the ſeveral ſervices of domeſtic animals towards the human race; and ordered that the parts of ſuch, which in their lives have been the moſt uſeful, ſhould after death contribute the leaſt to our benefit. The chief uſe that the *exuviæ* of the horſe can be applied to, is for collars, traces, and other parts of the harneſs; and thus, even after death, he preſerves ſome analogy with his former employ. The hair of the mane is of uſe in making wigs; of the tail, in making the bottoms of chairs, floor-cloths, and cords; and to the angler in making lines.

TECHNICAL DESCRIPTION OF THE PARTS OF A HORSE.

The fore Part. 1. The forehead. 2. The temples. 3. Cavity above the eye. 4. The jaw. 5. The lips. 6. The noſtrils. 7. The tip of the noſe. 8. The chin. 9. The beard. 10. The neck. 11. The mane. 12. The fore top. 13. The throat. 14. The withers. 15. The ſhoulders. 16. The cheſt. 17. The elbow. 18. The arm. 19. The plate vein. 20. The cheſnut. 21. The knee. 22. The ſhank. 23. The main tendons. 24. The fetlock joint. 25. The fetlock. 26. The paſtern. 27. The coronet. 28. The hoof. 29. The quarters. 30. The toe. 31. The heel. *The Body.* 32. The reins. 33. The fillets. 34. The ribs. 35. The belly. 36. The flanks. *The hind Part.* 37. The rump. 38. The tail. 39. The buttocks.

40. The haunches. 41. The ſtifle. 42. The thighs. 43. The hock 44. The kerb. 45. The point of the hock. For a repreſentation ſee the Plates of Quadrupeds.

For the breeding, rearing, &c. of horſes, ſee the articles Horse, and Stallion; for the method of training and managing them, ſee Horsemanship; and for their diſeaſes, cure, &c. See Farriery.

In the Syſtem of Farriery *will be introduced Five Plates, repreſenting the Oſteology and Myology of this uſeful Animal. Two ſheets will be appropriated to illuſtrate them; and we flatter ourſelves they will be highly acceptable to our Readers, and ſtamp an additional value on the Work, as they will contain, though in ſo ſmall a compaſs, the whole of that ineſtimable production,* Mr. Stubb's Anatomy of the Horſe, *which ſells for* 5 Guineas.

The Aſs is likewiſe a domeſtic animal, and eaſily diſtinguiſhed from the horſe at firſt ſight; we never confound theſe two animals, even though they ſhould happen to be of the ſame colour and ſtature. However, when we view the different parts of the aſs, whether the external or internal, and compare them with the correſponding parts of the horſe, the reſemblance of theſe parts is ſo perfect, that we are ſurpriſed to find the individuals ſo different and ſo eaſily diſtinguiſhable by the eye. From this circumſtance, ſome naturaliſts have conſidered the aſs and the horſe to be of the ſame ſpecies of animals; and that the ſmall differences between them are accidental, or owing to the influence of climate, culture, &c. Linnæus's ſpecific mark of the horſe is, that the whole tail is covered with long hair; and his ſpecific mark of the aſs is, that the tail has long hair only towards the point, and a black croſs over the ſhoulders. On the other hand, when we conſider the differences in the temper, the manners and diſpoſitions of theſe two animals, and, above all, the impoſſibility of mixing them ſo as to produce a common or intermediate ſpecies capable of propagating and tranſmitting in the ſame manner as other diſtinct ſpecies; the notion that the horſe and the aſs are the ſame ſpecies will appear to be without any ſolid foundation. Beſides, the aſs differs materially from the horſe in the thickneſs of the head, the length of the ears, the hardneſs of the ſkin, and in the voice, the diſpoſitions, the manner of drinking, &c. With regard to animals, there is perhaps but one permanent and uniform ſpecific diſtinction in nature: a male and female of different ſpecies may copulate, may produce a third animal reſembling both, but very different from either: but here nature has put a final ſtop to all further procreation; the third animal, although it be ſeemingly furniſhed with every thing neceſſary for propagating, remains for ever barren. Now, the horſe may be made to copulate with the aſs: a mule, or mixture of the two, is the fruit of the unnatural embrace: but the impregnation of a mule is found by experience to be altogether impoſſible.

The aſs, therefore, is a diſtinct ſpecies, and his race as ancient as that of the horſe. Why, then, ſhould this uſeful, patient, ſober animal be ſo much deſpiſed? We are apt to compare him, on every occaſion, with the horſe, and from this compariſon are led to very falſe and unfavourable concluſions. The horſe is educated with great care and expence; while the poor aſs, abandoned to the abuſe of the meaneſt ſervants, or the cruelty of children, inſtead of deriving benefit from inſtruction, loſes in effect his natural good qualities by the bad treatment he ſuffers. He is the ſport and buffet block of every ruſtic, who beat and overload him without mercy or diſcretion. They never conſider that the aſs would be the moſt uſeful, the beſt made, and moſt diſtinguiſhed of all animals, if there were no horſes in the world.

The aſs is as humble, patient, and tranquil, as the horſe is bold, ardent, and impetuous. He ſubmits with firmneſs, perhaps with magnanimity, to ſtrokes and chaſtiſement; he is temperate both as to the quantity and quality of his food: he contents himſelf with the rigid and diſagreeable herbage which the horſe and other animals leave to him, and diſdain to eat: he is more delicate with regard to his drink, never uſing water unleſs it be perfectly pure. As his maſter does not take the trouble of combing him, he often rolls himſelf on the turf among thiſtles, ferns, &c. without regarding what he is carrying, he lies down to roll as often as he can, ſeeming to reproach his maſter for neglect and want of attention.

When very young, the aſs is a gay, ſprightly, nimble, and gentle animal. But he ſoon loſes theſe qualities, probably by the bad uſage he meets with; and becomes lazy, untractable, and ſtubborn. When under the influence of love, he becomes perfectly furious. The affection of the female for her young is ſtrong: Pliny aſſures us, that when an experiment was made to diſcover the ſtrength of maternal affection in a ſhe aſs, ſhe run through the flames in order to come at her colt.

Although the aſs be generally ill uſed, he diſcovers a great attachment to his maſter; he ſmells him at a diſtance, ſearches the places and roads he uſed to frequent, and eaſily diſtinguiſhes him from the reſt of mankind. The aſs has a very fine eye, an excellent ſcent, and a good ear. When overloaded, he hangs his head, and ſinks his ears: when too much teazed or tormented, he opens his mouth and retracts his lips in a diſagreeable manner, which gives him an air of ridicule and deriſion. If you cover his eyes, he will not move another ſtep; if you lay him on his ſide, and place his head ſo that one eye reſts on the ground, and cover the other with a cloth, he will remain in this ſituation without making any attempt to get up. He walks, trots, and gallops in the ſame manner as the horſe; but all his motions are ſlower. Whatever be the pace he is going at, if you puſh him he inſtantly ſtops.

The cry of the horſe is known by the name of neighing; that of the aſs by braying, which is a long, diſagreeable noiſe, conſiſting of alternate diſcords from ſharp to grave and from grave to ſharp; he ſeldom cries but when preſſed with hunger or love: the voice of the female is clearer and more piercing than that of the male.

The aſs is leſs ſubject to vermin than other animals covered with hair; he is never troubled with lice, probably owing to the hardneſs and dryneſs of his ſkin; and it is probably for the ſame reaſon, that he is leſs ſenſible to the whip and ſpur than the horſe. The teeth of the aſs fall out and grow at the ſame age and in the ſame manner as thoſe of the horſe; and he has nearly the ſame marks in his mouth.

Aſſes are capable of propagating when two years old. The females are in ſeaſon during the months of May and June. The milk appears in the dugs ten months after impregnation: ſhe brings forth in the twelfth month, and always one at a time. Seven days after the birth, the ſeaſon of the female returns, and ſhe is again in a condition to receive the male. The colt ſhould be taken from her at the end of five or ſix months, that the growth and nouriſhment of the fetus may not be obſtructed. The ſtallion or jack aſs ſhould be the largeſt and ſtrongeſt that can be found; he ſhould be at leaſt three years old, and never ought to exceed ten. The aſs, like the horſe, takes three or four years in growing, and lives till he be 25 or 30: he ſleeps leſs than the horſe, and never lies down to ſleep but when exceſſively fatigued. He is more robuſt, and leſs ſubject to diſeaſes, than the horſe.

Travellers inform us that there are two ſorts of aſſes in Perſia; one of which is uſed for burdens, they being ſlow and heavy: the other is kept like horſes for the ſaddle; for they have ſmooth hair, carry their head well, and are much quicker in their motion; but when they ride them, they ſit nearer their buttocks than when on a horſe: they are dreſſed like horſes, and are taught to amble like them; but they generally cleave their noſtrils to give them more room for breathing. Dr. Ruſſel likewiſe tells us they have two ſorts in Syria; one of which is like ours, and the other very large, with remarkably long ears; but they are both put to the ſame uſe, which is, to carry burdens.

The Onager, or wild aſs, has, by ſome authors, been confounded with the zebra; but very improperly, for this laſt is a diſtinct ſpecies; for the onager is not ſtreaked like this, nor is his ſhape ſo beautiful. Wild aſſes are ſaid to be very ſwift of courſe; and when they ſee a man, they make a bound, and immediately fly away; inſomuch, that there is no taking of them, but by traps and gins. They have much the ſame ſhape as common aſſes; but they are of a brighter colour, and there runs a white liſt from the head to the tail. Of the hide of theſe aſſes, and particularly of that part next the rump, they make that excellent leather which we call ſhagreen, and which is put to ſo many curious uſes.

In America there were originally no aſſes at all, nor yet horſes: but they were carried thither long ago, at firſt by the Spaniards, and afterwards by other nations, where they have multiplied greatly; inſomuch, that, in ſome places, there are whole droves of them that run wild, and are very hard to be caught. Aſſes in general carry the heavieſt burdens in proportion to their bulk; and, as their keeping coſts little or nothing, it is a great wonder that they are not put to more uſes than they generally are among us. The fleſh of the common aſs is never eaten in theſe parts of the world; tho' ſome pretend their colts are tender, and not diſagreeable.

The Zebra. This animal has the figure and gracefulneſs of the horſe, joined to the ſwiftneſs of the ſtag. He is about 7 feet long, from the point of the muzzle to the origin of the tail, and about 4 feet high. The colour of his ſkin is beautiful and uniform, conſiſting of alternate parallel rings of black and white, diſpoſed in the moſt regular manner, as repreſented in the plate. He is generally leſs than the horſe, and larger than the aſs.

The zebra is found no where but in the eaſtern and ſouthern provinces of Africa, from Ethiopia to the Cape of Good Hope, and from the Cape of Good Hope to Congo. The Dutch have been at great pains to tame and uſe them for domeſtic purpoſes, but with little ſucceſs. He is hard-mouthed, and kicks when any perſon attempts to touch or come near him. He is reſtleſs and obſtinate as a mule: but perhaps the wild horſe is naturally as untractable as the zebra; for, it is probable, if he were early accuſtomed to obedience and a domeſtic life, he would become as docile as the horſe.

ERASED, in heraldry, expreſſes any thing that ſeems violently torn off from its proper place. It is uſed in contradiſtinction to couped, which ſignifies a thing clean cut off.

ERATO, from ερaω, *I love*, in mythology, the name of one of the nine muſes who preſided over love-poetry. To this muſe ſome have aſcribed the invention of the lyre and lute: and ſhe is repreſented with a garland of myrtles and roſes, holding a lyre in one hand, and a bow in the other, and at her ſide a Cupid with his torch.

EREBUS, Ερεϐος, from ערב, *night*, in mythology, a term denoting darkneſs. According to Heſiod, Erebus was the ſon of chaos and the night, and the father of the day. This was alſo the name of part of the inferi among the ancients: they had a peculiar expiation for thoſe who were detained in Erebus.

ERECT, in heraldry, any bearing placed perpendicular.

ERECTION, the act of raiſing or elevating a thing in a right line. The erecting a perpendicular on a line given, is a popular problem in geometry. The term erection is alſo uſed figuratively; as the erection of a marquiſate into a duchy; biſhoprics can only be erected by the king.

Erection is particularly uſed by medical writers, for the ſtate of the penis when ſwelled and diſtended by the action of the muſcles, called erectores. There is alſo an erection of the clitoris, which is performed by muſcles provided for that purpoſe, called alſo erectores. An alternate ſtate of erection and flaccidity in the penis, Dr. Drake obſerves, is of abſolute neceſſity; the firſt to the performance of its office, the ſecond for the ſecurity of the part. Without an erection it were impoſſible to emit and lodge the ſeed where it ought to be; and with a conſtant one, almoſt as impoſſible to ſecure the part from external injuries. To ſay nothing of the loſs of inſtigation, which muſt be a neceſſary conſequence of conſtant erection. The erection of the penis conſiſts in a diſtenſion of its corpora cavernoſa, by an extraordinary quantity of blood pent up therein. That the blood is the matter which diſtends the penis in erection, is evident from abundance of experiments; though the moſt convincing is that of firmly tying the penis of an animal (as has been frequently done to a dog) in coitu, wherein nothing has been found but blood to extend it. Hence, in the bodies of criminals, that hang long after death, the penis becomes erected; the blood in that poſition falling to the inferior parts, and ſtopping there. By blowing into the blood veſſels of the penis after death, the part becomes erected. This was firſt diſcovered by Mr. Cowper, upon viewing its veins, after he had diſtended them with wind; whence it plainly appeared, that the external trunks paſſed, ſome under its ſkin only, and ſome over the oſſa pubis; beſides, that a vaſt number of other veins on the dorſum penis unite and empty themſelves into one trunk, called vena penis, which paſſes immediately under a tranſverſe ligament of the oſſa pubis, which is compreſſed by the approximation of the dorſum penis to the ligament of the pubis.

ERECTORES *Clitoridis*, in anatomy, a pair of muſcles ariſing from the protuberances of the iſchium, and inſerted into the ſpongious body of the clitoris, which they ſerve to erect in coition.

ERECTORES *Penis*, in anatomy, a pair of muſcles, ariſing fleſhy from the protuberances of the iſchium below the beginning of the cavernous bodies of the yard, into whoſe thick membranes they are inſerted. Their uſe is to pull the yard upwards towards the os pubis, whereby the greateſt vein is compreſſed, and the refluent blood denied its paſſage under thoſe bones, which makes it ſwell. See Syſtem of Anatomy, Plate 10, *fig.* 1, Letters II.

ERIDANUS, in aſtronomy, a conſtellation of the ſouthern hemiſphere, in form of a river. See Syſtem of Astronomy, Sect. VIII.

ERINACEUS, or Hedge-hog, a genus of quadrupeds, belonging to the order of feræ, in the firſt claſs of the animal kingdom called Mammalia; the characters of which are theſe; they have two foreteeth in the upper jaw, at a conſiderable diſtance from one another, and two in the under jaw, leſs diſtant; and they have two recumbent dog-teeth, one on each ſide. There are three ſpecies, viz. 1. the europæus, or common hedge-hog, with round ears, and creſted noſtrils. It is about nine inches long; the upper part of the body is totally covered with ſharp prickles, and the under part is covered with hair. The hedge-hog, even when ſtanding on his legs, has a very ugly aſpect. His body is an oblong maſs, convex above, terminated on the fore-part by a very ſharp muzzle, and mounted on four ſhort legs, of which nothing appears but the feet, and the tail is not diſcernible. His ears are broad, round, and ſhort; and his eyes are ſmall and protuberant. The length of his body, from the point of the muzzle to the anus, is about nine inches. The hedge hog has a very uncommon method of defending himſelf from the attacks of other animals; being poſſeſſed of little ſtrength or agility, he does not attempt to fly from or aſſail his enemies; but erects his briſtles, and rolls himſelf up like a ball, expoſing no part of his body that is not furniſhed with ſharp weapons of defence; he will not unfold himſelf, unleſs thrown into water; the more he is frightened or harraſſed, the cloſer he ſhuts himſelf up: and frequently diſcharges his urine, which has a very fetid and lothſome ſmell. While in this ſtate, moſt dogs, inſtead of biting him, ſtand off and bark, not daring to ſieze him; or, if they attempt it once, their mouths are ſo prickled with his briſtles, that they cannot be prevailed upon to attempt it a ſecond time. Both the male and female are covered with briſtles from the head to the tail. Theſe briſtles are of great uſe in defending them from other animals; but muſt be very incovenient when they incline to copulate. This operation they cannot perform in the manner of other quadrupeds; but do it face to face, either ſtanding on end, or the female lying on her back. The females come in ſeaſon in the ſpring, and bring forth their young in the beginning of ſummer. They commonly bring forth three or four, and ſometimes five, at a time. The young ones are of a whitiſh colour, and only the points of the briſtles appear above the ſkin. It is impoſſible to tame them: the mother and her young have frequently been confined together, and furniſhed with plenty of proviſions; but, inſtead of nouriſhing them, ſhe uniformly devoured them one after another. Males and females have likewiſe been kept in one apartment, where they lived, but never copulated. Hedge-hogs feed upon fallen fruits, ſome roots, and inſects: they are very fond of fleſh-meat, whether raw or roaſted. They frequent woods, and live under the trunks of old trees, in the chinks of rocks, or under large ſtones. Naturaliſts allege, that they go into gardens, mount the trees, and come down with pears, apples, or plums, ſtuck upon their briſtles. But this is a miſtake: although kept in a garden, they never attempt to climb trees, or ſtick even fallen fruit upon their briſtles, but lay hold of their food with their mouth. They never come out of their holes in the day, but go about in queſt of food during the night. They eat but little, and can live very long without taking any nouriſhment. They do not lay up any ſtore of proviſions in harveſt: ſuch an inſtinct would be uſeleſs, as they ſleep all the winter. They lie under the undeſerved reproach of ſucking cattle and hurting their udders; but the ſmallneſs of their mouth renders that impoſſible. 2. The inauris, or white hedge-hog, has no external ears. It is a native of America. 3. The malaccenſis has hanging ears, and is a native of Aſia.

ERMIN, a ſpecies of the genus muſtella, of the order of Feræ, in the firſt claſs of the animal kingdom, called Mammalia.

ERMIN, or Ermine, in heraldry, this word alone ſignifies black ſpots on a white field, but if the word *plain* be uſed with it, it denotes nothing but white furs.

ERMINES, in heraldry, the reverſe of ermine, i. e. white ſpots on a black field.

EROSION, in medicine, the act of ſharp, acrid fluids, or humours, gnawing and tearing off parts from the fleſh, and other ſubſtances. Arſenic, and other poiſons, make eroſions in the inteſtines. See Corrosion.

EROWA, the name of a kind of nettle, which grows in the mountains at Otaheite in the South Sea, with which the inhabitants make fiſhing lines, which ſerve to hold the ſtrongeſt and moſt active fiſh, and are much ſtronger than our ſilk lines of twice the thickneſs.

ERRATA, a liſt uſually placed at the beginning or end of a book, containing the faults that have eſcaped in the impreſſion, and, ſometimes, even in the compoſition of the work.

ERRATIC, in general, ſometing that wanders, or is not regular; hence it is, the planets are called erratic ſtars in contradiſtinction to the fixed ſtars.

ERRHINA, Ερρινα, from εν, *in*, and ῥιν, *noſe*, in medicine, are remedies taken by the noſe to enliven the ſpirits, ſtop bleeding, &c.

ERROUR, Error, in philoſophy, a miſtake of our judgment, giving aſſent to that which is not true. Mr. Locke reduces the cauſes of error to theſe four; firſt, want of proofs; ſecondly, want of ability to uſe them; thirdly, want of will to uſe them; and, fourthly, wrong meaſures of probability. He obſerves upon the firſt of theſe cauſes of error, that the greateſt part of mankind want conveniencies and opportunities of making experiments and obſervations themſelves, or of collecting the teſtimony of others, being prevented by the neceſſity of their condition. Upon the ſecond of theſe cauſes, he obſerves, that there are many, who, from the ſtate of their condition, might beſtow time in collecting proofs, but yet are not able to carry a train of conſequences in their heads, nor weigh exactly the preponderancy of contrary proofs and teſtimonies, merely from the difference in mens underſtandings, apprehenſions, and reaſonings. Thirdly, he remarks, that though ſome have opportunities and leiſure enough, and want neither parts, learning, nor other helps, that they never come to the knowledge of ſeveral truths within their reach, either upon account of their attachment to pleaſure or buſineſs; and otherwiſe becauſe of their lazineſs or averſion to ſtudy. The fourth cauſe of error, viz. wrong meaſures of probability, he imputes, 1. To the practice of taking for principles, propoſitions that are not in themſelves certain and evident, but, on the contrary, doubtful and falſe. 2. To received hypotheſes. 3. Predominant paſſions or inclinations. And, 4. To authority, or the giving up our aſſent to the common received opinions either of our friends or party, neighbours or country.

The cauſes of error in philoſophy, or the reaſons why all former philoſophers have through ſo many ages erred, according to Lord Bacon, are theſe following. 1. Want of time ſuited to learning. 2. The little labour beſtowed upon natural philoſophy. 3. Few entirely addicted to natural philoſophy. 4. The end of the ſciences wrong fixed. 5. A wrong way choſen. 6. The neglect of experiments. 7. Regard to antiquity and authority. 8. Admiration of the works in uſe. 9. The artifice of teachers and writers on the ſciences. 10. Oſtentatious promiſes of the moderns. 11. Want of propoſing worthy taſks. 12. Superſtition and zeal being oppoſite to natural philoſophy, as thinking philophy dangerous, on account of the ſchool-theology; from the opinion that deep natural inquiries ſhould ſubvert religion. 13. Schools and academies proving unfavourable to philoſophy. 14. Want of rewards. And, 15. Deſpair, and the ſuppoſition of impoſition.

ERVUM, the lentil; a genus of the decandria order, belonging to the diadelphia claſs of plants. There are ſix ſpecies; of which the moſt remarkable is the lens, or common lentil. It is cultivated in many parts of England, either as fodder for cattle, or for the ſeeds which are frequently uſed in meagre ſoups. It is an annual plant, and riſes with weak ſtalks about 18 inches high, garniſhed with winged leaves compoſed of ſeveral pairs of narrow lobes, terminated by a claſper or tendril, which faſtens to any neighbouring plant, and is thereby ſupported. The ſeeds of this plant are moſt commonly ſown in the month of March, where the land is dry; but in moiſt ground, the beſt time is April. The uſual quantity of ſeed allowed for an acre of land is from one buſhel and a half to two buſhels. If theſe are ſown in drills, in the ſame manner as peaſe, they will ſucceed better than when ſown in broadcaſt: the drills ſhould be a foot and an half aſunder, to allow room for the Dutch hoe to clean the ground between them; for if the weeds are permitted to grow among them, they will get above the lentils and ſtarve them. There is another ſort of lentil alſo cultivated in this country under the name of French lentil. It is twice the ſize of the former, both in plant and ſeed; and is much better worth cultivation than the other.

ERUCA, denotes caterpillars of all kinds. See CATERPILLAR.

ERUDITION, denotes learning, or knowledge; and chiefly that of hiſtory and antiquity, of languages and of books, which is the reſult of hard ſtudy, and extenſive reading. Mr. Locke ſays, it is of more uſe to fill the head with reflections than with points of erudition. If the mind be not juſt and right, ignorance is better than erudition, which only produces confuſion and obſcurity.

ERUPTION, in general, a burſting forth, or excluſion of ſomething which was before covered, or concealed. In medicine, it denotes a ſudden and copious excretion of humours, as pus or blood, and any breaking out of puſtules or ſpots in various diſorders; as in the ſmall pox, meaſles, plague, fevers, &c.

The eruption of volcanos, or burning mountains, is frequently the effect and iſſue of earthquakes. See EARTHQUAKE, &c.

Dr. St. Clair, in the Philoſophical Tranſactions, gives an account of a conſtant eruption of fire on one ſide of one of the Appennines, between Bologna and Florence; a ſpot of ground three or four miles in diameter, he obſerves, inceſſantly ſends up a flame, riſing very high, without noiſe, ſmoke, or ſmell, though it gives a very great heat. In great rains it ſometimes intermits, but rekindles with greater vigour and heat. Within three or four yards of it, he adds, there grows corn. The flame he conjectures to ariſe from a vein of bitumen, or naphtha. There are three other ſuch fires on the ſame hills.

ERYNGIUM, SEA-HOLLY, or *Eryngo*; a genus of the digynia order, belonging to the pentandria claſs of plants. There are nine ſpecies; moſt of which are hardy herbaceous perennials, producing erect ſtalks from one to two or three feet high. They all flower moſtly in July, and the ſeeds ripen in September. They are propagated by ſeeds ſown in a bed or border, either in ſpring or autumn. The plants are to be removed the autumn after they come up, into thoſe places where they are deſigned to remain. The leaves of one of the ſpecies, (viz. the maritimum, which grows naturally on the ſea coaſts of England and Scotland) are ſweetiſh, with a light aromatic warmth and pungency. The roots are accounted aphrodiſiac, and are ordered to be kept candied in the ſhops. The young flowering ſhoots eaten like aſparagus are very grateful and nouriſhing.

ERYSIPELAS, Ερυσιϖελας, in medicine, a diſeaſe of the ſkin, called alſo *ſacer ignis*, and *St. Antony's fire*; and in many parts of Great Britain, the *roſe*. See Syſtem of MEDICINE.

ERYTHROIDES, in anatomy, the firſt of the proper membranes that encloſe the teſticles. It is interſperſed with fleſhy fibres, derived to it from the cremaſter muſcle, which makes it appear reddiſh. And hence its name from ερυθρος, *red*, and ειδος, *form*.

ESCALADE, or SCALADE, a furious attack of a wall or a rampart; carried on with ladders, to paſs the ditch, or mount the rampart; without proceeding in form, breaking ground, or carrying on regular works to ſecure the men.

ESCAPE, in law, an evaſion out of ſome lawful reſtraint, either by violence or ſtealth. Eſcapes are either voluntary, or negligent. Voluntary, as when one arreſts another for felony, or other crime, and afterwards lets him go, in which eſcape, the party that permits it, is, by law, to ſuffer puniſhment as if guilty of the fault committed by the perſon who eſcapes, be it felony, treaſon, or treſpaſs; after the original delinquent is actually found guilty or convicted. Negligent eſcape is, when one is arreſted, and afterwards eſcapes againſt his will that arreſted him; and is not purſued by freſh ſuit, and taken again, before the party purſuing hath loſt ſight of him. Keepers of priſons conniving at eſcapes ſhall forfeit 500l. and in civil caſes, the ſheriff is anſwerable for the debt.

ESCAPE *Warrant*, in law. If any perſon committed or charged in cuſtody in the king's bench or Fleet priſon in execution, or on meſne proceſs, &c. go at large: on oath thereof before a judge of the court where the action was brought, an eſcape warrant ſhall be granted, directed to all ſheriffs, &c. throughout England, to retake the priſoner, and commit him to goal when taken, there to remain until the debt is ſatisfied; and a perſon may be taken on a Sunday upon an eſcape warrant. Stat. 1 Anne, cap. 6.

ESCARTELE, in heraldry, quartered, or quarterly.

ESCHAR, in ſurgery, a hard cruſt, or ſcab, formed on the fleſh, by means of a hot iron, or a cauſtic medicine, or ſome ſharp corroſive humour within.

ESCHARA, the name of a ſpecies of corralline, &c. the characters of which are theſe: they are of a ſtony, or coral like hardneſs, and reſemble a woven cloth in their texture; and the microſcope ſhews us that they conſiſt of arrangements of very ſmall cells, whoſe ſurfaces appear much in that form. Linnæus makes it a ſpecies of millepora, a genus in the claſs of lithophytes. See Syſtem of VERMEOLOGY.

ESCHRAKITES, or ESRAKITES, a ſect of philoſophers, among the Mahometans, who adhere to the doctrines and opinions of Plato. The Eſchrakites, or Mahometan Platoniſts, place their higheſt good and happineſs in the contemplation of the divine majeſty. They are very careful in avoiding all vice; they preſerve an equal and eaſy temper, love muſic, and divert themſelves with compoſing little poems, or ſpiritual ſongs. The ſheics, or prieſts, and the chief among the preachers of the imperial moſques, are Eſchrakites.

ESCLAIRCISSEMENT, a French term, which we find retained in ſome Engliſh writers; it properly ſignifies the act, or effect, of clearing a thing, or rendering it more bright and tranſparent; being formed from the verb *eſclaircir*, *to clear*, &c. It is chiefly uſed in a figurative ſenſe, for an explanation of an obſcurity or difficulty. The eſclairciſſement of difficult paſſages in the Bible, is to be ſought for from ſimilar paſſages, or paſſages of the like kind occurring in other places.

ESCLATTE, in heraldry, is applied to a thing violently broken. Thus a bend, or rather partition, *eſclatte*, is repreſented torn, or broken off, like a ſhield ſhattered with the ſtroke of a battle-ax.

ESCORT, a French term, ſometimes uſed in Engliſh authors to denote a convoy, or company of armed men, attending ſome perſon or thing, in a journey or voyage, to defend or ſecure it from inſults.

ESCU, or ECU, the French crown, of ſixty ſols, or three livres. The eſcu was thus called, becauſe the eſcutcheon, or arms of France, which they call eſcu, was ſtruck thereon.

ESCULAPIUS, in mythology, the god of medicine. He was the ſon of Apollo, by the nymph Coronis, born at Epidauris, where he had a famous temple; in which his image, made of gold and ivory, was placed on a throne of the ſame materials; it was crowned with rays, had a knotty ſtick in one hand, and the other arm leaned upon a ſerpent, and a dog lay at his feet.

ESCULENTS, from *eſculentus*, *eatable*, a term uſually applied to vegetables which are fit for food, as artichokes, carrots, turneps, parſeheps, cabbages, cauliflowers, &c.

ESCURIAL, by the Spaniards writen ESCORIAL, a term that occurs pretty frequently in our gazettes, and news-papers, for a place of reſidence of the kings of Spain.

ESCUTCHEON, or SCUTCHEON, in heraldry, the field or coat, wherein the bearing, or arms, of any perſon, are repreſented. The word eſcutcheon is formed of the French *eſcuſſon*, and that from the Latin *ſcutum*, *ſhield*; which was the place arms were originally borne on, before ever they came on banners: and ſtill, wherever they are placed, it is on ſomething repreſenting the form of a ſhield. The eſcutcheon is of a ſquare figure, excepting the bottom part, which is uſually a little rounded, ending in a point in the middle. See Syſtem of HERALDRY.

ESOX, in ichthyology, a genus of fiſhes belonging to the order of abdominales. The body is elongated; the head is plainiſh above; the upper jaw is plain, and ſhorter than the under one, which is dotted; and the branchioſtege membrane has from ſeven to twelve rays.

There are nine ſpecies, of which the following are the moſt remarkable. The lucius, or pike, is common in moſt of the lakes of Europe; but the largeſt are thoſe taken in Lapland, which, according to Scheffer, are ſometimes eight feet long. They are taken there in great abundance, dried, and exported for ſale. The largeſt fiſh of this kind ſaid to be caught in England, weighed 35 pounds. All writers who treat of this ſpecies bring inſtances of its voraciouſneſs. It hath been known to choke itſelf by attempting to ſwallow one of its own ſpecies which proved too large a morſel. Yet its jaws are very looſely connected, and have on each ſide an additional bone like the jaw of a viper, which renders them capable of greater diſtenſion when it ſwallows its prey. It does not confine itſelf to feed on fiſh and frogs; it will devour the water-rat, and draw down the young ducks as they are ſwimming about. In the ſhallow water of the Lincolnſhire fens, they are often taken in a manner, we believe, peculiar to that country, and to the iſland of Ceylon. The fiſherman makes uſe of what is called a *crown-net*; which is no more than a hemiſpherical baſket, open at top and bottom. He ſtands at the end of one of the little fen-boats, and frequently puts his baſket down to the bottom of the water; then poking a ſtick into it, diſcovers whether he has any booty by the ſtriking of the fiſh: and vaſt numbers of pike are taken in this manner.

The longevity of this fiſh is very remarkable, if we may credit the accounts given of it. Rzaczynſki tells us of one that was 90 years old: but Geſner relates, that in the year 1497, a pike was taken near Hailbrun in Suabia, with a brazen ring affixed to it, on which were theſe words in Greek characters: "I am the fiſh which was firſt put into this lake by the governor of the univerſe, Frederick the Second, the 5th of October 1230:" So that the former muſt have been an infant to this Methuſalem of a fiſh. Pikes ſpawn in March or April, according to the coldneſs or warmneſs of the weather. When they are in high ſeaſon, their colours are very fine, being green, ſpotted with bright yellow; and the gills are of a moſt vivid and full red. When out of ſeaſon, the green changes to a grey, and the yellow ſpots turn pale.

The belone, or gar, ſometimes grows to the length of three feet or more. This fiſh, which is found in many places, is known by the name of the *ſea-needle*. It comes in ſhoals on our coaſts in the beginning of ſummer, and precedes the mackerel: it has a reſemblance to it in taſte: but the light green which ſtains the back bone of this fiſh gives many people a diſguſt to it.

The ſauruy, or ſaury. The tail is much forked: the back duſky: the belly bright and ſilvery. Great numbers of theſe fiſh were thrown aſhore on the ſands of Leith near Edinburgh, after a great ſtorm in November 1768. Rondeletius deſcribes this ſpecies among the fiſh of the Mediterranean: but ſpeaks of it as a rare kind.

ESPALIERS, in our gardening, are rows of trees, planted regularly round the outſide of a garden, or plantation, for the general ſecurity thereof, from the violence and injury of the winds; or elſe only round ſome part of a garden, for the particular ſecurity of a plantation of orange-trees, lemon-trees, myrtles, or other tender plants: or, laſtly, for the bounding of borders, walks, avenues, &c. See Treatiſe on Gardening.

ESPLANADE, in fortification, called alſo the glacis; the ſloping of the parapet of the covered-way towards the campaign.

ESPOUSALS, *ſponſalia*, in law, a contract or mutual promiſe between a man and a woman to marry each other. Marriage or matrimony is ſaid to be an *eſpouſal de preſenti*.

ESQUIMAUX, a people of North America, inhabiting all that vaſt tract of land known by the name of Labrador, or New Britain. They differ very conſiderably, both in aſpect and behaviour, from the other American nations; agreeing in moſt reſpects with the inhabitants of Weſt Greenland.

ESQUIRE, from the French *eſcu*, and the Latin *ſcutum*, in Greek σκυτος, which ſignify an hide, of which ſhields were anciently made, and afterwards covered; (for, in the time of the Anglo-Saxons, the ſhields had a covering of leather) was originally he, who, attending a knight in time of war, did carry his ſhield; whence he was called *eſcuier*, in French, and *ſcutifer*, or *armiger*, i.e. armour bearer, in Latin. Hotoman ſays, that thoſe whom the French call eſquires, were a military kind of vaſſals, having *jus ſcuti*, viz. liberty to bear a ſhield, and in it the enſigns of their family, in token of their gentility or dignity. But this addition hath not of long time had any relation to the office or employment of the perſon to whom it hath been attributed, as to carrying of arms, &c. but hath been merely a title of dignity, and next in degree to a knight. Officers of the king's courts, and of the king's houſhold, counſellors at law, juſtices of the peace, are only eſquires in reputation; and he who is a juſtice of peace has this title only during the time he is in commiſſion, and no longer, if he is not otherwiſe qualified to bear it. A ſheriff of a county being a ſuperior officer, bears the title of eſquire during his life; in reſpect of the great truſt he has in the commonwealth. The chief of ſome ancient families are eſquires by preſcription; and in late acts of parliament, many wealthy perſons commonly reputed to be ſuch, were ranked among the eſquires of this kingdom.

ESSAY, in matters of learning, is a peculiar kind of compoſition; whoſe character is to be free, eaſy, and natural; not tied to ſtrict order, or method, nor worked up, and finiſhed like a formal ſyſtem. The matter of an eſſay is ſuppoſed to conſiſt principally of ſudden and occaſional reflections, which are to be wrote much at the rate, and in the manner, a man thinks; ſometimes leaving the ſubject, and then returning again, as the thoughts happen to ariſe in the mind.

At leaſt, this has hitherto been the practice; and Montagne, who has acquired no ſmall reputation by this way of writing, ſeldom keeps many lines to the ſubject he propoſes; though it is our opinion, that lord Bacon, in many of his works, is a better pattern in the eſſay kind. Mr. Locke, however, and a few other authors, uſe eſſay in a ſeverer ſenſe: the eſſay on human underſtanding, every body knows, is a regular, artful, and laboured work; though perhaps ſo called to guard againſt too ſevere ſtrictures, by pleading the title.

Essay, in metallurgy, are chymical operations made in ſmall, to determine the quantity of metal or other matter which is contained in minerals, or to diſcover the value or purity of any maſs of gold or ſilver. See Assay.

ESSENCE, in metaphyſics, that which conſtitutes the particular nature of each genus or kind, and diſtinguiſhes it from all others; being nothing but that abſtract idea to which this name is affixed, ſo that every thing contained in it is eſſential to that particular kind. This Mr. Locke calls the nominal eſſence; in contradiſtinction to the real eſſence, or conſtitution of ſubſtances on which this nominal eſſence depends. Thus, the nominal eſſence of gold, is that complex idea the word gold ſtands for; let it be, for inſtance, a body, yellow, weighty, malleable, fuſible, and fixed: but its real eſſence is the conſtitution of its inſenſible parts, on which thoſe qualities and all its other properties depend, which is wholly unknown to us.

Essence, in medicine and chymiſtry, denotes the pureſt, moſt ſubtil, and balſamic part of a body, extracted from the reſt by means of fire. Of theſe there is a great variety, drawn from flowers, fruits, and the like, uſed on account of their agreeable ſmells, and taſtes, by the apothecaries, perfumers, &c. the principal are, eſſence of roſemary; of turpentine; of aniſe; of cloves; of cinnamon; and of citron. The eſſences commonly ſold by the perfumers, are only the diſtilled oils of balm, and of bitter almonds; to which they give the ſmell of certain flowers, or ſpices: as violets, jeſſamine, cinnamon, &c.

The eſſences to be drank, or mixed, with liquors, are of a more elaborate compoſition: the moſt uſual, and beſt, are prepared with ſpirit of wine, cloves, cinnamon, mace, long-pepper, and coriander. The whole, being put up in a very cloſe veſſel, is expoſed to the ſun for ſix weeks, or two months, during the day-time, and in the night ſet near the fire.

In winter they uſe the fire alone. This eſſence being exceedingly ſtrong, is frequently uſed only to give a ſtrength to other weaker liquors. After the ſame manner may the eſſences of ambergriſe, muſk, &c. be drawn. The eſſence of odoriferous flowers, to give a fine ſmell to liquors, is drawn by diſpoſing ſtrata, or lays, of the flowers, and of ſugar, alternately, in a proper veſſel, and leaving them to infuſe, in a cellar, for twenty-four hours; and after that, as long in the ſun; and, laſtly, ſtraining, or percolating, the whole through a ſieve, without ſqueezing the flowers.

ESSENES, or Essenians, in Jewiſh antiquity, one of the three ancient ſects among that people. They allowed a future ſtate, but denied a reſurrection from the dead. Their way of life was very ſingular: they did not marry; but adopted the children of others, whom they bred up in the inſtitutions of their ſect; they deſpiſed riches, and had all things in common, they never changed their cloaths till they were entirely worn out. When initiated, they were ſtrictly bound not to communicate the myſteries of their ſect to others; and if any of their members were found guilty of enormous crimes, they were expelled.

Pliny tells us, that they dwelt on the weſt ſide of the lake of Aſphaltites: and that they were a ſolitary kind of men, living without women or money, and feeding upon the fruit of the palm-tree; he adds, that they were conſtantly recruited by new comers, whom the ſurges of ill fortune had made weary of the world; in which manner the ſect was kept up for ſeveral hundreds of years, without any being born among them. The reaſon why we find no mention made of them in the New Teſtament, may be their recluſe and retired way of life, not leſs than their great ſimplicity and honeſty, whereby they lay open to no cenſure or reproof. For a particular account of this ſect, See Maynard's Tranſlation of Joſephus's Wars of the Jews, Book II. Chap. VII.

ESTATE, in law, ſignifies the title or intereſt that a perſon has in lands, tenements, or other effects; comprehending the whole in which a perſon hath any property, and will paſs the ſame. Eſtates are either real or perſonal: otherwiſe diſtinguiſhed into freeholds, which deſcend to heirs; or chattels, that go to executors or adminiſtrators. A fee-ſimple is the ampleſt eſtate our law admits of. Eſtates, in a political ſenſe, is uſed either to denote the dominions of ſome prince, or the general claſſes into which the people are divided. In Britain, the eſtates are the king, lords, and commons; or rather the lords and commons, who meet the king in parliament, for reforming abuſes, and enacting good and wholeſome laws.

ESTHER, a canonical book of the Old Teſtament; containing the hiſtory of a Jewiſh virgin, dwelling with her uncle Mordecai at Shuſhan, in the reign of Ahaſuerus, one of the kings of Perſia. The great beauty of this maid raiſed her to the throne of Perſia; whereby ſhe had an opportunity to ſave her countrymen, whoſe deſtruction was plotted by Haman, a favourite of that prince. The learned are not agreed who this Ahaſuerus was. Archbiſhop Uſher ſuppoſes him to be Darius Hyſtaſpes, and Artyſtona to be Eſther. Scaliger makes him the ſame with Xerxes, and his queen Hameſtris to be Eſther. Joſephus, on the contrary, poſitively aſſerts, that the Ahaſuerus of the ſcriptures, is the Artaxerxes Longimanus of profane ſtory; and the Septuagint, throughout the whole book of Eſther, tranſlate Ahaſuerus by Artaxerxes. Moſt people ſubſcribe to this laſt opinion; and, indeed the extraordinary kindneſs ſhewed by Artaxerxes to the Jews, can ſcarce be accounted for otherwiſe, than by ſuppoſing that they had ſo powerful an advocate as Eſther to ſolicit for them.

ETCHING, a method of engraving on copper, in which the lines or ſtrokes, inſtead of being cut with a tool or graver, are eaten in with aquafortis.

TREATISE ON THE ART OF ETCHING.

Etching is of a later invention, though not very modern, than engraving with the tool; of which it was at firſt only an imitation, that was practiſed by painters and other artiſts, who could much ſooner form their hand to, and attain a faculty of, working in this way, than with the graver. But being then nevertheleſs conſidered as a counterfeit kind of engraving, and therefore inferior to the other, it was cultivated in a very confined manner; the cloſeneſs of the reſemblance of the work to that performed by the tool, being made the teſt of its merit, and conſequently the principal object of aim in thoſe who purſued it. This ſervile confinement of the art of etching to the imitation of the original kind of engraving, was a great cauſe of retarding its advancement towards perfection, as many of the moſt able maſters cramped their talents with the obſervance of it; which may be ſeen in the inſtances of Sadelers, Swauneberg, Vilamene, and particularly Le Boſſe; who, in his treatiſe on engraving, has laid down as a principle, that the perfection of this kind conſiſts in the cloſe ſimilitude of the work with that done by the tool. This abſurd prepoſſeſſion has been ſince worn out; and the method of working with aquafortis has been ſo far improved, that, inſtead of being now deemed a ſpurious kind of engraving, it evidently appears the foundation of an excellence in many modern works, that could never have been produced without it; ſince, though the neatneſs and uniformity of the ſtrokes, which attend the uſe of the tool, is more advantageous with reſpect to portraits; yet the liberty and facility of the other manner give a much greater opportunity to exerciſe the force of genius and fancy in hiſtory-engraving; where the effect of the whole, and not the minute exactneſs in finiſhing all the parts, conſtitutes the principal value. There are two methods practiſed of engraving in this way; the one with a hard varniſh or ground, the other with a ſoft. The firſt was formerly much uſed, being better accommodated to the intention of imitating the engraving with the tool; as the firmneſs of the body of the varniſh gave more opportunity of retouching the lines, or enlarging them with the oval-pointed needles, called by the French *echoppes*, as was practiſed by Le Boſſe and others for that purpoſe. The latter has now almoſt wholly ſuperſeded the uſe of the other, by the free manner of working it admits of; which affords a power of expreſſion incompatible with the greater inflexibility of the hard varniſh, that confines the lines and ſtrokes to ſuch a regularity and ſameneſs, as gives a ſtiffneſs of manner and coldneſs of effect to the work.

The mixture of the uſe of the tool and aquafortis, which are now both employed in many caſes, has, however, given that perfection to engraving which it poſſeſſes at preſent. The truth and ſpirit of the out-line, that the method of working with aquafortis affords, and the variety of ſhades which the different kinds of black produce in this way, as well as other means of expreſſing the peculiar appearance and character of particular ſubjects, furniſh what was defective in the ſole uſe of the tool; while, on the other hand, the exactneſs and regularity of the lines, which are required for finiſhing many kinds of deſigns, are ſupplied by the graver; and by a judicious application of both, that complete finiſhing is obtained, which either of them alone muſt neceſſarily want.

The manner by which this art is performed, is the covering the ſurface of the plate with a proper varniſh or ground, as it is called, which is capable of reſiſting aquafortis; and then ſcoring or ſcratching away, by inſtruments reſembling needles, the parts of this varniſh or ground, in the places where the ſtrokes or hatches of the engraving are intended to be: then, the plate being covered with aquafortis, the parts that are laid naked and expoſed by removing the ground or varniſh, are corroded or eaten away by it; while the reſt, being ſecured and defended, remain untouched.

There are two methods of etching, as hath been already obſerved: the difference of which from each other conſiſts, as well in the difference of the varniſh or ground, as in that of the aquafortis, adapted to each kind: but the general method of performing them are alike in both. Theſe varniſhes or grounds are diſtinguiſhed by the names of hard and ſoft: for, in their conſiſtence, or the reſiſtance they give to the needles, lies their eſſential variation from each other. The hard varniſh, it is with good reaſon conjectured, was not the firſt in uſe: but ſoon took place of the other; and was, for ſome time, the moſt received in practice, on account of its admitting the work to be made more like that of the graver: the ſoft has, however, ſince, in its turn, prevailed to the excluſion of it in ſome degree, except in the caſe of particular ſubjects; but not ſo entirely as to take away the expedience of ſhewing how it is performed. The manner of etching with the ſoft varniſh is now, however, one of the important objects of the art of engraving; and it is at preſent in univerſal uſe, ſometimes alone, but more frequently intermixed with the work of the tool, and, in ſome caſes, with great advantage, even where the whole is intended to paſs for being performed by the graver.

Preparation of the ſoft Varniſh; according to Mr. Lawrence, an eminent Engliſh Engraver at Paris.

"Take of virgin's wax and aſphaltum, each two ounces; of black pitch and Burgundy pitch, each half an ounce. Melt the wax and pitch in a new earthen-ware glazed pot; and add to them, by degrees, the aſphaltum finely powdered. Let the whole boil, till ſuch time as that, taking a drop upon a plate, it will break when it is cold, on bending it double two or three times betwixt the fingers. The varuiſh being then enough boiled, muſt be taken off the fire; and, letting it cool a little, muſt be poured into warm water, that it may work the more eaſily with the hands, ſo as to be formed into balls; which muſt be rolled up, and put into a piece of taffety for uſe."

It muſt be obſerved, firſt, that the fire be not too violent, for fear of burning the ingredients; a ſlight ſimmering will be ſufficient: ſecondly, that while the aſphaltum is putting in, and even after it is mixed with them, the ingredients ſhould be ſtirred continually with the ſpatula: and thirdly, that the water, into which this compoſition is thrown, ſhould be nearly of the ſame degree of warmth with it, to prevent a kind of cracking that happens when the water is too cold. The varniſh ought always to be harder in ſummer than in the winter; and it will become ſo if it be ſuffered to boil longer, or if a greater proportion of the aſphaltum or brown reſin be uſed. The experiment above-mentioned, of the drop ſuffered to cool, will determine the degree of hardneſs or ſoftneſs that may be ſuitable to the ſeaſon when it is uſed.

Preparation of the hard Varniſh uſed by Callot, commonly called the Florence Varniſh.

Take four ounces of fat oil very clear, and made of good linſeed oil, like that uſed by painters: heat it in a clean pot of glazed earthen ware, and afterwards put to it four ounces of maſtich well powdered; and ſtir the mixture briſkly, till the whole be well melted; then paſs the whole maſs through a piece of fine linen, into a glaſs bottle with a long neck, that can be ſtopped very ſecurely; and keep it for the uſe that will be below explained. There are many other methods of making varniſh or ground, which we ſhall not enumerate; but only obſerve that thoſe who wiſh to procure ground, without the trouble of preparing it, may be ſupplied at ſeveral of the print or colour ſhops; where may alſo be had the oiled or tranſparent paper, neceſſary to trace the objects on the varniſh from the print or drawing.

Method of applying the ſoft Varniſh to the Plate, and of blackening it.

The plate being well poliſhed and burniſhed, as alſo cleanſed from all greaſineſs by chalk or Spaniſh white, fix a hand vice on the edge of the plate where no work is intended to be, to ſerve as a handle for managing it when warm: then put it upon a chafing diſh, in which there is a moderate fire; obſerving to hold it ſo, that it may not burn: keep the plate over the fire till it be ſo hot, that the varniſh being brought into contact with it, may melt: then cover the whole plate equally with a thin coat of the varniſh; and while the plate is warm, and the varniſh upon it in a fluid ſtate, beat every part of the varniſh gently with a ſmall ball or dauber made of cotton tied up in taffety; which operation ſmooths and diſtributes the varniſh equally over the plate.

When the plate is thus uniformly and thinly covered with the varniſh, it muſt be blackened by a piece of flambeau, or of a large candle, which affords a copious ſmoke; ſometimes two, or even four, ſuch candles are uſed together for the ſake of diſpatch, that the varniſh may not grow cold: which if it does during the operation, the plate muſt then be heated again, that it may be in a melted ſtate when that operation is performed: but great care muſt be taken not to burn it; which, when it happens, may be eaſily perceived by the varniſh appearing burnt and loſing its gloſs. The following expedient is made uſe of for the more commodious blackening the varniſh, being particularly neceſſary where the plates are large: fix a ſtrong hook in the roof of the room, through which paſs four pieces of cord of equal length, at the end of which are fixed four iron rings of about four inches diameter, for ſupporting the corners of the plate. The plate being thus ſuſpended in the air, with the varniſhed ſide downwards, may be blackened with great convenience: but this is not, however, abſolutely requiſite, except in the caſe of large plates that could not, without difficulty, be held up, unleſs this, or ſome other ſuch contrivance, were made uſe of.

It is proper to be very cautious in keeping the flambeau or candle at a due diſtance from the plate, leſt the wick touch the varniſh, which would both ſully and mark it. If it appear that the ſmoke has not penetrated the varniſh, the plate muſt be again placed for ſome little time over the chafing diſh; and it will be found, that, in proportion as the plate grows hot, the varniſh will melt and incorporate with the black which lay above it, in ſuch a manner that the whole will be equally pervaded by it.

Above all things, the greateſt caution ſhould be uſed in this operation, to keep all the time a moderate fire; and to move frequently the plate, and change the place of all the parts of it, that the varniſh may be alike melted every where, and kept from burning. Care muſt alſo be taken, that during this time, and even till the varniſh be entirely cold, no filth, ſparks, or duſt, fly on it; for they would then ſtick faſt, and ſpoil the work.

Method of applying the hard Varniſh.

This is preciſely the ſame as for the ſoft; being ſpread equally over the warm plate with the taffety-ball, and ſmoaked in the ſame manner: only after it is ſmoaked, it muſt be baked, or dried over a gentle fire of charcoal, till the ſmoke from the varniſh begins to decreaſe; taking care not to overheat the plate, which would both ſoften it and burn the varniſh.

The plate being thus prepared, and an exact drawing of the outlines of the deſign made upon thin paper, the other ſide of the paper muſt be well rubbed with chalk, or Spaniſh whitening, or, which is better, with red chalk ſcraped to a powder; and the looſe chalk is cleared off with a linen rag: then the ſtained ſide of the paper is laid upon the varniſh, fixing the corners to the plate with wax or wafers, to prevent its ſhuffling; and with a blunted needle, or pointer, the drawing is ſlightly traced, and communicates to the varniſh an exact outline of the deſign to be etched.

A variety of pointers is neceſſary for the work. Thoſe uſed for the broad large ſtrokes ought to be very blunt, exceeding round, and well poliſhed at the point; the ſole of a ſhoe anſwers very well for poliſhing the points. The fineſt ought to be as ſharp as a needle. If any ſcratches or falſe ſtrokes happen in the working, they are to be ſtopped up with a hair pencil dipped in Venetian varniſh, mixed with lamp black, by which means theſe places will be defended from the action of the aquafortis.

The next operation is that of eating or corroding the plate with aquafortis; in order to which, a border of ſoft wax (being a compoſition of bees wax melted and tempered with a little Venice turpentine and tallow), muſt be faſtened round the plate about an inch high, in the form of a little wall or rampart, to contain the aqua fortis. At one of the corners of this border a gutter is uſually made, which ſerves for pouring commodiouſly the aquafortis off the plate. The plate being thus bordered, take a due quantity of the refiners aquafortis; mix it with half its quantity of common water; and pour it gently on, till it riſe more than a finger's breadth above the ſurface of the plate: when, if all things have been rightly conducted, it will be ſeen that the aquafortis will ſoon exert its action in the ſtrokes, which have been ſtrongly touched; but thoſe more weakly engraved will appear at firſt clear, and of the colour of the copper. The menſtruum muſt therefore be ſuffered to continue on the plate till its effects become viſible on the more tender parts: then the aquafortis ſhould be poured off, the plate waſhed with clean water, and dried before the fire: then take a ſmall pencil dipped into the Venetian varniſh, and cover with it the lighter parts of the plate. This being done, the aquafortis muſt again be poured on, and ſuffered to continue a longer or ſhorter time, according to the ſtrength of the menſtruum, or the nature of the engraving; when it muſt be again poured off as before, and the plate immediately waſhed with water.

It may not be improper to obſerve, that, when the aquafortis is on the plate, a feather ſhould be uſed to cleanſe away the foulneſs of the verdigreaſe that gathers in the ſtrokes when the aquafortis operates on them, and to give it more room to exert its action; for by moving the aquafortis to and fro on the plate by the feather, and bruſhing away the black ſaline matter where it appears to be formed, the ſtrokes will be cleanſed, and the aquafortis exert its whole force equally on every part.

The plate being thus ſufficiently corroded by the aquafortis, and well waſhed with water, it muſt be warmed at the fire, and the border of wax removed; after which, it muſt be made hotter till the varniſh melt: then it muſt be well wiped with a linen cloth, and afterwards rubbed heartily with oil of olives; when it will be ready to be retouched and finiſhed by the graver. See the article ENGRAVING.

ETERNITY, an attribute of the Deity, expreſſing his infinite or endleſs duration. According to Mr. Locke, we come by an idea of eternity, by being able to repeat any part of time, as a year, as often as we will, without ever coming to an end.

ETHER. See ÆTHER.

ETHICS, the doctrine of manners, or the ſcience of moral philoſophy. The word is formed from ηθος, ηθη, *mores*, manners; by reaſon the ſcope or object thereof is to form the manners. See *Moral* PHILOSOPHY.

ETHMOIDAL, ETHMOIDALIS, in anatomy, a denomination given to one of the ſutures of the human cranium. The common ſutures are thoſe which ſeparate the bone of the cranium from thoſe of the cheeks, and are four; the tranſverſal, ethmoidal, ſphenoidal, and zygomatical. The ethmoidal takes its denomination from its turning round the os ethmoides.

ETHMOIDES, Εθμοειδης, in anatomy, a bone ſituate in the midddle of the baſis of the forehead or os frontis, and at the top of the root of the noſe. See Syſtem of ANATOMY. Part II. Sect. XIII.

ETIQUETTE, a French term, primarily denoting a ticket or title, affixed to a bag or bundle of papers, expreſſing its contents. It is alſo uſed when applied to the Spaniſh and ſome other courts, to ſignify a particular account of what is to be done daily in the king's houſhold, and in the chief ceremonies relating to it. It likewiſe denotes thoſe forms that regulate the decorum of conduct towards perſons of various ranks and ſtations.

ETYMOLOGY, that part of grammar which conſiders and explains the origin and derivation of words, in order to arrive at their firſt and primary ſignification, whence Quintilian calls it *originatio*. The word is formed of the Greek ετυμος, *verus*, true, and λεγω, *dico*, I ſpeak; whence λογια, *diſcourſe*, &c.; and thence Cicero calls the etymology, *notatio*, and *veriloquium*: though Quintilian chooſes rather to call it *orignatio*.

A judicious inquiry into etymologies, is thought by ſome of conſiderable uſe; becauſe nations, who value themſelves upon their antiquity, have always looked on the antiquity of their language as one of the beſt titles they could plead; and the etymologiſt, by ſeeking the true and original reaſon of the notions and ideas fixed to each word and expreſſion, may often furniſh an argument of antiquity, from the traces remaining thereof, compared with the ancient uſes. Add, that etymologies are neceſſary for the thorough underſtanding of a language. For, to explain a term preciſely, there ſeems a neceſſity of recurring to its firſt impoſition, in order to ſpeak juſtly and ſatisfactorily thereof. The force and extent of a word is generally better conceived when a perſon knows its origin and etymology. It is objected, however, that the art is arbitrary, and built altogether on conjectures and appearances; and the etymologiſts are charged with deriving their words from where they pleaſe. And indeed it is no eaſy matter to go back into the ancient Britiſh and Gauliſh ages, and to follow, as it were, by the track, the various imperceptible alterations a language has undergone from age to age, and as thoſe alterations have ſometimes been merely owing to caprice, it is eaſy to take a mere imagination or conjecture for a regular analogy: ſo that it is no wonder the public ſhould be prejudiced againſt a ſcience which ſeems to ſtand on ſo precarious a footing. It muſt certainly be owned, that etymologies are frequently ſo far fetched, that one can ſcarce ſee any reſemblance or correſpondence therein. Quintilian has ſhewn, that the ancient etymologiſts, notwithſtanding all their learning, fell into very ridiculous derivations. The etymologies of our Engliſh words have been derived from the Saxon, Welch, Walloon, Daniſh, Latin, Greek, &c. In this work the etymologies of terms are generally noted, where their obviouſneſs does not render it unneceſſary, or their doubtfulneſs or unimportance uſeleſs.

EVACUANTS, in medicine, remedies proper to expel or carry off any ill, peccant, or redundant humours in the human body, by the proper outlets or emunctories.

EVACUATION, in medicine, a diminution of the animal fluids, in order to a diſcharge of ſome morbid or redundant matters; or only for the ſake of thinning, attenuating, and thereby promoting motion and circulation. See Syſtem of MEDICINE.

EVACUATION is likewiſe uſed in the art of war, where, to evacuate a place is to make the garriſon quit or march out of it, in order for another power to take poſſeſſion of it, or to make room for another garriſon.

EVANGELISTS, the inſpired authors of the Goſpels. The word is derived from the Greek, ευαγγελιον, formed of ευ *bene, well*, and αγγελος, *angel, meſſenger*. The denomination evangeliſts was likewiſe given in the ancient church to ſuch as preached the Goſpel, without being attached to any particular church, being either commiſſioned by the apoſtles to inſtruct the nations, or of their own accord, abandoning every worldly attachment, conſecrated themſelves to the ſacred office of preaching the Goſpel. In this ſenſe ſome interpreters think it is that St. Philip, who was one of the ſeven deacons, is called the evangeliſt, in the twenty-firſt chaper of the acts of the apoſtles, ver. 8. Again, St. Paul writing to Timothy, Ep. ii. chap. iv. ver. 5. bids him do the work of an evangeliſt. The ſame apoſtle, Eph. iv. 11, ranks the evangeliſts after the apoſtles and prophets.

EVAPORATION, in natural philoſophy, is the diſſipation of the parts of any ſubſtance, either ſolid or fluid, into the air, in the form of ſmoke, or otherwiſe, in an inviſible manner, ſo that the ſubſtance evaporated then forms a fluid of equal ſubtilty and tranſparency with air itſelf. When any ſubſtance is diſſipated ſlowly and inſenſibly by ſimple expoſure to the atmoſphere, as water, camphor, &c. the evaporation is ſaid to be *ſpontaneous*.

TREATISE ON EVAPORATION.

Evaporation, in all caſes, is greatly promoted by heat. Many ſubſtances may be made to evaporate by means of a ſtrong fire, which otherwiſe appear abſolutely fixed; and there are but few which can reſiſt the violent action of the focus of a large burning mirror, without being in great part diſſipated.

Degrees of Heat requiſite to make different Fluids boil.

The degree of heat in which different bodies begin ſenſibly to evaporate is very different. When fluids of all kinds have been heated to a certain degree, their evaporation is attended with great inteſtine motion called *boiling*; and as then the diſſipation becomes much more ſenſible than before, this degree of heat is called their *evaporific point*; but improperly, for they begin ſenſibly to evaporate long before. The boiling point of all fluids is by no means the ſame; and the degree of heat which would cauſe the moſt fuſible metal to boil, is prodigiouſly greater than what would diſſipate the moſt fixed and ponderous fluid with the utmoſt rapidity. Vitriolic, and eſpecially nitrous ether, boil with a heat very little greater than that of our atmoſphere in ſummer. Spirit of wine requires Fahrenheit's thermometer to be raiſed 175 degrees above 0, before it boils; water requires 212 of the ſame degrees; oil of vitriol 550, oil of turpentine 560, quickſilver and linſeed oil 600, before they boil.

The quantity of any ſubſtance evaporated is found to depend ſo much on the degree of heat applied to it, that heat alone is generally reckoned to be the ſole cauſe of evaporation. Many perplexing circumſtances, however, occur, when we attempt to explain the manner in which a body, water for inſtance, naturally 800 times heavier than air, ſhould become ſo much ſpecifically lighter, as to be carried up by it to a very conſiderable height. One of the moſt generally received opinions concerning the formation of vapour is that adopted by Dr. Halley.

Dr. Halley's Theory of Evaporation.

He ſuppoſes that a bubble, compoſed of a particle of air incloſed by a thin film of water is rarefied by heat to ſuch a degree, that it becomes ſpecifically lighter than common air; in conſequence of which, ſuch particles, whatever be their number, muſt aſcend, and be ſuſpended in the air when they arrive at ſuch an height as to find the atmoſphere preciſely of the ſame ſpecific gravity with themſelves. But many objections may be made to ſuch a theory. For though a great quantity of air is diſperſed in water, it is not eaſy to account for the formation of a bubble diſtinct from the maſs of water; nor, though we could account for this, ought it to be taken for granted without ſufficient proof; and it remains to be explained by what means theſe bubbles would aſcend into the air: becauſe, by reaſon of their extreme ſmall ſize, the cold of the external air would almoſt inſtantly reduce the rarefied air-bubble to the ſame ſpecific gravity with itſelf. The bubble would then become ſpecifically heavier than the atmoſphere, and immediately fall down; ſo that vapour, inſtead of riſing to the height of two or three miles, could ſcarce riſe to the height of as many feet.

Lord Kaims's and Profeſſor Hamilton's Theory.

To avoid the difficulties to which the above-mentioned theory is liable, another hath been publiſhed by Lord Kaims and profeſſor Hamilton. They account for evaporation on the principle of elective attraction, and then ſolve the natural phenomena in the following manner. 1. "By an elective attraction between air and water, there is always a quantity of air in water and of water in air. 2. When water is ſaturated with air, it will take up no more; and in like manner, air ſaturated with water attracts no more. 3. This power of elective attraction is augmented by heat; for after air is ſaturated with water, or water with air, they will attract more by increaſing their heat. 4. The air with its moiſture being rarefied by heat, aſcends to a higher region, giving place to purer air not yet ſaturated, which accordingly attracts more moiſture, and water by that means is diffuſed through the air. 5. The groſſer particles of water, ſwimming in the air, being accumulated by wind, eſpecially contrary winds, become viſible clouds, and fall down in rain by the force of gravity overcoming the elective attraction. 6. Cold alſo contributes its part, by condenſing the watery particles, which fall down in ſnow when the cold is violent; and by theſe means a conſtant circulation of moiſture is carried on." This hypotheſis is alſo liable to be overthrown: for, according to it; evaporation ought not to take place *in vacuo* which is contrary to experience. The anſwer given by lord Kaims to this objection is a denial of the fact. Profeſſor Hamilton owns the diſſipation of water by heat *in vacuo*; but denies that this is really evaporation, which he maintains to be a true ſolution of water in air; and as a proof of this, he puts ſome water well purged of air under the exhauſted receiver of an air-pump, and found that it loſt only 2½ grains in the ſame time that an equal quantity expoſed to the air loſt 35 grains.

Mr. Watt's Experiment concerning the Evaporation of Water in vacuo.

That water can be converted into ſteam *in vacuo*, cannot be denied without the greateſt ſcepticiſm. It is even found much more eaſily diſſipated *in vacuo*, than when expoſed to the open air, and boils with much leſs heat; 92 or 95 degrees being ſufficient to make water boil *in vacuo*, whereas it requires 212° to make it boil when expoſed to the air. Concerning this, Dr. Black relates the following experiment.—Mr. Watt of Glaſgow, having formed a project of performing the evaporation of water *in vacuo*, with a view to convert it into ſteam with leſs expence of fuel, communicated his ſcheme to the doctor. The experiment was made with a ſmall ſtill reſembling the body of a retort, with a veſſel ſerving as a condenſer. The whole apparatus was cloſe, except a little hole at the extremity of the condenſing veſſel. Into this diſtilling veſſel a quantity of water was put; it was then exhauſted of air, by taking the condenſing veſſel, and holding it up, that the retort might be undermoſt. Being held over the fire in this poſition, the whole was ſoon filled with ſteam, which expelled the air: and upon ſtopping the little hole, a pretty perfect vacuum was formed in the retort and condenſing veſſel. The diſtilling veſſel being then ſet upon the fire, and the condenſing veſſel plunged in cold water, the water in the ſtill began to boil, as might be known by the noiſe, with a degree of heat very little greater than that of the human body, and the ſteam came over, and was condenſed in the refrigeratory; but Mr. Watt obſerved that the evaporation was not quicker *in vacuo*, than when air was admitted.

Profeſſor Hamilton's Experiments inconcluſive.

Thus we ſee that water may be converted into ſteam by the effect of heat alone, without the aſſiſtance of air; and thus the hypotheſis of Lord Kaims falls to the ground. Profeſſor Hamilton's experiment is evidently inconcluſive, becauſe it does not appear to have been fairly made. He put a certain quantity of water under an exhauſted receiver for 24 hours, and expoſed an equal quantity to the air in the ſame room; the firſt loſt 2½ grains, the latter 35. From this we can conclude nothing but that the quantity of fluid, whatever it is, which remains after the receiver of an air-pump is exhauſted, is capable of taking up 2½ grains of water. As no more of this fluid could be admitted to the water, than the preciſe quantity contained in the receiver, it is plain, that the other quantity of water which was expoſed to the open air of a room, ought to have been included within a receiver of the ſame ſize with the firſt, from which the air was not exhauſted: for in the manner wherein this experiment was conducted, an immenſe quantity of air had acceſs to one veſſel, and only as much as could be contained in the receiver of an air-pump, of the medium remaining after the air is exhauſted, had acceſs to the other; ſo that it would have been very abſurd to expect the ſame reſult in both caſes. Even circumſtanced as the experiment is, it makes directly againſt that hypotheſis which the profeſſor is deſirous of ſupporting: for, as the air-pump he made uſe of was capable of rarefying the air two and forty times, had the evaporation depended on the ſmall quantity of air which was left in the receiver, only the two and fortieth part ought to have been diſſipated of what would have been loſt had the water been placed under a receiver full of air. Inſtead of this, a like quantity of water expoſed to the air contained in a large room, loſt only 14 times as much. Had the vacuum of the receiver been as large as the room, it is impoſſible to ſay how much would have been loſt; and the only concluſion we can draw is, that the air, however neceſſary to the aſcent of vapour, is in reality prejudicial to its firſt formation.

Cold produced by Evaporation.

A very remarkable circumſtance concerning the evaporation of fluids is, that ſome degree of cold is always produced in conſequence of it; and by means of ſome of the more volatile ones, a great degree of cold is produced. If ſome vitriolic ether is put into a phial, ſet in a ſmall veſſel of water, and the whole placed under an air-pump, the ether boils violently as ſoon as the air is exhauſted, while the water is frozen by the cold produced in conſequence of its evaporation. This circumſtance hath been made uſe of as a proof that evaporation is not occaſioned by heat; and the ſenſible coldneſs of vapour has been thought a demonſtration that heat could by no means be concerned in its formation. Dr. Black, however, who treats particularly of the formation of vapour, hath accounted for this in a very ſatisfactory manner; and gives heat, in a certain degree, as the cauſe of evaporation in all caſes whatever.

Dr. Black's Account of ſenſible and latent Heat.

This gentleman is of opinion, that all fluid ſubſtances, beſides the heat contained in them capable of affecting our ſenſes or a thermometer, contain a certain quantity united to them in ſuch a manner as not to be diſcoverable by either of theſe methods; which, however, on certain occaſions, is apt to break forth, and ſhew its proper qualities as heat or fire. Theſe two different ſtates of this fluid, he diſtinguiſhes by the names of ſenſible and latent heat. A proof that heat exiſts in this latent ſtate, he gives from a mixture of ice and with water. He obſerves, that, when two equal maſſes of the ſame matter heated to different degrees, are mixed together, the heat of the mixture ought to be an arithmetical mean betwixt the two extremes. But, on pouring hot water upon ice, he found the caſe to be conſiderably different, and that a quantity of heat was entirely loſt; which he could account for in no other manner than by ſuppoſing, that it entered into the compoſition of the water, in ſuch a manner as to be in a latent ſtate, and the inviſible cauſe of the fluidity of that element.

Of the Formation of Vapour.

What happened in this caſe, to a mixture of ice and water, the doctor thinks, always happens on the converſion of water into ſteam or vapour by means of heat; a great quantity of the heat thrown into the fluid enters into it when in the ſtate of vapour, and forms a part of the fluid itſelf; in which ſtate it is not diſcoverable either by the thermometer or by the touch, but yet is ready to appear again in its proper form when the vapour is condenſed. The moſt concluſive experiments, mentioned by Dr. Black, as a proof of this theory, are, that hot water put under the exhauſted receiver of an air pump boils with great violence, and a part of it is ſuddenly diſperſed in vapour. During this time the water itſelf cools remarkably faſt, a part of the heat diſappears, and is neither to be found in the ſteam nor in the water. What then has become of it? The doctor concludes it ſtill exiſts in the ſteam, though in a latent ſtate, and not to be diſcovered by the common methods.

In this manner, likewiſe, he accounts for the above-mentioned experiment of the water freezing under an exhauſted receiver, in conſequence of the evaporation of the ether. This fluid being ſo extremely volatile that it went off in vapour when the temperature of the air was only 50°, abſorbed the ſenſible heat of the ſurrounding water, which entered into the compoſition of the ethereal vapour, and there remained in a latent ſtate. Certain it is, that, in this experiment, there was no perceptible increaſe of heat either in the ether or its vapour; the water indeed loſt heat conſiderably, but neither of theſe gained it.

The element of fire, however, is ſo exceedingly ſubtile, and ſo much eludes our moſt diligent ſearch, that we cannot conclude from its diſappearance in one place, that it has imperceptibly occupied another; the doctor, therefore, has yet a ſtronger argument in favour of his theory. He maintains, that, in the condenſation of ſteam by the refrigeratory of a common ſtill, as much heat is communicated to the water in the refrigeratory as would be ſufficient to heat the water which comes over to the heat of red hot iron, were it all to exiſt in it in the form of ſenſible heat. Nevertheleſs, the ſteam is at no time hotter than the boiling water which emits it. The exceſs of heat, therefore, muſt have exiſted in the ſteam in a latent ſtate, and become ſenſible during the condenſation.

The method of calculating this quantity of heat is very eaſy. For, ſuppoſing the refrigeratory to contain 100 pounds of water, and that one pound has been diſtilled: if the water in the refrigeratory has received 10 degrees of heat during the diſtillation, we know that the one pound diſtilled has parted with 1000. If, in paſſing through the worm of the refrigeratory, it has been reduced to the temperature of 50° of Fahrenheit's; having been at 212 when it entered the worm in form of ſteam, it has loſt only 162° of ſenſible heat; all the reſt of that heat which it communicated to the refrigeratory, amounting to above 800°, was contained in it while in the form of a ſteam, in ſuch a ſtate as not to be indicated by the thermometer.

By calculating in this manner, the doctor generally found, that the heat communicated by the ſteam was about 800 degrees; which would have been ſufficient to render a maſs of iron equal in bulk to the water which came over, red hot. In the experiment made by Mr. Watt, no leſs than 1000 degrees were communicated; though all the time the ſteam came over with a very gentle heat; but little ſuperior to what the hand could bear.

This experiment, no doubt, unanſwerably confirms the doctor's theory of heat. It is proper, however, to take notice, that a deception may very eaſily take place with ſuch as repeat the experiment in a careleſs manner. The upper part of the water in a refrigeratory grows very hot, while the under part is quite cold; and if a thermometer is plunged into it without ſtirring the water, a much greater degree of heat will be thought to be communicated than really there is. To avoid this miſtake, it is neceſſary to ſtir the water well about, and then meaſure its degree of heat. This theory of ſenſible and latent heat, ſo well eſtabliſhed, cannot but be looked upon as a valuable diſcovery in natural philoſophy; and will enable us to give a more ſatisfactory account of the formation of vapour when ſtrong degrees of heat are applied, as well as in the common heat of our atmoſphere, than any that hath hitherto been publiſhed. We ſhall begin with the converſion of any fluid, water, for inſtance, into vapour, when ſuch a degree of heat is applied as to make it boil.

How boiling Water is converted into Steam.

Here, the water has already received the utmoſt degree of heat which it is capable of containing. When a larger quantity continues ſtill to be thrown in, it muſt either paſs through the ſubſtance of the water and be diſſipated in the air, or combine with the aqueous particles in the form of ſteam. That the extreme agility of heat cauſes great part of it to paſs through the water and be loſt, cannot be denied; but it is alſo evident, that a very conſiderable part combines with the ſubſtance of the water, and is converted into vapour. The action of boiling conſiſts in the aſcent of a great number of bubbles from the bottom of the veſſel containing the water. Theſe, growing continually larger as they aſcend, break on the ſurface of the water, and are found to be compoſed of ſteam or vapour. As they continue till the evaporation of the very laſt drop of water, long after it has parted with all its air, this cannot be ſuppoſed to have any ſhare in their formation. Indeed, Dr. Boerhaave and others have proved, that there is no air contained in them; and both Dr. Black and Profeſſor Hamilton have ſhewn, that they are the very fluid which is diſſipated in the form of ſmoke. If, therefore, ſteam exiſts, and appears in its own proper form, when the air has no acceſs to it, which it has not till the bubble aſcends to the top and breaks in the air, it is impoſſible that air can have a ſhare in its formation; though by its ſuperior gravity it is the ſole cauſe of its aſcent.

If we are inclined, then, to call vapour a ſolution of water in any thing, it muſt be in heat, or fire; ſeeing, according to profeſſor Hamilton himſelf, it appears in the proper form of vapour before it has had any connection with the air.

Spontaneous Evaporation accounted for.

Upon the ſame principles we may eaſily account for the ſpontaneous or inſenſible evaporation of water when a degree of heat much leſs than that requiſite to cauſe it to boil is applied to it. From Dr. Black's experiments it appears, that a certain degree of heat is neceſſary to keep it in a fluid ſtate; and whatſoever degree is applied to it ſuperior to that abſolutely neceſſary to keep it fluid, appears to be but looſely connected with it, ſo that the water will very readily part with this ſuperfluous degree of heat to any colder body that comes in contact with it. Water in its fluid ſtate, then, we may conſider as a kind of compound, conſiſting of the pure element, and a certain quantity of heat ſo looſely combined with it as to affect the thermometer; but it is impoſſible that two ſubſtances having a tendency to mutual union can fail to be united in the cloſeſt manner of which they are capable when brought very near or in contact with each other. The water, therefore, having a conſtant tendency, to abſorb the ſenſible heat, and convert it into latent heat, muſt continue to do ſo more or leſs ſlowly according to the quantity contained in it. By this means there is a proportional quantity of vapour formed; for we muſt remember, that when heat and water are combined in the moſt intimate manner, they form a new ſubſtance totally different from water in its elementary ſtate. The particles of vapour thus formed, muſt neceſſarily aſcend to the ſurface of the water, and thence into the air, for the reaſons already mentioned; and thus there will be a conſtant exhalation from the ſurface of water, when the atmoſphere is of ſuch a temperature as to keep it fluid.

Why there is an Evaporation from Ice.

It now remains to account for the evaporation of water from ice; when the atmoſphere is of ſuch a nature as to deprive the water of great part of its ſenſible heat, and reduce it to a ſolid form. From a very curious experiment, Dr. Black hath ſhewn, that, in the act of freezing, the latent heat of the water is called forth, and becomes ſenſible. The ice, therefore, during the proceſs of congelation, is always a little warmer than the external air. In this caſe then, with regard to the external atmoſphere, it may be conſidered as ſimilar to water having a ſmall fire under it, ſo as to make it a degree or two warmer than the ſurrounding atmoſphere. The conſequence of this would be, that the freezing water would communicate part of its ſenſible heat to the air, and another part would intimately combine with the aqueous particles, and form a vapour which would be carried up into the atmoſphere. In like manner, the piece of ice, having a degree of ſenſible heat ſuperior to that of the air, will communicate to it part of that heat; while another part from its ſtrong tendency to unite with the water, will undoubtedly do ſo in its paſſage from the ice into the air, and carry off part of the aqueous particles in an imperceptible vapour.

Thus, according to Dr. Black's theory, whether the degree of heat contained in the atmoſphere is greater or leſs than that of water, there muſt be a continual evaporation of that fluid. There is only one caſe, upon his principles, where the evaporation muſt be little or nothing; and that is, when a piece of ice is in the action of melting. Here the water indeed receives heat from the atmoſphere: but as faſt as it is received, it paſſes from a ſenſible into a latent ſtate; and, till the water is ſaturated with latent heat, very little ſenſible heat can combine with the aqueous particles, ſo as to form them into ſteam. In this inſtance likewiſe, the Doctor's theory is verified by experience; for profeſſor Hamilton having incloſed a piece of ice, while thawing, in an exhauſted receiver, and likewiſe in one full of air, found that it loſt nothing by evaporation in 24 hours.

Evaporation promoted by Electricity.

From ſome experiments made by the Abbe Nollet, it appears, that evaporation is promoted by electricity. The conſequences of his experiments are as follow:

1. Electricity augments the natural evaporation of fluids; all that were tried, except mercury and oil, were found to ſuffer a diminution greater than what could be aſcribed to any other cauſe.

2. Electricity augments the evaporation of thoſe fluids the moſt, which are moſt ſubject to evaporate of themſelves; the volatile ſpirit of ſal ammoniac, ſuffering a greater loſs than ſpirit of wine or oil of turpentine; theſe two more than common water, and water more than vinegar or the ſolution of nitre.

3. The effects ſeemed always to be greater when the veſſels containing the fluids were non-electrics.

4. The increaſed evaporation was more conſiderable when the veſſel which contained the liquor was more open; but the effects did not increaſe in proportion to the apertures.

5. Electricity was alſo found to increaſe the evaporation of moiſture from ſolid bodies, and of conſequence to increaſe the inſenſible perſpiration of animals.

As the electric fluid is generally thought to be the ſame with the element of fire, it cannot be thought that this diſcovery can be any objection to Dr. Black's theory of the formation of vapour, but muſt rather tend to confirm it; as the phenomena of electricity preſent us with fire in a ſtate wherein it has no ſenſible heat, and which, agreeable to the Doctor's mode of expreſſion, may very properly be called its latent ſtate. The very great readineſs which this fluid ſhews to be converted into actual fire, ſo as even to fuſe metals, may alſo be reckoned a kind of demonſtration of the facility wherewith the ſenſible heat of any body may become latent, or the latent heat ſenſible.

Evaporation by means of heat, is one of the capital operations in chymiſtry; and where very great quantities of water are to be diſſipated, as in the making of common ſalt and green vitriol, it is a matter of no ſmall conſequence to contrive the evaporating veſſels in ſuch a manner as to diſſipate a large quantity of liquid in a ſhort time, and with little fuel. In the warmer countries, ſalt is made by the heat of the ſun alone; and even in the ſouthern parts of England, the heat of the ſolar rays is advantageouſly uſed to concentrate the brine.

Methods of evaporating great Quantities of Liquid in a ſhort Time.

This, however, can be but very ſeldom practiſed, and artificial evaporation is almoſt the only kind made uſe of in this country. The two great requiſites for promoting this, are, a ſufficient degree of heat to form a large quantity of ſteam, and a current of air to carry it off; for, though the vapour is always formed by the heat, yet if the air ſtagnates on the ſurface of the fluid, that part next the ſurface is heated to ſuch a degree, and ſo loaded with ſmoke, that the ſucceeding quantities of vapour are very conſiderably retarded in their aſcent. For this reaſon, evaporation is greatly promoted by having as large a ſurface of fluid expoſed to the air as poſſible, that the aſcent may be very quick; and where it is poſſible to procure a conſiderable blaſt of air along the ſurface of the veſſel containing the fluid, it will very much accelerate the diſſipation of it. On the ſame account, blowing air through the water while evaporating, increaſes the quantity of vapour to a ſurpriſing degree. It is obvious, however, that, by either of theſe methods, only time can be ſaved: for as the blaſt of cold air, whether directed along the ſurface of the fluid, or into its ſubſtance, will diminiſh the heat conſiderably; though the evaporation goes on very faſt, yet a proportional quantity of fuel will be required; and it is doubtful whether this method might in the end be attended with all the advantages promiſed by it at firſt view.

Diſtillation the beſt Method of evaporating.

On many accounts, diſtillation ſeems to be the moſt advantageous method of evaporating fluids, particularly as it both prevents any of the ſalts they may contain from being diſſipated, and ſeems to be the method by which the largeſt quantities of liquid can be evaporated in the ſhorteſt time, and with leaſt fuel. It is well known, that water in a ſtill, or any covered veſſel, can be kept boiling with much leſs heat than an equal quantity in an uncovered veſſel. As the quantity of ſteam is the ſame that ariſes from an equal ſurface of water where the heat is the ſame, whether the veſſel is covered or uncovered; it follows, that if proper vent is given to the ſteam in a covered veſſel, an equal quantity will be raiſed in a cloſe veſſel with leſs than in an open one and with an equal quantity of fuel, much moro might be evaporated, in the ſame time, in a cloſe than in an open veſſel. This ſeems confirmed by what Dr. Hales has advanced in his experiments concerning the freſhening of ſea water. He has found, that, by blowing air through the water contained in a ſtill, it is made to yield double thequantity which it otherwiſe would do. By this method, he obſerves, a ſtill which holds 20 gallons will yield, in 20 hours, 240 gallons of diſtilled water; and one which holds only five gallons may be made to diſtil 64, in the ſame time. Theſe are prodigious quantities; and which, we believe, could not be made to ariſe in an equal time from open veſſels of the ſame ſize, by any manœuvre whatever. Even deducting one half for the action of the bellows, the quantity is exceedingly great, being upwards of a gallon and an half per hour from a veſſel holding ony five gallons; and how difficult it would be to make this quantity ariſe from an open veſſel of ſuch a ſize, thoſe who are much concerned in evaporation will eaſily know.

EVAPORATION, in pharmacy, chymiſtry, &c. denotes an operation by which the more aqueous and volatile parts of fluids are ſpent, or driven away in ſteam, ſo as to leave the remaining part ſtronger, or of a higher conſiſtence than before. Evaporation is effected by ſetting liquor over a gentle heat, to carry off the moſt fluid and volatile parts, without leſſening the quantity of the other matters with which the liquor is impregnated.

EVATES, a branch or diviſion of the ancient Celtic philoſophers the Druids. Strabo diſtributes the philoſophers among the Britons and Gauls into three ſects; Βαρδοι, *Bards*; Ουατεις, *Evates*, and Δρυιδαι, *Druids*. He adds, that the Bardi were poets and muſicians; the Evates, prieſts and naturaliſts; and the Druids, moraliſts as well as naturaliſts. But Marcellinus, Voſſius, and Hornius, reduce them all to two ſects, viz. Bardi and Druids. Laſtly, Cæſar, lib. vi. comprehends them all under the name of Druids.

EUCHARIST, *Euchariſtia*, the ſacrament of the ſupper, or a participation of the body and blood of Chriſt, under the ſpecies or figures of bread and wine. The word in its original Greek, Ευχαριστια, literally imports *thankſgiving*, being formed of ευ, *bene, well*, and χαρις, *gratia, thanks*.

EUCHITES, or EUCHITÆ, a ſect of ancient heretics, who were firſt formed into a religious body, towards the end of the fourth century, though their doctrine and diſcipline ſubſiſted in Syria, Egypt, and other eaſtern countries before the birth of Chriſt; they were thus called becauſe they prayed without ceaſing, imagining that prayer alone was ſufficient to ſave them. Their great foundation were thoſe words of St. Paul, Epiſt. i. to the Theſſalonians, cap. v. ver. 17. *Pray without ceaſing*.

EUDIOMETER, in pneumatics, is an inſtrument lately invented, in conſequence of the experiments and diſcoveries of Dr. Prieſtley, for determining the ſalubrity of different kinds of air. The name is formed of ευδια, ſignifying the *good quality of air*, derived from ευ, *good*, and δια, denoting, in compoſition a *medium*, and μετρω, *I meaſure*. See Syſtem of PNEUMATICS.

EVER GREENS, a claſs of perennials, which continue their verdure, leaves, &c. all the year. Of theſe our gardeners reckon twelve, which are peculiarly fit for Engliſh air, viz. the alternus, arbutus, bay tree, box-tree, holly, juniper, lauruſtinus, phyllirea, pyracantha, or ever-green thorn, Italian green privet, and the yew-tree.

EVICTION, from *evinco, I overcome*, in law, ſignifies a recovery of lands or tenements by law.

EVIDENCE, that perception of truth which ariſes either from the teſtimony of the ſenſes, or from an induction of reaſon.

EVIDENCE, in law, ſignifies ſome proof, by teſtimony of men upon oath, or by writing or records. It is called evidence, becauſe thereby the point in iſſue in a cauſe to be tried, is to be made evident to the jury; for "probationes debent eſſe evidentes et perſpicuæ." The ſyſtem of evidence, as now eſtabliſhed in our courts of common law, is very full, comprehenſive, and refined; far different from, and ſuperior to, any thing known in the middle ages; as far ſuperior in that as in all other improvements and refinements in ſcience, arts, and manners. Vid. Blackſt. Comment. iii. 367, 375. iv. 350, 360.

The nature of evidence during the ages of ignorance was extremely imperfect, and the people were incapable of making any rational improvement. Thus it was the imperfection of human reaſon that cauſed the invention and introduction of the Ordeal, as an appeal to the ſupreme Being. As men are unable to comprehend the manner in which the Deity carries on the government of the univerſe, by equal, fixed, and general laws, they are apt to imagine, that, in every caſe which their paſſions or intereſt render important in their own eyes, the ſupreme Ruler of all ought viſibly to diſplay his power in vindicating innocence and puniſhing vice.

The evidences of the Chriſtian religion are diſtinguiſhed into two kinds, the direct and collateral; the direct evidences are external and internal; the external are miracles and propheſy; the internal evidence is deduced from its excellence, conſidered in reference to the main and principal end of Chriſtianity. Whatever does not either belong to its excellence conſidered in this light, or fall under the head of, miracles wrought on purpoſe to atteſt it, or of prophecies fulfilled, and yet affords a proof or any real preſumption of its truth and divinity, is a collateral evidence for it. All the collateral evidences of the truth of Chriſtianity are in one ſenſe internal evidences, becauſe they all ariſe from ſome particulars in the nature of this religion, from ſome circumſtances which have attended its reception or ſprung from it, or from ſome remarkable facts connected with it, and related in the Goſpel hiſtory. Of this kind is the argument deduced from its great efficacy at its firſt appearance, in baniſhing polytheiſm, idolatry, ſuperſtition, and the arts of magic; in ſoftening the rigour of deſpotiſm, introducing moderation into government, excluding many inconvenient civil laws once generally prevalent, giving riſe to others of a very happy tendency, refining the laws of war, humanizing the manners and improving the cuſtoms of nations, and reforming the temper and conduct of thoſe who embraced it. Another claſs of collateral arguments for the truth of the Chriſtian religion, ariſes from particulars in its nature or effects produced by it, or from facts in the goſpel hiſtory, which cannot be at all accounted for but on the ſuppoſition of a Divine original; or which are, at leaſt, moſt naturally explicable on that ſuppoſition. To this claſs may be referred thoſe preſumptive arguments deduced from the character of Jeſus, ſo exalted, and yet ſo uniformly ſupported; the nature of his laſt diſcourſes with his diſciples; the character of ſome of his apoſtles; that of Judas the traitor; the controverſies among Chriſtians in the apoſtolic age; and the method uſed by Chriſt and his apoſtles, of referring their claims to the impartial inquiries of men. Other collateral arguments have an affinity to the external evidences of Chriſtianity; ſuch are thoſe derived from the miraculous converſion of the apoſtle Paul, and his ſubſequent conduct: from the character of the man of ſin foretold by Paul; from the quick and extenſive propagation of the Goſpel; from the continuance and preſent ſtate of the nation of the Jews. Some of theſe arguments have an immediate relation to the proof of Chriſtianity from prophecies; others are related to the proof from miracles. Other arguments have an equal relation to the internal and external evidence of Chriſtianity; ſuch is that deduced from the manner in which Chriſt and his apoſtles propoſed the evidences of their miſſion, and the advantage they have gained in conſequence of the oppoſition and ſcrutiny of unbelievers. See on this ſubject Lord Lyttelton's Obſervations on the Converſion and Apoſtleſhip of St. Paul, Duchal's preſumptive Arguments for the truth of the Chriſtian Religion, Gerard's Diſſertation on the Genius and Evidences of Chriſtianity, and Fleetwood's Life of Chriſt.

EVIL, *malum*, in ethics, a privation or abſence of ſome proper or neceſſary good, or of ſome meaſure or degree thereof. Evil is either natural or moral; between which there is this relation, that moral evil produces natural.

Moral EVIL, is defined a deviation from right reaſon; a diſcernment of right from wrong, being given us as a guide of our actions; or it is the diſagreement between the actions of a moral agent and the rule of thoſe actions, whenceſoever it is derived and howſoever made known; and no action can be morally evil unleſs the agent be properly ſuch, intelligent, free, capable of diſtinguiſhing, chooſing, and acting for himſelf. This the philoſophers call *inhoneſtum*, and *turpe*, as ſtaining the image of God, and ſullying our original beauty, likewiſe *malum culpæ*.

Natural EVIL, is a want of ſomething neceſſary to the *bene eſſe*, or perfection of a thing, or to its anſwering all its purpoſes; ſuch are defects of the body, blindneſs, lameneſs, hunger, diſeaſes, death. This ſpecies is denominated *triſte, injucundum, noxium*, and *malum pœnæ*. Again, evil is either abſolute, as envy, impiety, &c.

or relative, as meat, which in itſelf being good, may be evil to a man on account of ſome diſeaſe; as wine to a feveriſh perſon, &c.

Evil, or *King's* **Evil**, in medicine, a diſeaſe by the phyſicians, called *ſtrumæ* and *ſcrophulæ*, conſiſting in ſcirrhous tumours, ariſing moſt commonly about the neck; but ſome alſo on the other glandulous parts, as the breaſt, arm-pits, groin, &c.

EULOGY, an encomium on any perſon, on account of ſome virtue or good quality.

EUNUCH, Ευνουχος, a term applied in the general to all who have not the faculty of generating, either through imbecility or frigidity; but more particularly ſuch as have been caſtrated, or have loſt ſome of the parts neceſſary for that purpoſe. In England, France, &c. eunuchs are never made but on occaſion of ſome diſeaſe which renders ſuch an operation neceſſary; but in Italy they make eunuchs for the ſake of preſerving the voice; and in the Eaſt they make eunuchs to be guards or attendants on their women. Great numbers of children, from one to three years of age, are yearly caſtrated in Italy to ſupply the operas and theatres, not only of Italy but other parts of Europe, with ſingers; though it is not one in three, that, after having loſt their virility, have a good voice for a recompence.

Tavernier aſſures us, that in the kingdom of Boutan in the Eaſt Indies, there are every year made twenty thouſand eunuchs, and ſold thence into other countries. The ſeraglios of the Eaſtern emperors are chiefly ſerved and guarded by eunuchs; and yet we have very good teſtimonies, that the rich eunuchs in Perſia and other countries keep ſeraglios for their own uſe. This is a puniſhment of crimes in ſome countries.

By an arret of the grand chamber of Paris in 1665, it is adjudged that an eunuch could not marry, not even with the conſent of the woman, and all the parties on both ſides. Claudian has a very ſevere ſatire againſt the eunuch Eutropius, who had been elected conſul of Rome. He repreſents him as an old woman, dreſſed up in the honours of the conſulate.

In the council of Nice thoſe were condemned, who, out of an indiſcrete zeal, and to guard themſelves from ſenſual pleaſures, ſhould make themſelves eunuchs. Such as thus mutilated their bodies were excluded from holy orders; witneſs Leontius, biſhop of Antioch, who was depoſed for having practiſed this cruelty on himſelf: and the biſhop of Alexandria excommunicated two monks who had followed his example, on pretence of ſecuring themſelves from the impetuous motions of concupiſcence. Several of the emperors made very ſevere prohibitions againſt the making of eunuchs, or people's caſtrating themſelves.

EVOLUTE, **Evoluta**, is the higher geometry, a curve firſt propoſed by Mr. Huygens, and ſince much ſtudied by the later mathematicians. The evolute is a curve, ſuppoſed to be evolved, or opened; and which, in opening, deſcribes other curves. See Syſtem of **Geometry**.

EVOLUTION, in the art of war, is a term applied to the diverſe figures, turns and motions, made by a body of ſoldiers, either in ranging themſelves in form of battle, or in changing their form: and this, whether in the way of exerciſe, or in the time of an actual engagement. It is by the evolutions that the form and poſture of a battalion, ſquadron, &c. are changed, either to make good the ground they are upon, or to poſſeſs themſelves of another, that they may attack the enemy or receive an onſet more advantageouſly. The military evolutions are converſions, countermarches or wheelings, doublings of rank and file, &c.

EUONYMUS, the ſpindle-tree; a genus of the monogynia order, belonging to the pentandria claſs of plants. There are two ſpecies. The europæus, diſcloſing their ſeeds in a beautiful manner in autumn; and the americanus, or evergreen ſpindle-tree. The berries of the firſt ſort vomit and purge very violently; and are fatal to ſheep. If powdered and ſprinkled upon hair, they deſtroy lice. If the wood is cut when the plant is in bloſſom, it is tough and not eaſily broken; and in that ſtate it is uſed by watchmakers for cleaning watches, and for making ſkewers and and tooth-pickers. Cows, goats, and ſheep, eat this plant; horſes refuſe it.

EUPATORIUM, hemp-agrimony; a genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants. There are 13 ſpecies. One of which the cannabinum, or water hemp-agrimony, is a native of Britain. It grows by the banks of rivers and brooks, and has pale-red bloſſoms. The whole plant hath a very bitter taſte. A decoction of the roots operates as a violent emetic and cathartic; and is ſometimes taken by the lower claſs of people, to cure the jaundice, dropſy, &c. Dr. Boerhaave uſed an infuſion of this plant to foment ulcers and putrid ſores. Tournefort informs us, that the Turks cure the ſcurvy with it. An ounce of the juice or a dram of the extract is a doſe.

EUPHONY, ΕυΦωνια, in grammar, an eaſineſs, ſmoothneſs, and elegancy of pronunciation. The word is formed of ευ, *bene*, *well*, and Φωνη, *vox*, *voice*. Quintilian calls *euphonia*, *vocalitas*; Scaliger, *facilis pronunciatio*. Euphonia is properly a kind of figure, whereby we ſuppreſs a too harſh letter, or convert it into a ſmoother, contrary to the ordinary rules. There are examples enough in all languages.

EUPHORBIA, ſpurge; a genus of the trigynia order, belonging to the dodecandria claſs of plants. There are 62 ſpecies, ſix of which are natives of Great Britain. The juice of all the ſpecies is ſo acrid, that it corrodes and ulcerates the body wherever it is applied; ſo that phyſicians have ſeldom ventured to preſcribe it internally. Warts, or corns, anointed with the juice, preſently diſappear. A drop of it put into the hollow of an aching tooth, gives relief, like other corroſives, by deſtroying the nerve. Ipecacuanha is the root of one of the ſpecies.

EUROPA, in fabulous hiſtory, daughter of Agenor, king of Phœnicia; with whom Jupiter being in love, transformed himſelf into a bull, and ran away with her into this part of the world, which from her is called Europe.

EUROPE, one of the quarters of the world, bounded on the north by the Frozen Ocean, on the weſt by the Weſtern Ocean, on the ſouth by the Mediterranean, which ſeparates it from Africa, and by the Archipelago, which divides it in part from Aſia, as alſo by the Black Sea, then by the river Don, till it comes near the river Volga or Wolga.

EURYDICE, in mythology, the wife of Orpheus, who, flying from Ariſtæus that endeavoured to raviſh her, was ſlain by a ſerpent. Her huſband went down to the ſhades, and by the force of his muſic perſuaded Pluto and Proſerpine to give him leave to carry back his wife; which they granted, provided he did not look on her till he came to the light: but he, breaking the condition, was forced to leave her behind him.

EURYTHMY, Ευρυθμια, in architecture, painting, and ſculpture, a certain majeſty, elegance, and eaſineſs, appearing in the compoſition of divers members, or parts of a body, building, or painting, and reſulting from the fine proportions thereof. The word is Greek, and ſignifies literally a conſonance, or fine agreement, or, as we may call it, a harmony of all the parts, being compounded of ευ, *well*, and ρυθμος, *rhythmus*, *cadence*, or *agreement of numbers*, *ſounds*, or the like things. Vitruvius ranks eurythmia among the eſſential parts of architecture, he deſcribes it as conſiſting in the beauty of the conſtruction or aſſemblage of the ſeveral parts of the works, which renders its aſpect or whole appearance graceful; e. gr. when the height correſponds to the breadth, and the breadth to the length, &c.

From theſe three ideas or deſigns, viz. orthography, ſcenography, and profile, it is that eurythmy, *majeſtica*, and *venuſta ſpecies ædificii*, do reſult, which creates that agreeable harmony between the ſeveral dimenſions, ſo as nothing ſeems diſproportionate, too long for this, or too broad for that, but correſponds in a juſt and regular ſymmetry, and conſent of all the parts with the whole.

EUTERPE, of ευ, *well*, and τερπω, *I delight*, in mythology, one of the nine muſes, which preſided over wind inſtruments: ſhe is repreſented with a crown of flowers, playing on a double flute, with Cupid at her knees. To her the invention of tragedy is aſcribed.

EWE, the Engliſh name for a female ſheep.

EXACTION, in law, a wrong done by an officer, or one pretending to have authority: in taking a reward, or fee, for that in which the law allows not of any. The difference between exaction and extortion, conſiſts in this: that extortion is, where the officer takes more than his due; and exaction, where he wreſts a fee, or reward, where none is his due.

EXAGGERATION, in rhetoric, a figure whereby we enlarge or heighten things; making them appear more than they really are, whether as to goodneſs, badneſs, or other qualities. The word is formed of the Latin *exaggero*, *I exaggerate*; which is a compound of *ex* and *agger*, a *mound*, or *elevation of earth*.

Exaggeration, in painting, an affectation or method of repreſenting things different from nature, by introducing an extravagance of outline and colouring. Exaggerating differs from caricaturing; in that the latter perverts, or gives a turn to the features, &c. of a face, which they had not; whereas the former only heightens what they had. The latter is a kind of burleſque on the object, and is generally meant to ridicule: the former is uſually an exalting or enlivening of the beauties of the object, beyond what nature allows. The painter is obliged to have recourſe to an exaggeration of colours, both on account of the ſurface of his ground, the diſtance of his work, and of time, and the air, which diminiſh and weaken the force of the colours; but this exaggeration muſt be conducted in ſuch a manner, as not to put the objects out of their natural characters.

EXALTATION, *Elevation*, is chiefly uſed in a figurative ſenſe, for the raiſing or advancing a perſon to ſome eccleſiaſtical dignity: and particularly to the papacy. The term exaltation is, in ſome meaſure, appropriated the pope; and expreſſes his inauguration, coronation, taking poſſeſſion, and the beginning of his pontificate.

Exaltation, in phyſics, denotes the act, or operation, of elevating, purifying, ſubtilizing, or perfecting any natural body, its principles and parts; alſo the quality, or diſpoſition, which bodies acquire by ſuch operation.

EXAMEN, or **Examination**, an exact and careful ſearch or enquiry, in order to diſcover the truth or falſhood of a thing.

EXAMINERS, in chancery, are two officers, whoſe buſineſs is to examine, on oath, the witneſſes produced on both ſides, upon ſuch interrogatories as the parties to the ſuit exhibit for the purpoſe.

EXANTHEMA, formed of ἐξανθέω, *I flower*, in medicine, a preternatural eruption, or efflоreſcence, on the ſkin. Exanthemata are of two kinds; the one only a diſcolouring of the ſkin; ſuch as the meaſles, the purple ſpots in malignant fevers, &c. The other are little eminences, or papillæ, ſtanding out from the ſkin; ſuch are puſtules, ſmall pox, &c.

EXARTICULATION, a diſlocation of ſome of the jointed bones; or a breach of articulation.

EXCAVATION, formed of *ex* and *cavus*, *hollow*, or *cave*, a *pit*, &c. the act of hollowing, or digging a cavity, particularly in the ground.

EXCELLENCY, a quality, or title of honour, given to ambaſſadors, and other perſons, who are not qualified for that of highneſs, as not being princes; and yet are to be elevated above the other inferior dignities. In England, and France, the title is now peculiar to ambaſſadors; but it is very common in Germany and Italy. Thoſe to whom it was firſt appropriated were the princes of the blood, of the ſeveral royal houſes; but they quitted it for that of highneſs, upon ſeveral great lords aſſuming excellency. The Italian and French have improved on ſimple excellency; and made *excellentiſſimo*, and *excellentiſſime*, which have been beſtowed on certain popes, kings, &c.

EXCENTRIC, in the general ſenſe, departing or deviating from a centre. Excentric character, not adhering to any rule or mode, but totally governed by whim and caprice.

Excentric, in geometry, is applied where two circles, or ſpheres, though contained, in ſome meaſure, within each other, yet have not the ſame centre; and, conſequently, are not parallel; in oppoſition to concentric, where they are parallel, having one and the ſame common centre.

EXCENTRICITY, in aſtronomy, is the diſtance of the centre of the orbit of a planet from the centre of the ſun; that is, the diſtance between the centre of the ellipſis and the focus thereof. See Syſtem of Astronomy, Sect. VII.

EXCEPTION, ſomething reſerved, or ſet aſide, and not included in a rule. It is become proverbial, that there is no rule without an exception: intimating, that it is impoſſible to comprehend all the particular caſes under one and the ſame maxim. But it is dangerous following the exception preferably to the rule.

Exception, in law, is a ſtop or ſtay to an action. The term is uſed indifferently, both in the civil and common law; and in each, exceptions are divided into dilatory and peremptory. In law proceedings exception is a denial of a matter alledged in bar to the action; and in chancery it is that which is alledged againſt the ſufficiency of an anſwer, &c. Exception, in a general ſenſe, includes all the kinds of defence, or vindication, which a perſon, againſt whom a proceſs is brought, makes uſe of to prevent or retard its effect.

EXCESS is diſtinguiſhed into natural and moral: the firſt, is a part whereby one quantity is greater than another. Thus, we ſay, this lines is longer than that; but the exceſs is inconſiderable. The latter, is an intemperance, or going beyond the juſt bounds and meaſures preſcribed for any thing. Thus, we ſay, exceſs in wine, women, &c. is prejudicial to the health.

EXCHANGE, in a general ſenſe, a contract or agreement whereby one thing is given for another.

Exchange, in arithmetic, is the reduction of different coins, or any denomination of money, whether there be real coins anſwering to them, or no, from one to another; or the method of finding how many of one ſpecies, or denomination, are equal in value to a given number of another; in order to which it is neceſſary to know the value of the coins and monies of account of different countries, and their proportion to each other, according to the ſettled rate of exchange. The ſeveral operations in this caſe are only different applications of the rule of three. See Syſtem of Arithmetic, Article XVI.

Exchange, *Permutation*, in commerce, an agreement, whereby one thing is trucked or given for another. The firſt commerce carried on among men was by exchange; people furniſhing each other mutually with what things they wanted; but ſuch exchanges were clogged with two conſiderable difficulties. 1. On account of the unequal values of commodities; and, 2. Becauſe every body had not juſt what might accommodate the perſon with whom he would exchange. To remove theſe inconveniences, money was invented for a common medium; and inſtead of exchanging, buyiug and ſelling were introduced.

Yet, there are nations among whom the primitive way of exchange ſtill obtains; and even among the moſt civilized people, there are frequent occaſions, in which they have recourſe to this method. Such for inſtance, is the trade of ſeveral cities of the North, and Baltic Sea, where the French exchange their wines and brandies for woods, metals, hemps, and furs.

The commerce of bills of exchange is, itſelf, a mere trading by exchange: a truck of money for money. Exchange therefore, properly denotes the buſineſs, or trade of money, as carried on between one place and another, by means of bills of exchange, i. e. by giving money in one city, and receiving a bill to entitle the giver to receive the value in another city. See Bill of *Exchange*.

A regular bill of exchange is a mercantile contract, in which four perſons are concerned, viz. 1. The drawer, who receives the value: 2. His debtor, in a diſtant place, upon whom the bill is drawn, and who muſt accept and pay it: 3. The perſon who gives value for the bill, to whoſe order it is to be paid: and, 4. The perſon to whom it is ordered to be paid, creditor to the third.

By this operation, reciprocal debts, due in two diſtant parts, are paid by a ſort of transfer, or permutation of debtors and creditors.

A in London is creditor to B in Paris, value 100l. C again in London is debtor to D in Paris for a like ſum. By the operation of the bill of exchange, the London creditor is paid by the London debtor, and the Paris creditor is paid by the Paris debtor; conſequently, the two debts are paid, and no money is ſent from London to Paris, nor from Paris to London.

In this example, A is the drawer, B is the accepter, C is the purchaſer of the bill; and D receives the money. Two perſons here receive the money, A and D; and two pay the money, B and C; which is juſt what muſt be done when two debtors and two creditors clear accounts.

This is the plain principle of a bill of exchange; from which it appears, that reciprocal and equal debts only can be acquitted by them. When it therefore happens, that the reciprocal debts of London and Paris (to uſe the ſame example) are not equal, there ariſes a balance on one ſide. Suppoſe London to owe Paris a balance, value 100l. How can this be paid? Anſwer, It may either be done with or without the intervention of a bill.

Firſt with a bill, if an exchanger, finding a demand for a bill upon Paris for the value of 100l. when Paris owes no more to London, ſends 100l. to his correſpendent at Paris in coin, at the expence (ſuppoſe) of 1l. and then, having become creditor on Paris, he can give a bill for the value of 100l. upon his being repaid his expence, and paid for his riſk and trouble.

Or, ſecondly it may be paid without a bill, if the London debtor ſends the coin himſelf to his Paris creditor, without employing an exchanger. This laſt example ſhews of what little uſe bills are in the payment of balances. As far as the debts are equal, nothing can be more uſeful than bills of exchange; but the more they are uſeful in this eaſy way of buſineſs, the leſs profit there is to any perſon to make a trade of exchange, when he is not himſelf concerned either as debtor or creditor.

When merchants have occaſion to draw and remit bills for the liquidation of their own debts, active and paſſive, in diſtant parts, they meet upon 'Cchange; where, to purſue the former example, the creditors upon Paris, when they want money for bills, look out for thoſe who are debtors to it. The debtors to Paris again, when they want bills for money, ſeek for thoſe who are creditors upon it.

This market is conſtantly attended by brokers, who relieve the merchant of the trouble of ſearching for thoſe he wants. To the broker every one communicates his wants, ſo far as he finds it prudent; and by going about among all the merchants, the broker diſcovers the ſide upon which the greater demand lies, for money, or for bills.

He who is the demander in any bargain, has conſtantly the diſadvantage in dealing with him of whom he demands. This is no where ſo much the caſe as in exchange, and renders ſecrecy very eſſential to individuals among the merchants. If the London merchants want to pay their debts to Paris, when there is a balance againſt London, it is their intereſt to conceal their debts, and eſpecially the neceſſity they may be under to pay them; from the fear that thoſe who are creditors upon Paris would demand too high a price for the exchange over and above par.

On the other hand, thoſe who are creditors upon Paris, when Paris owes a balance to London, are as careful in concealing what is owing to them by Paris, from the fear that thoſe who are debtors to Paris, would avail themſelves of the competition among the Paris creditors, in order to obtain bills for their money, below the value of them, when at par. A creditor upon Paris, who is greatly preſſed for money at London, will willingly abaet ſomething of his debt, in order to get one who will give him money for it.

From the operation carried on among merchants upon 'Cchange, we may diſcover the conſequence of their ſeparate and jarring intereſts. They are conſtantly intereſted in the ſtate of the balance.

hoſe who are creditors on Paris, fear the balance due to Londoe; thoſe who are debtors to Paris, dread a balance due to Paris. The intereſt of the firſt is to diſſemble what they fear; that of the laſt, to exaggerate what they wiſh. The brokers are thoſe who determine the courſe of the day; and the moſt intelligent merchants are thoſe who diſpatch their buſineſs before the fact is known.

Merchants endeavour to ſimplify their buſineſs as much as poſſible; and commit to brokers many operations which require no peculiar talents to execute. This of exchange is of ſuch a nature, that it is hardly poſſible for a merchant to carry on the buſineſs of his bills, without their aſſiſtance, upon many occaſions. When merchants come upon 'Change, they are ſo full of fear and jealouſies, that they will not open themſelves to one another, leſt they ſhould diſcover what they want to conceal. The broker is a confidential man, in ſome degree, between parties, and brings them together.

Beſides the merchants who circulate among themſelves their reciprocal debts and credits ariſing from their importation and exportation of goods, there is another ſet of merchants who deal in exchange; which is the importation and exportation of money and bills.

But when balances come to be paid, exchange becomes intricate; and merchants are ſo much employed in particular branches of buſineſs, that they are obliged to leave the liquidation of their debts to a particular ſet of men, who make it turn out to the beſt advantage to themſelves.

The punctuality of acquitting theſe obligations is eſſential to commerce; and no ſooner is a merchant's accepted bill proteſted, than he is conſidered as a bankrupt. For this reaſon, the laws of moſt nations have given very extraordinary privileges to bills of exchange. The ſecurity of trade is eſſential to every ſociety; and were the claims of merchants to linger under the formalities of courts of law when liquidated by bills of exchange, faith, confidence, and punctuality, would quickly diſappear, and the great engine of commerce would be totally deſtroyed.

Exchange is not to be looked on as a loan, from which it differs; becauſe in the one, the riſque, or danger, lies on the perſon who borrows; and in the other, on him who lends. It likewiſe differs from intereſt, becauſe exchange is not paid in proportion to the time as intereſt is. Exchange is alſo uſed in divers places for the profit allowed for exchanging one ſort, or ſpecies of money for another. This is particularly called *ſmall exchange, natural exchange, pure exchange, &c.*

The coin of every ſtate has, beſides this, a relative value as it is compared with the money of other countries. This relative value is eſtabliſhed by the exchange, and greatly depends on its poſitive value. It is fixed by the current courſe of commerce, and by the general opinion and conſent of merchants, but never by the decrees of the prince, becauſe it is liable to inceſſant variations, depending on the accidental circumſtances of trade, the money tranſactions between nations, and the ſtate of public credit, &c. The ſeveral nations, in fixing the relative value of exchange, are chiefly guided by that which poſſeſſes the greateſt quantity of ſpecie. If ſhe has as much ſpecie as all others together, it is then moſt proper for the others to regulate their's by her ſtandard; and this regulation between all the others, will nearly agree with the regulation made with this principal nation. The relative abundance or ſcarcity of ſpecie in different countries, forms, what is called, the courſe of exchange; and this plenty or ſcarcity, on which the mutability of the courſe of exchange depends, is not real but relative: e. gr. when France has greater occaſion for funds in Holland than the Dutch of having funds in France, ſpecie is ſaid to be common in France, and ſcarce in Holland; and *vice verſa*. We may obſerve, in general, that there is much ſpecie in a place, when there is more ſpecie than paper; there is little, when there is more paper than ſpecie; and in order to judge of the ſcarcity or plenty of ſpecie, we muſt know, for example, that if there are more bills from Holland than there are from France, then ſpecie is ſcarce in France, and common in Holland; and therefore it becomes neceſſary that the exchange ſhould riſe, and the Dutch give more for ſpecie of the ſame value in France, than the French for that of an equivalent value in Holland. When money of the ſame ſtandard and weight in France yields money of the ſame ſtandard and weight in Holland, the exchange is then ſaid to be at par.

When the exchange is below par between one country and another, the former loſes as debtor and buyer, and gains as creditor and ſeller. Thus if France owes Holland a certain number of gros, the more of theſe there are in a crown, the more crowns ſhe has to pay; and as there muſt be the ſame number of gros to buy the ſame quantity of merchandiſe, while the exchange is low, every French crown is worth fewer gros. On the contrary, if France is creditor for a certain number of gros, the leſs of them there are in a crown, the more crowns ſhe will receive; and if France ſells her merchandiſe in Holland for a certain number of gros, the more crowns will ſhe receive, in proportion as each crown contains fewer of theſe gros. The ſame reaſoning will apply, *mutatis mutandis*, to the commercial intercourſe of other countries, and to any par of exchange. It is evident, that a merchant may ſend his ſtock into a foreign country, when the exchange is below par, without injuring his fortune; becauſe when it returns, he recovers what he had loſt; but a prince, who ſends only ſpecie into a foreign country, which can never return, is always a loſer. When merchants have great dealings in any country, the exchange there infallibly riſes, on account of their numerous engagements, buying great quantities of merchandiſe, and drawing on foreign countries to pay for them. The arbitration of exchanges is an article of great importance in the diſcuſſion of this ſubject; this is a kind of truck, which two bankers or merchants mutually make of their bills upon different parts, at a conditional price and courſe of exchange. When the courſe of exchange riſes above par, the places where it riſes may conclude for certain, that the balance of trade runs againſt them. The truth of this will appear if we ſuppoſe Britain to import from any foreign place, goods to the value of 100,000*l.* at par, and export only to the value of 80,000. In this caſe, bills on the ſaid foreign place, will be ſcarce in Britain, and conſequently will riſe in value; and after the 80,000 is paid, bills muſt be procured from other places, at a high rate, to pay the remainder, ſo that perhaps 120,000*l.* may be paid for bills to diſcharge a debt of 100,000*l.* Though the courſe of exchange be in a perpetual flux, and riſes or falls according to the circumſtances of trade, yet the exchanges of London, Holland, Hamburgh, and Venice, in a great meaſure, regulate thoſe of all other places in Europe.

In order to underſtand this branch of commerce, it is neceſſary to know how to reduce the ſterling money of England into the foreign monies of exchange and of account of all places through Europe, according to the direct courſes of exchange eſtabliſhed for theſe purpoſes, and *vice verſâ*; and alſo thoſe of other places, with which England has no direct eſtabliſhed courſes of exchange, but is under the neceſſity of making uſe of the intermediate changes of other places. The nature of the agios, and the manner of converting bank monies into current, and the reverſe, ſhould likewiſe be well underſtood. The method of reducing the foreign monies of Europe into thoſe of every other diſtant country, according to the direct or intermediate exchange, ſhould be thoroughly known; beſides, it is neceſſary to know the intrinſic value of foreign monies, according to the moſt accurate aſſays that have been made for that purpoſe; and alſo the general natural cauſes of the riſe and fall of the courſes of exchange between one nation or one city, and another; which depend on the balance of trade being either in favour of or againſt ſuch trading nation or city. By an accurate obſervation and compariſon of the courſes of exchange between various countries and cities, the merchant will have an opportunity of profit, which ſhould not eſcape his cognizance. He will find that they ſeldom ebb and flow in an exact equality of proportion, ſince the balance of trade differs between different nations. The greateſt profit may be made by ſeizing the opportunity of drawing and remitting to certain places preferably to others. Farther, when the exchange is lower than the ſpecie of a country, a profit may be made by ſending it abroad; when it is higher, there is a profit in cauſing it to return; but there is a caſe in which profit may be made, by ſending the ſpecie out of the kingdom, when the exchange is at par; that is, by ſending it into a foreign country, to be received; when it returns, an advantage may be made of it, whether it be circulated in the country, or paid for foreign bills. See farther on this ſubject, Poſt. Dict. Com. articles *Arbitration* and *Exchange*.

Exchange alſo denotes a public place, in moſt conſiderable cities, wherein the merchants, negociants, agents, bankers, brokers, interpreters, and other perſons concerned in commerce, meet, on certain days, and at certain times thereof; to confer, and treat together of matters relating to exchanges, remittances, payments, adventures, aſſurances, freightments, and other mercantile negociations, both by land and ſea. In Flanders, Holland, and ſeveral cities of France, theſe places are called *burſes*; at Paris and Lyons, *places de change*; and in the Hanſe towns, *colleges of merchants*. Theſe aſſemblies are held with ſo much exactneſs, and merchants and negociants are ſo indiſpenſably required to attend at them, that a perſon's abſence alone makes him be ſuſpected of a failure or bankruptcy. The moſt conſiderable exchanges in Europe, are that of Amſterdam; and that of London, called the Royal Exchange. For an account of the latter, ſee Royal Exchange.

Even in the time of the ancient Romans there were places for the merchants to meet, in moſt of the conſiderable cities of the empire. That ſaid by ſome to have been built at Rome in the year of the city 259, 493 years before our Saviour, under the conſulate of Appius Claudius and Publius Servilius, was called *collegium mercatorum*; whereof it is pretended there are ſtill ſome remains, called by the modern Romans *logia*, the *lodge*: and now, uſually, the *place of St. George*.

Exchange, in law, is a mutual grant of equal intereſt in lands or tenements, the one in exchange for the other; and in our common law it more particularly denotes the compenſation which the warrantor muſt make the warrantee, value for value, if the land warranted be recovered from the warrantee.

Exchange, *the King's*, is the place appointed by the king for exchange of plate, or bullion for the king's coin. Theſe places have formerly been numerous; but now there is only one, viz. that of the Tower of London, joined with the *Mint*.

Exchange *Brokers*, are perſons who make it their buſineſs to know the alteration of the courſe of exchange, to inform merchants how it goes, and to notify to thoſe who have money to receive or pay beyond ſea, who are proper perſons for executing their orders.

Exchangers, are thoſe who return money beyond ſea, by bills of exchange, &c. called anciently alſo *excambiators*, and ſince *remitters*.

EXCHEQUER, or ſimply *Chequer*, originally denotes a cheſsboard; or a frame divided into ſixty-four ſquares, of two colours, whereon to play at draughts, cheſs, &c.

Exchequer, is more particularly uſed for a chamber, or apartment, in Weſtminſter-hall, conſiſting of two parts; the court of exchequer and the lower exchequer. See Court *of Exchequer*.

Exchequer *Bills*, are a ſpecies of paper firſt eſtabliſhed by Mr. Montague, in 1696, to ſupply the want of circulating caſh, during the re-coinage at that period. They were then taken at the exchequer for all payment of the revenue, and, when re-iſſued, they were allowed 7*l.* 12*s.* *per cent.* intereſt. They have ſince been iſſued yearly; and the bank of England, ever ſince the year 1706, have been the contractors for their circulation, at a certain premium. The commiſſioners of the treaſury are empowered, by various ſtatutes, to borrow money, within a ſpecific ſum, limited by thoſe ſtatutes, by iſſuing exchequer bills on the credit of certain duties; which bills, by 12 Anne, cap. 11 & 12. Geo. I. cap. 11. bear an intereſt of 2*d.* a day per cent. payable to the bearers. Theſe bills are numbered arithmetically, and regiſtered accordingly, ſo that the principal ſums may be paid off in courſe, and the intereſt ſhall be payable every three months. The ſaid exchequer bills ſhall be current to all receivers and collectors of the cuſtoms, exciſe, or any revenue, and at the receipt of the exchequer; and as any of them are paid or lent into the exchequer, the officers there ſhall cauſe tallies to be levied and delivered to the payers or lenders, as if they had made ſuch payments or loans in ſpecie. If any exchequer bills be loſt, upon affidavit before a baron of the exchequer, and certificate from him, and ſecurity given to pay the ſame if found, duplicates are to be made out; and when bills are defaced, new ones ſhall be delivered. Forging of theſe bills, or of the endorſements on them, is felony.

Black Book of the EXCHEQUER, is a book under the keeping of the two chamberlains of the exchequer; ſaid to have been compoſed in 1175, by Gervais of Tilbury, nephew of king Henry II. and divided into ſeveral chapters. Herein is contained a deſcription of the court of England, as it then ſtood, its officers, their ranks, privileges, wages, perquiſites, power, and juriſdiction; and the revenues of the crown, both in money, grain, and cattle. Here we find, that for one ſhilling, as much bread might be bought as would ſerve a hundred men a whole day; that the price of a fat bullock was only twelve ſhillings, and a ſheep, four, &c.

EXCISE, (from the Belgic *accüſſe, tributum*, tribute,) an inland duty or impoſition, paid ſometimes upon the conſumption of the commodity, or frequently upon the wholeſale, which is the laſt ſtage before the conſumption. This is doubtleſs, impartially ſpeaking, the moſt œconomical way of taxing the ſubject; the charges of levying, collecting, and managing the exciſe-duties, being conſiderably leſs in proportion, than in other branches of the revenue. It alſo renders the commodity cheaper to the conſumer, than charging it with cuſtoms to the ſame amount would do; for the reaſon juſt now given, becauſe generally paid in a much later ſtage of it. But, at the ſame time, the rigour and arbitrary proceedings of exciſe-laws, ſeems hardly compatible with the temper of a free nation. For the frauds that might be committed in this branch of the revenue, unleſs a ſtrict watch is kept, make it neceſſary, wherever it is eſtabliſhed, to give the officers a power of entering and ſearching the houſes of ſuch as deal in exciſeable commodities, at any hour of the day, and, in many caſes, of the night likewiſe. And the proceedings, in caſe of tranſgreſſions, are ſo ſummary and ſudden, that a man may be convicted in two days time in the penalty of many thouſand pounds, by two commiſſioners or juſtices of the peace; to the total excluſion of the trial by jury, and diſregard of the common law. For which reaſon, though lord Clarendon tells us, that to his knowledge the earl of Bedford (who was made lord treaſurer by king Charles I. to oblige his parliament) intended to have ſet up the exciſe in England, yet it never made a part of that unfortunate prince's revenue; being firſt introduced, on the model of the Dutch prototype, by the parliament itſelf after its rupture with the crown. Yet ſuch was the opinion of its general unpopularity, that when in 1642 "aſperſions were caſt by malignant perſons upon the houſe of commons, that they intended to introduce exciſes, the houſe for its vindication therein did declare, that theſe rumours were falſe and ſcandalous, and that their authors ſhould be apprehended and brought to condign puniſhment." Its original eſtabliſhment was in 1643, and its progreſs was gradual; being at firſt laid upon thoſe perſons and commodities where it was ſuppoſed the hardſhip would be leaſt perceivable, viz. the makers and venders of beer, ale, cyder, and perry; and the royaliſts of Oxford ſoon followed the example of their brethren at Weſtminſter, by impoſing a ſimilar duty; both ſides proteſting, that it ſhould be continued no longer than to the end of the war, and then be utterly aboliſhed. But the parliament at Weſtminſter ſoon after impoſed it on fleſh, wine, tobacco, ſugar, and ſuch a multitude of other commodities, that it might be fairly denominated general; in purſuance of the plan laid down by Mr. Pymme (who ſeems to have been the father of the exciſe) in his letter to Sir John Hotham ſignifying, "that they had proceeded in the exciſe to many particulars, and intended to go on farther; but that it would be neceſſary to uſe the people to it by little and little." And afterwards, when the nation had been accuſtomed to it for a ſeries of years, the ſucceeding champions of liberty boldly and openly declared "the impoſt of exciſe to be the moſt eaſy and indifferent levy that could be laid upon the people:" and accordingly continued it during the whole uſurpation. Upon king Charles's return, it having then been long eſtabliſhed and its produce well known, ſome part of it was given to the crown, in 12 Car. II. by way of purchaſe for the feodal tenures and other oppreſſive parts of the hereditary revenue. But, from its firſt original to the preſent time, its very name has been odious to the people. It has, nevertheleſs, been impoſed on abundance of other commodities in the reigns of king William III. and every ſucceeding prince, to ſupport the enormous expences occaſioned by our wars on the continent. The articles of exciſe are now become ſo numerous that it would be tedious to recapitulate them; in fact they amount to a liſt, which no friend to his country would wiſh to ſee farther encreaſed.

The exciſe was formerly farmed out; but is now managed for the king by commiſſioners in both kingdoms, who receive the whole product of the exciſe, and pay it into the exchequer. Theſe commiſſioners are nine in number in England, and four in Scotland. The former have a ſalary of 1000*l.* a year, the latter 500*l.* They are obliged by oath to take no fee or reward but from the king himſelf; and from them there lies an appeal to five other commiſſioners called commiſſioners of appeals. Complaints made at the chief office of exciſe are to be heard by three or more commmiſſioners; but two juſtices of the peace have the power to determine in ſeizures out of the limits of the exciſe-office in London See further, Table to the quarto edition of the Statutes at Large; alſo an account of the method of charging the duties of exciſe, &c. at the end of Gilb. Exch. edit. 1758, p. 293.

EXCISION, in ſurgery, the cutting out, or cutting off any part of the body.

EXCLAMATION, in rhetoric, a figure, wherein, by raiſing the voice, and uſing an interjection either expreſly or underſtood, we teſtify an uncommon warmth, and paſſion of mind; and expreſs the magnitude of the thing, or the importance of the occaſion. Such is, O heavens! O earth! &c. ſuch alſo is that of Cicero againſt Cataline: O times! O manners! this the ſenate knows, the conſul ſees—and yet he lives! Lives, ſaid I? nay, and comes into the ſenate! In Engliſh, the interjections O! or oh! alas! or good God! are generally adjoined in an exclamation.

EXCLUSION, the act whereby a perſon or thing is excluded, i. e. ſhut out, or ſet aſide. A crown imports an excluſion from the papacy: he appointed a ſtranger his heir, in excluſion of his own relations. Great efforts were made towards the cloſe of the reign of king Charles II. to procure a bill of excluſion, for ſetting aſide the Duke of York, the king's brother, on account of his being a papiſt.

EXCLUSIVE, is ſometimes uſed adjectively, for the force, or power, of excluding: as, a patent carries with it an excluſive privilege. Sometimes it is alſo uſed adverbially: as, he ſent him all the gazettes, from N° 195, to N° 300, excluſive; i. e. all between thoſe two numbers, which themſelves were excepted.

EXCOMMUNICATION, an anathema, or eccleſiaſtical cenſure, and puniſhment; whereby a heretic is cut off from the ſociety of the faithful, or an obſtinate ſinner from the communion of the church, and the participation of the ſacraments. This cenſure of excommunication was originally inſtituted for preſerving the purity of the church; but ambitious eccleſiaſtics converted it by degrees into an engine for promoting their own power, and inflicted it on the moſt frivolous occaſions.

The power of excommunication properly belongs to the biſhop; but he may delegate it to any prieſt, with the chancellor. Excommunication is either major or minor, i. e. greater or leſs; the firſt, which is that underſtood when we ſay, ſimply, excommunication, ſeparates, or cuts off, the delinquent from all communion and fellowſhip with other Chriſtians; diſables him from defending his rights, bringing an action at law, being a witneſs, &c. The ſecond, or leſſer, only excludes from the communion of the Lord's ſupper.

In Spain, to this day, a perſon who is not abſolved from his excommunication in a year's time, is deemed a heretic. But, afterwards, the occaſions of excommunications growing more frequent, they began to uſe it with leſs circumſpection and reſervedneſs. In the ninth century, the eccleſiaſtics were continually making uſe of this ſpiritual weapon, to repel any violences, or affronts, offered them; and time and familiarity rendering offenders more and more obdurate, they proceeded, by degrees, to rigours unknown to antiquity, as the excommunicating of whole families, or provinces; prohibiting the exerciſe of all religion therein; and even accompanying the excommunication with horrible ceremonies, and direful imprecations.

In the tenth and eleventh centuries, the ſeverity againſt the excommunicated was carried to its higheſt pitch: no-body might come near them, not even their own wives, children, or ſervants; they forfeited all their natural and legal rights and privileges, and were excluded from all kinds of offices. Thus was an excommunicated king reduced to the condition of a private man. By thus ſtretching the power of the church to extravagance, they rendered it contemptible. Gregory VII. tempered it a little; exempting the wives and children of excommunicated perſons from incurring excommunication, by holding converſation with their huſbands and parents.

To render the excommunicated ſtill more odious, the prieſt was obliged to ſtop, and break off divine ſervice, if an excommunicated perſon entered the church; nothing of which averſion is any were diſcovered in the practice of the primitive church. At preſent we have but little of the terror or reſpect of our forefathers for excommunication; and it is even judged, and proclaimed, an abuſe, whenever impertinently employed.

The form of excommunication in the Romiſh church, as related by Feverct, is to take lighted torches, throw them on the ground with curſes and anathemas, and trample them out underfoot to the ringing of the bells. We have now none of this folly; the ſentence is gravely read, and the perſon remains excommunicated without farther ceremony. See the form of excommunication of the Engliſh church in Concilia M. Brit. & Hib. vol. iv. p. 663, &c.

The power of excommunicating was lodged in the whole church in general; that is, the biſhops and prieſts had the adminiſtration thereof, by and with the conſent of the people; which was practiſed even in St. Cyprian's time. But afterwards they ceaſed to conſult the people about the matter: the biſhop and clergy arrogated the whole power to themſelves. Recourſe, however, might ſtill be had to a ſynod of the province, to judge of the validity of an excommunication.

EXCOMMUNICATION was alſo practiſed among the Jews, who uſed to expel from their ſynagogue ſuch as had committed any grievous crime. See the Goſpel according to St. John ix. 22. xii. 42. xvi. 2. The Eſſeni, when excommunicated, durſt not ſo much as receive food at any perſons hands, for fear of violating their oath, but contented themſelves to live on herbs; inſomuch that they frequently periſhed, and died for want. See Maynard's Tranſlation of Joſephus—Wars of the Jews—Book 2. Chap. 7.

EXCOMMUNICATION, or a being ſecluded, or cut off from a participation in the myſteries of religion, was alſo in uſe under paganiſm. Such as were thus excommunicated were forbidden to aſſiſt or attend at the ſacrifices, or to enter within the temples; and were afterwards delivered over to the demons and furies of hell, with certain imprecations; which was called among the Romans, *diris devovere*. The Druids among the ancient Britons and Gauls, likewiſe, made uſe of excommunication againſt rebels; and interdicted the communion of their myſteries to ſuch as refuſed to acquieſce in their deciſions.

EXCORIATION, in medicine and ſurgery, the galling or rubbing off of the cuticle; eſpecially of the parts between the thighs, or about the anus. In adults, it is occaſioned by riding, much walking, or other vehement exerciſe, and may be cured by vulnerary applications. In children, there is often an excoriation of the parts near the pudenda, chiefly of the groin and ſcrotum, but likewiſe in the wrinkles of the neck, under the arms, and in other places, proceeding from the acrimony of the urine and ſweat, and occaſioning itching pains, crying, watching, and reſtleſſneſs. We alſo ſay, an excoriation in the throat, &c. when the membrane that covers it, or lines it, is torn by the acrimony of a humour, a medicine, or the like; which is ordinarily the caſe in what we call a ſore throat.

EXCORTICATION, the act of ſtripping off the cortex, or bark, from any thing; called alſo Decortication.

EXCREMENT, that which is evacuated, or excreted, out of the body of an animal, after digeſtion; being what in other reſpects is ſuperfluous and prejudicial thereto.

Excrement is all that matter taken in by way of food, which cannot be aſſimilated; and which, of conſequence, not growing or adhering to the body, wanders about through the laxer, and more patent parts thereof, till it be ejected. The urine and fæces, or fæcal matter, are the great excrements, expelled from the bladder, and the inteſtines, by ſtool, &c. The matter of inſenſible perſpiration is alſo an excrement, and a more conſiderable one than either of the others. Among excrements are likewiſe ordinarily ranked ſeveral humours and matters, ſeparated from the blood by the ſeveral ſtrainers, or emunctories of the body, though far from being uſeleſs, but ſerving valuable purpoſes of the animal œconomy. Such are the cerumen, or ear-wax; the mucus of the noſe: lachrymæ, or tears; ſaliva, bile, lympha, menſes, lochia, &c.

Unleſs the excretions are regular, health cannot be maintained; and therefore if they are too plentiful, defective, or ſuppreſſed, they will occaſion various diſorders. Hence if a perſon be coſtive, it is generally the forerunner of ſome diſeaſe. As a man generally takes more aliment than is neceſſary to generate blood and ſerum, and common excretions are not ſufficient to carry off ſuperfluous humours, extraordinary ones ſometimes happen at ſtated times; as the piles, hæmorrhages, &c.

EXCREMENT is alſo attributed, by way of analogy, to plants. Thus gums, diverſe juices, balms, &c. iſſuing ſpontaneouſly from their reſpective trees, are ſometimes called excrements.

EXCRESENCE, in ſurgery, denotes ſuperfluous, or luxurious fleſh, or other matter, growing on certain parts of the bodies of animals, contrary to, or beyond the ordinary ſtructure, and diſpoſition of nature. The word is formed of the Latin *ex*, and *creſco, I grow*; q. d. ſomething that grows from, or out of another. Such are wens, warts, ficuſes, polypuſes, &c. Natural, or cuſtomary excreſences, as thoſe of bones, &c. are called by phyſicians apophyſes.

EXCRETION, formed of *excernere, to ſeparate*, in medicine, the act of expelling or ejecting out of the body ſome humour that is uſeleſs, or even hurtful thereto. Moſt criſes are effected by excretion; as fluxes of blood and urine, ſweat, vomitings, looſeneſſes, &c.

EXCRETORY, in anatomy, is applied to certain little ducts, or veſſels, in the fabric of the glands. Excretory ducts are tubes through which the humours ſeparated in the ſeveral glands, are emitted, or diſcharged out of the gland, into ſome convenient receptacle, or emunctory. A capillary artery, to which a capillary vein is joined, with an excretory duct, convolved, or wound together, make up the body of the glands, the organs of ſecretion. The excretory ducts, ſpring from the extremities of the arteries and veins, and carry off a liquor ſeparated from the blood. The lymphatic glands have either lymphæducts for their excretory ducts, or lacteal veſſels, as in the meſentery. See Syſtem of ANATOMY, Part I. Sect. VI.

EXECRATION, *Execratio*, among the ancients, a kind of puniſhment, conſiſting of direful curſes and marks of infamy. Livy relates an inſtance of it, which was uſed againſt Philip, king of Macedon, by the Athenians. A general aſſembly of the people being called, they made a decree, that all the ſtatues and images of that king, and of all his anceſtors, both of the male and female ſex, ſhould be demoliſhed, and their very names raſed; that all the feſtivals, ſacred rites, prieſts, and whatever elſe had been inſtituted in honour of him, ſhould be profaned; that the very places where there had been any monument or inſcription to his honour, ſhould be deteſtable, and that nothing ſhould be ſet up, or dedicated in them, which could be done in clean places; and, laſtly, that the public prieſts, as often as they prayed for the Athenian people, allies, armies, and fleets, ſhould as many times deteſt and execrate Philip, his children, kingdom, land and ſea forces, and the whole race and name of the Macedonians.

EXECUTION, the act of executing, i. e. of accompliſhing, finiſhing, or atchieving any thing, to be done. We ſay, the execution of a teſtament; of a law; of a treaty; of a building, or the like.

EXECUTION, in common law, ſignifies the laſt performance of an act; as of a writ, a judgment, or the like.

EXECUTION *of a Judgment*, is the obtaining the poſſeſſion of any thing recovered by judgment of law. There are two ſorts of executions; one final, another with a quouſque, as only tending to an end.

Final EXECUTION, is that which maketh money of the defendant's goods, or extendeth his lands, and delivers them to the plaintiff; for this the party accepts in ſatisfaction; and this is the end of the ſuit, and all that the king's writ commands to be done.

EXECUTION *with a Quouſque*, is that which only tends to an end; as in the caſe of a *capias ad ſatisfaciendum*, &c. This is not final; but the body of the party is to be taken, to the intent and purpoſe to ſatisfy the plaintiff; and his impriſonment is not abſolute, but till he doth ſatisfy; ſo that the body is but a pledge for the debt.

Executions are either in perſonal, real, or mixed actions. In a perſonal action, the execution may be made three ways, viz. by the writ of *capias ad ſatisfaciendum*, againſt the body of the defendant; *fieri facias*, againſt his goods; or *elegit*, againſt his lands. In a real and mixed action, the execution is by writ of *habere facias ſeiſinam, and habere facias poſſeſſionem.*

Military EXECUTION is the pillage or plundering of a country by the enemies army.

Military EXECUTION, alſo denotes every kind of puniſhment inflicted on an army by ſentence of a court martial. This is of various kinds; as tying up to three halberts, and receiving a number of laſhes with a whip, compoſed of nine cord laſhes, and each laſh of nine knots, from the drummer. When a ſoldier is to be puniſhed with death, a detachment of about two hundred men from the regiment to which he belongs forms the parade, and a file of grenadiers ſhoots the priſoner to death.

EXECUTION, in criminal caſes, the completion of human puniſhment. This follows judgment, and muſt in all caſes, capital as well as otherwiſe, be performed by a legal officer, the ſheriff or his deputy; whoſe warrant for ſo doing was anciently by precept under the hand and ſeal of a judge, as it is ſtill practiſed in the court of the lord high ſteward, upon the execution of a peer: though, in the court of the peers in parliament, it is done by writ from the king. Afterwards it was eſtabliſhed, that, in caſe of life, the judge may command execution to be done without any writ. And now the uſage is, for the judge to ſign the calendar or liſt of all the priſoners names, with their ſeparate judgments in the margin, which is left with the ſheriff. As, for a capital felony, it is written oppoſite to the priſoner's name, " let him be hanged by the neck;" formerly, in the days of Latin abbreviation, "*Juſ. per coll.*" for "*Juſpendatur per collum.*" And this is the only warrant that the ſheriff has, for ſo material an act as taking away the life of another. It may certainly afford matter of ſpeculation, that in civil cauſes there ſhould be ſuch a variety of writs of execution to recover a trifling debt, iſſued in the king's name, and under the ſeal of the court, without which the ſheriff cannot legally ſtir one ſtep; and yet that the execution of a man, the moſt important and terrible taſk of any, ſhould depend upon a marginal note.

The ſheriff, upon receipt of his warrant, is to do execution within a convenient time; which in the country is alſo left at large. In London, indeed, a more ſolemn and becoming exactneſs is uſed, both as to the warrant of execution, and the time of executing thereof: for the recorder, after reporting to the king in perſon the caſe of the ſeveral priſoners, and receiving his royal pleaſure, that the law muſt take its courſe, iſſues his warrant to the ſheriffs, directing them to do execution on the day and at the place aſſigned. And in the court of king's bench, if the priſoner be tried at the bar, or brought there by *habeas corpus*, a rule is made for his execution; either ſpecifying the time and place, or leaving it to the diſcretion of the ſheriff. And, throughout the kingdom, by ſtatute 25 Geo. II. c. 37. it is enacted that, in caſe of murder, the judge ſhall in his ſentence direct execution to be performed on the next day but one after ſentence paſſed. But, otherwiſe, the time and place of execution are by law no part of the judgment. It has been well obſerved, that it is of great importance, that the puniſhment ſhould follow the crime as early as poſſible; that the proſpect of gratification or advantage, which tempts a man to commit the crime, ſhould inſtantly awake the attendant idea of puniſhment. Delay of execution ſerves only to ſeparate theſe ideas: and then the execution itſelf affects the minds of the ſpectators rather as a terrible ſight, than as the neceſſary conſequence of tranſgreſſion.

The ſheriff cannot alter the manner of the execution, by ſubſtituting one death for another, without being guilty of felony himſelf. It is held alſo by Sir Edward Coke and Sir Matthew Hale, that even the king cannot change the puniſhment of the law, by altering the hanging or burning into beheading; though, when beheading is part of the ſentence, the king may remit the reſt. And notwithſtanding ſome examples to the contrary, Sir Edward Coke ſtrongly maintains, that *judicandum eſt legibus, non exemplis*. But others have thought, and more juſtly, that this prerogative, being founded in mercy, and immemorially exerciſed by the crown, is part of the common law. For hitherto, in every inſtance, all theſe exchanges have been for more merciful kinds of death; and how far this may alſo fall within the king's power of granting conditional pardons, (viz. by remitting a ſevere kind of death, on condition that the criminal ſubmits to a milder) is a matter that may bear conſideration. It is obſervable, that when Lord Stafford was executed for the popiſh plot in the reign of king Charles II. the then ſheriffs of London, having received the king's writ for beheading him, petitioned the houſe of lords, for a command or order from their lordſhips, how the ſaid judgment ſhould be executed: for, he being proſecuted by impeachment, they entertained a notion (which is ſaid to have been countenanced by Lord Ruſſel), that the king could not pardon any part of the ſentence. The lords reſolved, that the ſcruples of the ſheriffs were unneceſſary; and declared, that the king's writ ought to be obeyed. Diſappointed of raiſing a flame in that aſſembly, they immediately ſignified to the houſe of commons by one of the members, that they were not ſatisfied as to the power of the ſaid writ. That houſe took two days to conſider of it; and then ſullenly reſolved, that the houſe was content that the ſheriff do execute Lord Stafford by ſevering his head from his body. It is farther related, that when afterwards the ſame Lord Ruſſel was condemned for high treaſon upon indictment, the king, while he remitted the ignominious part of the ſentence, obſerved, "that his Lordſhip would now find he was poſſeſſed of that prerogative, which in the caſe of Lord Stafford he had denied him." One can hardly determine (at this diſtance from thoſe turbulent times), which moſt to diſapprove of, the indecent and ſanguinary zeal of the ſubject, or the cool and cruel ſarcaſm of the ſovereign,

To conclude: it is clear, that if, upon judgment to be hanged by the neck till he is dead, the criminal be not thoroughly killed, but revives, the ſheriff muſt hang him again. For the former hanging was no execution of the ſentence; and, if a falſe tenderneſs were to be indulged in ſuch caſes, a multitude of colluſions might enſue. Nay, even while abjurations were in force, ſuch a criminal, ſo reviving, was not allowed to take ſanctuary and abjure the realm; but his fleeing to ſanctuary was held an eſcape in the officer.

EXECUTIVE *Power*, ſupreme, is by the conſtitution of theſe kingdoms lodged in a ſingle perſon, the king or queen, for the time being.

EXECUTOR, a perſon nominated by a teſtator, to take care to ſee his will and teſtament executed or performed, and his effects diſpoſed of according to the tenor of the will. The appointment of an executor, either by expreſs words, or by ſuch as ſtrongly imply the ſame, is eſſential to the making of a will; but if the teſtator names no executors, or names incapable perſons, or if the executors that are named refuſe to act, the ordinary muſt grant letters of adminiſtration.

A perſon appointed to be executor is not compellable to execute the will; he may refuſe the charge, before he has adminiſtered as executor, or performed ſuch acts, as paying debts due by the teſtator, or receiving debts due to him, or giving acquittances for the ſame; but if he meddles with the goods of the teſtator, as executor, his ſubſequent refuſal is void, and he ſhall be charged as executor. A perſon to whom a legacy is left may be compelled either to ſtand the executorſhip, or to reſign his legacy. The refuſal of executorſhip muſt be entered and recorded in court. If ſeveral executors are named in a will, and ſome of them refuſe, and others prove the will, they who refuſe may afterwards adminiſter and act; and they muſt be joined in all ſuits, where the co-executors are plaintiffs; but not where they are defendants, becauſe the plaintiff in the action is not bound by law to take notice of any beſides thoſe who have proved the will.

As to the office or duty of an executor, it is to be obſerved that he may do many things before he proves the will, which an adminiſtrator cannot do; becauſe the former derives his power from the will, and not from the probate, or appointment of the ordinary, as the latter does. He may maintain actions of treſpaſs, replevin, or detinue, releaſe an action, aſſent to a legacy, be ſued, alien, or otherwiſe intermeddle with the goods of the teſtator: by adminiſtrating, the executor is entitled to receive all debts due to the teſtator, and all payments made to him are good, though he ſhould die, and never prove the will; but he cannot maintain a ſuit or action of debt, or the like, before he has proved the will. The ordinary, &c. may cite the executor, either to prove the will, or refuſe the office; and he may ſequeſter the goods of the deceaſed, till the executor has proved it; and if he does not appear on the proceſs, the ordinary may excommunicate him. On the other hand, the ordinary is compelled by mandamus to proceed to probate, when the will is not controverted. The executor muſt bury the deceaſed in a manner ſuitable to the eſtate he leaves behind him; neceſſary funeral expences are allowed, previous to all other debts and charges; but if he be extravagant, he is chargeable with devaſtation, or waſte of the ſubſtance of the deceaſed, which ſhall be only prejudicial to himſelf, and not to the creditors or legatees of the deceaſed. He is then to make an inventory of all the goods and chattles, whether in poſſeſſion or action of the deceaſed, which he is to deliver in to the ordinary upon oath, if lawfully required, at the time of probate. He is then to collect all the goods and chattels ſo inventoried; for which purpoſe the law confers on him ample powers, as the repreſentative of the deceaſed; and having the ſame property in his goods as the principal had when living, and the ſame remedies to recover them; and if there be two or more executors, a ſale or releaſe by one of them ſhall be good againſt all the reſt. The executor muſt in the next place pay the debts of the deceaſed, in the order of their priority.

If no ſuit is commenced againſt him, the executor may pay any one creditor in equal degree his whole debt, though he has nothing left for the reſt; for, without a ſuit commenced, the executor has no legal notice of the debt. After the debts, the executor is to pay the legacies, which he is to pay as far as his aſſets will extend; but he may not give himſelf the preference herein, as in the caſe of debts. In caſe of a deficiency of aſſets all the general legacies muſt abate proportionably, in order to pay the debts; but a ſpecific legacy, as of a piece of plate, houſe, &c. is not to abate at all, unleſs there be not ſufficient without it. If the legatees have been paid their legacies, and debts come in more than enough to exhauſt the reſiduum, they are afterward bound to refund a ratable part.

When all the debts and legacies are diſcharged, the ſurplus or reſiduum muſt be paid to the reſiduary legatee, if any be appointed by the will; if there be none, it was formerly underſtood to belong to the executor; but it ſeems to be now the general opinion, that, if there be an expreſs legacy given to an executor, and no deviſe of the ſurplus, ſuch ſurplus ſhall not go to the executor, but be diſpoſed to the next of kin, according to the ſtatute of diſtributions; the executor ſtanding on the ſame footing as an adminiſtrator.

Where no expreſs legacy is given to the executor, the ſurplus ſhall go to the executor, if not otherwiſe diſpoſed of by will. When there are ſeveral executors, and ſome of them are dead, the legatory muſt ſue the ſurviving executors, and not the executors or adminiſtrators of thoſe that are dead. And if all the executors are dead, he muſt ſue the executors or adminiſtrators of thoſe that died laſt, and not thoſe of the reſt.

EXECUTORY, that which has, or carries with it a ſufficient authority for being executed. A contract is only executory, when it is in form, and ſealed: the great ſeal of England is executory throughout the whole iſland.

EXEMPLAR, a model, or original, to be imitated, or copied. Exemplar alſo denotes the idea, or image, conceived, or formed in the mind of the artiſt, whereby he conducts his work. Such is the idea of Cæſar, which a painter has in his mind when he goes to make a picture of Cæſar.

EXEMPLIFICATION *of Letters Patent*, denotes an exemplar, or copy of letters patent, made from the inrollment thereof, and ſealed with the great ſeal of England. Such exemplifications are as effectual to be ſhewed, or pleaded, as the letters patent themſelves.

EXEMPTION, a privilege, or diſpenſation, whereby a perſon is excepted out of ſome general rule.

Exemption, in law, denotes a privilege to be free from ſervice or appearance; thus knights, clergymen, &c. are exempted from appearing at the county courts by ſtatute, and peers from ſerving on inqueſts. Perſons ſeventy years of age, apothecaries, &c. are alſo exempted by law from ſerving on juries, and juſtices of peace, attornies, &c. from pariſh offices.

EXERCISE, a repetition of any operation for the ſtrengthening, or retaining of a habit. Thus we uſe exerciſe of the body for acquiring, or maintaining health; as it contributes both to the expulſion of the excrements, and preſerving the tone and ſpring of the ſolids. People who lead a ſedentary life, and do not uſe exerciſe, are liable to an univerſal relaxation of the ſolids, which brings on other diſorders, glandular obſtructions, weak nerves, and defect of perſpiration.

Exerciſe may be continued to a beginning of wearineſs, and ought to be uſed before dinner in a pure light air; for which reaſon, journeys, and going into the country, contribute greatly to preſerve and re-eſtabliſh health. Exerciſe increaſes the circulation of the blood, attenuates and divides the fluids, and promotes a regular perſpiration, as well as a due ſecretion of all the humours: for it accelerates the animal ſpirits, and facilitates their diſtributing into all the fibres of the body, ſtrengthens the parts, creates an appetite, and helps digeſtion. Whence it ariſes, that thoſe who accuſtom themſelves to exerciſe are generally very robuſt, and ſeldom ſubject to diſeaſes.

Boerhaave recommends bodily exerciſe in diſeaſes of a weak and lax fibre. By riding on horſeback, ſays his commentator, the pendulous viſcera of the abdomen are ſhaken every moment, and gently rubbed as it were one againſt another, while in the mean time the pure air acts on the lungs with greater force. But it is to be obſerved, that a weak man ſhould not ride with a full ſtomach, but either before dinner, or after the digeſtion is near finiſhed; for when the ſtomach is diſtended, weak people do not bear theſe concuſſions of the horſe without difficulty; but when the primæ viæ are near empty, the remaining feces are diſcharged by this concuſſion. Sailing in a ſhip is alſo an exerciſe of great uſe to weak people. If the veſſel moves with an even motion, by increaſing perſpiration it uſually excites a wonderful alacrity, creates an appetite, and promotes digeſtion. Theſe exerciſes are more eſpecially ſerviceable to weak people; but, in order to ſtrengthen the body by muſcular motion, running and bodily exerciſes are to be uſed. In theſe we ſhould begin with the moſt gentle, ſuch as walking, and increaſe it by degrees till we come to running. Thoſe exerciſes of the body are more eſpecially ſerviceable which give delight to the mind at the ſame time, as tennis, fencing, &c.; for which reaſon, the wiſdom of antiquity appointed rewards for thoſe who excelled in theſe gymnaſtic exerciſes, that by this means the bodies of their youth might be hardened for warlike toils.

As nothing is more conducive to health than moderate exerciſe, ſo violent exerciſe diſſipates the ſpirits, weakens the body, deſtroys the elaſticity of the fibres, and exhauſts the fluid parts of the blood. No wonder, then, that acute and mortal fevers often ariſe from too violent exerciſe of the body; for the motion of the venous blood towards the heart being quickened by the contraction of the muſcles, and the veins being thus depleted, the arteries more eaſily propel their contained humours through the ſmalleſt extremities into the now leſs reſiſting veins; and therefore the velocity of the circulation will be increaſed through all the veſſels. But this cannot be performed without applying the humours oftener, or in a greater quantity, to the ſecretory organs in the ſame time, whence the more fluid parts of the blood will be diſſipated, and what remains will be inſpiſſated; and by the greater action of the veſſels upon their contained fluids, and of the reacting fluids upon the veſſels, the blood acquires an inflammatory denſity. Add to this, that by the violent attrition of the ſolids and fluids, together with the heat thence ariſing, all the humours will incline to a greater acrimony, and the ſalts and oils of the blood will become more acrid and volatile. Hence, ſays Boerhaave, thoſe fevers which ariſe from too much exerciſe or motion, are cured by reſt of body and mind, with ſuch aliments and medicines as moiſten, dilute, and ſoften or allay acrimony.

Labour or exerciſe, Dr. Cheyne obſerves, is indiſpenſably neceſſary to preſerve the body any time in due plight. Let any diet be purſued, however adjuſted, both in quantity and quality; let whatever evacuations be uſed to leſſen the malady, or any ſuccedaneum be propoſed to prevent the ill effects, ſtill our bodies are ſo made, and the animal œconomy is ſo contrived, that, without due labour and exerciſe, the juices will thicken, the joints will ſtiffen, the nerves will relax; and, from theſe diſorders, chronical diſeaſes, and a crazy old age, muſt enſue. Eſſay on Health, p. 90.

Of all the exerciſes that are, or may be, uſed for health, as walking, riding on horſeback, or in a coach, fencing, dancing, bowling, digging, pumping, ringing, &c. walking is the moſt natural, and would be the moſt uſeful, if it did not ſpend too much of the ſpirits of the weakly. But riding is certainly the moſt manly, the moſt healthy, and is leſs laborious and expenſive of ſpirits than any.

It is generally ſaid that riding is a more healthful exerciſe than walking; which appears to be an aſſertion a little too general; for walking is much more effectual in promoting an increaſe of muſcular ſtrength, and in imparting to the fibres a due elaſticity, than riding. But where any of the viſcera are much obſtructed, and a patient is too weak to ſupport ſufficient walking exerciſe, in ſuch caſe riding may be more beneficial. Upon the whole, it may be ſaid, that walking is beſt for the preſervation of health, but riding for the relief of chronical diſtempers; for in thoſe which are acute, neither of them is adviſeable.

Thoſe organs of the body that are moſt uſed, always become ſtrongeſt; ſo that we may ſtrengthen any weak organ by exerciſe. Thus the legs, thighs, and feet of chairmen; the arms and hands of watermen; the backs and ſhoulders of porters, grow thick, ſtrong, and brawny, by time and uſe. It is certain, alſo, that ſpeaking ſtrong and loud will ſtrengthen the voice, and give force to the lungs. To the aſthmatic, therefore, and thoſe of weak lungs, I would recommend, ſays Dr. Cheyne, talking much and loud; walking up eaſy aſcents, &c. to thoſe of weak nerves, and digeſtion, riding on horſeback; to thoſe troubled with the ſtone, riding over rough cauſeways in a coach; to thoſe troubled with rheumatic pains, playing at billiards, cricket, or tennis; to thoſe of weak arms, or hams, playing at tennis, or football; to thoſe of weak backs, or breaſts, ringing a bell, or working at the pump. Walking through rough roads, even to laſſitude, will beſt recover the uſe of the limbs to the gouty; though riding will beſt prevent the diſeaſe; but the ſtudious, the contemplative, the valetudinary, and thoſe of weak nerves, muſt make exerciſe a part of their religion. A condition neceſſary to render exerciſe as beneficial as may be, is, that it may be uſed on an empty ſtomach. Under the head of exerciſe, cold bathing, and the fleſh-bruſh come alſo to be recommended.

EXERCISE, in the art of war, denotes the ranging of a body of ſoldiers in form of battle, and making them practiſe the ſeveral motions, and military evolutions, with the diverſe management of their arms, &c. to make, or keep them expert therein againſt occaſion.

Manual EXERCISE, conſiſts in the obſervance of certain words of command appointed for this purpoſe. See MILITARY *Exerciſe*.

EXERCISE, in a naval ſenſe. See NAVAL *Exerciſe*.

EXERCISES are alſo underſtood of what young perſons learn in the academies and riding ſchools, ſuch as fencing, drawing, riding, &c. How uſeful, how agreeable ſoever, ſtudy may be to the mind, it is very far from being equally ſalutary to the body. Every one obſerves, that the Creator has formed an intimate connexion between the body and the mind; a perpetual action and reaction, by which the body inſtantly feels the diſorders of the mind, and the mind thoſe of the body. The delicate ſprings of our frail machines loſe their activity and become enervated, and the veſſels are choked by obſtructions when we totally deſiſt from exerciſe, and the conſequences neceſſarily affect the brain: a more ſtudious and ſedentary life is therefore equally prejudicial to the body and the mind. The limbs likewiſe become ſtiff; we contract an aukward conſtrained manner; a certain diſguſtful air attends all our actions, and we are very near being as diſagreeable to ourſelves as to others. An inclination to ſtudy is highly commendable; but it ought not, however, to inſpire us with an averſion to ſociety. The natural lot of man is to live among his fellows: and whatever may be the condition of our birth, or our ſituation in life, there are a thouſand occaſions where a man muſt naturally deſire to render himſelf agreeable; to be active and adroit; to dance with a grace; to command the fiery ſteed; to defend himſelf againſt a brutal enemy; to preſerve his life by dexterity; as by leaping, ſwimming, &c. Many rational cauſes have therefore given riſe to the practice of particular exerciſes, and the moſt ſagacious and benevolent legiſlators have inſtituted, in their academies and univerſities, proper methods of enabling youth, who devote themſelves to ſtudy, to become expert alſo in laudable exerciſes.

EXFOLIATION, compounded of *ex* and *folium*, *leaf*, in ſurgery, the ſcaling of a bone; or its riſing, and ſeparating in leaves, or laminæ. Any part of the ſurface of the cranium that has been bared, is liable to exfoliation. The wound muſt not be ſtopped too much, but the bone left at liberty to recover itſelf, which it ſometimes does, without exfoliating, particularly in children.

EXFOLIATIVE. An exfoliative trepan is a trepan proper to ſcrape, and at the ſame time pierce, a bone, and ſo to exfoliate, or raiſe, ſeveral leaves, or ſcales, one after another. The uſe of the exfoliative trepan is very dangerous; as being apt to ſhake and diſorder the brain.

EXHALATION, a fume, or ſteam, exhaling, or iſſuing, from a body, and diffuſing itſelf in the atmoſphere. The terms exhalation and vapour are ordinarily uſed indifferently, but the more accurate writers diſtinguiſh them; appropriating the term vapour to the moiſt fumes raiſed from water and other liquid bodies; and exhalation to the dry one emitted from ſolid bodies; as earth, fire, minerals, ſulphurs, ſalts, &c. In this ſenſe, exhalations are dry, ſubtil corpuſcles, or effluvia, looſened from hard terreſtrial bodies, either by the heat of the ſun, or the agitation of the air or ſome other cauſe; and emitted upwards to a certain height of the atmoſphere, where, mixing with the vapours, they help to conſtitute clouds, and return back again in dews, miſts, rains, &c. Sir

Iſaac Newton takes true and permanent air to be formed from the exhalations raiſed from the hardeſt and moſt compact bodies.

EXHAUSTED *Receiver*, a glaſs, or other veſſel, applied on the plate of an air-pump, and having the air extracted out of it by the working of the engine. Things placed in an exhauſted receiver, are ſaid to be in vacuo. See Syſtem of PNEUMATICS, Plate III. *Fig.* II.

EXHIBITION, in a general ſenſe, the act of diſplaying, explaining, or rendering viſible; the act of expoſing to public view; alſo a producing, or ſhewing, of titles, authorities, and other proofs, on a matter in conteſt. Anciently, they uſed the phraſe, exhibition of a tragedy, comedy, or the like; but now we ſay repreſentation, in lieu thereof.

EXIGENCE, or EXIGENCY, that which a thing requires, or which is expedient and ſuitable thereto.

EXILE is uſed for the delegating a perſon into a place, whence he is obliged not to ſtir without leave. The word is derived from the Latin *exilium*, or from *exul*, a baniſhed perſon; and that, probably, from *extra ſolum*, out of his native ſoil. Figuratively, we uſe the phraſe, honourably exile, for an office, or employment, which obliges a man to reſide in ſome remote and diſagreeable place.

EXISTENCE, that whereby a thing has an actual eſſence, or is ſaid to be. See METAPHYSICS.

EXIT, properly expreſſes the departure of a player from off the ſtage, when he has acted his part. The word is alſo uſed in a figurative ſenſe, to expreſs any kind of departure, even death.

EXITUS, iſſues in law, the yearly rents or profits of lands or tenements, &c.

EXOCOETUS, or the FLYING-FISH, in ichthyology, a genus belonging to the order of abdominales. The head is ſcaly, and it has no teeth. It has 10 radii in the branchioſtege membrane; the body is whitiſh, and the belly is angular; the pectoral fins, the inſtruments of flight, are very large. When purſued by any other fiſh, it raiſes itſelf from the water by means of theſe long fins, and flies in the air to a conſiderable diſtance, till the fins dry, and then it falls down into the water. It is a fiſh that ſeems to lead a moſt miſerable life. In its own element, it is perpetually haraſſed by the dorados and other fiſh of prey. If it endeavours to avoid them by having recourſe to the air, it either meets its fate from the gulls, or the albatroſs, or is forced down again into the mouth of the inhabitants of the water, who, below, keep pace with its aerial excurſion. Neither is it unfrequent that whole ſhoals of them fall on board of ſhips that navigate the ſeas in warm climates. It is therefore apparent, that nature in this creature hath ſupplied it with inſtruments which frequently bring it into the deſtruction it ſtrives to avoid, by having recourſe to an element unnatural to it.

EXODIUM, in the ancient Greek drama, one of the four parts or diviſions of tragedy, being ſo much of the piece as included the cataſtrophe and unravelling of the plot, and anſwering nearly to our fourth and fifth acts.

EXODIUM, in the Septuagint, ſignifies the end or concluſion of a feaſt. Particularly it is uſed for the eighth day of the tabernacles, which, it is ſaid, had a ſpecial view to the commemoration of the exodus or departure out of Egypt.

EXODUS, a canonical book of the Old Teſtament; being the ſecond of the pentateuch, or five books of Moſes. It is ſo called from the Greek [Εξοδος], the going out or departure of the children of Iſrael from the land of Egypt; the hiſtory of which is delivered in this book, together with the many miracles wrought on that occaſion.

EX OFFICIO, denotes the power a perſon has in virtue of his office, to do certain things without being applied to. By a branch of ſtatute 1 Eliz. the queen, by her letters patent, might authoriſe any perſons exerciſing eccleſiaſtical juridiction to adminiſter an oath, *ex officio*, whereby ſuppoſed offenders were forced to confeſs, accuſe, or clear themſelves of any criminal matter, &c. but this branch relating to this oath is repealed by 17 Car. I. cap. 11.

EXOMPHALUS, in ſurgery, called alſo *omphalocele*, and *hernia umbilicalis*, is a preternatural tumour of the abdomen, at the navel, from a rupture or diſtenſion of the parts which inveſt that cavity.

EXONEIROSIS, from εξ, *out*, and ονειρος, *dream*, a nocturnal emiſſion of the ſemen in dreams. This, if it happens but rarely, is uſually a ſign only of redundant vigour; but if it happens frequently, is a ſign of weakneſs of the ſeminal veſſels, which is moſt frequently the caſe.

EXOPHTHALMIA, of εξ, *out*, and οφθαλμος, *eye*, in ſurgery, is a protuberance of the eye out of its natural poſition.

EXORCISM, among eccleſiaſtical writers, the expelling devils from perſons poſſeſſed, by means of conjurations and prayers. Exorciſm makes a conſiderable part of the ſuperſtition of the church of Rome, the rituals of which forbid the exorciſing any perſon without the biſhop's leave. The ceremony is performed at the lower end of the church, towards the door. The exorciſt firſt ſigns the poſſeſſed perſon with the ſign of the croſs, makes him kneel, and ſprinkles him with holy water. Then follow the litanies, pſalms, and prayers; after which the exorciſt aſks the devil his name, and adjures him by the myſteries of the Chriſtian religion not to afflict the perſon any more; then, laying his right hand on the dæmoniac's head, he repeats the form of exorciſm, which is this; "I exorciſe thee, unclean ſpirit, in the name of Jeſus Chriſt: tremble, O Satan! thou enemy of the faith, thou foe of mankind, who haſt brought death into the world, who haſt deprived men of life, and haſt rebelled againſt juſtice; thou ſeducer of mankind, thou root of evil, thou ſource of avarice, diſcord, and envy." The Romaniſts likewiſe exorciſe houſes and other places, ſuppoſed to be haunted by unclean ſpirits; and the ceremony is much the ſame with that for perſons poſſeſſed.

EXORCISTS, in church hiſtory, an order of men, in the ancient church, whoſe employment it was to exorciſe or caſt out devils. See the preceding article.

EXORDIUM, in oratory, is the preamble or beginning, ſerving to prepare the audience for the reſt of the diſcourſe. Exordiums are of two kinds, either juſt and formal, or vehement and abrupt. The laſt are moſt ſuitable on occaſions of extraordinary joy, indignation, or the like. See Treatiſe on the Art of ORATORY.

EXOSTOSIS, from εξ, *out*, and οςεον, a *bone*, in anatomy, is properly an acute eminence or excreſcence, puſhing preternaturally above the bone, but creating ſometimes no diſturbance, pain, or deformity, and unaccompanied with a caries or ſpina ventoſa. When this is the caſe, it is always beſt to let it alone; for the attempt to remedy often proves much worſe than the diſeaſe; and by laying the bone bare, a caries, or other inconvenience is brought on. On the other hand, when this diſorder occaſions pain or deformity, or impedes any action, or produces other miſchief, it may be remedied by taking off the protuberant part of the bone in the ſame manner as in caſes of *ſpina ventoſa*.

EXOTIC, Εξωτικος, a term properly ſignifying *foreign*, or *extraneous*, i. e. brought from a remote or ſtrange country. In which ſenſe we ſometimes ſay, *exotic*, or *barbarous terms* or *words*, &c. The word is derived from the Greek, εξω, εξωθεν, *extra*, *without*, *on the outſide*.

EXOTIC, is chiefly applied to plants which are natives of foreign countries, particularly thoſe brought from the Eaſt and Weſt Indies, and which do not naturally grow in Europe. The generality of exotics, or exotic plants, do not thrive in England without ſome peculiar care and cultures; they require the warmth of their own climates; whence the uſe of hot beds, glaſs frames, green-houſes, &c.

EXPANSION, in metaphyſics, expreſſes the idea we have of laſting, or preſerving diſtance, i. e. of diſtance, all the parts whereof exiſt together.

EXPANSION, in phyſics, is the dilating, ſtretching, or ſpreading out of a body; whether from any external cauſe as the cauſe of rarefaction, or from an internal cauſe, as elaſticity. Bodies naturally expand by heat beyond their dimenſions when cold, whence their ſpecific gravities are different at the different ſeaſons of the year. Air compreſſed or condenſed, as ſoon as the compreſſing or condenſing force is removed, expands itſelf by its elaſtic power to its former dimenſions.

Spirit of wine, with a heat leſs than that of boiling water, expanded itſelf by one-twelfth part of its bulk, and then began to boil. The moſt ſenſible expanſion of water is in freezing. Mr. Boyle, in his Hiſt. of Cold, aſſures us, that ice takes up one-twelfth part more ſpace than water.

EX PARTE, i. e. *partly*, or of *one part*. A *commiſſion ex parte* is that taken out and executed by one part only: where both parties join, it is called a *joint commiſſion*.

EXPECTANT *Fee*, in law, where lands are given to a man and his wife, and the heirs of their body; in which ſenſe it differs from *fee ſimple*, where lands are given to a man and his wife in frank marriage, to hold to them and their heirs.

EXPECTANCY, *Eſtates in*, are of two ſorts; one created by act of the parties, called a *remainder*; the other by act of law, called a *reverſion*.

EXPECTATION, in the doctrine of chances, is applied to any contingent event, and is capable of being reduced to the rules of computation. Thus, a ſum of money in expectation, when a particular event happens, has a determinate value before that event happens; ſo that if a perſon is to receive any ſum, i. e. 10l. when an event takes place which has an equal probability of happening and failing, the value of the expectation is half that ſum of 5l. and in all caſes, the occaſion of obtaining any ſum is eſtimated by multiplying the value of the ſum expected by the fraction, which repreſents the probability of obtaining it. For the expectation or chance upon cards, dice, lottery, &c. ſee the Article GAMING.

EXPECTATION *of Life*, in the doctrine of life annuities, denotes, according to the moſt obvious ſenſe of the term, that particular number of years which a life of a given age has an equal chance of enjoying, or the time which a perſon of a given age may juſtly expect to continue in being. But Mr. Simpſon has ſhewn, that this period does not coincide with what the writers on annuities call the *expectation of life*, except on the ſuppoſition of an uniform decreaſe in the probabilities of life: and Dr. Price adds, that even on this ſuppoſition, it does not coincide with what is called the *expectation of life*, in any caſe of joint lives; for two lives of 40 have an even chance. See Syſtem of ANNUITIES, Chap. II.

EXPECTORANTS, in pharmacy, are medicines that promote expectoration. See the next *Article*.

EXPECTORATION, of *ex*, *out*, and *pectus*, *breaſt*, the act of evacuating or bringing up phlegm or other matters out of the trachea, lungs, &c. by coughing, hawking, ſpitting, &c. Expectoration eaſes the lungs of the viſcid or putrid matters which obſtruct their veſſels, and ſtraiten the breaſt.

EXPEDITION, in a general ſenſe, quickneſs of time or motion, alſo the march of an army to ſome diſtant place, with a view of hoſtilities. Such were the expeditions of Cyrus againſt Xerxes, and of Bacchus and Alexander from the Indies. Expeditions for the recovery of the Holy Land were called Croiſades.

EXPENDITORS, are perſons appointed by commiſſioners of ſewers, to pay, diſburſe, or expend the money collected by the tax for the repairs of ſewers, &c. when paid into their hands by the collectors on the reparations, amendments, and reformations ordered by the commiſſioners; for which they are to render accounts when required for that purpoſe.

EXPERIENCE, a kind of knowledge acquired by long uſe, without any teacher. Experience conſiſts in the ideas of things we have ſeen or read, which the judgment has reflected on, to form for itſelf a rule or method. Authors make three kinds of experience: the firſt is the ſimple uſes of the external ſenſes, whereby we perceive the phenomena of natural things, without any direct attention thereto, or making any application thereof. The ſecond is, when we premeditatedly and deſignedly make trials of various things, or obſerve thoſe done by others, attending cloſely to all effects and circumſtances. The third is that preceded by a foreknowledge, or at leaſt an apprehenſion of the event, and determines whether the apprehenſion were true or falſe; which two latter kinds, eſpecially the third, are of great ſervice in philoſophy.

EXPERIMENT, in philoſophy, a trial of the effect or reſult of certain applications and motions of natural bodies, in order to diſcover ſomething of the laws and relations thereof, or to aſcertain ſome phenomenon, or its cauſe. The learned define experiment, a compariſon of ſeveral things before obſerved by the ſenſes, and retained in the memory in ſome one ſimilar convenient inſtance.

The nature of experiment, therefore, according to them conſiſts in comparing ſeveral things by one act; whence they diſtinguiſh two things in every experiment, the one material, viz. the ſeveral ideas remembered; the other formal, viz. the comparing of theſe ideas in the mind. This will be illuſtrated by an example: a phyſician gives a quantity of rhubarb to ten ſeveral perſons, and remembers each of them. Now, coming afterwards to compare the ſeveral remembrances together, and finding the effect of the exhibition of rhubarb to be the ſame in all, viz. a purging; this is an experiment of rhubarb.

The making of experiments is grown into a kind of formed art; and we now abound in Syſtems of experiments, under the denomination of courſes of experimental philoſophy. Sturmius has made a curious collection of the principal diſcoveries and experiments of the laſt age, under the title of *collegium experimentale*. Dr. Deſaguliers has alſo publiſhed a comprehenſive and uſeful courſe of experimental philoſophy. The chymiſts chooſe to call their experiment, by way of diſtinction or eminence, *proceſſes* or *operations*.

EXPERIMENTAL PHILOSOPHY.

That philoſophy which proceeds on experiments, which deduces the laws of nature, and the properties and powers of bodies, and their actions upon each other, from ſenſible experiments and obſervations.

I. It is not very long ſince this ſcience has been known to the world, or, to ſpeak more properly, ſince it was firſt reduced into a ſyſtem. Natural philoſophy has been, for theſe 50 centuries, nothing more than a confuſed heap of ſyſtems laid one upon another, and very frequently the one claſhing againſt the other. Each philoſopher thought, that he had an equal right to erect a ſimilar edifice to his own memory. They adopted barbarous terms and expreſſions, that conveyed confuſed ideas only. For explications, they gave certain unintelligible or unmeaning words, which had been introduced by the authority of ſome celebrated name, but from which a man of underſtanding could not receive the leaſt information. At length, the true phyſics was brought to light; it was drawn from the obſcurity of the ſchools, where it had grown old under the authority of Ariſtotle, and ſcarce any thing been ſuffered to remain of it but the name. This reformation proceeded principally from the manner of ſtudying it. Inſtead of gueſſing at it, they began to inveſtigate it by experiments; and whereas they formerly confined themſelves to ſpeculations, and vague reſearches concerning phenomena and their cauſes, that were always merely conjectural, they now gave ocular demonſtrations of cauſes and effects by means of experiments; and this is what they call experimental philoſophy.

II. The principles of this philoſophy are as follow. All the material ſubſtances, whoſe aſſemblage compoſes the univerſe, are called natural bodies. What we perceive in theſe ſubſtances that is uniform and invariable, and of which we do not know the cauſe, is called their properties. Phyſics ſets out with this, as from a fixed point, in order to explain the different phenomena that are perceived on the earth, in the water, the air, or fire, and in all that theſe elements contain. For though it does not pretend to know all that bodies have in common among themſelves, or all that is peculiar to each one of them; yet it knows a certain number of their properties, which it regards as primary, till it diſcovers a precedent cauſe of which they may be the effect; and which properties are general, and in a manner inſeparable from all matter, as for example, *extenſion*. There are likewiſe properties of an inferior order, which do not appertain to all bodies but as they are in certain ſtates, or under certain circumſtances; theſe, in general, are nothing more than combinations of the primary properties; and form a ſecond claſs, as for example, *fluidity*. Laſtly, theſe properties of the firſt and ſecond order combine more and more, and become common to a ſtill ſmaller number of bodies: and here they are no longer extended to all bodies, as the firſt; nor are peculiar to certain ſtates, as the ſecond; but are confined to genders, ſpecies, or even individuals. Such are ſeveral properties of the air, fire, light, metals, the magnet, &c. Theſe three orders of properties are the ſubject of the inquiries of experimental philoſophy, which proves by experiments thoſe that are already known, and frequently diſcovers others that were unknown.

III. It is neceſſary here to deſcend to ſome particulars. The firſt property of bodies, which preſents itſelf to our ideas and our ſenſes, is their extenſion; which is a limited bulk of any form whatever, of which we can conceive parts that may be diſtinguiſhed from each other. This material extenſion has three dimenſions, which are length, breadth, and depth. Every body, whoſe extenſion is large enough to be ſeen or felt, may be divided into ſeveral parts, and which muſt conſequently decreaſe in proportion as the diviſion is encreaſed; from hence comes the infinite diviſibility of matter, at leaſt in idea; for in the ſmalleſt particle we can ſtill imagine two halves, though the fact has never been proved by experiment; for nature does not at all times conform to imagination, ſeeing that the minuteſt particles, and their decompoſition, eſcape our obſervation even in the moſt accurate experiments. However, we ſhould never have believed, without having made the trial, to what degree experimental philoſophy is capable of dividing bodies, and of reducing them to particles that are almoſt indiviſible.

IV. The order, or arrangement, which the ſurfaces of bodies take among themſelves, is called their figures. As theſe ſurfaces cannot be confounded, but are always diſtinguiſhable by their ſituations, it is evident that figure is a common and neceſſary property of all bodies. The experiments by which this truth is demonſtrated by the aid of the microſcope, are equally curious and convincing: and from hence it is alſo proved, that there are no two bodies that are abſolutely ſimilar. The ſolidity of a body is nothing more than the quantity of matter that is contained within its bulk: this property is eſſential to all bodies, and the moſt certain ſign of their exiſtence. Reſiſtance is a neceſſary conſequence of the foregoing property; and every phyſical reſiſtance proves a real ſolidity in a greater or leſs degree. Fluids being the only bodies in which ſolidity is in any manner neceſſary to be proved, it has been there demonſtrated bv numberleſs experiments. The poroſity of bodies is, on the contrary, nothing but that ſpace which is found between their ſolid parts. This ſpace has its degrees. When a dry ſponge is plunged into water, a quantity of air comes out of it, in proportion to the water that penetrates it; and when moiſt bodies are dried, they become more light in proportion as they loſe by evaporation what their poroſity had admitted. This is the firſt ſort of ſpace or vacuum. Light, or the matter of fire that we ſee paſs through bodies impenetrable to air and water, ſuppoſes pores more delicate, and a ſpace more ſubtile. It is almoſt indubitable, that after theſe firſt kinds of vacuum, and which indeed are improperly ſo called, as they are filled with other matter, there are others ſtill ſmaller, and which are ſo in a literal ſenſe. That freedom, which is requiſite to motion, ſeems to prove it; for though we may ſay, matter being diviſible almoſt *ad infinitum*, that a body or ſubſtance more ſolid may move in another ſubſtance that is more ſubtile, and that will give way to its motion, we muſt nevertheleſs have recourſe to a laſt reſort, and admit of an ultimate vacuum, which will give room ſufficient to the leaſt corpuſcle, that its part A may take the place of its part B, without the leaſt reſiſtance; beſides, it is not to be imagined, that nature, in fact, admits of that infinite diviſibility which our imagination can conceive, and that every thing which is poſſible in idea is at all times practicable. All that exiſts is poſſible, but all that is poſſible does not however exiſt. The air-pump is of very great uſe in proving theſe three ſorts of vacuums. By denſity, is underſtood the proportion between the extenſion and ſolidity of a body; one body therefore is more denſe than another, when, under the ſame degree of extenſion, it contains more ſolid matter; and this quality ariſes from condenſation and compreſſion. Elaſticity is nothing more than that effort by which certain bodies, when compreſſed, endeavour to reſtore themſelves to their former ſtate; and this property ſuppoſes them compreſſible. As all theſe natural properties of bodies are of great utility in explaining the principles of phyſics, and in applying them to all the arts, experimental philoſophy proves their reality by a thouſand examples.

V. We diſcover ſtill other properties in bodies; ſuch as mobility, which we muſt not here confound with motion. This mobility ariſes from certain diſpoſitions which are not in an equal degree in all bodies; from whence it comes that ſome are more eaſily moved than others: and this proceeds from the reſiſtance to motion which is perceived in all bodies, having regard merely to their maſſes; and this reſiſtance is called *vis inertiæ*, or *inert force*. A body is ſaid to be in motion, when it is actually moving from one place to another; or, whenever a body changes its ſituation with regard to the objects that ſurround it, either nearly or remotely, it is ſaid to be in motion. There are three principal matters to be conſidered in a moving body; its direction, its velocity, and the quantity of its motion: and here phyſics explains the force or moving power; it likewiſe diſtinguiſhes between ſimple and compound motion. Simple motion is that which ariſes from only one force, or which tends to only one point. It deſcribes the laws, and explains the reſiſtance, of mediums; the reſiſtance of friction; the difficulties of a perpetual motion; the alteration of direction, occaſioned by the oppoſition of a fluid matter; reflected or reverberated motion; the communication of motion by the ſhock of bodies, &c. Compound motion is that of a body impelled to move by ſeveral cauſes or powers which act according to their different directions. Phyſics here likewiſe inveſtigates the laws of motion; and is particularly applied to the explaining, under this head, what are called the *central forces*; which produce a motion that is either circular or in a curve line, and which inceſſantly urge the moving body either to approach or recede from the centre. To diſtinguiſh theſe from each other, the former is called the *centripetal force*, and the latter the *centrifugal force*.

VI. By gravity, or ponderoſity, is to be underſtood that force which occaſions bodies to paſs from a higher to a lower place, when nothing oppoſes their courſe, or when the obſtacles are not ſufficient to ſtop them. Speculative philoſophy inveſtigates its cauſe, and perhaps in vain. Experimental philoſophy contents itſelf with deſcribing the phenomena, and teaching the laws of gravity, which are thoroughly eſtabliſhed by a thouſand reiterated experiments. In order properly to underſtand this ſubject, we muſt take care not to confound the term gravity, with that of weight. By the former, we underſtand that force which urges bodies to deſcend through a certain ſpace in a given time. By the latter, is meant the quantity of a heavy body that is contained under the ſame bulk. The phenomena are explained by the experiments themſelves, and by inferences deduced from them.

VII. Hydroſtatics is a ſcience whoſe object is the gravity and equilibrium of fluids in particular. Though the gravity of theſe bodies is the ſame with that of others, and is ſubject to the ſame laws, yet their ſtate of fluidity gives riſe to particular phenomena, which it is of conſequence to know. But as hydroſtatics cannot be ſucceſsfully treated on without the aſſiſtance of calculation, it has been ranged among the mathematical ſciences. See MATHEMATICS.

VIII. We ſay the ſame with regard to mechanics; which is the art of employing, by the aid of machines, the motion of bodies, in conformity to its properties and laws, as well with regard to ſolids as fluids, either more commodiouſly or more advantageouſly.

IX. After it has made the moſt accurate experiments, and the judicious obſervations, on all theſe different ſubjects, and the properties of bodies in particular, experimental philoſophy paſſes to the examination of the air, the water, fire, the wind, colours, &c. The air is a fluid with which we are ſurrounded from the inſtant of our birth, and without which we cannot exiſt. It is by the properties and the influences of the air, that nature gives increaſe and perfection to all that it produces for our wants and conveniencies; it is the ſpirit of navigation: ſound, voice, ſpeech itſelf, are nothing more than percuſſions of the air: this globe that we inhabit is completely ſurrounded by air; and this kind of coverture, which is commonly called the atmoſphere, has ſuch remarkable functions, that it evidently appears to concur to the mechaniſm of nature. Experimental phyſics, therefore, conſiders the air, 1. Of itſelf, independent of its bulk, and the figure of its whole body: it examines its eſſential properties; as its gravity, denſity, ſpring, &c. The air pump is here of indiſpenſable uſe; and by this machine phyſics examines in what manner ſpace, or a vacuum, is made. It likewiſe ſhows the neceſſity of air to the preſervation of animal life; the effect it has on ſound, fire, and gunpowder, *in vacuo*; and a hundred other experiments of various degrees of curioſity. 2. It conſiders the air as the terreſtrial atmoſphere, ſometimes as a fluid at reſt, and ſometimes as in motion. And by theſe means it accounts for the variation of the mercury in the barometer, and why it ſinks in proportion as the height of the atmoſphere diminiſhes; as alſo for the figure, the extent, and weight of the atmoſphere: it ſhews the method of determining the height of mountains, the nature of ſound in general, of its propagation, and of ſonorous bodies.

X. It is here alſo, that experimental philoſophy conſiders the nature of the wind; which is nothing more than agitated air, a portion of the atmoſphere that moves like a current, with a certain velocity and determinate direction. This fluid, with regard to its direction, takes different names according to the different points of the horizon from whence it comes, as Eaſt, Weſt, North, and South. Winds are likewiſe diſtinguiſhed into three ſorts; one of which is called general or conſtant, as the trade-winds, which continually blow between the tropics: another is the periodical, which always begin and end within a certain time of the year, or a certain hour of the day, as the monſoons, the land breezes, and ſea breezes, which riſe conſtantly in the morning and evening; and laſtly, ſuch as are variable, as well with regard to their direction as their velocity and duration.

M. Mariotte computes the velocity of the moſt impetuous wind, to be at the rate of 32 feet in a ſecond, and Mr. Derham makes it 66 feet in the ſame time. The firſt, doubtleſs, meant the wind of the greateſt velocity that had then come to his knowledge.

XI. The force of the wind, like that of other bodies, depends on its velocity and maſs; that is, the quantity of air which is in motion: ſo the ſame wind has more or leſs force on any obſtacle that oppoſes it, in proportion as that obſtacle preſents a greater or a leſs ſurface: for which reaſon it is that they ſpread the ſails of a veſſel more or leſs, and place the wings of a wind mill in different directions. The machines, by which the winds are meaſured, are called anemometers. They ſhew the direction, the velocity, and the duration of winds. It is by the agitations of the wind, that the air is purified; that the ſeeds of trees and herbs are conveyed to the foreſts and fields; that ſhips are driven from one pole to the other; that our mills turn upon their axes, &c.; and art, by imitating nature, ſometimes procures us artificial winds, by which we refreſh our bodies, invigorate our fires, purify our corn, &c.

XII. Water is an univerſal agent, which nature employs in all her productions. It may be conſidered as in three ſtates, 1. As a liquid; 2. As a vapour; 3. As ice. Theſe three different ſtates do not in any manner change its eſſence, but make it proper to anſwer different ends. The natural ſtate of water would be that of a ſolid body, as fat, wax, and all thoſe other bodies which are only fluid when heated to a certain degree: for water would be conſtantly ice, if the particles of fire, by which it is penetrated in the temperate climates, did not render it fluid, by producing a reciprocal motion among its parts; and, in a country where the cold is continually ſtrong enough to maintain the congelation, the aſſiſtance of art is neceſſary to make it fluid in the ſame manner as we do lead, &c. Water, when not in ice, is a fluid that is inſipid, tranſparent, without colour, and without ſmell, aud that eaſily adheres to the ſurface of ſome bodies, that penetrates many, and extinguiſhes fire. Experimental philoſophy inveſtigates the origin of fountains; the cauſe of the ſaltneſs of the ſea; the means of purifying water; what is its weight, and what are its effects when heated, &c. It likewiſe examines this fluid in the ſtate of vapour; and, finds that a drop of water, when in vapour, occupies a ſpace vaſtly greater than it did before. It explains the *æolipile* and its effects: fire engines; and the force of vapours that give motion to immenſe machines in mines and elſewhere, &c. and laſtly, it conſiders water in the ſtate of ice. Ice conſequently is more cold than water; and its coldneſs increaſes if it continue to loſe that matter, already too rare, or too little active, to render it fluid. Experimental phyſics endeavours to inveſtigate the cauſes of the congelation of water, and why ice is lighter than water; from whence it derives that expanſive force by which it breaks the containing veſſel; the difference there is between the congelation of rivers and that of ſtanding waters; why ice becomes more cold by the mixture of ſalts: and many other ſimilar phenomena.

XIII. The nature of fire is yet very much unknown to the moſt learned philoſophers. As objects when at a great diſtance are not perceptible to our ſenſes, ſo when we examine them too nearly, we diſcern them but confuſedly. It is ſtill diſputed whether fire be a homogene, unalterable matter, deſigned, by its preſence, or by its action, to produce heat, inflammation, and diſſolution, in bodies; or if its eſſence conſiſts in motion only, or in the fermentation of thoſe particles which we call inflammable, and which enter as principles, in greater or leſs quantities, in the compoſition of mixed bodies. The moſt learned inquirers into nature incline to the former opinion; and to have recourſe to a matter, which they regard as the principle of fire. They ſuppoſe that there is in nature a fluid adapted to this purpoſe, created ſuch from the beginning, and that nothing more is neceſſary than to put it in action. The numberleſs experiments which are daily made in electricity, ſeem to favour this opinion, and to prove that this matter, this fluid, this elementary fire, is diffuſed through all nature, and in all bodies, even ice itſelf. We cannot ſay to what important knowledge this great diſcovery of electricity may lead if we continue our inquiries concerning it. It appears, however, that we may believe, without any inconvenience or abſurdity, that fire and light, conſidered in their firſt principle, are one and the ſame ſubſtance differently modified.

XIV. Be this matter however as it may, experimental philoſophy is employed in making the moſt ingenious and moſt uſeful reſearches concerning the nature of fire, its propagation, and the means by which its power may be excited or augmented; concerning the phoſphorous and its inflammation; fire excited by the reflection of the ſun's rays from a mirror; and on the effects of fire in general; concerning lightning and its effects; the fuſion of metals; gunpowder and its exploſion; flame, and the aliments of fire; and an infinity of like objects which it explains, or concerning which it makes new diſcoveries, by the aid of experiment.

XV. By the word *light*, we underſtand that agent by which nature affects the eye with that lively, and almoſt conſtantly pleaſing ſenſation, which we call ſeeing, and by which we diſcern the ſize, figure, colour, and ſituation of objects, when at a convenient diſtance. All philoſophers agree, that the light, which is diffuſed in any place, is a real body. But what this body is, and by what means it enters that place where it is perceived, is a queſtion about which philoſophers are divided.

XVI. Experimental philoſophy is applyed in diſcovering or proving, by an infinity of experiments, what is the nature of light, in what manner it is propagated, what its velocity and progreſſive motion. It alſo inveſtigates and explains the principles of optics, properly ſo called, and ſhews the directions which light obſerves in its motions. From thence it proceeds to the examen of the principles of catoptrics, and deſcribes the laws and effects of reflected light. It next treats of the principles of dioptrics, and explains the laws of refracted light: and laſtly, it teaches, from the principles of natural and artificial viſion, the conſtruction of optical inſtruments, as lenſes, concave mirrors, priſms, teleſcopes, &c. &c. and the uſes to which they are applied.

XVII. By reſolving or ſeparating the rays of light, philoſophy has obtained true and clear diſcoveries of the nature of colours. We are naturally led to imagine that colours, and their different degrees, make a part of the bodies that preſent them to our ſight; that white is inherent in ſnow, green in leaves and graſs, and red in a ſtuff dyed of that colour. But this is far from being true. If an object, which preſents any colour to our ſight, be not illuminated, it preſents no colour whatſoever. In the night all is black. Colours, therefore, depend on light; for without that we could form no idea of them: but they depend alſo on bodies; for of ſeveral objects preſented to the ſame light, ſome appear white, others red, blue, &c. But all theſe matters being ſeparate from our own bodies, we ſhould never acquire any ideas of them, if the light, tranſmitted or reflected by theſe objects, did not make them ſenſible to us, by ſtriking upon the organs of our ſight, and if theſe impreſſions did not revive in us thoſe ideas which we have been uſed to expreſs by certain terms. For theſe reaſons philoſophy conſiders colours from three points of view, 1. As in the light; 2. In bodies, as being coloured; and, 3. From the relation they have to our viſual faculties, which they particularly affect, and by which we are enabled to diſtinguiſh them.

It is unneceſſary in this place to ſay more either on colour in particular, or experimental philoſophy in general. The different ſubjects of this collective article are particularly treated under their proper names, in the order of the alphabet: the reader will therefore turn, as he has occaſion, to ACOUSTICS, CATOPTRICS, DIOPTRICS, HYDROSTATICS, MECHANICS, OPTICS, PNEUMATICS, ELECTRICITY, MAGNETISM, &c. &c. &c.——Alſo AIR, BURNING-*Glaſs*, COLD, COLOUR, CONGELATION, EVAPORATION, FIRE, FLAME, FLUIDITY, HEAT, IGNITION, LIGHT, SOUND, STEAM, WATER, WIND, &c.

EXPERIMENTUM CRUSIS, a capital, leading, or deciſive experiment; thus termed, either on account of its being like a croſs, or direction poſt, placed in the meeting of ſeveral roads, guiding men to the true knowledge of the nature of that thing they are inquiring after; or, on account of its being a kind of torture, whereby the nature of the thing is as it were extorted by force.

EXPIATION, a religious act, by which ſatisfaction, atonement, or amends, is made for the commiſſion of ſome crime, the guilt done away, and the obligation to puniſhment cancelled. The method of expiation among the Jews was chiefly by ſacrifice, whether for ſins of ignorance, or to purify themſelves from certain pollutions.

Great Day of EXPIATION, an annual ſolemnity of the Jews, upon the tenth day of the month Tiſri, which anſwers to our September. On this occaſion, the high prieſt laid aſide his breaſtplate and embroidered ephod, as being a day of humiliation. He firſt offered a bullock and a ram for his own ſins, and thoſe of the prieſts; then he received from the heads of the people two goats for a ſin offering, and a ram for a burnt offering, to be offered in the name of the whole multitude. It was determined by lot which of the goats ſhould be ſacrificed, and which ſet at liberty. After this he perfumed the ſanctuary with incenſe, and ſprinkled it with blood: then, coming out, he ſacrificed the goat upon which the lot had fallen. This done, the goat which was to be ſet at liberty being brought to him, he laid his hands upon its head, confeſſed his ſins and the ſins of the people, and then ſent it away into ſome deſert place: it was called azazel, or the ſcape-goat. As to the expiations among the heathens, they were of ſeveral kinds; as ſacrifices, and religious waſhings.

EXPIATION, in a figurative ſenſe, is applied by divines to the pardon procured to mens ſins, by the merits of Chriſt's death.

EXPIRATION, in medicine, that motion in an animal whereby the air inſpired into the lungs is expelled or thrown out of the ſame, and the cavity of the breaſt contracted. Reſpiration conſiſts of two alternate motions or actions of the lungs, correſponding to thoſe of a pair of bellows: inſpiration, whereby the air is drawn in; and expiration, whereby it is driven out again. By the means of this alteration, the circulation of the blood, and the motion of the heart, are maintained. Expiration is alſo uſed figuratively, for the end of a term of time granted, agreed on, or adjudged.

EXPLICIT, ſomething clear, diſtinct, formal and unfolded. The will or intention is ſaid to be explicit when it is fully explained in proper terms; and implicit, when it is only to be learnt by deductions and conſequences. The Jews had not all an explicit knowledge of Jeſus Chriſt, but they had at leaſt an implicit one. Such a teſtator has declared his will explicitly, i. e. in formal terms; there is no need to have recourſe to explications.

EXPLOSION, from *explodo, I drive away with noiſe*, in phyſics, the act of a thing which drives another away out of the place it before poſſeſſed. The term is chiefly uſed for the going off of gunpowder, and the expulſion of the ball, ſhot, or the like conſequent thereon. Hence, exploſion comes likewiſe to be figuratively uſed to expreſs ſuch ſudden actions of bodies as have ſome reſemblance to theſe; e. gr. thoſe which ferment with violence, immediately upon their mixture, and occaſion a crackling ſound.

EXPONENT, in algebra, the ſame with index. See the definition in Syſtem of ALGEBRA, Sect. I.

EXPONENT is alſo uſed in arithmetic in the ſame ſenſe as index or logarithm.

EXPORTATION, in commerce, the act of ſending commodities out of one country into another. Exportation is a part of foreign commerce, diſtinguiſhed by the appellation *active*, or *ſelling part*, in oppoſition to importation, which is called the *paſſive*, or *buying part*. It is obſerved, as a general maxim, that commerce, when active, muſt produce a flow of riches, the balance being received in money; whereas, if it be paſſive, treaſures will be exhauſted, as the balance of trade muſt continually be made good out of the remaining coin. Hence plenty of money in any place implies, that the quantity of goods exported far exceeds that of goods imported: and wherever money is ſcarce, it may be concluded, that greater quantities of goods have been imported than exported. See EXCHANGE. The merchandiſes yearly exported from England are immenſe. The principal articles are corn, cattle, cloth, iron, lead, tin, leather, coal, hops, flax, hemp, hats, malt liquors, fiſh, watches, ribbands, &c.

EXPOSING, the act of ſetting a thing to public view. In the Romiſh church, the ſacrament is ſaid to be expoſed when it is ſhewn in public, uncovered, on feſtival days, and during the time of plenary indulgences. Expoſing is alſo uſed with farther latitude; thus, we ſay, it is prohibited to expoſe falſe and clipped money. Such a houſe ſtands very high, and has a delicious proſpect; but it is expoſed to all the four winds. Such a city being on the frontiers, and not fortified, is expoſed to the inſults of every party of forces.

EXPOSITION, in a literary ſenſe, the explaining an author, paſſage, writing, or the like, and ſetting their meaning in an obvious and clear light. Such is Bankes's Expoſition and Commentary on the Holy Bible, wherein all the difficult paſſages are fully explained and illuſtrated.

EXPOSITOR, or EXPOSITORY, a title given to ſmall dictionaries, ſerving to explain the hard words of a language.

EXPOSTULATION, in rhetoric, a warm addreſs to a perſon, who has done another ſome injury, repreſenting the wrong in the ſtrongeſt terms, and demanding redreſs.

EXPOSURE, in gardening, the ſituation of a garden-wall, or the like, with reſpect to the points of the compaſs, as ſouth or eaſt. See GARDENING.

EXPRESS, ſomething that is preciſe, in formal terms, or for ſome particular deſign. I told him as much in expreſs terms: he gave me a commiſſion expreſs; he had expreſs orders; a courier was diſpatched expreſs. We alſo ſay, ſomewhat abuſively, to ſend an expreſs, meaning a courier.

EXPRESSED *Oils*, are ſuch as are procured from bodies only by preſſing: as the oils of olives, almonds, and the like.

EXPRESSION, in reading. See READING.

EXPRESSION, in muſic, denotes the performing of a piece of melody, or a ſingle paſſage, with that energy and feeling which the poetry or paſſion to be impreſſed upon the hearer requires.

EXPRESSION, in oratory, denotes the manner of delivering or conveying a man's ideas to another. Expreſſion is more particularly uſed for the elocution, diction, and choice of words in a diſcourſe. See LANGUAGE and ORATORY.

It is not enough that a poet or orator have fine thoughts, he muſt likewiſe have a happy expreſſion. Defects in the expreſſion ordinarily ariſe from defects in the imagination; abundance of the beauties of the ancient writers are annexed either to expreſſions which are peculiar to their language: or to relations, which, not being ſo familiar to us as to them, do not give us the ſame pleaſure.

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EXTIRPATION, formed of *ex* and *ſtirps*, *root*, the act of pulling up, or deſtroying, a thing to the very roots.

Extirpation is alſo uſed, in ſurgery, for cutting off any part entirely; as a wen, &c. or the eating it away, as a wart, &c. by corroſive medicines.

EXTORTION, in law, an illegal manner of wreſting any thing from a man, either by force, menace, or authority. If an officer, by terrifying another, on pretence of his office, takes more than his ordinary fees, or dues, he commits, and is indictable for extortion. So the exacting of unlawful uſury, winning by unlawful game, and, in fine, all taking of more than is juſtly due, by colour or pretence of right, as exceſſive tolls in millers, exceſſive prices of ale, bread, victuals, wares, &c. come under extortion.

EXTRA *Judicial*, ſomething done out of the proper court, or the ordinary courſe of law. As when judgment is given in a cauſe, or caſe, not depending in that court where ſuch judgment is given, or wherein the judge has no juriſdiction.

Extra *Parochial*, a place out of the bounds of any pariſh; or privileged and freed from the duties of a pariſh.

EXTRACT, **Extractum**, in pharmacy, the pureſt and fineſt part of a vegetable, or other body, ſeparated from the coarſer, by diſſolution and digeſtion with a proper menſtruum; and afterwards reduced into a thick, moiſt conſiſtence by diſtillation, or evaporation of the humidity of the menſtruum. Extracts are prepared from a variety of different drugs; as the bark, gentian, jalap, opium, &c.

Extract, in matters of literature, denotes a ſhort abridgment of a book or paper, or of ſome of the matters thereof. The journals, nouvalles, bibliotheques, memoires, and other monthly reviews, or quarterly accounts of the affairs of learning, conſiſt principally of extracts of the moſt material paſſages, doctrines, &c. found in the ſeveral books publiſhed in that time.

EXTRACTION, in pharmacy and chymiſtry, an operation, whereby eſſences, tinctures, &c. are drawn from natural bodies.

Extraction, in ſurgery, denotes an operation whereby ſome foreign matter lodged in the body, contrary to the order of nature, is drawn out of the ſame by manual application, or the help of inſtruments. Such is the extraction of a ſtone, formed in the bladder, or in the kidneys, &c.

Extraction, or *Deſcent*, in genealogy, denotes the ſtock, or family which a perſon is deſcended from. In ſome military orders, chapters, &c. a candidate muſt make proof of the nobility of his extraction before he is admitted.

Extraction *of Roots*, the method of finding the roots of given numbers, or quantities. The ſquare, cube, and other powers of a number, or root, are formed by multiplying the given number into itſelf a greater or leſs number of times, as the power required is higher or lower. See Syſtem of Arithmetic. Article XII.

EXTRACTOR, in midwifry, an inſtrument contrived to extract children in caſes of difficult births. See Syſtem of Midwifry.

EXTRAORDINARY, ſomething out of the common courſe. Extraordinary couriers, are thoſe ſent expreſs on ſome urgent occaſion. Extraordinary ambaſſador, or envoy, is ſuch a one as is ſent to treat or negotiate ſome ſpecial and important affair, as a marriage, a treaty, confederacy, &c. or even on occaſion of ſome ceremony, as condolence, congratulation, &c. A gazette, journal, or other news paper extraordinary, is that publiſhed after ſome great and notable event, containing the detail or particulars thereof, which are not found in the ordinary papers. Our news writers generally uſe poſtſcripts, or ſupplements, inſtead of extraordinaries.

EXTRAVASATION, in contuſions, fiſſures, depreſſions, fractures, and other accidents of the cranium, is when one or more of the blood veſſels, that are diſtributed in the dura mater, is broke or divided, whereby there is ſuch a diſcharge of blood as greatly oppreſſes the brain, and diſturbs its office; frequently bringing on violent pains, and other miſchiefs; and at length death itſelf, unleſs the patient is timely relieved.

Extravasation is ſometimes likewiſe uſed in ſpeaking of other humours beſide the blood; as the lympha, urine, &c. The gardeners uſe the term in ſpeaking of gums, juices, &c. which ouſe out of their trees either ſpontaneouſly, or at inciſions.

EXTRAVERSIO, in chymiſtry, a term uſed to expreſs the rendering manifeſt any thing ſaline, alkaline, or acid, concealed in mixed bodies; and is juſt the reverſe to one of the ſpecies of concentration, which hides theſe qualities.

EXTREAM, or **Extreme**, is applied to the laſt and outermoſt part of any thing; or that which finiſhes and terminates it on that ſide. The extreams of a line are points. There is no paſſing out of one extream into the other, without going through the middle. Extream remedies muſt only be had recourſe to in extream neceſſity. Anatomiſts apply the denomination extremes, or extremities, to the arms and legs.

Extreams, in logic, denote the two extream terms of the concluſion of a ſyllogiſm; viz. the predicate and ſubject. They are called extreams, from their relation to another term, which is a medium or mean between them.

Extream *Unction*, one of the ſacraments of the Romiſh church, the fifth in order, adminiſtered to people dangerouſly ſick, by anointing them with holy oils, and pronouncing ſeveral prayers over them. It is called extream unction, as being only given to perſons in extremity.

EXTREMITIES *of Figures*, in painting, is uſed for the head, hands, and feet. Theſe ſhould be drawn with more niceneſs and exactneſs, or more terminated than other parts; and thus help to render the action more expreſſive.

EXTRINSIC is applied in various ſenſes. Sometimes it ſignifies a thing's not belonging to the eſſence of another; in which ſenſe, the efficient cauſe, and the end, or ſcope of a thing, are ſaid to be extrinſic, or extrinſic cauſes. Sometimes it implies a thing not being contained within the capacity of another. In which ſenſe, thoſe cauſes are ſaid to be intrinſic, which introduce ſomething into a ſubject from without: as when fire introduces heat, &c. Sometimes it denotes a thing added, or applied to another. Thus, accidents and adherences are ſaid to be extrinſic to the ſubject; and thus viſion is extrinſic to the object ſeen.

EXTUBERANCES, in medicine, are ſwellings forth, or riſings up in the fleſh, or other parts of the body.

EXUDATION, the act of ſweating out. In which manner, gums, balſams, &c. are uſually produced from trees.

EXULCERATION, in medicine, the act of cauſing, or producing ulcers. Thus, arſenic exulcerates the inteſtines; corroſive humours exulcerate the ſkin.

Exulceration is ſometimes alſo uſed for an ulcer itſelf; but, more generally, for thoſe beginning eroſions which wear away the ſubſtance, and form ulcers. Exulcerations in the inteſtines are marks of poiſon.

EXUVIÆ, formed from *exuere, to put off, to diveſt*, in phyſiology, tranſient parts of certain animals, which they put off, or lay down, and aſſume new ones. Such, eſpecially, are the ſkins, or ſloughs of ſerpents; ſhells of lobſters, and the like; which are annually changed, and renewed in the ſpring.

The outer integument of the body, which in man and other large animals is ſo durably fixed on the body, is in many of the animals of the reptile kind much more looſely fixed, and is changeable ſeveral times during the period of their lives. The ſerpent-kind all ſhift their ſkins ſeveral times in their lives, and the water-newt has been lately obſerved to do the ſame: but no creature in the world does it ſo often as the caterpillar, almoſt every ſpecies of theſe inſects throwing off their old ſkin once in ten or twelve days, or leſs; and this in ſuch a manner as is extremely worthy an attentive obſervation. See Caterpiller.

Exuviæ is alſo uſed for ſome ſhells, and other marine bodies, frequently found in the bowels of the earth; ſuppoſed to have been depoſited there at the deluge, as being the real ſpoils of once living creatures. See Shell, Fossil, and Deluge.

EYE, the organ, or part, of the body, whereby a viſion is effected; i. e. whereby viſible objects are repreſented to the mind. For a full deſcription of the ſeveral parts, ſee Syſtem of Anatomy, Part VI. Sect. XI. For the repreſentation, ſee Plate XI.

EYRE, or Eire, in law, ſignifies the court of juſtices itinerant. The word ſeems formed of the old French *irre, iter, way or track*. Hence juſtices in *eyre*, are thoſe whom Bracton calls *juſticiarii itinerantes*.

Eyre *of the Foreſt*, is otherwiſe called *juſtice-ſeat*, which by the ancient cuſtoms was to be held every three years by the juſtice of the foreſt, journeying up and down for that purpoſe.

EZEKIEL, a canonical book of the Old Teſtament, referring chiefly to the degenerate manner and corruptions of the Jews in the times when the author wrote. It abounds with fine ſentiments and rich compariſons, and diſcovers much learning in profane matters. Ezekiel was carried captive to Babylon with Jechoniah or Jehoiachin, and began his prophecies in the fifth year of the captivity, or in the year before Chriſt 595. He was contemporary with Jeremiah, who propheſied at the ſame time in Judea. He foretold many events, particularly the deſtruction of the temple, the fatal cataſtrophe of thoſe who revolted from Babylon to Egypt, and the happy return of the Jews to their own land.

EZRA, or Ezdras, in divinity. The Book of Ezra is a book of Holy Scripture, compoſed in Hebrew by Ezra or Ezdras, the high prieſt of the Jews during the captivity; and particularly about the time when they returned to Paleſtine, under the reign of Cyrus. This Book contains the hiſtory of the Jews from the time of Cyrus's edict for their return, to the twentieth year of Artaxerxes Longimanus. It ſpecifies the number of Jews who returned, and Cyrus's proclamation for rebuilding the temple, the obſtruction it met with, and the finiſhing thereof in the reign of Darius. It is canonical, and allowed as ſuch both by the church and the ſynagogue. The books of Ezra, called in the Engliſh verſion the Firſt and Second Books of Eſdras, though held by ſome, particularly the Greeks, for canonical, are thrown by the Engliſh church into the number of apocryphal books, being only extant in Greek. The Canon of Ezra is the collection of the books of the Scripture made by that pontiff. It appears, however, that the ſynagogue added other books to Ezra's canon; witneſs the book of Ezra itſelf, that of Nehemiah, and ſeveral others.

F

F, THE fourth conſonant, and ſixth letter of the alphabet. The letter F is borrowed from the digamma or double gamma of the Ælians, as is evident from the inſcription on the pedeſtal of the Coloſſus at Delos; and was undoubtedly formed from the old Hebrew vau: and though this letter is not found in the modern Greek alphabet, yet it was in the ancient one, from whence the Latins received it, and tranſmitted it to us.

It is formed by a ſtrong expreſſion of the breath, and joining at the ſame time the upper teeth and under lip. It has but one ſort of ſound, which has a great affinity with *v* and *ph*, the latter being written for it by us in all Greek words, as philoſophy, &c. though the Italians write it *filoſofia*.

F, in phyſical preſcriptions ſtands for *fiat*, or "Let it be done." Thus *f. s. a.* ſignifies *fiat ſecundum artem*. F was alſo a numeral letter, ſignifying 404.

FABLE, a tale, or feigned narration, deſigned either to inſtruct or divert, diſguiſed under the allegory of an action, &c. Fables were the firſt pieces of wit that made their appearance in the world; and have continued to be highly valued, not only in times of the greateſt ſimplicity, but in the moſt polite ages of the world. Jotham's fable of the trees is the oldeſt that is extant, and as beautiful as any that have been made ſince. Nathan's fable of the poor man is next in antiquity. We find Æſop in the moſt diſtant ages of Greece; and in the early days of the Roman commonwealth, we read of a mutiny appeaſed by the fable of the belly and the members. As fables had their riſe in the very infancy of learning, they never flouriſhed more than when learning was at its greateſt height.

Fable is the fineſt way of giving counſel, and moſt univerſally pleaſing, becauſe leaſt ſhocking; for, in the reading of a fable, a man thinks he is directing himſelf, whilſt he is following the dictates of another, and conſequently is not ſenſible of that which is the moſt unpleaſing circumſtance in advice. Beſides, the mind is never ſo much pleaſed as when ſhe exerts herſelf in any action that gives her an idea of her own abilities; this natural pride of the ſoul is very much gratified in the reading of fable.

Fable is alſo uſed for the plot of an epic or dramatic poem; and is, according to Ariſtotle, the principal part, and, as it were, the ſoul of the poem.

There are two reaſons why fables have pleaſed in all ages and places. The firſt is, that ſelf-love is ſpared in the inſtruction. The ſecond, that the mind is exerciſed by the allegory. Men do not love direct precepts; too proud to condeſcend to thoſe philoſophers who ſeem to command what they teach, they require to be inſtructed in a more humble manner; they would never amend, if they thought that to amend were to obey: add, that there is a ſort of activity in the mind which muſt be humoured: it pleaſes itſelf in a penetration which diſcovers more than is ſhewn; and in apprehending what is hid under a veil, fancies itſelf in ſome meaſure the author of it.

The truth or idea intended ſhould ariſe in the readers mind from the fable itſelf. However, for the conveniency of the leſs diſcerning readers, it may be a good way to point out the truth or moral in preciſer terms. To have the moral at the end of the fable ſeems much better than at the beginning: the mind is apt to be fore-ſtalled in the latter caſe; I carry the key along with me, ſo that there is no room to exerciſe my mind in finding any thing myſelf.

The writers of fables are not many. If there were any before Æſop, who lived in the time of Solon, about the fifty ſecond Olympiad, his ſucceſs has quite effaced their memory; and even occaſioned all the good things of that kind to be aſcribed to him.

Among the moderns, the moſt celebrated writers are Meſſ. de la Fontaine and De la Motte: the firſt of whom has picked out all the beſt things in Æſop, Phædrus, and Pilpa, and given them anew in French, with a delicacy and ſimplicity peculiar to himſelf; and which in the judgment of his countrymen, ſets him even above Phædrus. The latter, rather than content himſelf with what De la Fontaine had left, choſe to be an inventor. He has ſucceeded. His fables are many of them very happy, though ſome think them too full of thought and reaſoning. His verſification is infinitely more correct than that of La Fontaine, and more ſuitable to the ſubject than that of Le Noble. We have likewiſe ſome fables much eſteemed of Mr. Gay, and Mr. Moore.

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FABRIC, in general, denotes the ſtructure or conſtruction of any thing; but particularly of buildings, as a church, hall, houſe, &c. See Syſtem of Architecture on the Principles of the Art.

FACE, the ſurface, or firſt ſide which a body preſents to the eye; ſee Surface. We ſay, the face of the earth, of the waters, &c. Polyhedrons have ſeveral faces; ſee Polyhedron. A die, or cube, has ſix faces; ſee Cube.

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EXTINCTION, the act of extinguiſhing, that is, of putting out or deſtroying fire, flame, or light.

Extinction, in chymiſtry and pharmacy, is when a metal, mineral, or the like body, after having been heated red hot in the fire, is plunged in ſome fluid; either to ſoften or temper its acrimony, as tutty in roſe water; or to communicate its virtue to the liquor, as iron or ſteel to common water; or, laſtly, to give it a temper, as in the extinction of ſteel in water, or ſome other preparation.

EXTIRPATION, formed of *ex* and *ſtirps, root*, the act of pulling up, or deſtroying, a thing to the very roots.

Extirpation is alſo uſed, in ſurgery, for cutting off any part entirely; as a wen, &c. or the eating it away, as a wart, &c. by corroſive medicines.

EXTORTION, in law, an illegal manner of wreſting any thing from a man, either by force, menace, or authority. If an officer, by terrifying another, on pretence of his office, takes more than his ordinary fees, or dues, he commits, and is indictable for extortion. So the exacting of unlawful uſury, winning by unlawful game, and, in fine, all taking of more than is juſtly due, by colour or pretence of right, as exceſſive tolls in millers, exceſſive prices of ale, bread, victuals, wares, &c. come under extortion.

EXTRA *Judicial*, ſomething done out of the proper court, or the ordinary courſe of law. As when judgment is given in a cauſe, or caſe, not depending in that court where ſuch judgment is given, or wherein the judge has no juriſdiction.

Extra *Parochial*, a place out of the bounds of any pariſh; or privileged and freed from the duties of a pariſh.

EXTRACT, Extractum, in pharmacy, the pureſt and fineſt part of a vegetable, or other body, ſeparated from the coarſer, by diſſolution and digeſtion with a proper menſtruum; and afterwards reduced into a thick, moiſt conſiſtence by diſtillation, or evaporation of the humidity of the menſtruum. Extracts are prepared from a variety of different drugs; as the bark, gentian, jalap, opium, &c.

Extract, in matters of literature, denotes a ſhort abridgment of a book or paper, or of ſome of the matters thereof. The journals, nouvalles, bibliotheques, memoires, and other monthly reviews, or quarterly accounts of the affairs of learning, conſiſt principally of extracts of the moſt material paſſages, doctrines, &c. found in the ſeveral books publiſhed in that time.

EXTRACTION, in pharmacy and chymiſtry, an operation, whereby eſſences, tinctures, &c. are drawn from natural bodies.

Extraction, in ſurgery, denotes an operation whereby ſome foreign matter lodged in the body, contrary to the order of nature, is drawn out of the ſame by manual application, or the help of inſtruments. Such is the extraction of a ſtone, formed in the bladder, or in the kidneys, &c.

Extraction, or *Deſcent*, in genealogy, denotes the ſtock, or family which a perſon is deſcended from. In ſome military orders, chapters, &c. a candidate muſt make proof of the nobility of his extraction before he is admitted.

Extraction *of Roots*, the method of finding the roots of given numbers, or quantities. The ſquare, cube, and other powers of a number, or root, are formed by multiplying the given number into itſelf a greater or leſs number of times, as the power required is higher or lower. See Syſtem of Arithmetic. Article XII.

EXTRACTOR, in midwifry, an inſtrument contrived to extract children in caſes of difficult births. See Syſtem of Midwifry.

EXTRAORDINARY, ſomething out of the common courſe. Extraordinary couriers, are thoſe ſent expreſs on ſome urgent occaſion. Extraordinary ambaſſador, or envoy, is ſuch a one as is ſent to treat or negotiate ſome ſpecial and important affair, as a marriage, a treaty, confederacy, &c. or even on occaſion of ſome ceremony, as condolence, congratulation, &c. A gazette, journal, or other news paper extraordinary, is that publiſhed after ſome great and notable event, containing the detail or particulars thereof, which are not found in the ordinary papers. Our news writers generally uſe poſtſcripts, or ſupplements, inſtead of extraordinaries.

EXTRAVASATION, in contuſions, fiſſures, depreſſions, fractures, and other accidents of the cranium, is when one or more of the blood veſſels, that are diſtributed in the dura mater, is broke or divided, whereby there is ſuch a diſcharge of blood as greatly oppreſſes the brain, and diſturbs its office; frequently bringing on violent pains, and other miſchiefs; and at length death itſelf, unleſs the patient is timely relieved.

Extravasation is ſometimes likewiſe uſed in ſpeaking of other humours beſide the blood; as the lympha, urine, &c. The gardeners uſe the term in ſpeaking of gums, juices, &c. which ouſe out of their trees either ſpontaneouſly, or at inciſions.

EXTRAVERSIO, in chymiſtry, a term uſed to expreſs the rendering manifeſt any thing ſaline, alkaline, or acid, concealed in mixed bodies; and is juſt the reverſe to one of the ſpecies of concentration, which hides theſe qualities.

EXTREAM, or Extreme, is applied to the laſt and outermoſt part of any thing; or that which finiſhes and terminates it on that ſide. The extreams of a line are points. There is no paſſing out of one extream into the other, without going through the middle. Extream remedies muſt only be had recourſe to in extream neceſſity. Anatomiſts apply the denomination extremes, or extremities, to the arms and legs.

Extreams, in logic, denote the two extream terms of the concluſion of a ſyllogiſm; viz. the predicate and ſubject. They are called extreams, from their relation to another term, which is a medium or mean between them.

Extream *Unction*, one of the ſacraments of the Romiſh church, the fifth in order, adminiſtered to people dangerouſly ſick, by anointing them with holy oils, and pronouncing ſeveral prayers over them. It is called extream unction, as being only given to perſons in extremity.

EXTREMITIES *of Figures*, in painting, is uſed for the head, hands, and feet. Theſe ſhould be drawn with more niceneſs and exactneſs, or more terminated than other parts; and thus help to render the action more expreſſive.

EXTRINSIC is applied in various ſenſes. Sometimes it ſignifies a thing's not belonging to the eſſence of another; in which ſenſe, the efficient cauſe, and the end, or ſcope of a thing, are ſaid to be extrinſic, or extrinſic cauſes. Sometimes it implies a thing not being contained within the capacity of another. In which ſenſe, thoſe cauſes are ſaid to be intrinſic, which introduce ſomething into a ſubject from without: as when fire introduces heat, &c. Sometimes it denotes a thing added, or applied to another. Thus, accidents and adherences are ſaid to be extrinſic to the ſubject; and thus viſion is extrinſic to the object ſeen.

EXTUBERANCES, in medicine, are ſwellings forth, or riſings up in the fleſh, or other parts of the body.

EXUDATION, the act of ſweating out. In which manner, gums, balſams, &c. are uſually produced from trees.

EXULCERATION, in medicine, the act of cauſing, or producing ulcers. Thus, arſenic exulcerates the inteſtines; corroſive humours exulcerate the ſkin.

EXULCERATION is ſometimes alſo uſed for an ulcer itſelf; but, more generally, for thoſe beginning eroſions which wear away the ſubſtance, and form ulcers. Exulcerations in the inteſtines are marks of poiſon.

EXUVIÆ, formed from *exuere, to put off, to diveſt*, in phyſiology, tranſient parts of certain animals, which they put off, or lay down, and aſſume new ones. Such, eſpecially, are the ſkins, or ſloughs of ſerpents; ſhells of lobſters, and the like; which are annually changed, and renewed in the ſpring.

The outer integument of the body, which in man and other large animals is ſo durably fixed on the body, is in many of the animals of the reptile kind much more looſely fixed, and is changeable ſeveral times during the period of their lives. The ſerpent-kind all ſhift their ſkins ſeveral times in their lives, and the water-newt has been lately obſerved to do the ſame: but no creature in the world does it ſo often as the caterpillar, almoſt every ſpecies of theſe inſects throwing off their old ſkin once in ten or twelve days, or leſs; and this in ſuch a manner as is extremely worthy an attentive obſervation. See CATERPILLER.

EXUVIÆ is alſo uſed for ſome ſhells, and other marine bodies, frequently found in the bowels of the earth; ſuppoſed to have been depoſited there at the deluge, as being the real ſpoils of once living creatures. See SHELL, FOSSIL, and DELUGE.

EYE, the organ, or part, of the body, whereby a viſion is effected; i. e. whereby viſible objects are repreſented to the mind. For a full deſcription of the ſeveral parts, ſee Syſtem of ANATOMY, Part VI. Sect. XI. For the repreſentation, ſee Plate XI.

EYRE, or **EIRE**, in law, ſignifies the court of juſtices itinerant. The word ſeems formed of the old French *irre, iter, way or track.* Hence juſtices in *eyre*, are thoſe whom Bracton calls *juſticiarii itinerantes.*

EYRE *of the Foreſt*, is otherwiſe called *juſtice-ſeat*, which by the ancient cuſtoms was to be held every three years by the juſtice of the foreſt, journeying up and down for that purpoſe.

EZEKIEL, a canonical book of the Old Teſtament, referring chiefly to the degenerate manner and corruptions of the Jews in the times when the author wrote. It abounds with fine ſentiments and rich compariſons, and diſcovers much learning in profane matters. Ezekiel was carried captive to Babylon with Jechoniah or Jehoiachin, and began his prophecies in the fifth year of the captivity, or in the year before Chriſt 595. He was contemporary with Jeremiah, who propheſied at the ſame time in Judea. He foretold many events, particularly the deſtruction of the temple, the fatal cataſtrophe of thoſe who revolted from Babylon to Egypt, and the happy return of the Jews to their own land.

EZRA, or **EZDRAS**, in divinity. The Book of Ezra is a book of Holy Scripture, compoſed in Hebrew by Ezra or Ezdras, the high prieſt of the Jews during the captivity; and particularly about the time when they returned to Paleſtine, under the reign of Cyrus. This Book contains the hiſtory of the Jews from the time of Cyrus's edict for their return, to the twentieth year of Artaxerxes Longimanus. It ſpecifies the number of Jews who returned, and Cyrus's proclamation for rebuilding the temple, the obſtruction it met with, and the finiſhing thereof in the reign of Darius. It is canonical, and allowed as ſuch both by the church and the ſynagogue. The books of Ezra, called in the Engliſh verſion the Firſt and Second Books of Eſdras, though held by ſome, particularly the Greeks, for canonical, are thrown by the Engliſh church into the number of apocryphal books, being only extant in Greek. The Canon of Ezra is the collection of the books of the Scripture made by that pontiff. It appears, however, that the ſynagogue added other books to Ezra's canon; witneſs the book of Ezra itſelf, that of Nehemiah, and ſeveral others.

F

F, THE fourth conſonant, and ſixth letter of the alphabet. The letter F is borrowed from the digamma or double gamma of the Ælians, as is evident from the inſcription on the pedeſtal of the Coloſſus at Delos; and was undoubtedly formed from the old Hebrew vau: and though this letter is not found in the modern Greek alphabet, yet it was in the ancient one, from whence the Latins received it, and tranſmitted it to us.

It is formed by a ſtrong expreſſion of the breath, and joining at the ſame time the upper teeth and under lip. It has but one ſort of ſound, which has a great affinity with *v* and *ph*, the latter being written for it by us in all Greek words, as philoſophy, &c. though the Italians write it *filoſofia*.

F, in phyſical preſcriptions ſtands for *fiat*, or "Let it be done." Thus *f. s. a.* ſignifies *fiat ſecundum artem*. F was alſo a numeral letter, ſignifying 404.

FABLE, a tale, or feigned narration, deſigned either to inſtruct or divert, diſguiſed under the allegory of an action, &c. Fables were the firſt pieces of wit that made their appearance in the world; and have continued to be highly valued, not only in times of the greateſt ſimplicity, but in the moſt polite ages of the world. Jotham's fable of the trees is the oldeſt that is extant, and as beautiful as any that have been made ſince. Nathan's fable of the poor man is next in antiquity. We find Æſop in the moſt diſtant ages of Greece; and in the early days of the Roman commonwealth, we read of a mutiny appeaſed by the fable of the belly and the members. As fables had their riſe in the very infancy of learning, they never flouriſhed more than when learning was at its greateſt height.

Fable is the fineſt way of giving counſel, and moſt univerſally pleaſing, becauſe leaſt ſhocking; for, in the reading of a fable, a man thinks he is directing himſelf, whilſt he is following the dictates of another, and conſequently is not ſenſible of that which is the moſt unpleaſing circumſtance in advice. Beſides, the mind is never ſo much pleaſed as when ſhe exerts herſelf in any action that gives her an idea of her own abilities; this natural pride of the ſoul is very much gratified in the reading of fable.

FABLE is alſo uſed for the plot of an epic or dramatic poem; and is, according to Ariſtotle, the principal part, and, as it were, the ſoul of the poem.

There are two reaſons why fables have pleaſed in all ages and places. The firſt is, that ſelf-love is ſpared in the inſtruction. The ſecond, that the mind is exerciſed by the allegory. Men do not love direct precepts; too proud to condeſcend to thoſe philoſophers who ſeem to command what they teach, they require to be inſtructed in a more humble manner; they would never amend, if they thought that to amend were to obey: add, that there is a ſort of activity in the mind which muſt be humoured: it pleaſes itſelf in a penetration which diſcovers more than is ſhewn; and in apprehending what is hid under a veil, fancies itſelf in ſome meaſure the author of it.

The truth or idea intended ſhould ariſe in the readers mind from the fable itſelf. However, for the conveniency of the leſs diſcerning readers, it may be a good way to point out the truth or moral in preciſer terms. To have the moral at the end of the fable ſeems much better than at the beginning: the mind is apt to be fore-ſtalled in the latter caſe; I carry the key along with me, ſo that there is no room to exerciſe my mind in finding any thing myſelf.

The writers of fables are not many. If there were any before Æſop, who lived in the time of Solon, about the fifty ſecond Olympiad, his ſucceſs has quite effaced their memory; and even occaſioned all the good things of that kind to be aſcribed to him.

Among the moderns, the moſt celebrated writers are Meſſ. de la Fontaine and De la Motte: the firſt of whom has picked out all the beſt things in Æſop, Phædrus, and Pilpa, and given them anew in French, with a delicacy and ſimplicity peculiar to himſelf; and which in the judgment of his countrymen, ſets him even above Phædrus. The latter, rather than content himſelf with what De la Fontaine had left, choſe to be an inventor. He has ſucceeded. His fables are many of them very happy, though ſome think them too full of thought and reaſoning. His verſification is infinitely more correct than that of La Fontaine, and more ſuitable to the ſubject than that of Le Noble. We have likewiſe ſome fables much eſteemed of Mr. Gay, and Mr. Moore.

FABLE is alſo uſed for the plot of an epic or dramatic poem, or the action which makes the ſubject of ſuch a poem or romance. The fable, according to Ariſtotle, is the principal part, and as it were the ſoul of a poem. It muſt be conſidered as the firſt foundation of the compoſition, or the principle which gives life and motion to all the parts. In this ſenſe the fable is defined, "A diſcourſe invented with art, to form the manners by inſtructions diſguiſed under the allegory of an action."

The fable, according to Ariſtotle, conſiſts of two eſſential parts, viz. truth as its foundation; and fiction, which diſguiſes the truth, and gives it the form of fable. The truth is the point of morality intended to be inculcated; the fiction is the action, or words the inſtruction is covered under.

FABRIC, in general, denotes the ſtructure or conſtruction of any thing; but particularly of buildings, as a church, hall, houſe, &c. See Syſtem of ARCHITECTURE on the Principles of the Art.

FACE, the ſurface, or firſt ſide which a body preſents to the eye; ſee SURFACE. We ſay, the face of the earth, of the waters, &c. Polyhedrons have ſeveral faces; ſee POLYHEDRON. A die, or cube, has ſix faces; ſee CUBE.

FACE is particularly uſed for the viſage of an animal, and eſpecially of man; and comprehends in the latter, all that part of the head which is not covered with the common long hair. The Latins call it *facies*, *vultus*, *os*, &c. The face, conſidered as the index of the paſſions, habits, &c. of the perſon, makes the ſubject of phyſiognomy. See PHYSIOGNOMY.

Anatomiſts uſually divide the face into two parts, the upper and lower: the upper is the front, or forehead; the lower includes the eyes, noſe, ears, mouth, and chin.

FACES *of Baſtion*, in fortification, are the two foremoſt ſides reaching from the flanks to the point of the baſtion where they meet. Theſe are commonly the firſt determinded, becauſe they reach fartheſt out, and are the leaſt flanked, and therefore weakeſt.

FACET, or **FACETTE**, a little face or ſide of a body, cut into a great number of angles. Multiplying glaſſes are cut in facets, or facet wiſe. Diamonds are alſo cut in facets or tables. In brilliants there are two ſorts, ſkew or ſkill facets, and ſtar facets. Skill facets are divided into upper and under. Upper ſkill facets are wrought on the lower part of the bezil, and terminate in the girdle. Under ſkill facets are wrought on the pavilions, and terminate in the girdle. Star facets are wrought on the upper part of the bezil, and terminate in the table. Jeffries on diamonds.

FACTION, a cabal or party formed in a ſtate to diſturb the public repoſe. The moſt celebrated factions are that of the Guelphs and Gibelins, who kept Italy in alarm for many ages; and with us that of the Whigs and Tories.

FACTOR, in commerce, an agent or perſon who acts and negociates for a merchant by commiſſion; called alſo commiſſioner, and on ſome occaſions broker, and throughout the Levant, coagis. Factors are either charged with the buying or the ſelling of goods, or with both. Thoſe of the firſt kind are uſually eſtabliſhed in places of conſiderable manufactories, or cities of great trade. Their office is to buy up commodities for merchants reſiding elſewhere; to ſee them packed, and ſend them to the perſons for whom they were bought. The duty of a factor is to procure the beſt intelligence of the ſtate of trade at his place of reſidence; of the courſe of exchange; of the quantity and quality of goods at market, their preſent price, and the probability that it may riſe or fall; to pay exact obedience to the orders of his employers; to conſult their advantage in matters referred to his direction; to execute their buſineſs with all the diſpatch that circumſtances admit; to be early in his intelligence, diſtinct in his accounts, and punctual in his correſpondence.

FACTORS *of Sale* are uſually fixed in places where there is a great trade. To theſe, merchants and manufacturers ſend their goods to be ſold for them according to the price and other conditions expreſſed in the orders delivered them. The wages or allowances for ſelling are uſually clear of all expences of carriage, exchange, remittances, &c. excepting poſtage of letters, which are never put to account. Factors ſhould ſtrictly obſerve the orders of their principals, or elſe they are liable to the damage accruing from the neglect of them. When factors have unlimited commiſſion to do for their conſtituents the beſt they can, they are excuſable, though their tranſactions are attended with loſs to their principals; but no factor, who has merely a commiſſion to ſell, &c. for another, is excuſable for entruſting another perſon beyond the uſual time allowed in the ſale of the commodities which he diſpoſes of: in ſuch a caſe he is anſwerable to the principal out of his own eſtate.

A factor that ſells a commodity under the price ordered by his principal ſhall be obliged to make good the difference; and if he purchaſes goods for another at a limited price, and they riſe in value, and he ſecures to himſelf the advantage, he is obliged to ſatisfy his principal for damages; or if he makes any advantage of the ſale of goods which his principal directed him to purchaſe, the principals ſhall recover it from him, and he is liable to be amerced for the fraud.

A factor who has money in hand belonging to his principals, and who neglects to inſure a ſhip and goods according to order, ſhall make good the damage if the ſhip miſcarry; and if he makes any compoſition with the inſurers after inſurance without orders, he is anſwerable for the whole inſurance. As fidelity and diligence are required from the factors, ſo the law requires the like from the principal: if, therefore, a perſon remits counterfeit jewels to his factor, who ſells them as true ones, and ſuſtains loſs or damage by impriſonment or other puniſhment, the principal ſhall not make ſatisfaction to the factor but to the party who purchaſed them. Buſineſs of this kind is called commiſſion-buſineſs; and traders in this way have current as well as commiſſion accounts conſtantly between them, and draw on, remit to, and ſend commiſſions to each other only by the intercourſe of letters, which among men of honour, are as obligatory and authoritative as all the bonds and ties of law.

FACTORAGE. The factorage or wages, called alſo commiſſion, is different at different places, and for different voyages; at a medium it may be fixed at about three per cent. of the value of the goods bought, beſide the charge of package, which is paid over and above. At Virginia, Barbadoes, and Jamaica, the factorage is about eight per cent. and the like throughout the greateſt part of the Weſt Indies. In Italy it is two and a half; in Holland one and a half; in Spain, Portugal, France, &c. it is two per cent.

FACTORY, a place where a conſiderable number of factors reſide to negociate and officiate for their maſters or principals. The term is chiefly uſed in ſpeaking of the Eaſt Indies, and other parts of Aſia, Turky, Italy, Portugal, &c. whither the European nations ſend their ſhips every year, and where they keep factors to buy the commodities of the country, and ſell thoſe brought from Europe. The moſt conſiderable factories belonging to the Britiſh are thoſe eſtabliſhed in the Eaſt-Indies, Portugal, Turky, &c.

FACULTY, a power or ability of performing an action. The term is much uſed by the ancient philoſophers, and ſtill retained in the ſchools for explaining the actions of natural bodies. Thus, to account for the act of digeſtion, they ſuppoſe a digeſtive faculty in the ſtomach: to account for motion, they imagine a motive faculty in the nerves, &c. which is only a ſubſtituting of one name of an unknown phenomenon for another. The faculties or powers of the ſoul are commonly reputed two, viz. the underſtanding and will. The faculties of the body are uſually diſtinguiſhed with regard to their ſeveral functions, into vegetative and animal. Under the vegetative faculty are comprehended the divers ſubaltern ones, whereby nutrition and generation are effected. Under the animal faculties are comprehended thoſe relating to ſenſe and motion. The vegetative faculty is ſubdivided into nutritive and generative, and the nutritive is again ſubdivided into natural and vital. To the firſt belong the functions of the lower belly, relating to the preparation of the food; to the latter, the actions of the heart and lungs, wherein life is chiefly concerned. Others ſubdivide the vegetative faculty into attractive, retentive, concoctive, and expulſive. The animal faculties being thoſe whereby an animal perceives and moves, become divided into ſenſitive and locomotive.

FACULTY is alſo applied in the ſchools, to the divers parts or members of an univerſity, divided according to the arts or ſciences taught or profeſſed there. There are four faculties in moſt univerſities; that of arts, which includes humanity and philoſophy, and is much the moſt ancient and extenſive: the ſecond is that of theology; the third, medicine; and the fourth, juriſprudence, civil or law. The degrees in the ſeveral faculties in the univerſities are thoſe of batchelor, maſter, and doctor.

FÆCES, or **FECES**, the dregs, ſediment, or impurities, remaining of a mixt body, after the purer, more volatile, and fluid, have been ſeparated from it by evaporation, diſſolution, decantation, derivation, or the like. Thus we ſay the fæces of wine, of oil, &c. Thoſe of wines are properly called lees; thoſe of oil, amurca; thoſe of malt-liquors, grounds.

FÆCES, in chymiſtry, denotes the lees, refuſe, dirt, mud, impurities, and heterogeneous matters, remaining in the alembic after the diſtillation of any body; what remains in the retort, inſtead of fæces, is properly denominated *caput mortuum, or terra damnata.*

FÆCES is particularly uſed in medicine, &c. for the groſs impure matters found at the bottom of the compoſitions and preparations of either pharmacy.

FÆCES is alſo uſed for the excrements of an animal voided by ſtool.

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Properties. The firſt ſpecies ſpreads its branches very wide, and affords a grateful ſhade; but no verdure will thrive under it. The maſt, or ſeeds, yield a good oil for lamps; and are a very agreeable food to ſquirrels, mice, and ſwine. The fat of ſwine fed with them, however, is ſoft, and boils away unleſs hardened by ſome other food. The wood is brittle; very fiſſile; durable in water, but not in open air: it is the beſt of all woods for fuel, and is ſometimes uſed by the wheelwright and turner to make axes, ſpokes, bowls, &c. ſword ſcabbards are alſo made of it; and ſhoe makers laſts, and formerly book binders uſed it in making covers for books. The leaves gathered in autumn, before they are much injured by the froſts, make much better matraſſes than ſtraw or chaff; and laſt for ſeven or eight years. The nuts, when eaten by the human ſpecies, occaſion giddineſs and headach; when well dried and powdered, they make wholeſome bread. They are ſometime roaſted, and ſubſtituted for coffee. The poor people in Sileſia uſe the expreſſed oil inſtead of butter. The cheſtnut tree ſometimes grows to an immenſe ſize. The largeſt in the known world are thoſe which grow upon Mount Ætna in Sicily. At Tortworth in Gloceſterſhire, is a cheſtnut tree 52 feet round. It is proved to have ſtood there ever ſince the year 1150, and was then ſo remarkable that it was called the *great cheſtnut of Tortworth*. It fixes the boundary of the manor, and is probably near 1000 years old. The wood of the cheſtnut tree is applicable to the ſame purpoſes with the oak. If the bark is not taken off, it makes poles for eſpaliers, dead fences, and hop yards; and pipes to convey water under ground, which will laſt longer than elm or oak. Some of the oldeſt buildings in London are ſaid to be conſtructed with this wood. The nuts are uſed for whitening linen cloth, and for making ſtarch.

FAILURE, or **FAILING**, a bankruptcy, popularly called breaking or ſtopping payment.

FAINT, or **FAINT-ACTION**, in law, is as much as feigned action; that is, ſuch an action as, though the words of the writ be true, yet, for certain cauſes, the party has no title to recover thereby. By which it differs from falſe-action, which is that where the words of the writ are falſe. Sometimes the two are confounded.

FAINTS, in the diſtillery, the weak ſpirituous liquor that runs from the ſtill in rectifying the low wines after the proof-ſpirit is run off.

FAINTS is alſo the laſt runnings of all ſpirits diſtilled by the alembic. The clearing the worm of theſe is ſo eſſential a point in order to the obtaining a pure ſpirit by the ſucceeding diſtillation, that all others are fruitleſs without it.

FAINTING. Some people are apt to faint during the operation of bleeding. In all caſes, therefore, where plentiful bleeding is indicated, it is beſt to do it in bed, in order to prevent the patient's fainting. It is likewiſe obſerved, that a perſon will bear the loſs of a much greater quantity of blood if the ſtream is ſmall than by a large orifice, which ſome think neceſſary, for making a more ſpeedy revulſion. Pringle, Obſerv. on the Diſeaſes of the Army, p. 131.

FAIR, a public place, where merchants, traders, and other perſons, from divers parts, meet, on ſome fixed day in the year, to buy and ſell commodities, and to partake of the diverſions uſually accompanying ſuch aſſemblies: or it denotes the concourſe of people aſſembled on ſuch occaſions. The word *fair* is formed of the French *foire*, which ſignifies the ſame thing; and *foire* ſome derive from the Latin *forum, market*; others from the Latin *feriæ*, becauſe *fairs* anciently were always held in the places where the wakes, or feaſts, of the dedications of churches, called *feriæ*, were alſo held. The Romans called them *mundinæ*. Eric Puteanus has a pretty little treatiſe on the *fairs* of the Romans, De Nundinis Romanorum, which he calls *nova faſtorum facula*.

Fairs can only be eſtabliſhed by virtue of the king's grant, or by long and immemorial uſage and preſcription, which ſuppoſes ſuch a grant. The duration of fairs is determined by proclamation; and if a perſon ſhall ſell any goods after the time of the fair expires, he ſhall incur a forfeiture of double the value of the goods ſold, one fourth to the proſecutor, and the reſt to the king.

Fairs make a very conſiderable article in the commerce of Europe, eſpecially that of the Mediterranean or inland parts; as Germany, &c. where the continual paſſage and repaſſage of veſſels is impracticable.

The principal fairs in Great Britain are, Stourbridge fair, near Cambridge; the two fairs of Briſtol; that of Exeter, Weſt Cheſter, Edinburgh, Weyhill, and Burford, fairs for ſheep: Pancras fair, in Staffordſhire, for ſaddle horſes; Barnet fair, near London, for lean and Welſh black cattle; St. Faith's, in Norfolk, for Scots runts; Yarmouth fiſhing fair for herrings; Ipſwich butter fair; that of Woodborough Hill, near Blandford in Dorſetſhire, famous for weſt country manufactures, Devonſhire kerſeys, Wiltſhire druggets, &c. two cheeſe fairs at Atherſton and Chipping Norton; beſides many more fairs in different parts of the kingdom.

FAIR, in ſea language, is uſed for the diſpoſition of the wind, when it is favourable to a ſhip's courſe, in oppoſition to that which is contrary or foul. The term fair is more comprehenſive than large, and includes about ſixteen or eighteen points of the compaſs; whereas large is confined to the beam or quarter, that is, to a wind which croſſes the keel at right angles, or obliquely from the ſtern, but never to one right a-ſtern. Falconer's Marine Dict.

FAIRY, a term frequently occuring in ancient traditions and romances, denoting a kind of genii, or imaginary deities, converſant on earth, and diſtinguiſhed by abundance of fantaſtical actions and offices, either good or evil. The fairies, according to theſe traditions, are peculiar ſpecies of divinities, that have but little relation to any of thoſe of the ancient Greeks and Romans; unleſs, perhaps, to the larvæ; though others will not have them ranked among deities, but ſuppoſe them an intermediate kind of beings, neither gods, nor angels, nor men, nor devils.

They are of oriental extraction, and ſeem to have been invented by the Perſians and Arabs, whoſe hiſtory and religion abound with tales of fairies and dragons. The Perſians call them Peri, and the Arabs Ginn; having a peculiar country, which they ſuppoſe them to inhabit, called Ginniſtian; and, by us, Fairy land. Fairies have been likewiſe deſcribed as of either ſex, and generally as of minute ſtature, though capable of aſſuming various forms and dimenſions. The moſt charming repreſentation imaginable of theſe children of romantic fancy, is in the Midſummer-Night's Dream of Shakeſpear; in referring to which, we ſhall no doubt have been anticipated by the recollection of almoſt every reader. Spenſer's Fairy Queen is an epic poem, under the perſons and characters of fairies. This ſort of poetry raiſes a pleaſing kind of horror in the mind of the reader, and amuſes his imagination with the ſtrangeneſs and novelty of the perſons who are repreſented in it; but, as a vehicle of inſtruction, the judicious object to it, as not having probability enough to make any moral impreſſion.

The belief of fairies ſtill ſubſiſts in many parts of our own country. And in the Highlands of Scotland, new born children are watched till the chriſtening is over, leſt they ſhould be ſtolen or changed by ſome of theſe phantaſtical exiſtences.

FAITH, in philoſophy and theology, that aſſent which we give to a propoſition advanced by another, the truth of which we do not immediately perceive from our own reaſon or experience; or it is a judgment, or aſſent of the mind, the motive whereof is not any intrinſic evidence, but the authority, or teſtimony, of ſome other, who reveals or relates it. Hence, as there are two kinds of authorities and teſtimonies, the one of God, and the other of man, faith becomes diſtinguiſhed into divine and human.

Divine **FAITH**, is that founded on the authority of God; or it is that aſſent we give to what is revealed by God. The objects of this faith, therefore, are matters of revelation.

Human **FAITH**, is that whereby we believe what is told us by men. The object hereof is matter of human teſtimony and evidence.

FAITH, *Implicit* or *Blind*, is that whereby we give our aſſent to a propoſition advanced by another, of whoſe knowledge and veracity we have no certain and evident reaſon, or proof. This is only opinion, under another name.

All our preſent religious faith is really human, as depending on the ſecondary teſtimony of men; of whoſe veracity, however, we have the ſtrongeſt proofs. The prophets, or thoſe to whom God immediately revealed his will, believed him, becauſe they knew he could not deceive. We, at this day, believe them, or rather their writings, for other reaſons; viz. the ſame which oblige us to believe all well-atteſted hiſtories. See **EVIDENCE**. Beſides the two ſpecies of faith, human and divine, the Romaniſts make a third, or intermediate kind, called,

Eccleſiaſtical **FAITH**, which is the aſſent orthodox perſons give to certain events decided by the church, and enjoined to be believed by all. As, when the church declares, that ſuch a book contains heretical doctrine, &c. This term, eccleſiaſtical faith, was firſt introduced by Mr. Perefixe, to diſtinguiſh the faith whereby we believe matters of divine revelation, from that whereby we believe matters of eccleſiaſtical determination.

FAITH, in practical theology, makes the firſt of the theological virtues, or graces. Faith in God, in this ſenſe, denotes ſuch a conviction of his being, perfections, character, and government, as produces love, truſt, worſhip, obedience, and reſignation. Faith in Chriſt, as it has been defined by ſome, is a mere aſſent to the Goſpel as true; according to others, it ſignifies ſuch a perſuaſion that he is the Meſſiah, and ſuch a deſire and expectation of the bleſſings which he has promiſed in his Goſpel to his ſincere diſciples, as engage the mind to fix its dependence upon him, and ſubject itſelf to him in all the ways of holy obedience; and thus defined it is a very extenſive principle, and includes in its nature and inſeparable effects, the whole of moral virtue. In this ſenſe it has been ſaid, that under the Goſpel a man is juſtified by faith. Faith likewiſe, in reſpect to futurity, is a moral principle, implying ſuch a conviction of the reality and importance of a future ſtate, as is ſufficient to regulate the temper and conduct.

FAITHFUL, an appellation which the Mahometans aſſume to themſelves.

FAITHFULNESS, in ethics, is an agreement between a man's promiſes and his actions.

FAKIR, or **FAQUIR**, a kind of derviſe, or Mahometan religious, who travels the country, and lives on alms. See **DERVISE**.

FALCATED, one of the phaſes of the planets, popularly called horned. The aſtronomers ſay, the moon, or any planet, is falcated, when the enlightened part appears in form of a ſickle, or reaping-hook, by the Latins called falx.

FALCO, in ornithology, a genus belonging to the order of accipitres, the characters of which are theſe: the beak is crooked, and furniſhed with wax at the baſe; the head is thick ſet with feathers, and the tongue is cloven. The principal ſpecies are, eſpecially of man; and comprehends in the latter, all that part of the head which is not covered with the common long hair. The Latins call it *facies*, *vultus*, *os*, &c. The face, conſidered as the index of the paſſions, habits, &c. of the perſon, makes the ſubject of phyſiognomy. See PHYSIOGNOMY.

Anatomiſts uſually divide the face into two parts, the upper and lower: the upper is the front, or forehead; the lower includes the eyes, noſe, ears, mouth, and chin.

FACES *of Baſtion*, in fortification, are the two foremoſt ſides reaching from the flanks to the point of the baſtion where they meet. Theſe are commonly the firſt determinded, becauſe they reach fartheſt out, and are the leaſt flanked, and therefore weakeſt.

FACET, or FACETTE, a little face or ſide of a body, cut into a great number of angles. Multiplying glaſſes are cut in facets, or facet wiſe. Diamonds are alſo cut in facets or tables. In brilliants there are two ſorts, ſkew or ſkill facets, and ſtar facets. Skill facets are divided into upper and under. Upper ſkill facets are wrought on the lower part of the bezil, and terminate in the girdle. Under ſkill facets are wrought on the pavilions, and terminate in the girdle. Star facets are wrought on the upper part of the bezil, and terminate in the table. Jeffries on diamonds.

FACTION, a cabal or party formed in a ſtate to diſturb the public repoſe. The moſt celebrated factions are that of the Guelphs and Gibelins, who kept Italy in alarm for many ages; and with us that of the Whigs and Tories.

FACTOR, in commerce, an agent or perſon who acts and negociates for a merchant by commiſſion; called alſo commiſſioner, and on ſome occaſions broker, and throughout the Levant, coagis. Factors are either charged with the buying or the ſelling of goods, or with both. Thoſe of the firſt kind are uſually eſtabliſhed in places of conſiderable manufactories, or cities of great trade. Their office is to buy up commodities for merchants reſiding elſewhere; to ſee them packed, and ſend them to the perſons for whom they were bought. The duty of a factor is to procure the beſt intelligence of the ſtate of trade at his place of reſidence; of the courſe of exchange; of the quantity and quality of goods at market, their preſent price, and the probability that it may riſe or fall; to pay exact obedience to the orders of his employers; to conſult their advantage in matters referred to his direction; to execute their buſineſs with all the diſpatch that circumſtances admit; to be early in his intelligence, diſtinct in his accounts, and punctual in his correſpondence.

FACTORS *of Sale* are uſually fixed in places where there is a great trade. To theſe, merchants and manufacturers ſend their goods to be ſold for them according to the price and other conditions expreſſed in the orders delivered them. The wages or allowances for ſelling are uſually clear of all expences of carriage, exchange, remittances, &c. excepting poſtage of letters, which are never put to account. Factors ſhould ſtrictly obſerve the orders of their principals, or elſe they are liable to the damage accruing from the neglect of them. When factors have unlimited commiſſion to do for their conſtituents the beſt they can, they are excuſable, though their tranſactions are attended with loſs to their principals; but no factor, who has merely a commiſſion to ſell, &c. for another, is excuſable for entruſting another perſon beyond the uſual time allowed in the ſale of the commodities which he diſpoſes of: in ſuch a caſe he is anſwerable to the principal out of his own eſtate.

A factor that ſells a commodity under the price ordered by his principal ſhall be obliged to make good the difference; and if he purchaſes goods for another at a limited price, and they riſe in value, and he ſecures to himſelf the advantage, he is obliged to ſatisfy his principal for damages; or if he makes any advantage of the ſale of goods which his principal directed him to purchaſe, the principals ſhall recover it from him, and he is liable to be amerced for the fraud.

A factor who has money in hand belonging to his principals, and who neglects to inſure a ſhip and goods according to order, ſhall make good the damage if the ſhip miſcarry; and if he makes any compoſition with the inſurers after inſurance without orders, he is anſwerable for the whole inſurance. As fidelity and diligence are required from the factors, ſo the law requires the like from the principal: if, therefore, a perſon remits counterfeit jewels to his factor, who ſells them as true ones, and ſuſtains loſs or damage by impriſonment or other puniſhment, the principal ſhall not make ſatisfaction to the factor but to the party who purchaſed them. Buſineſs of this kind is called commiſſion-buſineſs; and traders in this way have current as well as commiſſion accounts conſtantly between them, and draw on, remit to, and ſend commiſſions to each other only by the intercourſe of letters, which among men of honour, are as obligatory and authoritative as all the bonds and ties of law.

FACTORAGE. The factorage or wages, called alſo commiſſion, is different at different places, and for different voyages; at a medium it may be fixed at about three per cent. of the value of the goods bought, beſide the charge of package, which is paid over and above. At Virginia, Barbadoes, and Jamaica, the factorage is about eight per cent. and the like throughout the greateſt part of the Weſt Indies. In Italy it is two and a half; in Holland one and a half; in Spain, Portugal, France, &c. it is two per cent.

FACTORY, a place where a conſiderable number of factors reſide to negociate and officiate for their maſters or principals. The term is chiefly uſed in ſpeaking of the Eaſt Indies, and other parts of Aſia, Turky, Italy, Portugal, &c. whither the European nations ſend their ſhips every year, and where they keep factors to buy the commodities of the country, and ſell thoſe brought from Europe. The moſt conſiderable factories belonging to the Britiſh are thoſe eſtabliſhed in the Eaſt-Indies, Portugal, Turky, &c.

FACULTY, a power or ability of performing an action. The term is much uſed by the ancient philoſophers, and ſtill retained in the ſchools for explaining the actions of natural bodies. Thus, to account for the act of digeſtion, they ſuppoſe a digeſtive faculty in the ſtomach: to account for motion, they imagine a motive faculty in the nerves, &c. which is only a ſubſtituting of one name of an unknown phenomenon for another. The faculties or powers of the ſoul are commonly reputed two, viz. the underſtanding and will. The faculties of the body are uſually diſtinguiſhed with regard to their ſeveral functions, into vegetative and animal. Under the vegetative faculty are comprehended the divers ſubaltern ones, whereby nutrition and generation are effected Under the animal faculties are comprehended thoſe relating to ſenſe and motion. The vegetative faculty is ſubdivided into nutritive and generative, and the nutritive is again ſubdivided into natural and vital. To the firſt belong the functions of the lower belly, relating to the preparation of the food; to the latter, the actions of the heart and lungs, wherein life is chiefly concerned. Others ſubdivide the vegetative faculty into attractive, retentive, concoctive, and expulſive. The animal faculties being thoſe whereby an animal perceives and moves, become divided into ſenſitive and locomotive.

FACULTY is alſo applied in the ſchools, to the divers parts or members of an univerſity, divided according to the arts or ſciences taught or profeſſed there. There are four faculties in moſt univerſities; that of arts, which includes humanity and philoſophy, and is much the moſt ancient and extenſive: the ſecond is that of theology; the third, medicine; and the fourth, juriſprudence, civil or law. The degrees in the ſeveral faculties in the univerſities are thoſe of batchelor, maſter, and doctor.

FÆCES, or FECES, the dregs, ſediment, or impurities, remaining of a mixt body, after the purer, more volatile, and fluid, have been ſeparated from it by evaporation, diſſolution, decantation, derivation, or the like. Thus we ſay the fæces of wine, of oil, &c. Thoſe of wines are properly called lees; thoſe of oil, amurca; thoſe of malt-liquors, grounds.

FÆCES, in chymiſtry, denotes the lees, refuſe, dirt, mud, impurities, and heterogeneous matters, remaining in the alembic after the diſtillation of any body; what remains in the retort, inſtead of fæces, is properly denominated *caput mortuum, or terra damnata.*

FÆCES is particularly uſed in medicine, &c. for the groſs impure matters found at the bottom of the compoſitions and preparations of either pharmacy.

FÆCES is alſo uſed for the excrements of an animal voided by ſtool.

FAGUS, the BEECH TREE, a genus of the polyandria order, belonging to the monœcia claſs of plants. There are three ſpecies. 1. The ſylvaticus, or beech tree, riſes 60 or 70 feet high, and hath a proportionable thickneſs, branching upward into a fine regular head, garniſhed with oval ſerrated leaves, with flowers in globular catkins, ſucceeded by angular fruit called *maſt*. 2. The caſtanea, or cheſtnut tree, hath a large upright trunk growing 40 or 50 feet high, branching regularly round into a fine ſpreading head, garniſhed with large ſpear ſhaped acutely ſerrated leaves naked on the under ſide, having flowers in long amentums, ſucceeded by round prickly fruit, containing two or more nuts. 3. The pumila, dwarf cheſtnut tree, or chinkapin, riſes eight or ten feet high, with a branching ſhrubby ſtem, and oval, ſpear ſhaped, and acutely ſerrated leaves, hoary on the under ſide.

Culture. The firſt is very eaſily raiſed from the maſt or ſeed, which ripens in September, and may either be ſown then, or in a month or two after, or towards the ſpring. For this purpoſe, beds are to be prepared four feet wide. The earth is then to be raked evenly from the ſurface, about an inch deep; then ſow the maſt, and beat it gently down with the back of the ſpade, afterwards covering it up with earth to the above-mentioned depth. Many of the plants will come up in the ſpring, but others not till a year after; and when they are two years old, they muſt be planted out in nurſery rows two feet and a half aſunder, there to remain till they are four or five feet high, when they are to be tranſplanted to thoſe places where they are to continue. The ſecond and third ſorts are alſo propagated by ſeeds or nuts ſown in drills. The nuts ſometimes ripen perfectly in this country; but in default of this, there are vaſt quantities imported from Spain or Portugal. Theſe laſt are reckoned preferable even to the beſt ripened cheſtnuts of this country.

Properties. The firſt ſpecies ſpreads its branches very wide, and affords a grateful ſhade; but no verdure will thrive under it. The maſt, or ſeeds, yield a good oil for lamps; and are a very agreeable food to ſquirrels, mice, and ſwine. The fat of ſwine fed with them, however, is ſoft, and boils away unleſs hardened by ſome other food. The wood is brittle; very fiſſile; durable in water, but not in open air: it is the beſt of all woods for fuel, and is ſometimes uſed by the wheelwright and turner to make axes, ſpokes, bowls, &c. ſword ſcabbards are alſo made of it; and ſhoe makers laſts, and formerly book binders uſed it in making covers for books. The leaves gathered in autumn, before they are much injured by the froſts, make much better matraſſes than ſtraw or chaff; and laſt for ſeven or eight years. The nuts, when eaten by the human ſpecies, occaſion giddineſs and headach; when well dried and powdered, they make wholeſome bread. They are ſometime roaſted, and ſubſtituted for coffee. The poor people in Sileſia uſe the expreſſed oil inſtead of butter. The cheſtnut tree ſometimes grows to an immenſe ſize. The largeſt in the known world are thoſe which grow upon Mount Ætna in Sicily. At Tortworth in Glouceſterſhire, is a cheſtnut tree 52 feet round. It is proved to have ſtood there ever ſince the year 1150, and was then ſo remarkable that it was called the *great cheſtnut of Tortworth*. It fixes the boundary of the manor, and is probably near 1000 years old. The wood of the cheſtnut tree is applicable to the ſame purpoſes with the oak. If the bark is not taken off, it makes poles for eſpaliers, dead fences, and hop yards; and pipes to convey water under ground, which will laſt longer than elm or oak. Some of the oldeſt buildings in London are ſaid to be conſtructed with this wood. The nuts are uſed for whitening linen cloth, and for making ſtarch.

FAILURE, or **Failing**, a bankruptcy, popularly called breaking or ſtopping payment.

FAINT, or **Faint-Action**, in law, is as much as feigned action; that is, ſuch an action as, though the words of the writ be true, yet, for certain cauſes, the party has no title to recover thereby. By which it differs from falſe-action, which is that where the words of the writ are falſe. Sometimes the two are confounded.

FAINTS, in the diſtillery, the weak ſpirituous liquor that runs from the ſtill in rectifying the low wines after the proof-ſpirit is run off.

Faints is alſo the laſt runnings of all ſpirits diſtilled by the alembic. The clearing the worm of theſe is ſo eſſential a point in order to the obtaining a pure ſpirit by the ſucceeding diſtillation, that all others are fruitleſs without it.

FAINTING. Some people are apt to faint during the operation of bleeding. In all caſes, therefore, where plentiful bleeding is indicated, it is beſt to do it in bed, in order to prevent the patient's fainting. It is likewiſe obſerved, that a perſon will bear the loſs of a much greater quantity of blood if the ſtream is ſmall than by a large orifice, which ſome think neceſſary, for making a more ſpeedy revulſion. Pringle, Obſerv. on the Diſeaſes of the Army, p. 131.

FAIR, a public place, where merchants, traders, and other perſons, from divers parts, meet, on ſome fixed day in the year, to buy and ſell commodities, and to partake of the diverſions uſually accompanying ſuch aſſemblies: or it denotes the concourſe of people aſſembled on ſuch occaſions. The word *fair* is formed of the French *foire*, which ſignifies the ſame thing; and *foire* ſome derive from the Latin *forum, market*; others from the Latin *feriæ*, becauſe *fairs* anciently were always held in the places where the wakes, or feaſts, of the dedications of churches, called *feriæ*, were alſo held. The Romans called them *mundinæ*. Eric Puteanus has a pretty little treatiſe on the *fairs* of the Romans, De Nundinis Romanorum, which he calls *nova faſtorum facula*.

Fairs can only be eſtabliſhed by virtue of the king's grant, or by long and immemorial uſage and preſcription, which ſuppoſes ſuch a grant. The duration of fairs is determined by proclamation; and if a perſon ſhall ſell any goods after the time of the fair expires, he ſhall incur a forfeiture of double the value of the goods ſold, one fourth to the proſecutor, and the reſt to the king.

Fairs make a very conſiderable article in the commerce of Europe, eſpecially that of the Mediterranean or inland parts; as Germany, &c. where the continual paſſage and repaſſage of veſſels is impracticable.

The principal fairs in Great Britain are, Stourbridge fair, near Cambridge; the two fairs of Briſtol; that of Exeter, Weſt Cheſter, Edinburgh, Weyhill, and Burford, fairs for ſheep: Pancras fair, in Staffordſhire, for ſaddle horſes; Barnet fair, near London, for lean and Welſh black cattle; St. Faith's, in Norfolk, for Scots runts; Yarmouth fiſhing fair for herrings; Ipſwich butter fair; that of Woodborough Hill, near Blandford in Dorſetſhire, famous for weſt country manufactures, Devonſhire kerſeys, Wiltſhire druggets, &c. two cheeſe fairs at Atherſton and Chipping Norton; beſides many more fairs in different parts of the kingdom.

Fair, in ſea language, is uſed for the diſpoſition of the wind, when it is favourable to a ſhip's courſe, in oppoſition to that which is contrary or foul. The term fair is more comprehenſive than large, and includes about ſixteen or eighteen points of the compaſs; whereas large is confined to the beam or quarter, that is, to a wind which croſſes the keel at right angles, or obliquely from the ſtern, but never to one right a-ſtern. Falconer's Marine Dict.

FAIRY, a term frequently occuring in ancient traditions and romances, denoting a kind of genii, or imaginary deities, converſant on earth, and diſtinguiſhed by abundance of fantaſtical actions and offices, either good or evil. The fairies, according to theſe traditions, are peculiar ſpecies of divinities, that have but little relation to any of thoſe of the ancient Greeks and Romans; unleſs, perhaps, to the larvæ; though others will not have them ranked among deities, but ſuppoſe them an intermediate kind of beings, neither gods, nor angels, nor men, nor devils.

They are of oriental extraction, and ſeem to have been invented by the Perſians and Arabs, whoſe hiſtory and religion abound with tales of fairies and dragons. The Perſians call them Peri, and the Arabs Ginn; having a peculiar country, which they ſuppoſe them to inhabit, called Ginniſtian; and, by us, Fairy land. Fairies have been likewiſe deſcribed as of either ſex, and generally as of minute ſtature, though capable of aſſuming various forms and dimenſions. The moſt charming repreſentation imaginable of theſe children of romantic fancy, is in the Midſummer-Night's Dream of Shakeſpear; in referring to which, we ſhall no doubt have been anticipated by the recollection of almoſt every reader. Spenſer's Fairy Queen is an epic poem, under the perſons and characters of fairies. This ſort of poetry raiſes a pleaſing kind of horror in the mind of the reader, and amuſes his imagination with the ſtrangeneſs and novelty of the perſons who are repreſented in it; but, as a vehicle of inſtruction, the judicious object to it, as not having probability enough to make any moral impreſſion.

The belief of fairies ſtill ſubſiſts in many parts of our own country. And in the Highlands of Scotland, new born children are watched till the chriſtening is over, leſt they ſhould be ſtolen or changed by ſome of theſe phantaſtical exiſtences.

FAITH, in philoſophy and theology, that aſſent which we give to a propoſition advanced by another, the truth of which we do not immediately perceive from our own reaſon or experience; or it is a judgment, or aſſent of the mind, the motive whereof is not any intrinſic evidence, but the authority, or teſtimony, of ſome other, who reveals or relates it. Hence, as there are two kinds of authorities and teſtimonies, the one of God, and the other of man, faith becomes diſtinguiſhed into divine and human.

Divine **Faith**, is that founded on the authority of God; or it is that aſſent we give to what is revealed by God. The objects of this faith, therefore, are matters of revelation.

Human **Faith**, is that whereby we believe what is told us by men. The object hereof is matter of human teſtimony and evidence.

Faith, *Implicit* or *Blind*, is that whereby we give our aſſent to a propoſition advanced by another, of whoſe knowledge and veracity we have no certain and evident reaſon, or proof. This is only opinion, under another name.

All our preſent religious faith is really human, as depending on the ſecondary teſtimony of men; of whoſe veracity, however, we have the ſtrongeſt proofs. The prophets, or thoſe to whom God immediately revealed his will, believed him, becauſe they knew he could not deceive. We, at this day, believe them, or rather their writings, for other reaſons; viz. the ſame which oblige us to believe all well-atteſted hiſtories. See Evidence. Beſides the two ſpecies of faith, human and divine, the Romaniſts make a third, or intermediate kind, called,

Eccleſiaſtical **Faith**, which is the aſſent orthodox perſons give to certain events decided by the church, and enjoined to be believed by all. As, when the church declares, that ſuch a book contains heretical doctrine, &c. This term, eccleſiaſtical faith, was firſt introduced by Mr. Perefixe, to diſtinguiſh the faith whereby we believe matters of divine revelation, from that whereby we believe matters of eccleſiaſtical determination.

Faith, in practical theology, makes the firſt of the theological virtues, or graces. Faith in God, in this ſenſe, denotes ſuch a conviction of his being, perfections, character, and government, as produces love, truſt, worſhip, obedience, and reſignation. Faith in Chriſt, as it has been defined by ſome, is a mere aſſent to the Goſpel as true; according to others, it ſignifies ſuch a perſuaſion that he is the Meſſiah, and ſuch a deſire and expectation of the bleſſings which he has promiſed in his Goſpel to his ſincere diſciples, as engage the mind to fix its dependence upon him, and ſubject itſelf to him in all the ways of holy obedience; and thus defined it is a very extenſive principle, and includes in its nature and inſeparable effects, the whole of moral virtue. In this ſenſe it has been ſaid, that under the Goſpel a man is juſtified by faith. Faith likewiſe, in reſpect to futurity, is a moral principle, implying ſuch a conviction of the reality and importance of a future ſtate, as is ſufficient to regulate the temper and conduct.

FAITHFUL, an appellation which the Mahometans aſſume to themſelves.

FAITHFULNESS, in ethics, is an agreement between a man's promiſes and his actions.

FAKIR, or **Faquir**, a kind of derviſe, or Mahometan religious, who travels the country, and lives on alms. See Derviſe.

FALCATED, one of the phaſes of the planets, popularly called horned. The aſtronomers ſay, the moon, or any planet, is falcated, when the enlightened part appears in form of a ſickle, or reaping-hook, by the Latins called falx.

FALCO, in ornithology, a genus belonging to the order of accipitres, the characters of which are theſe: the beak is crooked, and furniſhed with wax at the baſe; the head is thick ſet with feathers, and the tongue is cloven. The principal ſpecies are, The coronatus, or crowned eagle of Edwards, with aſh coloured wax; the legs are covered with white downy feathers, interſperſed with black ſpots; the breaſt is reddiſh; and there are black belts on the ſides. It is a native of Guinea. The oſſifragus, or ſea eagle, with yellow wax, and half feathered legs; is about the ſize of a peacock; the feathers are white at the baſe, iron coloured in the middle, and black at the points; and the legs are yellow. It is found in ſeveral parts of Great Britain and Ireland. Mr. Willoughby tells us, that there was an aery of them in Whinfield Park, Weſtmoreland; and the bird ſoaring in the air with a cat in its talons, which Barlow drew from the very fact which he ſaw in Scotland, is of this kind. The cat's reſiſtance brought both animals to the ground, when Barlow took them up; and afterwards cauſed the event to be engraved in the 36th plate of his Collection of Prints. Turner ſays, that in his days this bird was too well known in England; for it made horrible deſtruction among the fiſh. All authors indeed agree, that it feeds principally on fiſh; which it takes, as they are ſwimming, near the ſurface, by darting itſelf down upon them.

The chryſaëtos, or golden eagle, weighs about 12 pounds and is in length about three feet, the wings, when extended, meaſuring about ſeven feet four inches. The ſight and ſenſe of ſmelling are very acute: the head and neck are cloathed with narrow, ſharp pointed feathers, of a deep brown colour bordered with tawney; the hind part of the head in particular is of a bright ruſt colour. Theſe birds are very deſtructive to fawns, lambs, kids, and all kinds of game; particularly in the breeding ſeaſon, when they bring a vaſt quantity of prey to their young. Smith, in his hiſtory of Kerry, relates, that a poor man in that country got a comfortable ſubſiſtence for his family, during a ſummer of famine, out of an eagle's neſt, by robbing the eaglets of the food the old ones brought; whoſe attendance he protracted beyond the natural time, by clipping the wings and retarding the flight of the former. It is very unſafe to leave infants in places where eagles frequent; there being inſtances in Scotland of two being carried off by them; but, fortunately, the theft was diſcovered in time, and the children were reſtored unhurt out of the eagles neſts. Yet quick as her ſight may be, her ſenſe of hearing ſeems ſtill more exquiſite. If hooded crows or ravens happen to be nearer the carrion, and reſort to it firſt, and give a ſingle croak, the eagle is certain of inſtantly repairing to the ſpot.

The fulvus, is common to the northern parts of Europe and America; that figured by Mr. Edwards differing from our ſpecies only in having ſome white ſpots on the breaſt. It is frequent in Scotland; where it is called the black eagle, from the dark colour of its plumage. It is very deſtructive to deer, which it will ſeize between the horns; and, by inceſſantly beating it about the eyes with its wings, ſoon makes a prey of the harraſſed animal. The eagles in the iſle of Rum have nearly extirpated the ſtags that uſed to abound there. This ſpecies generally builds in clefts of rocks near the deer foreſts; and makes great havock not only among them, but alſo among the white hares and ptarmigans. It is of equal ſize with the preceding, and is eaſily diſtinguiſhed from all the other ſpecies by a band of white on the upper part of the tail; the end only being of a deep brown. The legs are feathered to the feet, the toes yellow, the claws black.

The cæruleſcens, with yellow wax, a yellow ring round the eyes, and the feet yellow underneath; the back is of a blackiſh blue colour; and the temples are ſurrounded with a white line. This is the ſmalleſt bird of the genus, and is a native of Aſia.

The milvus, or kite, is a native of Europe, Aſia, and Africa. Bellonius relates, that, about the end of April, incredible numbers of them are ſeen flying over the Black Sea into Aſia. Its motion in the air diſtinguiſhes it from all other birds, being ſo ſmooth and even that it is ſcarce perceptible. Sometimes it will remain quite motionleſs for a conſiderable ſpace: at others, glide through the ſky, without the leaſt apparent action of its wings; from thence deriving the old name of *glead* or *glede*, from the Saxon *glida*. The tail of this bird, as being forked, is ſufficient to diſtinguiſh it from moſt other birds of prey. The kites vary in their colours. Mr. Pennant mentions a beautiful variety ſhot in Lincolnſhire, that was entirely of a tawny colour. Some have ſuppoſed them to be birds of paſſage, but in Britain they certainly continue the whole year.

The gentilis, or gentil falcon, inhabits the north of Scotland, and was in high eſteem as a bold and ſpirited bird in the days of falconry. It makes its neſt in rocks: it is larger than the goſhawk.

The buteo, or buzzard, is the moſt common of the hawk kind in England. It breeds in large woods; and uſually builds on an old crow's neſt, which it enlarges, and lines with wool and other ſoft materials. It lays two or three eggs, which are ſometimes perfectly white, ſometimes ſpotted with yellow. The cock buzzard will hatch and bring up the young if the hen is killed. The young keep company with the old ones for ſome little time after they quit the neſt; which is not uſual with other birds of prey, who always drive away their brood as ſoon as they can fly. It feeds on birds, rabbits, moles, and mice; it will alſo eat frogs, earthworms, and inſects. This bird is ſubject to ſome variety in its colours.

Haliætus, the fiſhing-hawk of Cateſby, or the oſpray, weighs three pounds and a quarter; it meaſures, from one end of the wing to the other, five feet and a half. The feathers of the thighs are ſhort, and adhere cloſe to them, contrary to others of the hawk kind, which nature ſeems to have deſigned for the more eaſily penetrating the water. Their manner of fiſhing is, after hovering a while over the water, to precipitate into it with prodigious ſwiftneſs; where they remain for ſome minutes, and ſeldom riſe without a fiſh. The white-headed eagle, who is generally on the watch, no ſooner ſpies him with his fiſh, than he flies furiouſly upon him: the hawk immediately mounts, and ſcreams out; but the eagle always ſoars above him, and compels him to let the fiſh fall: the eagle inſtantly darts down upon the fiſh, and ſeldom fails to catch it before it reaches the water. It is remarkable, that, whenever the hawk catches a fiſh he calls out, as if it were to give warning to his enemy the eagle, who always obeys the call, if within hearing. The lower parts of the rivers and creeks near the ſea in America, abound with theſe eagles and hawks, where ſuch diverting conteſts are often ſeen.

The gyrfalco, or gyrſalcon, with blue wax on the beak, yellow legs, a brown body marked with aſh-coloured ſtreaks underneath, and the ſides of the tail white. It is the gyrfalco of all the ornithologiſts except Linnæus, whoſe bird is unknown to the reſt. It is a native of Europe; and feeds upon cranes, pigeons, &c.

The niſus, or ſparrow-hawk, with green wax, yellow legs, a white belly undulated with grey, and the tail marked with blackiſh belts. This is the moſt pernicious hawk we have; and makes great havock among pigeons as well as partridges. It builds in hollow trees, in old neſts of crows, large ruins, and high rocks: it lays four white eggs, encircled near the blunter end with red ſpecks.

FALCON, or **Faucon**, a bird of prey of the hawk kind, ſuperior to all others for courage, docility, gentleneſs, and nobleneſs of nature. Several authors take the name falcon to have been occaſioned by its crooked talons or pounces, which reſemble a falx or ſickle. Giraldus derives it *a falcando*, becauſe it flies in a curve. See Plate I. ORNITHOLOGY.

The falcon, or falcon gentle, is both for the fiſt and for the lure. In the choice, take one that has wide noſtrils, high and large eye-lids, a large black eye; a round head, ſomewhat full on the top; barb feathers on the clap of the beaks, which ſhould be ſhort, thick, and of an azure colour; the breaſt large, round, and fleſhy; and the thighs, legs, and feet, large and ſtrong; with the ſear of the foot ſoft and bluiſh: the pounces ſhould be black, with wings long and croſſing the train, which ſhould be ſhort and very pliable.

The name falcon is reſtrained to the female: for the male is much ſmaller, weaker, and leſs courageous, than the female; and therefore is denominated taſſel, or tircelet. The falcon is excellent at the river, brook, and even field; and flies chiefly at the larger game, as wild-gooſe, kite, crow, heron, crane, pye, ſhoveler, &c. For further particulars, ſee FALCONRY, HAWK, and HAWKING.

FALCONER, a perſon who brings up, tames, and makes, that is, tutors and manages birds of prey; as falcons, hawks, &c.

The grand ſeignior uſually keeps 1000 falconers in his ſervice. The French king has a grand falconer, which is an office diſmembered from that of great hunt, *grand venur*. Hiſtorians take notice of this poſt as early as the year 1250.

FALCONRY, or **Fauconry**, the art of taming, managing, and tutoring, birds of prey, particularly falcons and hawks; and employing them with advantage in the purſuit of game; called alſo hawking. See HAWKING.

FALL, *deſcent*, in phyſics, the tendency of any heavy body towards the centre of the earth. Galileo firſt diſcovered the ratio of the acceleration of falling bodies; viz. that dividing the whole time of falling into equal parts, the body will fall thrice as far in the ſecond moment, as in the firſt; five times as far in the third; ſeven times in the fourth, &c. and ſo on in the order of the uneven numbers. See ACCELERATION.

Fall is alſo uſed in a moral ſenſe: as, the fall of Adam; the fall of the Roman empire, &c.

Fall, among ſeamen, denotes that part of the rope of a tackle which is haled upon. They ſay alſo that a ſhip hath falls when ſhe is not fluſh, but hath riſings of ſome parts of her decks more than others. Alſo a ſhip is ſaid to fall off, when being under ſail ſhe keeps not ſo near the wind as ſhe ſhould do.

FALLACY, a deception, fraud, or falſe appearance. The Epicureans deny that there is any ſuch thing as a fallacy of the ſenſes: for, according to them, all our ſenſations and perceptions, both of ſenſe and phantaſy, are true; whence they make ſenſe the primary criterion of truth.

The Carteſians, on the other hand, maintain, that we ſhould ſuſpect as falſe, or at moſt as dubious, every thing that preſents itſelf to us by means only of the external ſenſes, becauſe they frequently deceive us. They add, that our ſenſes, as being fallacious, were never given us by nature for the diſcovery of truth, or the contemplation of the principles of things; but only for pointing out to us what things are convenient or hurtful to our bodies.

The peripatetics keep a middle courſe. They ſay, that if a ſenſible object be taken in its common or general view, the ſenſe cannot be deceived; but that if the object be taken under its ſpecific view, the ſenſe may be miſtaken, from the want of the diſpoſitions neceſſary to a juſt ſenſation, as a diſorder in the organ, or any thing uncommon in the medium: thus, in ſome diſorders of the eye, all objects appear yellow; a ſtick in water appears broken or crooked, &c.

Fallacy, in logic, or ſyllogyſtic fallacy, is a captious argument, called alſo a ſophiſm. Fallacies either ariſe from words, or things: the foundation of an illuſion and fallacy in words, is ambiguity.

FALLING *Sickneſs*. See **Epilepsy**.

FALLOPIAN *Tubes*, in anatomy, two ducts ariſing from the womb, one on each ſide of the fundus, and thence extended to the ovaries; having a conſiderable ſhare in conception. See Syſtem of **Anatomy** for deſcription Part V. Sect. XII. For repreſentation, ſee Plate X, *fig*. 1, Letters DD.

FALLOW *Field*, or *Fallow Ground*, is land laid up, or that has lain untilled for a conſiderable time. See Syſtem of **Agriculture**, cloſe of Sect. XXIX.

FALSE, in general, ſomething contrary to truth, or not what it ought to be; thus we ſay a falſe action, falſe weights, falſe claim, &c.

False *Action*, if brought againſt one whereby he is caſt into into priſon, and dies pending the ſuit, the law gives no remedy in this caſe, becauſe the truth or falſehood of the matter cannot appear before it is tried: and if the plaintiff is barred, or non-ſuited at common law, regularly all the puniſhment is amercement.

False *Impriſonment*, is a treſpaſs committed againſt a perſon, by arreſting and impriſoning him without juſt cauſe, contrary to law; or where a man is unlawfully detained without legal proceſs: and it is alſo uſed for a writ which is brought for this treſpaſs. If a perſon be any way unlawfully detained, it is falſe impriſonment; and conſiderable damages are recoverable in thoſe actions.

False *Oath*. See **Perjury**.

FALSHOOD, **Falsity**, in philoſophy, an act of the underſtanding, repreſenting a thing otherwiſe than it is, as to its accidents; or falſe judgment of any thing.

FALX, in anatomy, a part of the dura mater, deſcending between the two hemiſpheres of the brain, and ſeparating the forepart from the hinder. It is called falx, i. e. ſickle, becauſe of its curvature, occaſioned by the convexity of the brain. It divides the brain as low as the corpus calloſum. See Syſtem of **Anatomy**, Part VI. Sect. I.

FAME, a heathen goddeſs, celebrated chiefly by the poets. She is feigned to have been the laſt of the race of Titans produced by the earth, to have her palace in the air, and to have a vaſt number of eyes, ears, and tongues. She is mentioned by Heſiod, and particularly deſcribed by Ovid and Virgil.

Fames *Canina*, by the Greeks called *cynodes orexis*, q. d. *dog appetite*, is ſuch an inſatiable hunger as is not to be ſatisfied with eating, but continues even when the ſtomach is full.

FAMILY, denotes the perſons that live together in one houſe, under the direction of one head or chief manager. It alſo ſignifies the kindred or lineage of a perſon.

Family, in natural hiſtory, a ſubordinate diſtinction. It has been too common with compilers of dictionaries to confound the words, claſs, order, genus, and family. The latter evidently denotes this diſtinction. For inſtance the genus ſimia or monkey is diſtributed into three families. 1. Simiæ apes, ſuch as want tails; 2. Cercopithici, monkies, ſuch as have tails; 3. Papiones, baboons, thoſe with ſhort tails, to diſtinguiſh them from the common monkeys, which have very long ones. So that family points out diſtinction of ſpecies, or one of the ſame genus.

FAN, a machine uſed to raiſe wind, and cool the air by agitating it. The cuſtom which now prevails of wearing fans was borrowed from the eaſt, where they are almoſt indiſpenſibly neceſſary for keeping off the ſun and the flies.

FANATICS, wild, enthuſiaſtic, viſionary perſons, who pretend to revelation and inſpiration. The ancients called thoſe *fanatici* who paſſed their time in temples *(fana)*, and being often ſeized, with a kind of enthuſiaſm, as if inſpired by the divinity, ſhewed wild and antic geſtures. Prudentius repreſents them as cutting and ſlaſhing their arms with knives. Shaking the head was alſo common among the fanatici; for Lampridius informs us, that the emperor Heliogabulus was arrived to that pitch of madneſs, as to ſhake his head with the gaſhed fanatics. Hence the word was applied among us to the Anabaptiſts, Quakers, &c. at their firſt riſe, and is now an epithet given to the modern prophets, muggletonians, &c.

FANCY, or imagination. See **Imagination**.

FANUM, among the Romans, a temple or place conſecrated to ſome deity. The deified men and women among the heathens had likewiſe their fana; even the great philoſopher Cicero erected one to his daughter Tullia.

FARCE, was originally a droll, petty ſhew, or entertainment, exhibited by charletans, and their buffoons, in the open ſtreet, to gather the crowd together. The word is French, and ſignifies literally, "force-meat or ſtuffing." It was applied on this occaſion, no doubt, on account of the variety of jeſts, gibes, tricks, &c. wherewith the entertainment was interlarded. Some authors derive farce from the Latin *facetia*; others from the Celtic *farce*, mockery; others from the Latin *faccire*, to ſtuff. At preſent it is removed from the ſtreet to the theatre; and inſtead of being performed by merry-andrews to amuſe the rabble, is acted by comedians, and become the entertainment of a polite audience. Poets have reformed the wildneſs of the primitive farces, and brought them to the taſte and manner of comedy. The difference between the two on our ſtage is, that comedy keeps to nature and probability, and therefore is confined to certain laws preſcribed by ancient critics; whereas farce diſallows of all laws, or rather ſets them aſide on occaſion. Its end is purely to make merry; and it ſticks at nothing which may contribute thereto, however wild and extravagant. Hence the dialogue is uſually low, the perſons of inferior rank, the fable or action trivial or ridiculous, and nature and truth every where heightened and exaggerated to afford the more palpable ridicule.

FARCIN, or **Farcy**, a diſeaſe in horſes, &c. ſomewhat of the nature of a ſcabies or mange. See Syſtem of **Farriery**.

FARE, a voyage or paſſage, or the money paid for paſſing by water, &c. For the fares of hackney coachmen, watermen, &c. ſee *Hackney* **Coaches**, and **Watermen**.

FARINA, the flour or powder of ſome ſort of grain or pulſe, ground or ſifted from the bran. The word is formed of *far*, *corn-wheat*; and *far*, according to Guichard, comes from the Hebrew גר, *bar*, ſignifying the ſame thing.

FARM, **Farin**, or **Firm**, *(Firma)*, in law, ſignifies a little country meſſuage, or diſtrict; containing houſe and land, with other conveniences; hired, or taken by leaſe, either in writing, or parole, under a certain yearly rent. See **Lease**.

This in divers parts is differently termed: in the north, it is a *tack*; in Lancaſhire a *fermeholt*; in Eſſex, a *wike*, &c.

Culture of a **Farm**. See **Agriculture**.

Farm, as connected with gardening, and ſuſceptible of embelliſhment. See **Gardening**:

In ſpeculation, it might have been expected that the firſt eſſay of improvement ſhould have been on a farm, to make it both advantageous and delightful; but the fact was otherwiſe: a ſmall plot was appropriated to pleaſure; the reſt was reſerved for profit only. And this may, perhaps, have been a principal cauſe of the vicious taſte which long prevailed in gardens. It was imagined that a ſpot ſet apart from the reſt ſhould not be like them: the conceit introduced deviations from nature, which were afterwards carried to ſuch an exceſs, that hardly any objects truly rural were left within the encloſure, and the view of thoſe without was generally excluded. The firſt ſtep, therefore, towards a reformation, was by opening the garden to the country, and that immediately led to aſſimilating them; but ſtill the idea of a ſpot appropriated to pleaſure only prevailed, and one of the lateſt improvements has been to blend the uſeful with the agreeable; even the ornamented farm was prior in time to the more rural; and we have at laſt returned to ſimplicity by force of refinement.

Of a Paſtoral Farm.

The ideas of paſtoral poetry ſeem now to be the ſtandard of that ſimplicity; and a place conformable to them is deemed a farm in its utmoſt purity. An alluſion to them evidently enters into the deſign of the leaſowes, in Shropſhire, between Birmingham and Stourbridge, where they appear ſo lovely as to endear the memory of their author; and juſtify the reputation of Mr. Shenſtone, who inhabited, made, and celebrated the place: it is a perfect picture of his mind, ſimple, elegant, and amiable; and will always ſuggeſt a doubt, whether the ſpot inſpired his verſe, or whether, in the ſcenes which he formed, he only realized the paſtoral images which abound in his ſongs. The whole is in the ſame taſte, yet full of variety; and, except in two or three trifles, every part is rural and natural. It is literally a grazing farm lying round the houſe; and a walk, as unaffected and as unadorned as a common field path, is conducted through the ſeveral encloſures. But for a detail of the plan and ſcenery, as illuſtrative of the preſent ſubject, the reader is referred to the particular deſcription of the Leaſowes publiſhed by the late Mr. Dodſley. We ſhall only take notice of one or two circumſtances independent on the general delineation.

The art with which the diviſions between the fields are diverſified is one of them. Even the hedges are diſtinguiſhed from each other: a common quickſet fence is in one place the ſeparation; in another, it is a lofty hedge row, thick from the top to the bottom; in a third, it is a continued range of trees, with all their ſtems clear, and the light appearing in the intervals between their boughs, and the buſhes beneath them; in others, theſe lines of trees are broken, a few groupes only being left at different diſtances; and ſometimes a wood, a grove, a coppice, or a thicket, is the apparent boundary, and by them both the ſhape, and the ſtyle of the encloſures are varied.

The inſcriptions, which abound in the place, are another ſtriking peculiarity: they are well known and juſtly admired; and the elegance of the poetry, and the aptneſs of the quotations, atone for their length and their number. But, in general, inſcriptions pleaſe no more than once; the utmoſt they can pretend to, except when their alluſions are emblematical, is to point out the beauties, or deſcribe the effects, of the ſpots they belong to; but thoſe beauties and thoſe effects muſt be very faint, which ſtand in need of the aſſiſtance. Inſcriptions, however, to commemorate a departed friend, are evidently exempt from the cenſure; the monuments would be unintelligible without them; and an urn, in a lonely grove, or in the midſt of a field, is a favourite embelliſhment at the Leaſowes: they are indeed among the principal ornaments of the place; for the buildings are moſtly mere ſeats, or little root-houſes; a ruin of a priory is the largeſt, and that has no peculiar beauty to recommend it: but a multiplicity of objects are unneceſſary in the farm; the country it commands is full of them; and every natural advantage of the place within itſelf has been diſcovered, applied, contraſted, and carried to the utmoſt perfection, in the pureſt taſte, and with inexhauſtible fancy.

An ancient Farm.

In ſuch an aſſortment, the more open and poliſhed ſcenes will generally be given to the Arcadian ſhepherd; and thoſe in a lower degree of cultivation, will be thought more conformable to the manners of the ancient Britiſh yeomanry.

The paſtures ſhould rather border on a waſte or a common: if large, they may be broken by ſtraggling buſhes, thickets, or coppices; and the ſcattered trees ſhould be beſet with brambles and briars. All theſe are circumſtances which improve the beauty of the place; yet appear to be only remains of the wild, not intended for embelliſhment. Theſe will ſufficiently break the ſameneſs of the ſpace; and tillage does not furniſh a more pleaſing ſcene, than ſuch a ſpace ſo broken, if the extent be moderate, and the boundary beautiful.

As much wood is eſſential to the character, a ſpot may eaſily be found, where turrets riſing above the covert, or ſome arches ſeen within it, may have the reſemblance of a caſtle or an abbey. The partial concealment is almoſt neceſſary to both; for to accord with the age, the buildings muſt ſeem to be entire; the ruins of them belong to later days: the diſguiſe is, however, advantageous to them as objects; none can be imagined more picturesque, than a tower boſomed in trees, or a cloyſter appearing between the ſtems and the branches. But the ſuperſtitions of the times furniſh other objects, which are more within compaſs: hermitages were then real; ſolitary chapels were common; many of the ſprings of the country being deemed holy wells, were diſtinguiſhed by little gothic domes built over them; and every hamlet had its croſs; even this, when perfect, ſet on a little ruſtic pillar, and that raiſed upon a baſe of circular ſteps, may in ſome ſcenes be conſiderable: if a ſituation can be found for a maypole, whence it would not obtrude itſelf on every view, that alſo might not be improper; and an ancient church, however unwelcome it may be when it breaks into the deſign of a park or a garden, in ſuch a farm as this would be a fortunate accident: nor would the old yew in the church yard be indifferent; it would be a memorial of the times when it was uſeful.

Of a ſimple Farm.

A part may alſo be free from either of theſe imitative characters, and laid out in a common ſimple farm. Some of the greateſt beauties of nature are to be found in the fields, and attend an ordinary ſtate of cultivation: wood and water may there be exhibited in ſeveral forms and diſpoſitions; we may enlarge or divide the incloſures, and give them ſuch ſhapes and boundaries as we pleaſe; every one may be an agreeable ſpot; together, they may compoſe beautiful views; the arable, the paſture, and the mead may ſucceed one another; and now and then a little wild may be intermixed without impropriety; every beauty, in ſhort, which is not unuſual in an incloſed country, whether it ariſe from neglect or improvement, is here in its place.

The buildings, alſo, which are frequent in ſuch a country, are often beautiful objects; the church and the manſion are conſiderable; the farm-yard itſelf, if an advantageous ſituation be choſen for it; if the ricks, and the barns, and the out-houſes, are ranged with any deſign to form them into groupes, and if they are properly blended with trees, may be made a picturesque compoſition. Many of them may be detached from the groupe, and diſperſed about the grounds: the dove-cote, or the dairy, may be ſeparated from the reſt; they may be elegant in their forms, and placed wherever they will have the beſt effect. Among ſo many buildings, ſome may be converted to other purpoſes than their conſtruction denotes; and, whatever be their exterior, may within be made agreeable retreats, for refreſhment, indulgence, or ſhelter. With ſuch opportunities of improvement, even to decoration within itſelf, and with advantages of proſpect into the country about it, a ſimple farm may undoubtedly be delightful. It will be particularly acceptable to the owner, if it be cloſe to his park or his garden: the objects which conſtantly remind him of his rank, impoſe a kind of conſtraint; and he feels himſelf relieved, by retiring ſometimes from the ſplendor of a ſeat into the ſimplicity of a farm: it is more than a variety of ſcene; it is a temporary change of ſituation in life, which has all the charms of novelty, eaſe, and tranquility, to recommend it. A place therefore, can hardly be deemed perfect, which is not provided with ſuch a retreat.

An ornamented Farm.

A ſenſe of the propriety of ſuch improvements about a ſeat joined to a taſte for the more ſimple delights of the country, probably ſuggeſted the idea of an ornamented farm, as the means of bringing every rural circumſtance within the verge of a garden. This idea has been partially executed very often; but no where, perhaps, ſo completely, and to ſuch an extent, as at Woburn farm. The place contains 150 acres; of which near 35 are adorned to the higheſt degree; of the reſt, about two thirds are in paſture, and the remainder is in tillage. The decorations are, however, communicated to every part; for they are diſpoſed along the ſides of a walk, which, with its appendages, forms a broad belt round the grazing-grounds; and is continued, though on a more contracted ſcale, through the arable. This walk is properly garden; all within it is farm; the whole lies on the two ſides of a hill, and on a flat at the foot of it; the flat is divided into corn-fields; the paſtures occupy the hill; they are ſurrounded by the walk, and croſſed by a communication carried along the brow, which is alſo richly dreſſed, and which divides them into two lawns, each completely encompaſſed with garden.

Theſe are in themſelves delightful; the ground in both lies beautifully; they are diverſified with clumps and ſingle trees; and the buildings in the walk ſeem to belong to them. On the top of the hill is a large octagon ſtructure; and, not far from it, the ruin of a chapel. To one of the lawns the ruin appears, on the brow of a gentle aſcent, backed and grouped with wood; other objects of leſs conſequence, little ſeats, alcoves, and bridges, continually occur. The buildings are not, however, the only ornaments of the walk; it is ſhut out from the country, for a conſiderable length of the way, by a thick and lofty hedge-row, which is enriched with woodbine, jeſſamine, and every odoriferous plant whoſe tendrils will entwine with the thicket. A path, generally of ſand or gravel, is conducted in a waving line ſometimes cloſe under the hedge, ſometimes at a little diſtance from it; and the turf on either hand is diverſified with little groupes of ſhrubs, of firs, or the ſmalleſt trees, and often with beds of flowers; theſe are rather too profuſely ſtrewed, and hurt the eye by their littleneſſes; but then they repleniſh the air with their perfumes, and every gale is full of fragrancy. In ſome parts, however, the decoration is more chaſte; and the walk is carried between larger lumps of evergreens, thickets of deciduous ſhrubs, or ſtill more conſiderably open plantations. In one place it is entirely ſimple, without any appendages, any gravel, or any ſunk fence to ſeparate it from the lawn; and is diſtinguiſhed only by the richneſs of its verdure, and the nicety of its preſervation. In the arable part it is alſo of green ſward, following the direction of the hedges about the ſeveral incloſures; theſe hedges are ſometimes thickened with flowering ſhrubs; and in every corner or vacant ſpace, is a roſary, a cloſe or an open clump, or a bed of flowers; but if the parterre has been rifled for the embelliſhment of the fields, the country has on the other hand been ſearched for plants new in a garden; and the ſhrubs and the flowers which uſed to be deemed peculiar to the one, have been liberally transferred to the other; while their number ſeems multiplied by their arrangement in ſo many and ſuch different diſpoſitions. A more moderate uſe of them would, however, have been better; and the variety more pleaſing, had it been leſs licentious.

But the exceſs is only in the borders of the walk; the ſcenes through which it leads are truly elegant, every where rich, and always agreeable. A peculiar cheerfulneſs overſpreads both the lawns, ariſing from the number and the ſplendor of the objects with which they abound, the lightneſs of the buildings, the inequalities of the ground, and the varieties of the plantations. The clumps and the groves, though ſeparately ſmall, are often maſſed by the perſpective, and gathered into conſiderable groupes, which are beautiful in their forms, their tints, and their poſitions. The brow of the hill commands two lovely proſpects; the one gay and extenſive, over a fertile plain, watered by the Thames, and broken by St. Anne's Hill and Windſor Caſtle; a large mead, of the moſt luxuriant verdure, lies juſt below the eye, ſpreading to the banks of the river; and beyond it the country is full of farms, villas, and villages, and every mark of opulence and cultivation.

With the beauties which enliven a garden are every where intermixed many properties of a farm; both the lawns are paſtured; and the lowings of the herds, the bleating of the ſheep, and the tinklings of the bell-wedder, reſound through all the plantations; even the clucking of poultry is not omitted; for a menagerie of a very ſimple deſign is placed near the Gothic building; a ſmall ſerpentine river is provided for the water-fowl; while the others ſtray among the flowering ſhrubs on the banks, or ſtraggle about the neighbouring lawn: and the corn-fields are the ſubjects of every rural employment, which arable land from ſeed-time to harveſt can furniſh. But though ſo many of the circumſtances occur, the ſimplicity of a farm is wanting; that idea is loſt in ſuch a profuſion of ornament; a ruſticity of character cannot be preſerved amidſt all the elegant decorations which may be laviſhed on a garden.

FARMER. He that rents a farm or is leſſee thereof. Alſo generally every leſſee for life, years, or at will, is called a farmer.

FARRIER, one whoſe employment is to ſhoe horſes, and cure them when diſeaſed or lame.

FARRIERY, the art of curing the diſeaſes of horſes.

BRITISH
18 MR 63
MUSEUM

Anatomy of the Horse representing the Muscles, Fascias Ligaments Nerves, Arteries, Veins and Glands, from Nature. See Farriery.

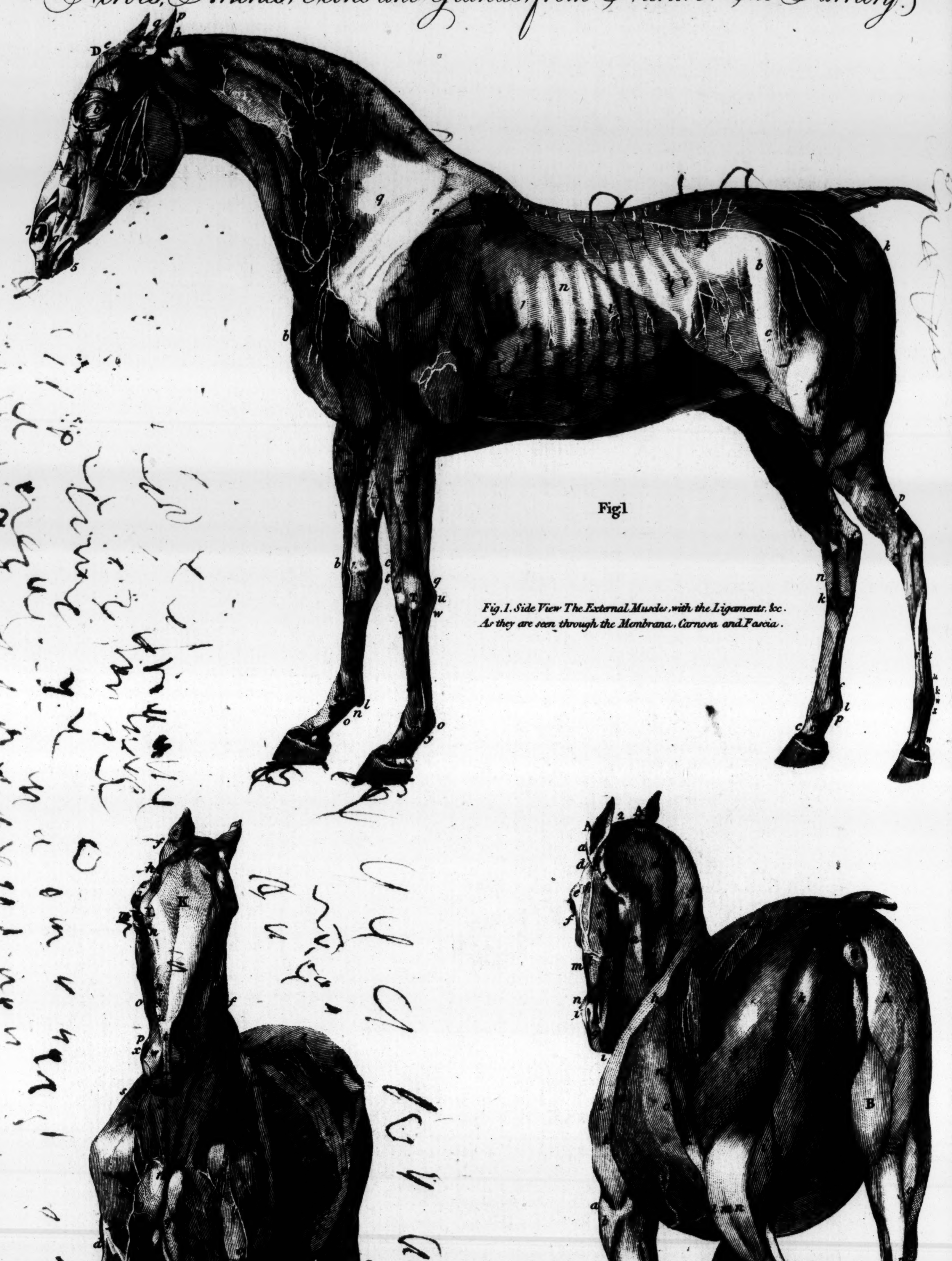

Fig1

Fig. 1. Side View The External Muscles, with the Ligaments, &c. As they are seen through the Membrana, Carnosa and Fascia.

Fig.2

Fig. 2 Front View. The External Muscles, with the Membrana Carnosa, Ligaments, &c.

Fig.3

Fig. 3 Back View The External Muscles, with the Membrana Carnosa, Ligaments, Fascia &c.

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Anatomy of the Horse, representing the Osteology in three Views. See System of Farriery.

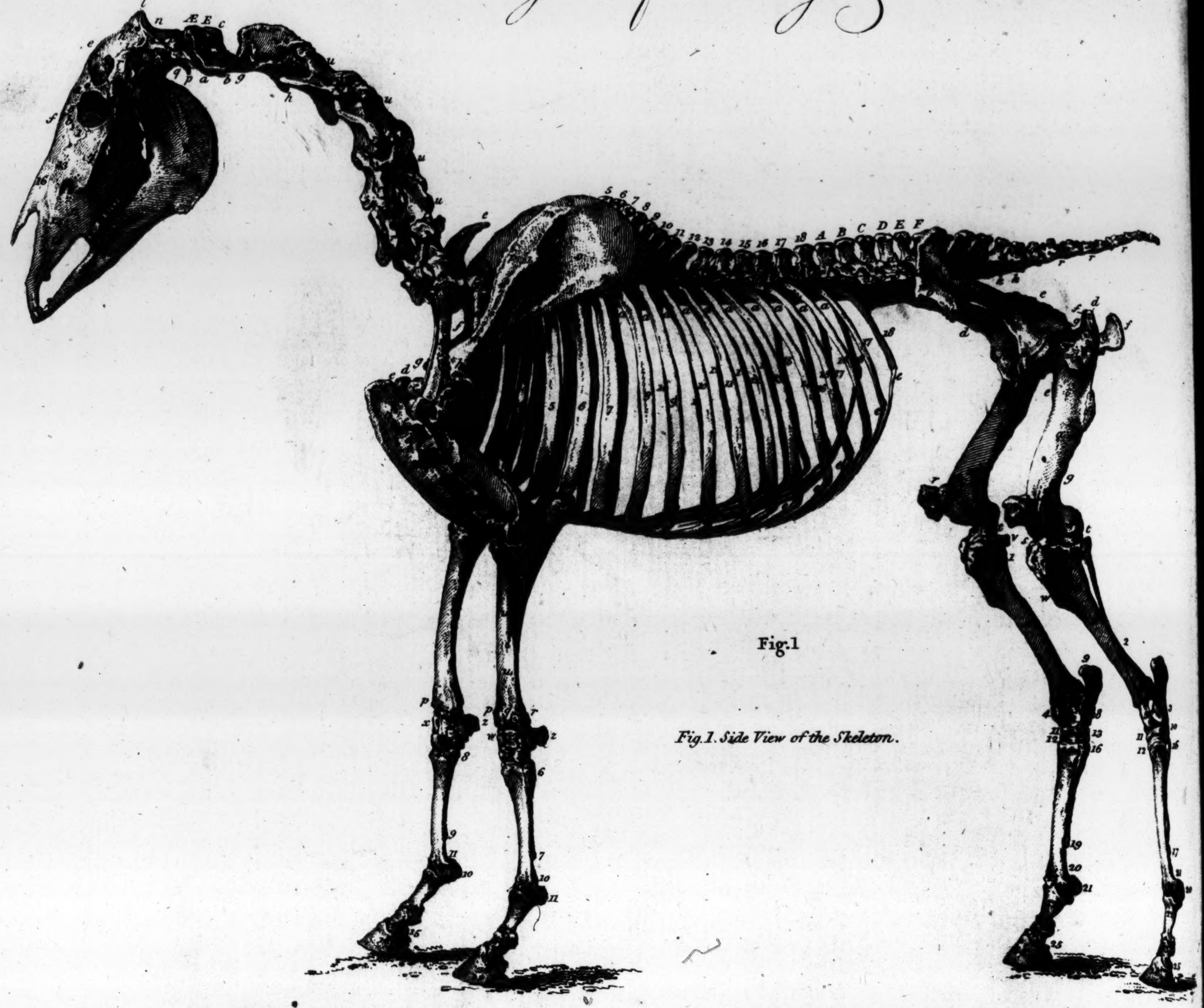

Fig. 1. Side View of the Skeleton.

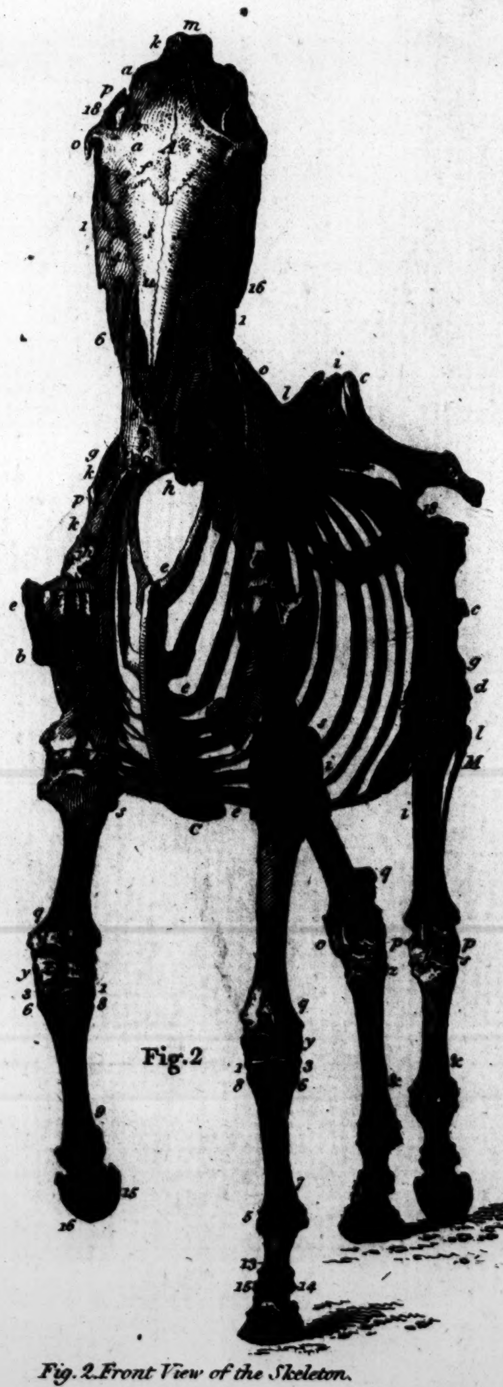

Fig. 2. Front View of the Skeleton.

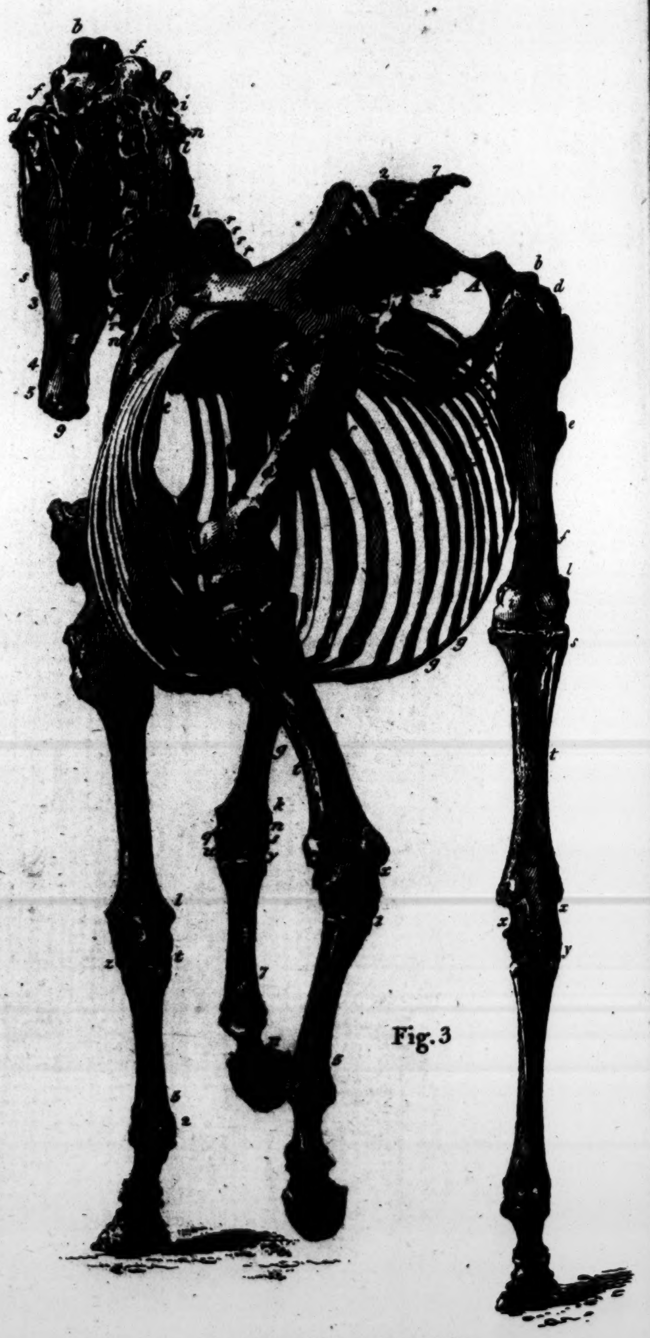

Fig. 3 Back View of the Skeleton.

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SYSTEM OF FARRIERY.

THE practice of this uſeful art has been too long, almoſt entirely, confined to a ſet of men, totally ignorant of anatomy and the general principles of medicine. It is not therefore ſurpriſing that their preſcriptions ſhould be as abſurd as the reaſons they give for adminiſtering them. It cannot indeed be expected that farriers who are almoſt univerſally illiterate men ſhould make any real progreſs in their profeſſion. They preſcribe draughts, they rowel, cauterize, &c. without being able to give any other reaſon for their practice, than that their fathers did ſo before them. How can ſuch men deduce the cauſe of a diſeaſe from its ſymptoms, or form a rational method of cure, when they are equally ignorant of the cauſes of diſeaſes and the operation of medicines? The wretched ſtate of this uſeful art, eſpecially in the country, has determined us to ſelect from the moſt approved authors, ſuch a ſyſtem of practice as ſeems to be formed on rational principles: this we hope will be a ſufficient apology for being rather copious upon this ſubject.

Previous to treating on the diſeaſes incidental to horſes, and the methods of cure, we ſhall introduce a deſcription of the Oſteology and Myology of that noble animal, which will be compriſed in ſix plates. As we have ſpared neither pains nor expence, to illuſtrate this Syſtem, as well as every other we have hitherto undertaken to diſcuſs, we preſume it will appear that we have not been wanting in any inſtance to merit public ſanction, or render our work conducive to the attainment of univerſal Science.

PART I.

THE ANATOMY OF THE HORSE,

Including a particular Deſcription of the BONES, CARTILAGES, MUSCLES, FASCIAS, LIGAMENTS, NERVES, ARTERIES, VEINS, and GLANDS, all done from Nature.

PLATE I. *Figure* I. — SIDE VIEW.

Bones in the Head.

abcdefg, The os frontis, or forehead bone; *c* a ſuture which joins the frontal bone with the zygomatic, or jugal proceſs of the temporal bone; *e* the coronal ſuture.

hik, The vertical, or parietal bone; *i* a ſquamoſe ſuture, common to the parietal bone with the temporal bone; *k* the lambdoid ſuture, common to the parietal bone with the occipital bone.

lnoppq, The occipital bone; *l* the occipital protuberance, which in this animal is very large, together with the internal ſpine, or protuberance, which, directly oppoſite to this, makes a ſtrong body of bone in this place; *p* the condyloid proceſs, which is incruſted with a ſmooth cartilage.

rstuwx, Os temporis, or temporal bone; *r* the zygomatic, or jugal proceſs of the temporal bone; *t* the part which articulates with the lower jaw bone; *uw* a part which, in young horſes, may be eaſily divided, but afterwards becomes firmly united; it is diſtinguiſhed by the name of os petroſa, or apophyſis petroſa; *u* the mammillary proceſs; *w* the bony meatus, or entrance of the ear; *x* a ſuture common to the cheek bone, with the zygomatic proceſs of the temporal bone. *yz*, The orbitary portion of the bone of the palate. 1, Os unguis. 7, Os jugale, or cheek bone. 15, Os maxillæ ſuperioris, or the upper jaw bone. 16, Os naſi. 17, 18, 19, 20, The lower mandible or jaw bone; 17, at ſeventeen expreſſed in the plate, are marked roughneſſes, from which ariſe the tendinous parts of the maſſeter; 19, 19, the coronal or acute proceſs; 20, its condyle or head, that is joined with the temporal bone. 21, A moveable cartilaginous plate which is interpoſed in the articulation of the lower jaw.

The Vertebræ of the Neck.

AÆE *abbcde*, The atlas or uppermoſt vertebra: AÆ the poſterior and ſuperior part of the left ſide of this vertebra, which articulates with the condyloid proceſs of the occipital bone; A the anterior and ſuperior part of the right ſide of the atlas, which articulates with the occipital bone as a large tubercle on the anterior part of this vertebra; *b* the two tranſverſe proceſſes; *c* the protuberance, tubercle, or inequality on the poſterior part of this vertebra, which ſeems to be in the place of a ſpinal apophyſis; *d* the poſterior, and inferior part of the right ſide of this vertebra, which articulates with the ſecond vertebra; *e* the tranſverſe hole through which a nerve and blood-veſſels paſs.

fghiklmn, 12. The epiſtrophæus or ſecond vertebra of the neck; *f* the inferior part of the body which receives and is ſuſtained by the third vertebra of the neck: *g* the ſuperior part of its body, which is received by and ſuſtains the atlas or firſt vertebra of the neck; *h* the anterior protuberance of the body of this vertebra; *i* the tranſverſe proceſs; *k* the ſpinal proceſs; *l* the lower oblique proceſs on the right ſide, which is covered with a ſmooth cartilage within the dotted lines; *m* the lower oblique proceſs on the left ſide; at 1 is a hole where the vertebral artery goes in and comes out at 2, called the tranſverſe hole.

opqrstuwxy, The third vertebra of the neck; *o* the anterior protuberance of the body of this vertebra; *p* is the ſuperior part of the body of this vertebra, which is received into the inferior part of the body of the ſecond vertebra; and *q* is the inferior which receives the ſuperior part of the body of the fourth vertebra; *r* the tranſverſe proceſs; *s* the right uppor oblique proceſs; *t* the right lower oblique proceſs; *u* the ſpinal proceſs; *w* the tranſverſe holes through which the vertebral arteries and veins of the neck paſs; *x*, the left upper oblique proceſs; *y* the left lower oblique proceſs.

A Continuation of the Bones of the Spine from the Neck.

1 *abcdef*G, The firſt or uppermoſt vertebra of the back; *a*, the body; *b*, the tranſverſe proceſs; *c*, the upper oblique proceſs, *d*, the lower oblique proceſs; *e*, the ſpinal proceſs; *f*, the lower oblique proceſs of the left ſide, ſeen through the large hole which contains the medulla ſpinalis; G, the ligament interpoſed betwixt the bodies of the firſt and ſecond vertebra of the back. 2 5 6 7 8 9 10 11 12 13 14 15 16 17 18, Are vertebræ of the back, the firſt vertebra of the back having been explained as above, and the ſame letters of reference, applied to ſimilar ſurfaces and foramina, &c. as likewiſe to the ſix vertebra of the loins, a further explanation is unneceſſary. ABCDEF, The ſix vertebræ of the loins. *ghiklm*, The os ſacrum or great bone of the ſpine; *g*, the anterior part or body of this bone which, in young animals, is divided into as many bodies as there are ſpines in this bone, it being then like five vertebræ, whoſe tranſverſe proceſſes make the unequal rough part *h*, of this bone; *i*, the five ſpines; *k*, three inferior and anterior holes, which tranſmit the nerves on each ſide. *nopq*, The firſt bone of the coccyx or tail; *n*, the body; *o*, the tranſverſe proceſs; *p*, the upper oblique proceſs, which articulates with the os ſacrum; there is no lower oblique proceſs; *q*, the ſpine; *r*, the ligament interpoſed betwixt the bodies of the firſt and ſecond bone of the tail, tying them together. There are 18 bones in the tail.

Bones in the Thorax and Shulder-blades.

ab. The ſternum or breaſt bone, of which the parts *a* are bony, the reſt, *b*, is chiefly cartilaginous, or ligamentous, by which the bony parts are connected together. 1 *ce*, The firſt rib; *c*, the head by which it is articulated with the tranſverſe proceſs of the firſt or uppermoſt vertebra of the back; *e*, the cartilaginous end by which it is continued to the ſternum. This explanation will ſerve for the reſt of the ribs, but it is to be obſerved, that the eight ſuperior ribs only are connected to the ſternum, the others are called falſe ribs. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18, Shew the external ſide of the ribs on the right ſide, and internal on the left ſide. *fg*, The inner ſide of the left ſcapula or ſhoulder-blade. *hiklmnopq*, The right ſcapula; *h*, its neck; *i*, its ſpine; *k*, the coracoid apophyſis, or epiphyſis; *l*, its inferior coſta; *m*, its ſuprior coſta; *n*, its baſis; *o*, foſſa ſub-ſpinalis; *p*, foſſa ſupra-ſpinalis; *q*, a cartilaginous continuation of the ſcapula.

Bones in the Right Upper Limb.

*abbhik*K*lm*, The humerus *or bone of the arm*; *b*, denotes a protuberance into which the teres minor is inſerted; *h*, the part of the head which is joined to the cavity of the ſcapula, covered with a ſmooth cartilaginous cruſt; *i*, the external condyle of the lower head; *k*K, the head covered with a ſmooth cartilage with which the radius is articulated; K, the double articular eminence; *l*, the anterior foſſula or ſinus that receives the upper head of the radius when the cubit is bent as much as it can be; *m*, the poſterior ſinus which receives the olecranon of the ulna when the cubit is extended as much as it can be.

nopqr, The radius; *no*, the upper head; *pqr*, the lower head of this bone; *p*, denotes a ſinus or groove through which goes the tendon of the extenſor carpi radialis; *q*, a ſinus through which goes the tendon of the extenſor degitorum communis; *r*, a ſinus through which goes the tendon which is analagous to the tendon of the extenſor minimi digiti.

sttuu, The ulna; *s*, the olecranon or elbow; *tt*, the part which articulates with the humerus; *uu*, the lower part, which is very ſmall, and in aged horſes becomes one bone with the radius.

wxyz, 23, The bones of the carpus; *w*, os ſcaphoides or naviculare; *x*, os lunare; *y*, os cuneiforme; *z*, os piſiforme or orbiculare; (the bone called trapezium, which articulates with the thumb is not in the horſe;) 2, os magnum or the great round-headed bone of the wriſt; 3, the unciform or hook-like bone of the wriſt. 4 5 6 7, The metacarpal bones in this animal called the ſhank-bones, of which that marked 4 5, is equal to two of the metacarpal bones joined together, viz. that of the middle finger, and that of the ring finger; 4, the upper head by which it articulates with the carpus; 5, the lower head, in this place incruſted with a ſmooth cartilage; 6 7, an imperfect metacarpal bone in the place of that in the human ſkeleton which belongs to the little finger; 6, the upper head by which it articulates with the unciform bone of the carpus; 7, the lower head, which is very ſmall, and (the bones of the little finger being wanting) forms no articulation. 10 11, Two bones which are always to be found in this joint; ſuch bones are called ſeſamoid bones in the human ſkeleton. 12 13, A bone which is equal to the bones of the phalanges of the middle and ring finger in the human ſkeleton; in a horſe this is called the great paſtern. 14 15, The bone of the ſecond phalanx of the fingers, or the little paſtern or coronary bone. 16, The bone of the third phalanx, in a horſe called the coffin bone.

In the Pelvis.

abcdefghikl, The right os innominatum or baſon bone including three others; *abcd*, the os ilium, hip, or flank bone; *bc*, the ſpine; *b*, the anterior part of the ſpine; *c*, the poſterior part; *efg*, the os iſchium, or hich bone; *e*, the acute proceſs; *f*, the tubercle of the iſchium; *gg*, the poſterior notch for the paſſage of the internal obturator muſcle; *h i*, the os pubis; *i*, the ſpine or ridge of the os pubis; *k*, the great foramen of the iſchium and pubis; *l*, the external margin of the acetabulum.

In the lower Limbs.

abcdehi, The right femur or thigh bone; *a*, the body or middle of this bone; *bcde*, the upper extremity, of which, *b*, is the neck; *c*, the head incruſted with a ſmooth cartilage where it is jointed into the acetabulum; *d*, the great trochanter or ſpoke; *e*, the leſs trochanter or ſpoke; *hi*, the lower extremity; *h*, the outer condyle of the lower head, which at *i* is covered with a ſmooth cartilaginous cruſt. *q r*, The patellæ or knee pan bones; *r*, that part which is covered with a ſmooth cartilaginous cruſt which forms part of the joint at the knee. *ſ*, The inner ſimilunar cartilages which are interpoſed in the joints of the knees. *t*, The outer ſimiluna cartilages in the joints of the knees. *uvwxy*, The tibiæ or greater bones of the legs; *u*, the upper head; *v*, that part of the upper head which, belonging to the joint of the knee, is covered with a ſmooth cartilaginous cruſt; *w*, a protuberance in which terminate the anterior ligaments which come from the patella and tie it to the tibia; *y*, the lower head of the right tibia; *z* the lower head of the left tibia. 1 2 1, The fibulæ or ſmall bones of the legs; 1, the upper head; 2, the lower extremity which ends here almoſt in a point. 3 4 5 6, The aſtragali or cockal bones; 4 5, the part which forms the juncture with the bone of the leg covered with a ſmooth cartilaginous cruſt. 7 8 9, The calcanei or heel-bones; 8, the projecting part that ſuſtains the aſtragalus; 9 the tubercle into which is inſerted the tendon of the gemellus, and to which the tendon of the plantaris is attached by ligaments. 10, The cubical bone of the tarſus or ancle. 11, The navicular bones of the tarſus. 12, The middle cuneiform bones of the tarſus. 13, The leſs cuneiform bone of the tarſus. N. B. What are called the great cuneiform bones of the tarſus in the human ſkeleton are (as well as the bones of the great toe) wanting in this animal.

14 15 16 17 18 19, The bones of the metatarſus or inſtep; 14 15, a bone which is equal to the metatarſal bones of the ſecond and third little toes both together in the human ſkeleton; 14 the upper head which articulates with the three lower bones of the tarſus; 15 the lower head, in this place covered with a ſmooth cartilaginous cruſt, where it articulates with the upper head of the bone of the firſt phalanx or order of the ſmall toes; 16 17 an imperfect metatarſal bone in the place of that which, in the human ſkeleton, belongs to the little toe; 16 the upper head, by which it articulates with the cubical bone of the tarſus; 17, the lower head which is very ſmall, and (the bones of the little toe being wanting) forms no articulation; 18 19, an imperfect metatarſal bone in the place of that which, in the human ſkeleton, belongs to the firſt of the ſmall toes; 18 the upper head by which it articulates with the leſs cuneiform bone of the tarſus; 19, the lower head which is very ſmall, and (the bones of the firſt of the ſmall toes being wanting) forms no articulation.

20 21, Bones which are always to be found in theſe joints, two in each, ſuch are called ſeſamoid bones in the human ſkeleton; 22 23 24, The bones which are in the places of the three phalanges, or orders of bones of the ſmall toes in the human ſkeleton: with farriers the firſt are called the great paſterns, the ſecond the little paſterns, or coronary bones, the third the coffin bones. 25 25, Seſamoid bones lying over the poſterior parts of the articulations of the coffin bones, with the coronary bones.

PLATE I. *Figure 2.* — FRONT VIEW.

Bones in the Head.

A, The os frontis, or forehead bone divided into two by the continuation A of the ſagittal or longitudinal ſuture. *h i k l*, The vertical or parietal bones; *i*, the ſquamoſe or ſcale-like ſutures, which are formed by the conjunction of the parietal with the temporal bones; *k*, the lambdoide ſuture formed by the conjunction of the parietal bones with the occipital bone; *l*, the ſagittal or longitudinal ſuture, formed by the union of the two parietal bones. *m*, The occipital bone; *m*, the large protuberance which is marked *l* in table the firſt, and which, in a horſe, is called the noſe bone. *op q*, The temporal bones; *o*, the zygomatic or jugal proceſſes of the temporal bones. *s*, The oſſa naſi, or bones of the noſe. *w*, The oſſa unguis. 1, The oſſa jugalia, or cheek bones. 4 5 6 7 8, The oſſa maxillaria, or great bones of the upper jaws; 5 5, the foramina, or holes of the channels, which paſs along the bottoms of the orbits of the eyes; 6 6, parts of the upper jaw bones which belong to the bottoms of the noſtrils and arch of the palate; 7 8 9, the anterior parts, which are joined to the poſterior parts of theſe bones by ſutures marked 14 in table the firſt of the ſkeleton; 7, parts belonging to the bottoms of the noſtrils and to the arch of the palate. 10 11 12 13 14 15, The ſix dentes inciſores, cutting teeth, or nippers, of the upper jaw. 16 18, Maxilla inferior, the lower mandible or jaw bone.

In the Spine.

aa, The tranſverſe proceſſes of the atlas or uppermoſt vertebra of the neck. 1 *d*, The tranſverſe proceſs of the fifth vertebra of the neck. 2 *bcdefg*, The ſixth vertebra of the neck; *b*, the anterior and lower part of the body of this vertebra, which receives the ſuperior part of the body of the ſeventh vertebra; *c*, the ſuperior part of the body of this vertebra, which is received by the fourth vertebra; *d*, the tranſverſe proceſs; *e*, the anterior oblique proceſs which is peculiar to this vertebra, and marked *z* & in table the firſt; *f*, the upper oblique proceſs; *g*, the lower oblique proceſs. 3 *bcdfg*, The ſeventh or laſt vertebra of the neck; 3, the body; *b*, the anterior protuberance of the body of this vertebra; *c*, the head or upper part of the body of this vertebra, which articulates with the vertebra above it; *d*, the tranſverſe proceſs; *f*, the upper oblique proceſs; *g*, the lower oblique proceſs.

h i k, &c. *l* & *c*, The vertebræ of the back; *h*, is placed on the body of the vertebræ, and explains the ſituation of the bodies of the 4 vertebræ, behind which are too ſmall to admit of letters; *k*, the tranſverſe proceſs, three more are ſeen behind; *l*, the ſpinal proceſs, five more are ſeen behind.

1 *mnop*, The firſt vertebra of the loins; *m*, the upper oblique proceſs; *n*, the lower oblique proceſs; *p*, the tranſverſe proceſs; *o*, the ſpinal proceſs. The ſame explanation will do for all thoſe of the loins. *qr*, The os ſacrum, or great bone of the ſpine; *q*, the upper oblique proceſs, by which it articulates with the lower oblique proceſs of the loweſt vertebra of the loins; *r*, the ſpinal proceſſes. *s*, The bones of the tail.

In the Thorax and Shoulder Blades.

ab, The ſternum, or breaſt bone, of which the parts *a* are bony, the reſt *b* is chiefly cartilaginous or ligamentous, and connects the bony parts together. C, The enſiform cartilage. 1 *cde*, The firſt rib on the right ſide; *c*, the head, by which it is articulated with the tranſverſe proceſs of the firſt or uppermoſt vertebra of the back; *d*, the anterior or former part of the ſaid head which is connected to the bodies of the ſeventh vertebra of the neck, and firſt of the back; *e*, the cartilaginous end by which it is continued to the ſternum. *fghiklmno*, *fghkkp*, the ſcapulæ, or ſhoulder blades; *f*, the neck; *g*, the ſpine; *h*, the coracoid or crow's-bill proceſs; *i*, the inferior coſta; *k*, the ſuperior coſta; *l*, the baſis; *m*, foſſa ſub-ſpinalis; *n*, foſſa ſupra-ſpinalis; *o*, a cartilaginous continuation of the baſis ſcapulæ; *p*, the internal and concave ſide of the left ſcapula.

In the Upper Limbs

abcdefghiklmn, The humeri, or bones of the arm; *b*, denotes a protuberance into which the teres minor is inſerted; *cdefgh*, the upper head; *cde*, three protuberances which form two ſinuſes or grooves, which are incruſted with a ſmooth cartilage; they ſerve to confine the heads of the biceps muſcle of the arm from ſliding ſideways, but ſuffer them eaſily to ſlide up and down; *h*, that part of the head which is covered with a ſmooth cartilaginous cruſt, and articulates with the ſcapula; *i*, the external condyle of the lower head; *kl*, the lower head covered with a ſmooth cartilage with which the radius is articulated; *k*, the round articular eminence; *l*, the double articular eminence; *m*, the anterior foſſula or ſinus that receives the upper head of the radius, when the cubit is bent as much as it can be; *n*, the internal condyle.

opq, The radii, or the radius of each arm; *o*, a protuberance in the upper head, into which the biceps and brachialis are inſerted: *p*, denotes a ſinus, or groove, in the lower head, through which goes the tendon of the extenſor carpi radialis; *q*, a ſinus, through which goes the tendon of the extenſor digitorum communis; *r*, a ſmooth cartilaginous incruſtation of the lower head, where it articulates with the bones of the carpus.

w x y, 1 2 3, The bones of the carpus; *w t*, os ſcaphoides, or naviculare; *t*, the part which articulates with the radius, covered with a ſmooth cartilaginous incruſtation; *x t*, os lunare, or the lunar bone of the carpus, or wriſt; *t*, the part incruſted with a ſmooth cartilage by which it articulates with the radius; *y*, the cuneiform or wedge-like bone of the carpus; 1 *u*, the trapezoid, cubical, or leaſt of the multangular bones of the carpus, at *u*, incruſted with a ſmooth cartilage for it's articulation with the navicular bone of the carpus; 2 *u*, os magnum, or the great round-headed bone of the wriſt; *u* the part which articulates with the os magnum and os lunare, incruſted with a ſmooth cartilage; 3 *u*, the unciform or hook-like bone of the wriſt, at *u* incruſted with a ſmooth cartilage, by which it articulates with the lunar and cuneiform bones of the carpus: theſe cartilaginous incruſtations do not appear in the left carpus, the joint being fully extended.

4 5 6 7 8 9, The metacarpal bones, called, in the ſkeleton of a horſe, the ſhank bones; 4 5, the ſhank bone which is equal to the metacarpal bone of the middle-finger, and that of the ring-finger both together; 4, the upper head; 5, the lower head, incruſted, in this place, with a ſmooth cartilage for it's articulation with the great paſtern or firſt phalanx of the fingers; 6 7, an imperfect metacarpal bone, in the place of that which, in the human ſkeleton, belongs to the little-finger; 6 the upper head by which it articulates with the unciform bone of the carpus; 7, the lower head which is very ſmall, and (the bones of the little-finger being wanting) forms no articulation; 8 9, an imperfect metacarpal bone in the place of that which, in the human ſkeleton, belongs to the index or firſt finger; 8 the upper head, by which it articulates with the trapezoid bone of the carpus; 9, the lower head, which is very ſmall, and (the bones of the firſt-finger being wanting) forms no articulation. 12 13, Bones which are equal to the bones of the firſt phalanges of the middle and ring-fingers in the human ſkeleton: in a horſe theſe are called the great paſterns. 14 15, Bones

of the ſecond phalanges; the little paſterns or coronary bones. 16, The bones of the third phalanges, or coffin bones.

In the Pelvis.

abcd, The innominata or baſon bones, including three others; *abc*, the os illium or flank bones; *b*, the anterior part of its ſpine; *c*, the poſterior part of its ſpine; *d*, part of the iſchion or hich bone, ſeen betwixt the ribs; *E*, part of the os pubis ſeen alſo betwixt the ribs.

In the lower Limbs.

abcde, *aff*, The thigh bones; *a*, the greater trochanter or ſpoke; *b*, the leſs trochanter; *c*, the protuberating part of the linea aſpera, into which the external glutæus is inſerted along with a part of the muſculus faſcia lata; *d*, the outer condyle; *e*, the inner condyle: *ff*, the anterior part of the lower head of the right femur. *g*, *g g*, The patellæ or knee-pan bones.

b, The outer ſemi-lunar cartilage in the joint of the knee.

iklm, *i m*, The tibiæ, or great bones of the legs; *kl*, the upper head; *k* a protuberance, into which is fixed the anterior ligaments of the patella; *l*, that part which belongs to the joint of the knee and is covered with a ſmooth cartilage; *m*, the lower head, which articulates with the bones of the tarſus. M, The fibula.

nop, The aſtragali, or cockal bones; *n o*, the part which forms the juncture with the bone of the leg, covered with a ſmooth cartilaginous cruſt. *q r*, The os calcis, or heel bone; *r*, the projecting part that ſuſtains the aſtragalus. *s*, The cuboid, or cubical bone of the tarſus. *t*, The navicular bones of the tarſus. *u*, The middle cuneiform bones of the tarſus. *w*, The ſmall cuneiform bone of the tarſus. *x y z &*, The metatarſal, or inſtep bones. 1, The great paſterns. 2, The little paſterns or coronary bones 3, The bones of the third phalanges, or coffin bones.

PLATE I. *Figure* 3. — BACK VIEW OF THE SKELETON.

Bones in the Head.

A That part of the os frontis which helps to form the orbit of the eye. *a b*, The occipital bone, of which *a b* is that which, in the ſkeleton of a horſe, is called the nole bone. *df*, The temporal bone; *d*, the zygomatic or jugal proceſs; *f*, the bony meatus or entrance of the ear. *g h* G, Oſſa palati; *g*, the orbitary part; *h*, the portia palatina, or part which compleats the arch of the palate. *iklmn*, Os ſphenoides; *i i*, denote roughneſſes into which the anterior recti muſcles of the head are inſerted; *m*, the pterygoid apophyſes; *l n*, *l n*, the large lateral proceſſes of the multiform, or ſphenoidal bone. *p q*, Os jugale, or cheek bone. *rstuw*, The oſſa maxillaria, or great bones of the upper jaw. *xy*, Os vomer; *y*, that part which forms the poſterior part of the ſeptum narium. 1, 2 z, Os ethmoides; 1, the part which helps to form the orbit; 2, the labyrinth of the noſtrils; *z*, conchæ narium ſuperiores. 3, Dentes molares, or grinding teeth of the upper jaw. 4, One of the canini of the upper jaw. 5, One of the dentes inciſores, cutting teeth, or nippers of the upper jaw. 678, Maxilla inferior, or the lower mandible, or jaw bone; 8 it's condyle or head, by which the mandible is articulated to the temporal bone. 9, Dentes inciſores, the cutting teeth, or nippers of the lower jaw.

In the Spine.

abcde, The atlas, or uppermoſt vertebra of the neck; *a*, the protuberance, tubercle, or inequality on the poſterior part of this vertebra, which ſeems to be in the place of a ſpinal apophyſis; *b*, the tranſverſe proceſs; *c*, the ſuperior and poſterior notch; *d*, the tranſverſe hole; *e*, a large tubercle on the anterior part of this vertebra.

fghikl, The epiſtrophæus, or ſecond vertebra of the neck; *f*, the ſpinal proceſs; at *g* the ſpine is divided into two, and continued to the lower oblique proceſſes; *h*, the lower oblique proceſſes; *i*, the tranſverſe proceſſes; *k*, the ſuperior part of it's body, which is received by, and ſuſtains the atlas; *l*, the tranſverſe hole.

klmnp, The third vertebra of the neck; *k*, the ſpinal proceſs; *ll*, the upper oblique proceſſes; *m m*, the lower oblique proceſſes; *n n*, the tranſverſe proceſſes; *p*, the internal ſide of the body of this vertebra.—This explanation will ſerve for thoſe of the neck which are below this; only it is to be obſerved, that *o* marks the upper part of the body of the fifth vertebra, where it articulates with the fourth at *p*; *r*, denotes the anterior oblique proceſs of the ſixth vertebra, and *q q*, thoſe parts of the oblique proceſſes which are incruſted with ſmooth cartilages.

r&c*s*&c*t*&c, The vertebræ of the back; *rr*&c, the ſpinal proceſſes; *ss*&c, the bodies; *tt* &c, the ligaments. *u* &c *w* &c *x* &c *yz* &c, The vertebræ of the loins; *uu*&c, the ſpinal proceſſes; *ww*, the bodies; *xx* &c, the tranſverſe proceſſes; *yy*, the ligaments interpoſed betwixt the bodies of the vertebræ, tying them to each other; *zz*&c, the openings betwixt the tranſverſe proceſſes through which the nerves come from the medulla ſpinalis.

1234&c. The os ſacrum, or great bone of the ſpine; 1, the rough part, compoſed of the tranſverſe proceſſes of this bone; 2 2, the ſpinal proceſſes; 3, the anterior part, which, in a young horſe, is divided into as many bodies as there are ſpines, betwixt which, in the parts 5, are bony lines that were formerly ligaments.

6, &c. 7, &c. 8, &c. 9, &c. The bones of the coccyx or tail; 66, &c. the tranſverſe proceſſes; 77, &c. the ſpinal proceſſes; 88 &c, the bodies; 99, the ligaments interpoſed betwixt the bodies of the bones of the tail.

In the Thorax and Shoulder-blades.

a, The ſternum. *b*, The enſiform cartilage. *c*, &c. *d*, &c. *e*, &c. *f*, &c. *g*, &c. The ribs; *c*, &c. the parts by which they articulate with the bodies of the vertebræ; *d*, &c. the cartilages by which they are continued to the ſternum, eight on each ſide; *e*, &c. the external ſide of the ribs; *ff*, &c. the internal ſide of the ribs; *gg*, &c. the cartilages of the falſe ribs which are ten on each ſide. *hikl*, The right ſcapula; *h*, it's ſpine; *ii*, it's baſis; *k*, a cartilaginous continuation of its baſis; *l*, it's foſſa ſubſpinalis. *m m n o*, The internal ſide of the left ſcapula; *n*, the coracoid proceſs, or a ſmall part of its neck.

In the Pelvis.

abcdefghi, A *bcfgh*, The innominata or baſon bones including three others; *a b c d*, the os ilium on the right ſide; *b c*, its ſpine; *d* a protuberance, from which ariſes the rectus muſcle of the leg; *ef*, the os iſchium or hich bone; *e*, the acute proceſs; *f*, the tubercle; *g*, the os pubis; *h*, the great foramen of the iſchium and pubis; *i*, the external margin of the acetabulum.

In the Upper Limbs.

abcd, A, The humeri or bones of the arm; *a b* the upper head; *b*, the part of the head which is joined to the cavity of the ſcapula, covered with a ſmooth cartilaginous cruſt; *d*, the external condyle of the lower head; A a ſmall part of the head of the right humerus. *efg*, *g*, The ulnæ; *e*, the olecranon; *f*, the part which articulates with the lower part of the ulna, which, in aged horſes, becomes one bone with the radius. *hiklmnop*, the radii; *h i*, the upper head of the radius; *klmno*, the lower head; *m*, the part which articulates with the os ſphenoides, or naviculare, incruſted with a ſmooth cartilage; *n*, the part which articulates with the os piſiforme or orbiculare, incruſted with a ſmooth cartilage.

P, *pqrstuwxyz*, The bones of the carpus; P os piſiforme or orbiculare; *p q*, os ſpenoides or naviculare; *p*, the part covered with a ſmooth cartilage for its articulation with the radius; *r*, os lunare; *s*, os cuneiforme; *t u*, os trapezium; *t*, the cartilaginous incruſtation by which it articulates with the os ſphenoides; *w x*, os magnum, or the great round-headed bone of the wriſt; *w*, the round head covered with a ſmooth cartilage for its articulation with the os lunare; *y z*, the unciform or hook like bone of the wriſt; *y*, the ſmooth cartilaginous incruſtation for its articulation with the cuneiform or wedge-like bones of the wriſt.

1234567, The metacarpal bones; 123, a bone which is equal to the metacarpal bones of the middle and ring-fingers, both together in the human ſkeleton.

8 9, Oſſa ſeſamoidea, two bones which are always to be found in this joint. 10, The bones of the firſt phalanges or order of bones in the fingers, in the horſe called the great paſterns. 11, The bones of the ſecond phalanges, called in the horſe, the little paſterns or coronary bones. 12, The bones of the third phalanges, or the coffin bones.

In the Lower Limbs.

abcddefghik, Oſſa femorum, or the thigh bones; *b*, the head, incruſted with a ſmooth cartilage for its articulation with the acetabulum; *c*, the leſs trochanter; *d d*, the great trochanter; *e*, a very prominent part of the linea aſpera, into which the external glutæus is inſerted along with part of the faſcia lata; *f*, a large foſſa or notch, out of and from the borders of which, the external head of the gemellus and the plantaris muſcles ariſe; *g*, a roughneſs from which ariſes the internal head of the gemellus; *h*, the outer condyle of the lower head, covered with a ſmooth cartilage; *i k*, the inner condyle, at *i* incruſted with a ſmooth cartilage.

l, The patellæ, or knee pan bones. *m*, The outer ſemi-lunar cartilages, which are interpoſed in the joints of the knees. *n*, The inner ſemi-lunar cartilages, which are interpoſed in the joints of the knees. *opqr*, The tibiæ, or great bones of the legs; *op*, the upper head; *r*, the lower head. *st*, The fibulæ, or ſmall bones of the legs; *s*, the upper head; *t*, the lower extremity which ends here almoſt in a point. *uwxxyz &*, 1, The bones of the tarſus. *uw*, The calcanei, or heel bones.

x, The aſtragali, or cockal bones. *y*, The cubical bones of the tarſus. *z*, The navicular bones of the tarſus. *&*, The middle cuneiform bones of the tarſus. 1, The leſs cuneiform bones of the tarſus. 234567, The bones of the metatarſus, or inſtep; 89, Oſſaſeſamoidea, they are bones which are always to be found in theſe joints, two in each; they ſerve to throw the bending tendons farther from the center of motion, and form a proper groove for them to ſlide in. 10 11 12, The bones which are in the places of the three phalanges or orders of bones in the human ſkeleton: with farriers the firſt are called the great paſterns; the ſecond the little paſterns or coronary bones; and the third the coffin bones.

PLATE II. *Figure* 1. — SIDE VIEW.

The External Muſcles, with the Ligaments, &c. As they are ſeen through the Membrana Carnoſa and Faſcia.

Muſles in the Head.

A, Epicranius, or muſcle of the ſcalp; *bcde*, The orbicular muſcle of the eye-lid; *e*, the origin of the fibres from the ligament by which the conjunction of the eye-lids, in the great canthus, is tied to the naſal part of the os unguis. *fg*, The corrugator of the eye-brow; *f*, its origin; at *g*, it is inſerted into the ſkin. *hik*, The elevator of the upper lip and corner of the mouth; *i k*, its oirgin from the epicranius; *p q*, The lateral dilator of the noſtril and upper lip. *r s t u w x*, Zygomaticus; *t*, its inſertion into the orbicularis of the mouth: *w x*, its origin from the orbicularis of the eye; it is a very thin muſcle. *z z*, & B, The orbicular muſcle of the mouth; 1 2, The depreſſor of the lower lip. 3 4, Part of the latiſſimus colli, which at 4, is inſerted into the lower jaw bone. 5, The elevators of the chin where they are inſerted into the ſkin, the fibres of which are intermixed with the fat of the chin. 6, The anterior dilator of the noſtril. 7, The tendon of the long naſal muſcle of the upper lip. 8, The tendon of the upper lip. 9, Septum narium.

Muſcles of the Outer Ear.

a, Retrahens; *c d h*, The ſuperior anterior muſcle through which is ſeen the origens; where it joins its fellow, having no origin fram the bone; *d*, its inſertion into the cartilage; *h*, a part of it which runs over the cartilage, and is inſerted near *h* into the outer ear. *g i*, Muſcles that run from the anterior cartilage *k*, to the external ear. *k*, The anterior cartilage of the outer ear. *l*, The lateral muſcle of the anterior cartilage of the outer ear; it ariſes above the orbit of the eye, and is inſerted into the anterior cartilage of the outer ear. *m*, A muſcle ariſing under *l*, which is inſerted at the inferior angle of the opening of the ear, anteriorly, with *i*. *n o*, The lateral depreſſor of the outer ear, ariſing at *n*, from the quadratus colli it is inſerted, cloſe by the muſcle *m*, into the lower angle of the opening of the ear poſteriorly. *p*, The outer ear.

In the Neck.

3 4, *a b c d*, Latiſſimus colli, or quadratus of the neck; *b*, its origin from the ſternum, a little below the top; 4, its inſertion into the lower jaw bone; *f g l*, Levator humeri proprius; *g*, that part which ariſes tendinous from the proceſſus maſtoideus; *l*, the portion that ariſes from the tranſverſe proceſſes of the four uppermoſt vertebræ of the neck near their extremities; its origin is the ſame with the angularis called levator ſcapulæ proprius in the human body; *o p x*, The upper part of the trapezius; *o p*, the origin of the fleſhy part; the external faſcia runs over the levator humeri proprius, and is attached to the edge of the quadratus colli, the internal faſcia goes on the internal ſurface of the levator humeri proprius; *x* the origin of the trapezius from the ligament of the neck. *y z &*, The inferior part of the trapezius.

In the Shoulder and Trunk.

abcdefghiklmnopqrs, Membrana carnoſa; *a*, the thickeſt fleſhy part; *b*, the thick fleſhy parts running upon the extenſors of the cubit, becomes tendinous at *c*, and goes to be inſerted with the latiſſimus dorſi and teres major into the humerus; *dd*, ſome of the thick fleſhy part going over the muſcles of the cubit and tending towards the cubit, forms the membranous tendon *q*; *f*, a fleſhy part which runs into the dublicature of this membrane, &c. as it goes towards the thigh; at *g*, it is fleſhy, but little more than a membrane, being very thin; *h*, a membranous part which runs over the penis; *i*, the tendinous membranous part which runs over the loins; *k*, the membranous part which helps to form the duplicature; *l*, a feint appearance of the outline of the latiſſimus dorſi; the part *m* is about as thick as the part *n*, and the latiſſimus dorſi both together; *o*, the part where the carnous fibres of the ſuperior portion of this muſcle.

t u w x y, Pectoralis; *t*, it's origin from the aponeuroſis of the external oblique muſcle of the abdomen.

Muſcles, &c. in the upper Limb or Extremity, as they appear under the Membrana-carnoſa.

a b, Extenſor carpi-radialis; *a* the fleſhy part; *b*, the tendon, *d e f g h*, Extenſor ulnaris & digitorum communis; *d*, the fleſhy part ſhewing itſelf under the membrane *e e*; *f g*, the tendon which goes under the ligament at *e*, and giving a ſlip *f*, to the tendon *i i*, of the extenſor, analagous to the extenſor minimi digiti; *h*, the tendon, ſending fibres laterally over the ligament *m*, *i*, Extenſor minimi digiti, to which the carnous membrane is attached at *i k*, and ſends tendinous fibres over it in the direction as marked. *n*, The bone, which is an imperfect metacarpal bone to which this membrane is attached. *o*, A ſort of ſpungy, fatty ſubſtance, probably a production of the membrana adipoſa, lying over the protuberating part of this joint to preſerve the bending tendons from bruiſes when this part touches the ground, &c. *p q*, Flexor carpi ulnaris; at *p*, the fleſhy fibres appear under the membrane, and alſo under its own tendinous ſurface. R *r*, Flexor digitorum profundus; R, the fleſhy part appearing under the tendinous ſurface of this muſcle as well as the carnous membrane. *s*, The tendon of the ſublimis, T *t*, The inter-muſcular ligament to the part of which the carnous membrane has ſome adheſion. *u*, Marks the ligaments ariſing at *u*, from the orbicular bone and running obliquely downwards and forwards. *x x*, Vena plantaris externa. &, The hoof.

In the Lower or Poſterior Limb.

a b c d e f g h i k K *l m n o p q r s t u w x y z &*, Faſcia lata, and muſculus faciæ latæ, with the membrana carnoſa, and expanſions of the muſcles; *a*, the part which is a continuation of the tendon of the latiſſimus dorſi, *b*, the origin of the muſculus faſciæ latæ from the ſpine of ilium. K, The patella with it's external lateral ligament. *l*, The extenſor longus digitorum; *m* peroneus; *n*, flexor digitorum pedis; *o*, Gemellus. *s*, The tendon of the extenſor digiti. *t*, The tendon of the flexors. *u*, The interoſſeus, &c, *w*, Veins ariſing from under the hoof, called venæ plantares, they run into the vena tibialis poſterior. *y*, A ligament ſent off by the interoſſeus, &c. A, The hoof.

Muſcles, &c. protuberating under the Membrana Carnoſa in the Left Upper Limb, viz. on the Cubit, Carpus, Metacarpus, and Extremity of the Limb.

a b, Extenſor carpi radialis; *c*, The tendon of the muſcle, which is analogous to the extenſor of the thumb. *d*, Biceps cubiti. *e*, Pectoralis, *f*, Flexor digitorum. *g*, Flexor carpi radialis. *h*, Sublimis. *i*, Profundus. *k*, The tendon of the extenſor ulnaris & digitorum communis. *l*, A ſort of ſpungy, fatty ſubſtance, probably a production of the membrana adipoſa. *m*, vena cephalica. *n*, Vena plantaris interna. *o*, Nervus plantaris internus. *p*, Interoſſeus, &c. *q*, A ligament coming from the interoſſeus and inſerted into the extending tendon. *r*, The hoof.

PLATE III. *Figure* I. — SIDE VIEW.

A full and compleat View of the External Muſcles, Ligaments, &c. the Membrana Carnoſa and Faſcia being removed.

In the Head.

a b c d, The lateral dilator of the noſtril and upper lip; *b c*, it's inſertion into the upper lip and noſtril; *d*, it's origin. *f*, The anterior dilator of the noſtril. *g*, The orbicular muſcle of the mouth; *g*, the part belonging to the lower lip: *i*, the part belonging to the upper lip. *l m o*, The long naſal muſcle of the upper lip; *l m n*, the fleſhy part; *m*, it's origin; at *n*, the tendon begins: *o*, the tendon. *p q*, The maſſeter. *r*, Buccinator. *s t*, The broad ligaments of the eye lids. *u w*, The ciliaris muſcle; *w*, it's origin. *x y*, A muſcle belonging, in part, to the alæ narium z, but chiefly to the concha narium inferior; *x* it's inſertion into the alæ narium; *y*, it's origin. z, Alæ narium. &, Septum narium. 2 3, The temporal muſcle; 3, it's inſertion into the coronary proceſs of the under jaw bone. 4, Muſcular fibres which extend and draw outwards the pituitary membrane 5. 5, Membrana pituitaria. 6 7, A muſcle called caninus, or elevator of the corner of the mouth.

9 10, The depreſſor of the lower lip; it ariſes along with the buccinator. 12, The elevator of the chin. 14, Vena angularis. 15, Arteria angularis. 16, A branch of the vena temporalis. 19, The ſalivary duct. 20, The anterior cartilage of the outer ear. 21, The outer ear. 22 23, A muſcle ariſing from the anterior cartilage at 22, and inſerted at 23 into the outer ear. 24, A muſcle which ariſes by two fleſhy heads from the internal ſurface of the anterior cartilage. 25, A muſcle which is a ſort of antagoniſt to that marked 24, 26 *c*, The parotid gland.

In the Neck.

a b c, Sterno maſtoidæus, or ſterno maxillaris; it ariſes from the top of the ſternum at *b*, and is inſerted by a flat tendon into the lower jaw bone, under the parotid gland at, or near, *c*. *d* The ſpungy, fatty ſubſtance of the mane cut directly dowe the middle, and the left ſide remaining on to ſhew its thickneſs. *e*, Ligamentum colli. *f f*, Caracohyoidæus; it ariſes from the upper and internal ſide of the humerus, betwixt the inſertions of the ſubſcapularis and teres major by a flat membranous tendon; and is inſerted into the os hyoides. *g*, Sternohyoidæus. *h i*, Tranſverſalis; *k l*, The tendon of the trachelomaſtoidæus; *l*, a faſcia or membranous part. *m n*, Rectus internus major capitis; *m*, it's loweſt origin from the tranſverſe proceſs of the fourth vertebra of the neck, and the part *p*, of the longus colli. *o*, Inter-tranſverſales minores colli. *p q*, Longus colli. *r s t u w*, Splenius. *x*, Sternothyroidæus. *y*, Hyothyroidæus. z, Cricothyroidæus. &, The lower conſtrictor of the pharinx. 1, Vena jugularis communis. 2, Vena jugularis externa anterior. 3, Vena jugularis externa, poſterior, or ſuperior. 4, Part of the carotid artery, or carotis communis.

Muſcles in the Neck and Trunk, which are inſerted into the Scapula.

a b, Rhomboides; *a*, the origin from the ligamentum colli; *b*, its inſertion, or the part going to be inſerted into the ſcapula. *c d e f*, Serratus minor anticus; *c d*, the fleſhy part ariſing near *c*, from the ſternum, and part of the firſt rib, and is connected to the teres minor by the faſcia *e f*, which is ſent from this muſcle over the infra-ſpinatus ſcapulæ and ſupra-ſpinatus ſcapulæ to its outer edge; *g h i k l o p*, Serratus major anticus.

Muſcles, &c. inſerted into the Humerus and Cubit.

1 2 3 4 5 6, Pectoralis; *a b c d e f*, Supra-ſpinatus ſcapulæ; *h k l n*, Infra-ſpinatus ſcapulæ; *o p q*, teres minor; *q*, its inſertion into the humerus; *r s t u w*, Latiſſimus dorſi.

In the Trunk.

I K L M, Obliquus externus, or deſcendens abdomenis; I, the place where the thickeſt carnous part ceaſes to ariſe from the ribs. K, the ending or inſertion of the carnous part into the tendinous part

In the Right Upper Limb.

NOP Triceps brachii; N, the head, which is called extenſor longus major; O the ſhort head of the triceps, called the extenſor brevis; P, the head called brachialis extenſor longus minor.

The

Anatomy of the Horse, representing the Muscles, Fascias, Ligaments, Nerves, Arteries, Veins and Glands, from Nature. See Farriery.

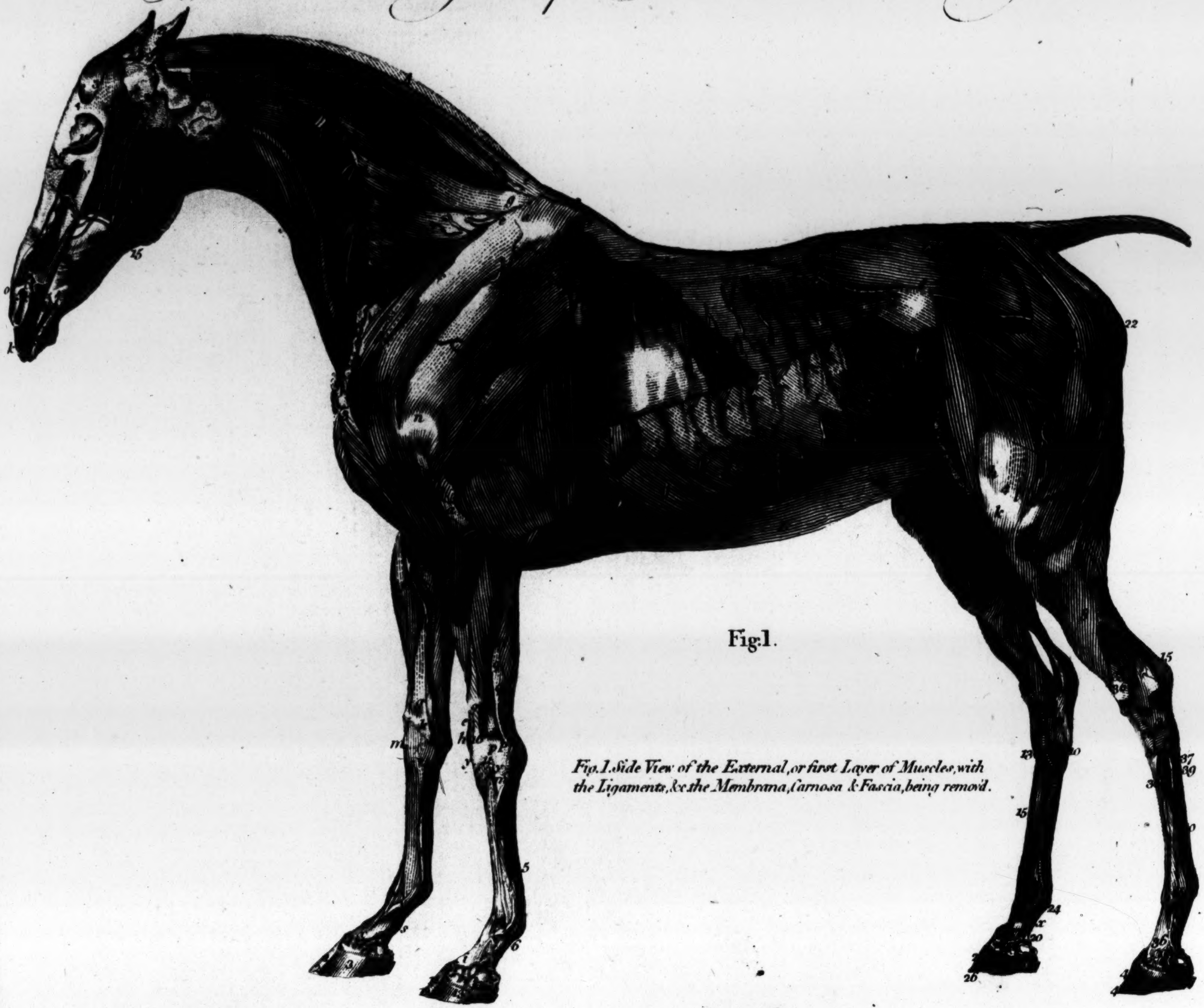

Fig. 1.

Fig. 1. Side View of the External, or first Layer of Muscles, with the Ligaments, &c. the Membrana, Carnosa & Fascia, being remov'd.

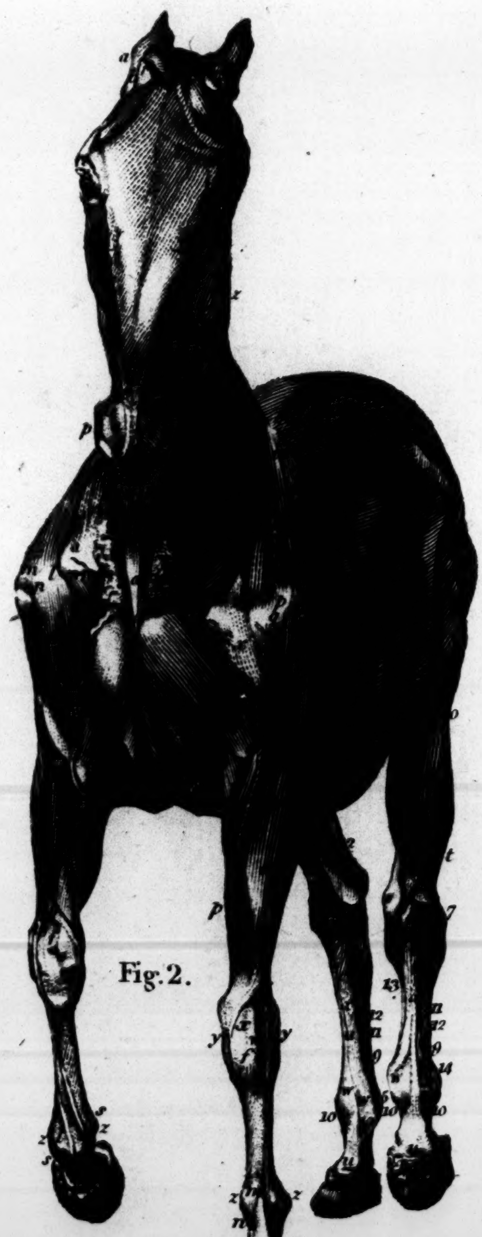

Fig. 2.

Fig. 2. Front View &c. The Membrana, Carnosa & Fascia, being remov'd.

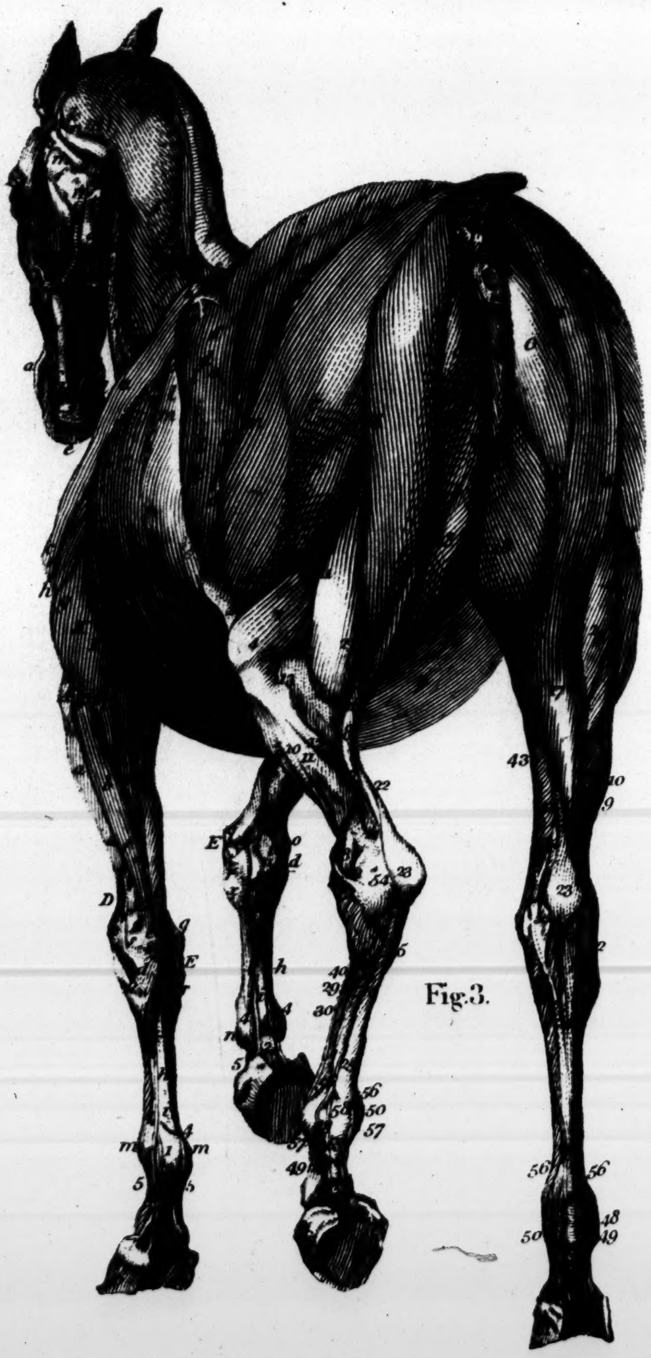

Fig. 3.

Fig. 3. Back View &c. The Membrana, Carnosa & Fascia, being remov'd.

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Anatomy of the Horse, representing the Muscles, Fascias, Ligaments, Nerves, Arteries, Veins and Glands, from Nature. See Farriey.

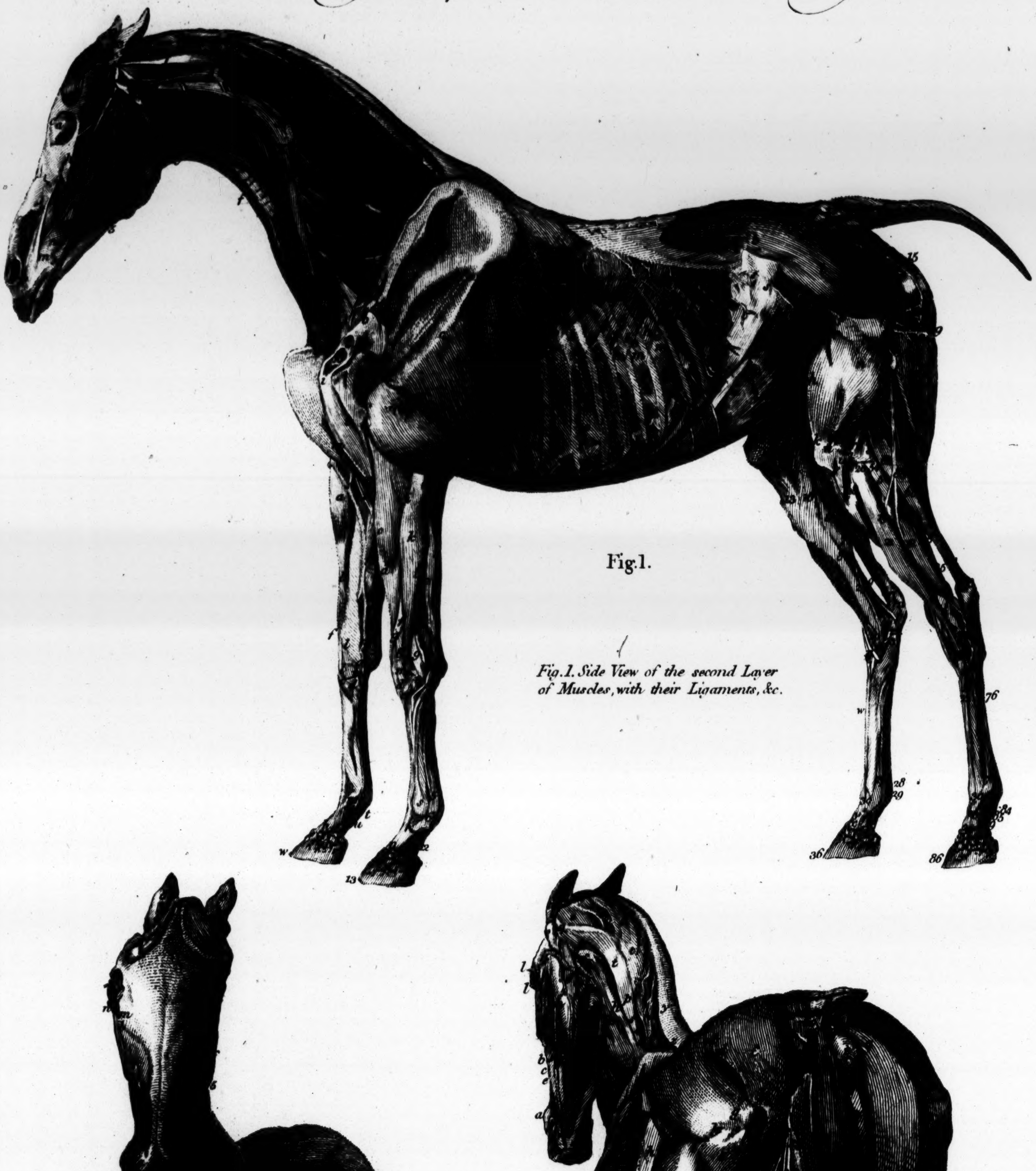

Fig.1.

Fig. 1. Side View of the second Layer of Muscles, with their Ligaments, &c.

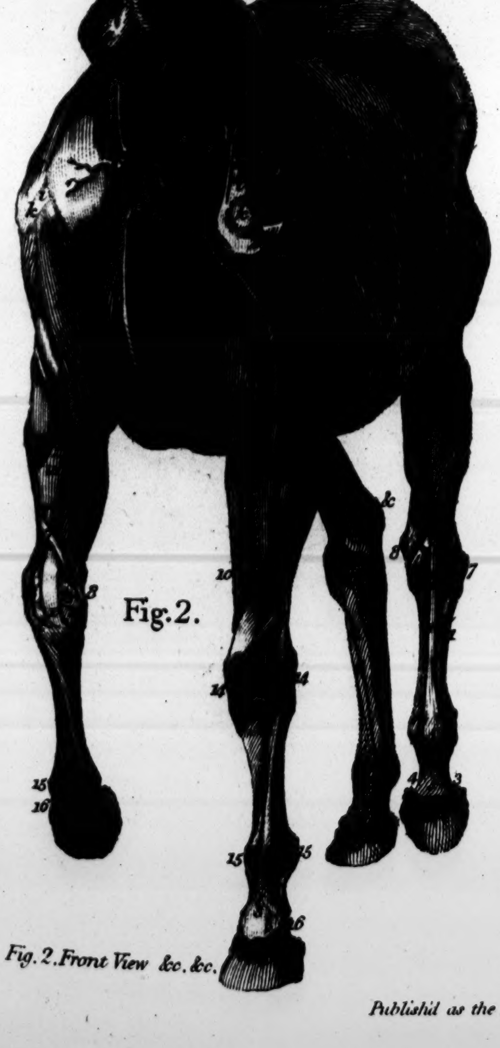

Fig.2.

Fig. 2. Front View &c. &c.

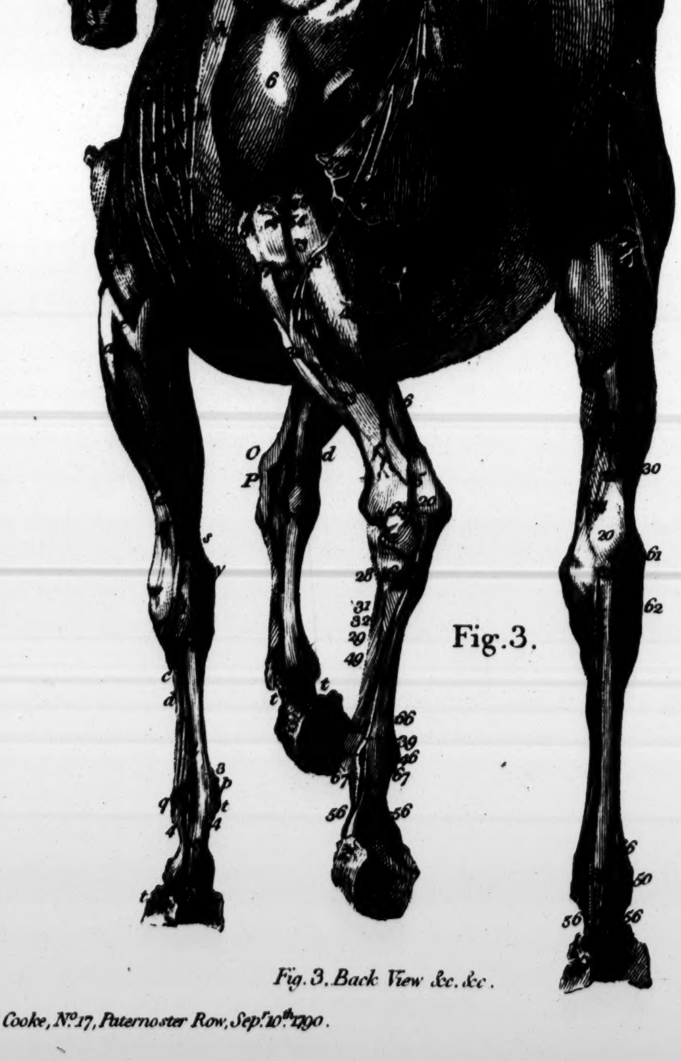

Fig.3.

Fig. 3. Back View &c. &c.

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Wooding sculp.

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The ſhort head O ariſes from the humerus, the other two from the ſcapula ; its inſertion is into the ancon. QRS, Biceps brachii, or caraco radialis ; Q, the belly of the ſhort head ; R, the belly of the long head ; S, the faſcia of this muſcle, which is ſent down upon the muſcles on the cubit. *aAbcdeegh*, A faſcia or ſtrong membranous production lying over the extending muſcles on the cubit. *f*, The tendon of the extenſor carpi radialis inſerted into the metacarpal bone. *i*, The tendon of the extenſor digitorum communis going to its inſertion into the coffin bone.

1 2, A liga-ment ariſing at 1 and inſerted at 2 *w* ; it helps to bind down the projecting bone of the carpus. 4, The tendon of the profundus. 5, The tendon of the ſublimis. 6, A vein ariſing from under the hoof called vena plantaris externa. 9, An articular ligament. 10, A ligament ſent from the interoſſeus and inſerted into the tendon of the extenſor digitorum communis, which it binds down. 11 12, The horny part of the hoof. 13, A ſubſtance reſembling the villous ſurface of a muſhroom ariſing from the coffin bone, received by the like ariſing from the hoof, which it mutually receives.

In the Right Lower Limb.

*abcc*D*efghikl*, Muſculus faſcia lata; *a*, it's origin from the ilium; *mnop*, Glutæus externus; *m*, a fleſhy origin from the ligament. *q*Q*rst*, Glutæus medius; *qrs*, its origin from the tendinous ſurface of the ſacro lumbalis ; *s*, its origin from the ilium; is inſerted into the great trochanter. *ikluwxyz*, 3 4 5 7 8 9 11, Biceps cruris; 15, The tendon of the plantaris. 16 17 18 19, Semi-tendinoſus; 16, its origin from the ligament which runs betwixt the ſpines of the ſacrum and the iſchium, from the ligament betwixt the ſpinal and tranſverſe proceſſes of the os coccygis; principal inſertion is by a flat tendon into the ſuperior and anterior part of the tibia internally, it is alſo attached to the plantaris near the bottom of its fleſhy part by a flat tendon or expanſion. 22, The large adductor of the thigh. 24 25 26 27 30 31 32 33 34, Ligaments which bind down the tendons, &c. on the tarſus, the inferior and anterior part of the leg or tibia, and the ſuperior part of the metatarſus laterally and anteriorly ; 35, A ligament which binds down the tendons of the flexors. 36 36, Extenſor longus digitorum pedis. 37 37, Peroneus anticus. 38, Flexor digitorum pedis. 39, A branch of the arteria tibialis anterior. 40, Plantaris. 41, Flexor digitorum pedis. 42 46, Vena plantaris externa. 43, Nervus plantaris externus. 44, The interoſſeus, &c. 45, A ligament ſent from the interoſſeus, &c. by which the tendon of the extenſor longus digitorum pedis 36, is bound down, otherwiſe it would ſtart from the bone when the fetlock joint gives much way. 47 48, The horny part of the hoof.

In the Internal Side of the Left Lower Limb.

a, The tendon of the rectus cruris. *b*, Vaſtus internus. *cd*, Sartorius. *ef*, Gracilis. *ghkl*, Semi-tendinoſus; *g*, the fleſhy part; *kl*, the tendon which is inſerted into the tibia at *k*; *m*, Gemellus; *m*, a fleſhy part ; under *n*, lies the tendon over which the tendon of the plantaris is twiſted. *n*, A tendon formed by that going off from the ſemi-tendinoſus at *l*, and by another tendinous faſcia. *opqrs*, The faſciæ which are inſerted into the os calcis gemellus and plantaris ; *t*, The tendon of the plantaris coming from under the faſcias and twiſting over the gemellus at *t* ; *y*, The tendon of the flexor digitorum pedis, the loweſt part of its inſertion is into the ſplint bone. z 1, the tibialis anticus appearing under faſcia. 2 3, The ligament marked 23 24 25 33 36, in this plate of the right leg ; 3 3, its inſertion into the tibia. 4, The ligament marked 30, on the right lower limb in this plate. 5, A ligament which covers the tendon of the tibialis poſticus. 6 7, A ligament ariſing at 7, from the aſtragalus, and inſerted at 6, into a cartilage lying under the tendon of the flexor digitorum pedis. 8 9, A ſtrong ligament which binds the os calcis to the aſtragalus, os naviculare, oſſa cuneiformia, and ſplint bone. 9 9, The articular ligament which binds the tibia to the bones of the tarſus. 10 11, A ligament running over the tendon of the lantaris, inſerted into the ligament 8 9, and ſplint bone. 12, A ſort of ligamentous facia betwixt which and the burſal ligament the mucilaginous glands are contained. 13, The ligament proper to the tendon of the extenſor longus digitorum pedis. 14 15 16 17, The tendon of the extenſor digitorum. 18, Interoſſeus, &c. 19, The ligament marked *d*, in plate the ſecond. 20, A ligament which ariſes from the internal lateral and inferior part of the firſt bone of the toe. 21, Vena ſaphena. 24, Vena plantaris interna. 25 26, The horny part of the hoof. 27, A ſubſtance reſembling the villous ſurface of a muſhroom.

In the Left Upper Limb.

c, Part of the biceps which ſends an expanſion over the bending muſcles lying upon the cubit. *def*, The expanſion marked *mnop*P*qrst*, on the left upper limb in this plate. *gg*, The faſcia marked *a*A*bcdegh*, on the left upper limb in this plate. *h*, The tendon of the muſcle which is analogous to the extending muſcles of the thumb. *iklm*, The ligament marked 16 *hyu*, on the left upper limb in this plate. *no*, A ligament ariſing at *n*, and inſerted about *o*. *p*, The ligament marked 3, on the right upper limb in this plate. *q*, The tendon of the profundus. *r*, The tendon of the ſublimis. *s*, A vein ariſing from under the hoof, called vena plantaris interna. *wx*, The tendon of the extenſor digitorum communis. *y*, A ligament which ariſes from the interoſſeus, &c. *z*, The interoſſeus, &c. 1 2, The horny part of the hoof.

PLATE IV. *Figure* I.—SIDE VIEW.——THE SECOND LAYER OF MUSCLES, WITH THEIR LIGAMENTS, &c.

In the Head.

ab, The elevator of the upper eye-lid. *c*, The lachrymal gland. *d*, The under eye-lid, *ee*, The tarſi ligamentum cilliare, or cilliar edges. *f*, Alæ narium. *ghi*, A muſcle ariſing by a ſmall tendon at *h*, and by a flat membranous tendon at *i*. *k*, The ſeptum narium. *mn*, Caninus or elevator of the corner of the mouth.

o, Orbicularis oris. *pqr*, The depreſſor of the lower lip. *s*, Buccinator. *t*, The anterior dilator of the noſtril. *u*, The elevator of the chin. *w*, The maſſeter. 1, Vena jugularis externa poſterior or ſuperior. 3, Vena temporalis. 4, Vena angularis. 5, Arteria angularis. 10 Glandulæ labiales. 11, The ſalivary duct. 12, The anterior cartilage of the outer ear. 13, The outer ear.

In the Neck.

abcde, Caracohyoidæus. *fg*, Sternohyoidæus. *hik*, Sternothyroidæus ; ariſes from the ſuperior and internal part of the ſternum. *l*, Part of the carotid artery. *n*, The thyroid gland. *q*, The lower conſtrictor of the pharinx. *r*, Hyothyroidæus. *s*, Cricothyroidæus. *t*, Cricoarytenoidæus poſticus. *u*, The inferior maxiliary gland. *wxy*, Rectus internus major capitis, or rectus anticus longus. ABCDEFGH, Tranverſalis cervicis.

I K L, Trachelo-maſtoidæus, complexus minor, or maſtoidæus lateralis. MOPQS, Complexus. U U, Obliquus capitis inferior. W W, Obliquus capitis ſuperior. X Y, Longus colli. 1 2, Branches of the cervical arteries and veins. 3, Part of the jugular vein.

Muſcles on the Shoulder.

ab, The ſubſcapularis, is inſerted into the caracoid proceſs a little below *b*. *cdefgh*, Triceps extenſor cubiti. *iklmn*, Biceps brachii, or rather caraco radialis *s*, Branches of the arteria and vena axillaris. *t*, A branch from the anieria axillaris.

In the Trunk.

abcd, Serratus minor poſticus. *efgh*, &c. Serratus major poſticus. *l*, Serratus major anticus. *m*, &c. *no*, &c. *pp*, &c. Intercoſtals. *stuwxy*, Obliquus internus, or aſcendens abdominis. *xy*, the flat tendon ; that part of the tendon which runs over the rectus is cut off from *t*, to *y*. z, Rectus abdominis.

In the Cubit and Right Upper Extremity.

abcd, Extenſor carpi radialis. *f*, The muſcle which is analogous to the extenſors of the thumb in the human body. *hiklmn*, Extenſor digitorum communis. *ooo*, Ligamentous faſcias. *pqrs*, Extenſor minimi digiti ; *p*, the part ariſing from the ſuperior part of the radius. *tuwxy*z, Flexor carpi ulnaris. 1 2 3, The profundus. 5, Interoſſeus, &c. 6, A ligament from the interoſſeus to the tendon of the extenſor digitorum communis. 8 8, The burſal ligament belonging to the anterior part of this joint. 9, The articular ligament. 10, The tendon of the ſublimis. 12, Vena plantaris externa. The villous covering of the coffin bone is here left on to ſhew it's thickneſs.

In the Right Lower Limb.

abcd, Glutæus medius. *e*, Iliacus internus. *ghik*, Rectus cruris. *nopqrs*, Vaſtus externus. *ruw*, The inſertions of the anterior part of the biceps. *yz*, The inferior ligament of the patella.

1 2, The lateral ligament of the patella. 3 4, The burſal or capſular ligament of the knee. 5, The place where the tendon of the glutæus externus is cut off from it's inſertion. The place where the expanſion is cut off which it ſends to the pyramidalis.

8, The ligament which runs from the ſpinal to the tranſverſe proceſſes of the os ſacrum. 8 9 10; the ligament which runs from the tranſverſe proceſſes of the os ſacrum to the iſchium. 9 11 ; the origin of the biceps from the tubercle of the iſchium. 19 20 21 22 23 24 30, Extenſor longus digitorum pedis. 26, A ligament which binds down the tendon of the extenſor longus digitorum pedis. 27, Extenſor brevis digitorum pedis. 28 ; the tibialis anticus. 31 32 33, Semi-membranoſus ariſing tendinous. 34 35, the inferior part of the ſemi-tendinoſus cut off at 34. 15 36 38 39 ; the large adductor of the thigh.

50 51 52 53, Peronæus. 58 59, Flexor digitorum ; 58, the fleſhy part ; 59, the tendon. 60 61 62 63 64, Gemellus ; 68, 69, the tendon of the plantaris. 70 71, Articular ligaments. 72, A capſular ligament. 74 75, Interoſſeus, &c. 76, Arteria tibialis anterior. 77, A vein from the biceps cruris. 81, A large vein, on which ſeveral valves are marked. 85, The external vena plantaris.

In the Internal Side of the Left lower Limb.

A*a*, The tendinous ſurface of the rectus cruris, inſerted at A, into the patella. *bc*, Vaſtus internus. *d*, The long adductor of the thigh. *e*, A flat tendon or ſaſcia from the large adductor of the thigh. *fg*, Gemellus. *h*, The tendon of the ſolæus. *lmnpr*, The tendon of the plantaris. *uwxyx*, 30, The extenſor digitorum pedis. *x*, The ligament marked 20, in plate the third. 1 2 3, Tibialis anticus. 6, Poplitæus; externally tendinous, particularly near its inſertion. 7, Tibialis poſticus. 8, Flexor digitorum pedis. 9 10, The burſal ligament. 11, The intermuſcular ligament marked 26 on the left limb in this plate.

12 13 14, The internal anterior ligament which binds the patella to the tibia. 15, A membraneous covering of the burſal ligament. 16, The internal articular ligament which connects the os femoris to the tibia. 18, The articular ligament which binds the tibia to the bones of the tarſus. 22 23, The ligament marked 8 9, in Plate the third. 26, The ligament marked 19 in Plate the third. 27, Interoſſeus, &c. marked 18 in Plate the third. 29, Vena plantaris interna. 36, The villous covering of the coffin bone.

In the Internal Side of the Left Upper Limb.

abc, Extenſor carpi radialis. *d*, A ligamentous faſcia. *e*, Profundus. *f g*, The muſcle which is analogous to the extenſors of the thumb. *h*, The tendon of the extenſor digitorum communis. *k*, Arteria brachialis, or the humeral artery. *llmm*, The burſal ligament on the anterior part of this juncture. *n*, Flexor carpi radialis. *o*, Sublimis. *p*, Flexor carpi ulnaris. *q*, Interoſſeus, &c. *s*, Vena cephalica. *t*, Vena plantaris interna. *w*, The villous covering of the coffin bone.

PLATE V. *Figure* I.—THE THIRD LAYER OF MUSCLES.

In the Head.

ab, The globe or ball of the eye; *a*, the pupil; *b*, the white of the eye, or tunica ſclerotica, covered with the albuginea. *c*, One of the lachrymal glands placed in the great canthus of the eye, called carancula lachrymalis and glandula lachrymalis inferior. *d*, The ſemi-lunar fold, formed by the conjunctiva. *e*, Attollens. *f*, Deprimens. *g*, Adducens. *h*, Abducens. *i*, Obliquus ſuperior. *k*, Obliquus inferior. *l*, The trochlea. *m o*, Caninus, or the elevator of the corner of the mouth. *p*, Orbicularis oris, or the orbicular muſcle of the mouth. *q r*, The glandulus membrane which lines the inſide of the lips. *s*, The elevator of the chin. *t u*, The ſhort naſal muſcle of the upper lip. *w w*, Buccinator. *x*, The anterior dilator of the noſtril. *y*, The pituitary membrane on the inſide of the alæ narium. z, The ſalivary duct. 1, Vena jugularis externa poſterior or ſuperior. 2, Vena temporalis. 3, Arteria angularis. 4, Vena angularis. 5, Nervus ſuperciliaris. 10, The anterior cartilage. 11, The ear.

In the Neck.

a, Glandula thyroides. *b c d e f*, The carotid artery. *g*, An artery and vein running over the gula. *i*, OEſophagus. *k*, Trachea arteria, aſpera arteria, or wind-pipe. *l m n*, Sternothyroidæus; *o p*, Crycothyroidæs; *p q*, The lower conſtrictor of the pharynx. *r*, Hyo-thyroidæus, or thyro-hyoidæus. *s*, The lower, and anterior part of the thyroid cartilage. *t u*, Rectus capitis poſticus major; *x w*, Rectus capitis poſticus minor, or rather medius; *y z*, Obliquus capitis ſuperior; A B, Obliquus capitis inferior; C D E F G H I K, Longus colli; L, &c. M, &c. Intertranſverſarii poſteriores colli; N, Intervertebrales. O P Q, The multifidæ of the ſpine. R T U, Spinalis cervicis; 1, Branches of the cervical nerves. 2, Branches of the cervical arteries. 3, Branches of the cervical veins. 4, Part of the jugular vein. 5, Ligamentum colli.

In the Shoulder.

a b, Sub-ſcapularis. *d e f*, Teres major; *g h i k l m*, Longus minor. *n o*, Brachialis externus; *p q*, The inferior part of the ſerratus major anticus. *r*, Nervus cubitalis. *s*, Nervus radialis. *t*, Nervus muſculo-cutaneus. *u*, Nervus medianus. *w*, Branches of the arteria and vena axillaris.

Muſcles, &c. on the Trunk.

1, &c. 2, &c. The external intercoſtals; 3, &c. 4, &c. The internal intercoſtals: *a b c d e f*, The ſemi-ſpinalis and ſpinalis dorſi. *g h i k*, Longiſſimus dorſi; *l m n*, &c, *o*, Sacro-lumbalis. P*p q r s t u*, Tranſverſalis abdominis. *w*, Arteria epigaſtrica, or the internal branch of the external iliaca. *x*, Branches of the nervi lumbares. *y*, The external branch of the outer iliaca. z, Mammaria interna.

In the Right lower Limb.

e f g, The iliacus internus. *h i k l*, Glutæus internus. *p q r s t*, The large adductor of the thigh. *u w*, The gracilis; *u*, the fleſhy part *x y*, Muſculus parvus. 1 2 3 4 5 6, Cruralis. 7 8 9, Vaſtus internus. 10, The lateral ligament of the external ſide of the patella. 11, The middle or anterior ligament of the patella which binds that bone to the tibia. 12, The lateral ligament of the internal ſide of the patella. 13, The burſal ligament of the knee. 14 15 16 17 18 19 20, Tibialis anticus. 23 24 25 26 27, Flexor digitorum pedis. 28 29, Poplitæus. 30, The articular ligament 31, An articular ligament. 32, A ligament which binds the os calcis to the ſplint bone. 33, An articular ligament. 34, Arteria ſciatica, accompanied with a vein. 35 35, Branches of the arteria glutæa. 36, A branch of the arteria obturatrix. 37, A branch of the arteria obturatrix. 38, A branch of the vena cruralis. 39, A branch of the arteria poplitæa. 51, A branch of the vena poplitæa. 52, Arteria poplitæa. 53, Vena poplitæa. 54, Nerves going to the tibialis anticus. 55, Arteria tibialis anterior. 56, Vena tibialis anterior. 57, Glandula poplitæa, commonly called the pope's eye. 58, Vena ſaphæna. 59, The outer cartilage belonging to the coffin bone. 60, The inner cartilage belonging to the coffin bone. 40 41 42 43 44 45 49, The plantaris. 46, A capſular ligament. 47, An articular ligament. 48, A capſular ligament. 49, A ligament which binds the tendon of the plantaris. 50, An articular ligament.

In the Left lower Limb.

a, Arteria cruralis. *b*, Vena cruralis. *h i*, Poplitæus; *k l m n o p*, Plantaris. *q*, A ligament which ariſes from one ſeſamoid bone and runs over the tendon of the plantaris to be inſerted into the other. 1 2 3, Tibialis poſticus. 4, Flexor digitorum pedis, marked 23 24 25 26 27. 10 11 12 13 15 16, Tibialis anticus. 17 18, The internal lateral ligament, which binds the patella to the os femoris. 19 20, The internal lateral ligament. 21 22, The external lateral or anterior ligament. 23 24, The internal, lateral, articular ligament. 25 25, The burſal ligament of the knee. 26, Interoſſeus, &c. 27 28, An articular ligament. 34, The articular ligament of the fetlock joint. 35, The burſal ligament. 36, A burſal ligament. 37, An articular ligament. 38, An articular ligament. 39, Branches of the vena tibialis anterior. 40, A nerve called ſciaticus internus. 41, The inner cartilage belonging to the coffin bone.

In the Right Upper Limb.

a b c, Brachialis internus. *d e f f g h i*, Flexor digitorum profundus. *k*, A ligament which runs down the ſmall end of the ulna. *l m*, Flexor digitorum ſublimis. *n*, Articular ligaments. *o*, Burſal ligaments. *p*, Vena cephalica. *q*, Interoſſeus, &c. *r*, The outer cartilage belonging to the coffin bone.

In the Left Upper Limb.

a b c, Brachialis internus. *d*, Nervus medianus. *e*, Arteria brachialis. *f*, Vena brachialis. *g*, Vena cephalica. *i*, Flexor carpi radialis. *l m*, Flexor digitorum ſublimis; *l*, the fleſhy part; *m*, the tendon. *n o p p*, Flexor digitorum profundus. *q*, Articular ligaments. *r*, Burſal ligaments. *s*, Interoſſeus, &c. *t*, The inner cartilage belonging to the coffin bone.

PLATE VI. *Figure* I. SIDE VIEW — THE FOURTH AND LAST LAYER OF MUSCLES.

In the Head.

a, Muſculus ſeptimus oculi ſuſpenſorius. *b*, Obliquus ſuperior. *c*, The trochlea. *d*, Obliquus inferior. *e*, Attolens. *f*, Deprimens. *g*, Adducens. *h*, Abducens. *i*, The ſemi-lunar fold. *k*, The optic nerve, where the eye is cut away. *lmnop*, The glandulous membrane of the inſide of the lips and cheek. *q*, The elevator of the chin. 1, Vena angularis. 2, Arteria angularis 3, Nervi maxillaris inferioris; they are the third branch of the fifth pair of nerves. 4 5 6, Nervi maxillaris ſuperioris. 7 8 9, The cartilages of the noſe. 10, The anterior cartilage of the outer ear. 11, The outer ear.

In the Neck.

a, Rectus anticus brevis, or minor. *d*, Cricoarytanoidæus lateralis. *e*, Cricoarytanoidæus poſticus. *f*, A very ſmall part of the arytenoidæus. *g h*, Œſophagus. *i k*, The thyroid cartilage. *l*, The annular, or crycoid cartilage. *n*, The ligament by which the thyroid or ſcutiform, and the crycoid or annular cartilages are tied one to the other. *m*, A ligament which ties the lower proceſs of the thyroid or ſcutiform cartilage to the crycoid cartilage. *o*, Trachea arteria, aſpera arteria, or wind-pipe. *p*, The carotid artery, or carotis communis. 1, Arteria carotis externa, or the external carotid. 2, Arteria carotis interna, or the internal carotid. *q*, The trunk of the eighth pair of nerves. 3, A branch of the eighth pair of nerves. 4, Arteria cervicalis, or the cervical artery. 5, Vena cervicalis. *r s*, Rectus poſticus brevis, or internus. *t u*, Intervertebralis. *u w*, &c. The five inferior intervertebrales. *x y*, The multifidus of the ſpine. *z*, One of the ſcalenæ, or rather the elevator of the firſt rib. 1 2 3 4 5 6, &c. 7 8, &c. Ligamentum colli. 13 14 15, The capſular ligament of the articulation betwixt the head and firſt vertebra of the neck. 16, The capſular ligament of the articulation betwixt the firſt and ſecond vertebræ of the neck. 17, Shew the capſular ligaments of the articulations of the five inferior vertebræ of the neck. 18, &c. The vertebral veins, arteries, and nerves of the neck. 19, Part of the jugular vein.

In the Trunk.

a b, &c. The elevators of the ribs. *c*, &c. *d*, &c. Multifidi ſpinæ. *e f*, The lateral muſcle of the tail. *g*, &c. The intertranſverſe muſcles of the tail ariſing from one vertebra, and inſerted into the next, and ſo on through the whole length of the tail. *h*, The ligament which runs over the ſpines of the os ſacrum. *i*, The elevating muſcle of the tail. *k*, The depreſſing muſcle of the tail. *l*, The lungs appearing through the pleura. *m n*, The diaphragm appearing through the pleura. *o*, &c. Nervi intercoſtales. *p*, &c. Arteriæ intercoſtales. *q*, The inteſtines, ſeen through the peritonæum.

In the Right Lower Limb.

a b c, Muſculus parvus in articulatione femoris ſitus. *d e f*, The head of the rectus. *i k l o*, Iliacus internus. *m n o*, Levator ani. *p*, The internal ſphincter ani. *s*, The inſertion of the pectinæus into the os femoris. *t u*, Sartorius. T, A ſort of faſcia under which theſe nerves and blood-veſſels lie. *w x*, The gracilis. z, Part of the adductor of the thigh. 1 2 3, Obturator internus with the gemini. 4, A tendinous faſcia. 10 11, The burſal ligament of the hip joint. 13, Mark where the burſal ligament had its origin from the os femoris, which inſerts itſelf into the patella and tibia. 14, A ligament which binds the cartilage 15, to the tibia. 15, the outer ſemi-lunar cartilage in the joint of the knee.

Plate 5.

Anatomy of the Horse representing the Muscles, Fascias, Ligaments, Nerves, Arteries, Veins and Glands, from Nature. See Farriery.

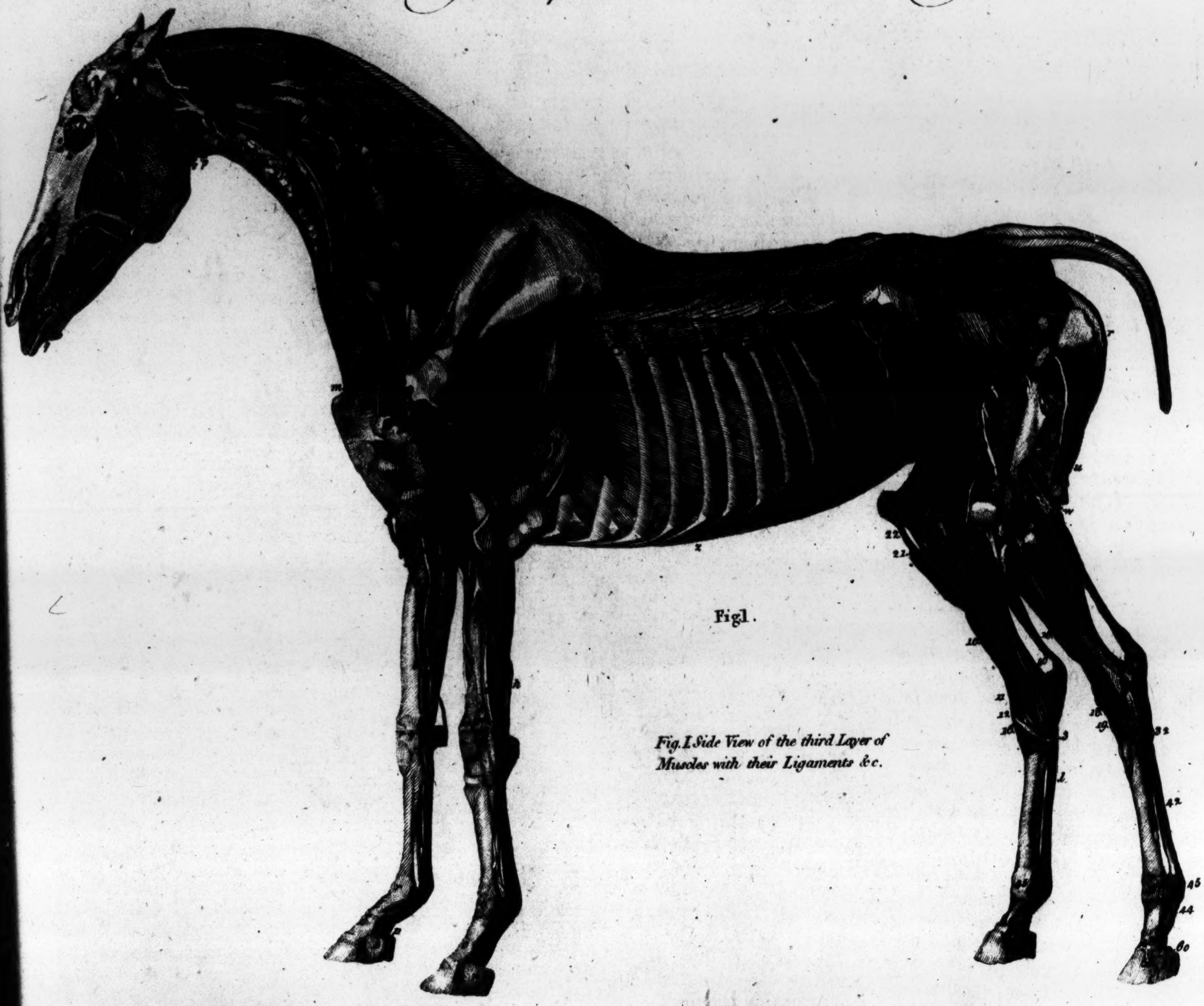

Fig. I.

Fig. I. Side View of the third Layer of Muscles with their Ligaments &c.

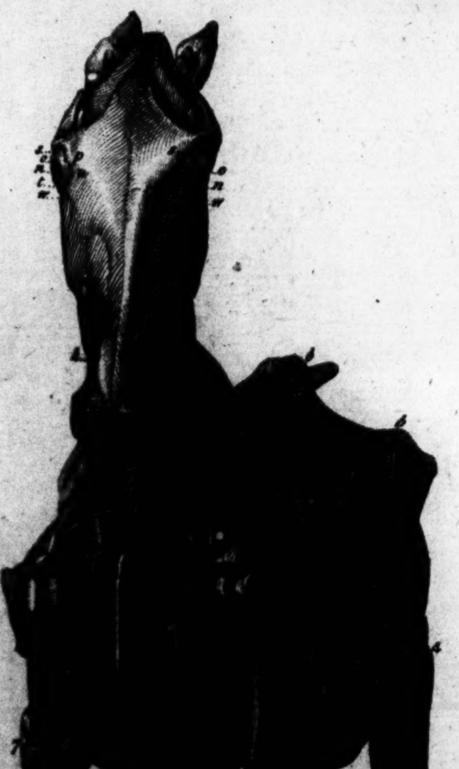

Fig. 2.

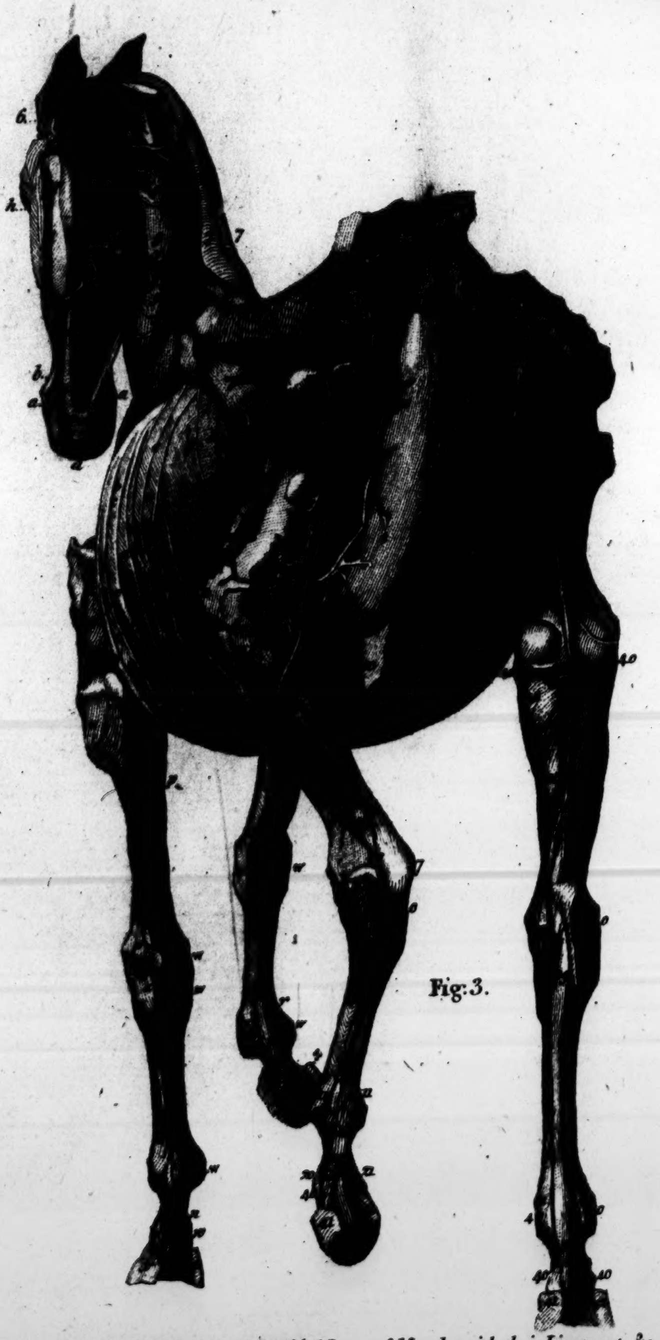

Fig. 3.

Fig. 2. Front View of the third Layer of Muscles, with their Ligaments, &c.

Fig. 3. Back View of the third Layer of Muscles with their Ligaments &c.

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Grainger sculp.

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Anatomy of the Horse, representing the Muscles, Fascias, Ligaments, Nerves, Arteries, Veins and Glands, from Nature. See Farriery.

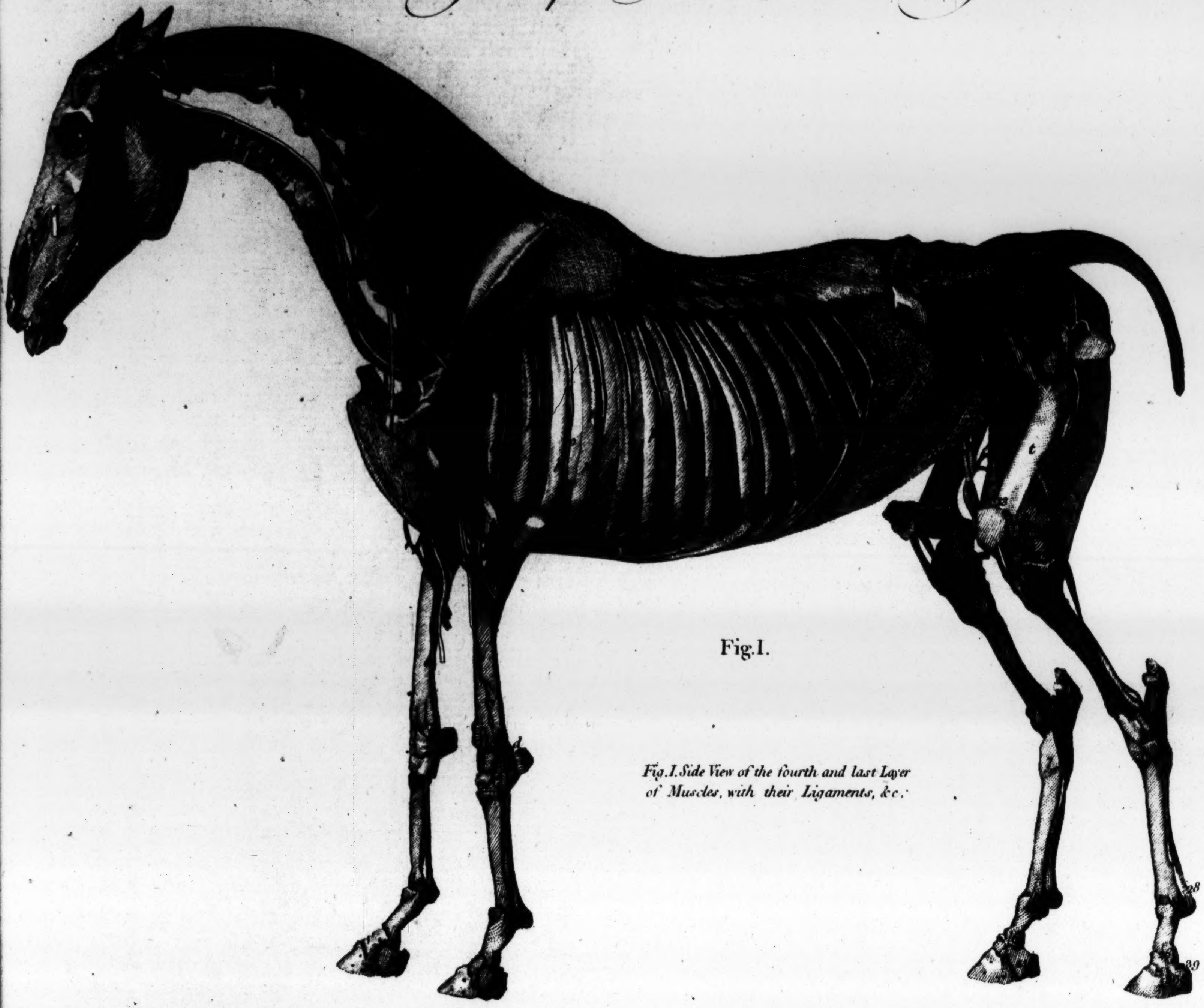


Fig. I.

Fig. I. Side View of the fourth and last Layer of Muscles, with their Ligaments, &c.

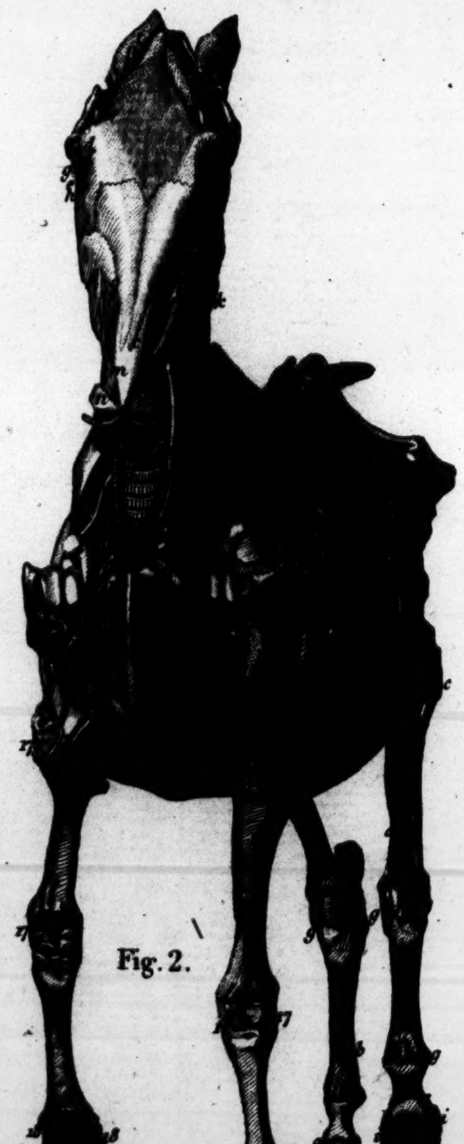
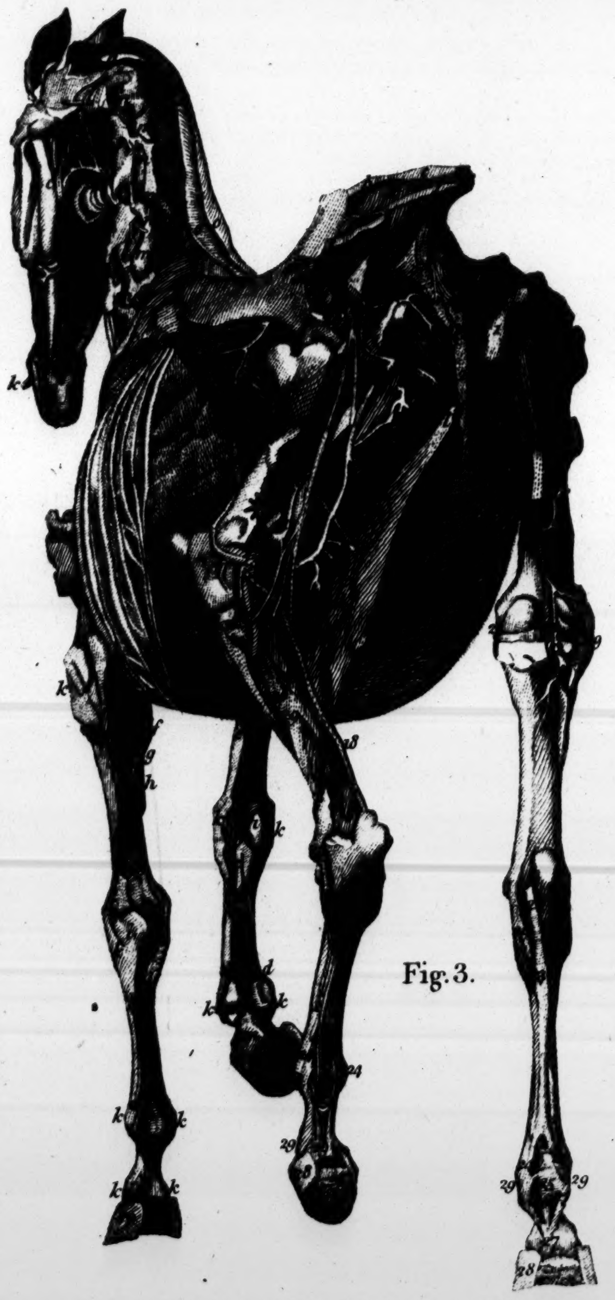

27
27
18
18
14
27
27
g
g
i

Fig. 2.


k
k
f
g
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28
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24
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29
28
29
29
28

Fig. 3.

Fig. 2 Front View of the fourth & last Layer of Muscles, &c.

Fig. 3. Back View of the fourth & last Layer of Muscles, &c.

Grainger sculp

Published as the Act directs, by C. Cooke, N.º 17, Paternoster Row, July 9th 1790.

BRITISH 18 MR 63 MUSEUM

knee. 18 19, the articular ligament of the knee. 20, A ligament which binds the fibula to the tibia. 21, the external lateral ligament. 22, the internal lateral ligament. 23, the anterior ligament. 24, Part of the tendon of the gemellus. 25, A ſtrong ligament which binds the os calcis to the ſplint bone. 26, the external articular ligaments of the foot. 27, A ligament running from the aſtragalus to the metatarſal bone. 28, Interoſſeus, &c. 29, Iliaca minor. 30, Arteria glutæa. 31, Pudica communis. 32 32, Arteria obturatrix. 33, Arteria cruralis. 34, Vena cruralis. 35, Nervus cruralis. 36, Arteria poplitæa. 37, Vena poplitæa. 38, The outer cartilage belonging to the coffin bone. 39, The inner cartilage belonging to the coffin bone.

In the internal Side of the left lower Limb.

1, The internal lateral ligament of the patella. 2, The internal lateral ligament of the patella. 3, The anterior ligament, which binds the patella to the tibia. 4, The internal articular ligament of the knee joint. 5, A ligament which binds the os calcis to the aſtragalus and os naviculare. 6, The internal articular ligaments of the foot. 7, A ligament which runs from the aſtragalus to the metatarſal bone. 8, Part of the tendon of the gemellus. 9, Interoſſeus, &c. 10, Arteria cruralis, 11, Vena cruralis. 12, The inner ſemi-lunar cartilage in the joint of the knee. 13, The outer ſemi-lunar cartilage. 14, The inner cartilage belonging to the coffin bone.

Muſcles, &c. on the Right upper limb.

a b, Subſcapularis. *d*, Ligaments which bind the orbicular bone to the radius, the bones of the carpus, and metacarpal bone. *e*, Articular ligaments. *f*, Nervus cubitalis. *g*, Nervus axillaris. *h*, Nervus radialis. *l*, Arteria axillaris. *m*, Vena axillaris. *n*, Vena cephalica. *o*, The outer cartilage belonging to the coffin bone.

In the internal Side of the left upper Limb.

a, Articular ligaments. *b*, Interoſſeus, &c. *d*, Arteria brachialis, or the humeral artery. *e*, Vena brahialis, or the humeral vein. *f*, Vena cephalica. *g*, The inner cartilage belonging to the coffin bone.

PLATE II. *Figure* 2.—FRONT VIEW.

THE EXTERNAL MUSCLES, WITH THE MEMBRANA CARNOSA, LIGAMENTS, &c.

In the Head.

a b, The anterior muſcles of the anterior cartilage; *c*, the lateral muſcles of the anterior cartilage of the outer ear; *d*, the origenes: *e*, the inſertion of the middle parts of the retrahens; *f*, muſcles which run from the anterior cartilage to the external ear; *h*, muſcles which ariſe from under the lateral muſcles of the ear; *i*, the lateral depreſſor of the outer ear; *k* K, the epicranius, or muſcle of the ſcalp; *l* 2 *m*, the orbicular muſcles of the eye-lids; L, the corrugators of the eye-brows; *n*, the elevator of the upper lip and corner of the mouth; *o* 3 5, the zygomatici; *p*, the lateral dilators of the upper-lip and noſtrils; *q r*, the orbicular muſcle of the mouth; *s*, part of the latiſſimus colli; *tu*, the tendons of the long naſal muſcles of the upper lip; *w*, the anterior dilators of the noſtrils; *x*, part of the membrana pituitaria.

In the Neck, Breaſt, Shoulders and Trunk.

abcdefghs, The quadratus genæ latiſſimus colli, or broad muſcle of the neck; *ikl*, the proper elevator of the humerus; *nopqr*, the pectoral muſcle; *s*, ſome of the ſuperior parts of the trapezius; *tuwxyz&*, membrana carnoſa.

In the upper Limb.

abcdefghik, The membranous continuation of the fleſhy pannicle down the upper limb, as it covers the muſcles which lie upon that limb.

In the lower Limb.

ABCD*abcdeghik*, The membranous continuation of the fleſhy pannicle down the lower limbs along with the faſcia lata, &c. *l*, The hoof.

PLATE III. *Figure* 2.—FRONT VIEW.

THE EXTERNAL MUSCLES AND LIGAMENTS, THE MEMBRANA CARNOSA, AND FASCIA BEING REMOVED.

In the Head

a, The anterior dilator of the noſtril; *bcd*, the lateral dilator of the noſtril and upper lip; *efgh*, the long naſal muſcle of the upper lip; *k*, Ales naris. *lmno*, A muſcle ariſing by a ſmall tendon along with the long naſal muſcle of the upper lip. *p*, Part of the membrana pituitaria. P, Muſculus caninus, or the elevator of the corner of the mouth; Q, the orbicular muſcle of the mouth; *q*, muſculus ciliaris; *q*, its origin; *st*, the broad ligament of the eye-lids; *uw*, the ball of the eye; *u*, the pupil; *w*, the iris; *xy*, the temporal muſcle; *z*, the maſſeter; 1, arteria angularis; 2, vena angularis; 3, the ſalivary duct.

In the Ear.

ab, A muſcle ariſing at *a* from the anterior cartilage, and inſerted at *b*, into the external ear; *c*, a muſcle which ariſes by two fleſhy heads from the internal ſurface of the anterior cartilage; *d*, a muſcle which is a ſort of antagoniſt to *c*; *f*, the anterior cartilage of the outer ear; *g*, the outer ear.

In the Neck.

abc, Sterno-maſtoideus, or ſterno-maxillaris; *d*, Caracohyoideus; *e*, longus colli; *f*, Scaleni; *gh*, Inter-tranſverſalis minor colli; *iklm*, ſerratus major anticus; *no*, the jugular veins.

In the Shoulders and Trunk.

abc, Serratus minor anticus; *defgh*, Pectoralis; *iklmn*, Supra ſpinatus ſcapulæ; *opq*, Infra ſpinatus ſcapulæ; *r*, Teres minor; *stuw*, Latiſſimus dorſi; *x*, Coraco radialis; *yz*, Triceps brachii; 1, &c. 2, &c. 3456, Obliquus externus, or deſcendens abdomenis; 66, part of its inſertion into the ſpine of the ilium; 77, Longiſſimus dorſi.

In the Upper Limbs.

abcdefghi, A facia or ſtrong membranous production, lying over the extending muſcles which are upon the cubit: *klm*, The tendon *i*, inſerted at *k*, into the coffin bone; *m*, Ligaments which confine the tendon of the extenſor digitorum communis down to the great paſtern; *op*, An expanſion which ariſes from the external articular ligament betwixt the humerus and cubit, and from the olecranon; *qr*, Vena cephalica; *ss*, Vena plantaris; *u*, A ligament proper to the tendon of the extenſor digitorum communis; *wxy*, A ligament whoſe fibres run in a tranſverſe direction over the anterior part of the carpus; *z*, the articular ligaments of the fetlock joint; &, A ſubſtance reſembling the villous ſurface of a muſhroom.

In the lower Limbs.

a, Part of the gluteus externus; *bcd*, Gluteus medius; *efghik*, Muſculus faſcia lata; *lmnopqrst*, Biceps cruris; *uwxz*, 1 2, The tendon of the extenſor longus digitorum pedis; 3, Extenſor brevis digitorum pedis; 4, A ligament common to the extenſor longus digitorum pedis and tibialis anticus; 5, a ligament proper to the extenſor longus digitorum pedis; 6, A ligament common to the extenſor longus digitorum pedis with the tendon of the peroneus: 7, A ligament which binds down the tendon of the peroneus; 8, A ſort of ligamentous facia; 9 10, interoſſeus, &c. 11, the tendon of the flexor digitorum pedis; 12, the tendon of the plantaris; 13, Vena ſaphæna; 14, Vena plantaris externa; 15, Vena plantaris interna; 16, the vena plantaris; 17, the tendon of the gemellus, or tendo achilles; 18, tibialis poſticus.

PLATE IV. *Figure* 2.— FRONT VIEW.

THE SECOND LAYER OF MUSCLES.

In the Head.

a, The anterior dilator of the noſtril; *b c* D, A muſcle which ariſes by a ſmall tendon along with the long naſal muſcles of the upper lip; *d*, orbicularis oris; *e*, canini, the elevators of the corners of the mouth; *f*, the maſſeter; *gh*, the temporal muſcle; *i*, part of the membrana pituitaris; K, the alæ narium; *kl*, the eye ball; *k*, the pupil; *l*, the iris; *mn*, muſculus ciliaris; *m*, its origin; *o*, the elevator of the eye lid; 1 2, nervus maxillaris ſuperior; 3, branches of the nervus maxillaris inferior; 4, arteria angularis; 5, vena angularis; 6, the ſalivary duct; 7, the anterior cartilage of the outer ear; 8, the outer ear.

In the Neck.

ab, Sterno thyroideus; *cd*, caracohyoideus; *f*, Scalenus; *g*, the inferior part of the tranſverſalis cervicis; *h*, the ſuperior part of the tranſveſalis cervis; *i*, part of the trachelo maſtoidæus, complexus minor; *k*, arteria carotis; *l*, part of the jugular vein.

In the Trunk.

abc, Muſculus in ſummo thorace ſitus; *gh*, Serratus minor poſticus; FG, the ſerratus minor anticus. *klm*, &c. Serratus major poſticus; H, Supra-ſpinatus ſcapulæ. I, Infra-ſpinatus ſcapulæ. *nop*, Longiſſimus dorſi. *qrst*, Sacro lumbalis, *yz*, 1 2, The external intercoſtals. 3, Fleſhy fibres which ariſe partly externally, tendinous. 4, &c. Parts of the internal intercoſtals. 5 6 7, Obliquus internus, or aſcendens abdominis. 8 9, Some appearance of the tranſverſalis abdominis. 10, Some branches of the nervi lumbares. 11; the external branch of the outer iliac artery. 12, the external branch of the outer iliac vein. 13, Branches of the arteriæ intercoſtales inferiores. 14, Branches of the arteriæ intercoſtales ſuperiores. 15, Branches of the arteriæ lumbares.

In the Shoulders and Upper Limbs.

A, Nervus muſculo-cutaneus. B, Nervus medianus. C, Nervus cubitalis. D, Nervus radialis. E, Nervus axillaris. F, Vena axillaris. *abc*, Subſcapularis. *de*; the internal part of the pectoralis. *fgh*, Triceps brachii. *iklmn*, Biceps brachii, or rather coraco-radialis. *o*, Part of the brachialis internus. *pqrstuwxy*, Extenſor carpi radialis. *zz*, A ligamentous faſcia. 1 2 3 4 5 6, Extenſor digitorum communis. 7 8, The muſcle which is analogous to the extenſors of the thumb in the human body. 9, Flexor carpi radialis. 10, Flexor carpi ulnaris internus. 12, Vena cephalica. 13, The burſal ligament. 14, The articular ligaments of the carpus. 15, The articular ligaments of the fetlock joint. 16, Vena plantaris.

In the lower Limbs.

abcd, Gluteus medius. *ef* G, Vaſtus externus. *ghik*, Tibialis anticus. *lmnopqrst*, Extenſor longus digitorum pedis. *u*, Extenſor brevis digitorum pedis. *wx*, Peroneus. *y*, Tibialis poſticus. *z*, The tendon of the gemellus. &, The tendon of the plantaris. 1, Arteria tibialis anterior. 2, Vena ſaphæna. 3, Vena plantaris externa. 4, Vena plantaris interna. 5, A ligament proper to the extenſor longus digitorum pedis. 9, A burſal ligament. 7 8, Articular ligaments; 9, the interoſſeus.

PLATE V. *Figure* 2. — FRONT VIEW. —— THE THIRD LAYER OF MUSCLES.

In the Head.

a, The anterior dilator of the noſtril; *ef*, the ſhort naſal muſcle of the upper lip; *g*, the orbicular muſcle of the mouth; *hik*, caninus, or the elevator of the corner of the mouth; *lm*, part of the buccinator; *nop*, the ball of the eye; *q*, one of the lachrymal glands; *r*, the ſemi-lunar fold, formed by the conjunctiva; *s*, attollens; *t*, deprimens; *u*, adducens; *w*, obliquus inferior; *xyz*, Nervi maxillares ſuperiores; 1, arteria angularis; 2, vena angularis; 3, The anterior cartilage of the outer ear; 4, the outer ear.

In the Neck.

ab, Sterno-thyroideus. *c*, Trachea arteria, aſperia arteria, or wind pipe. *defgh*, Longus colli; *ik*, Inter-tranſverſarii poſteriores colli; *m*, nerves coming from betwixt the ſixth and ſeventh vertebræ of the neck; *n*, Arteria carotis; *o*, part of the vena jugularis; *p*, part of the vena cephalica.

In the Trunk.

a, Semi-ſpinalis dorſi; *bcdefgh*, longiſſimus dorſi; *ikl*L, ſacro-lumbalis; *nop*, levatores coſtorum; *qr*, the external intercoſtals; *st*, the internal intercoſtals; *uwxy*, tranſverſalis abdominis; *z*, the elevating muſcle of the tail; 1, the lateral muſcle of the tail; 2, the inter-tranſverſal muſcles of the tail; 3, the depreſſing muſcle of the tail; 4, Branches of the nervi lumbares; 5, &c. branches of the nervi coſtales; 6, branches of the nervi lumbares; 7, ſmall arteries coming out of the ſacro-lumbalis to go to the gluteus medius; 8, Arteries from the intercoſtales inferiores; 9, &c. branches of the arteriæ intercoſtales ſuperiores; 10, the external branch of the outer iliac artery; 11, the external branch of the outer illiac vein.

In the Shoulders and Upper Limbs.

abcde, ſub-ſcapularis; *fgh*, teres major; *iklmno*, longus minor; *pq*, coraco brachialis; *rs*, brachialis internus; *t*, flexor carpi radialis; *u*, the firſt head of the profundus or perforans; *w*, nervus muſculus cutaneus; *x*, nervus medianus; *y*, nervus cubitalis; *z*, nervus radialis; 1, nervus axillaris; 2, arteria axillaris; 3, vena axillaris; 4, Arteria brachialis, or the humeral artery; 5, vena cephalica; 6, burſal ligaments; 7, articular ligaments; 8, cartilages belonging to the coffin bone.

In the Lower Limbs.

ab, Iliacus internus; *cdefghi*, tibialis anticus; *kl*, Flexor digitorum pedis; 1, Arteria tibialis anterior; 2, vena tibialis anterior; 3, the external anterior ligament of the patella; 4, the external lateral ligament; 5, the external articular ligament; 6, a burſal ligament; 7, the external aricular ligament of the tarſus; 8, the internal articular ligament of the tarſus; 9, the articular ligaments of the fetlock joint; 10, the articular ligaments of the great paſtern with the coronary bone; 11, the articular ligaments of the coronary bone with the coffin bone; 12, the anterior part of the burſal ligament of the tarſus; 13, the anterior part of the burſal ligament of the fetlock joint; 14 15, the anterior part of the burſal ligament of the articulation of the coronary bone with the coffin bone; 16 17, interoſſeus; 18, cartilages belonging to the coffin bone.

PLATE VI. *Figure* 2. — FRONT VIEW. —— THE FOURTH LAYER OF MUSCLES.

In the Head.

ab, The glandulous membrane. *c*, The concha narium inferior. *defg*, The four recti muſcles, or muſculi recti of the eye; *h*, obliquus inferior. *i*, Muſculus ſeptimus occuli ſuſpenſorius. *k*, Arteria angularis. *l*, Vena angularis. *m*, The middle portion of the cartilage of the noſe. *no*, The lateral cartilage of the noſe. *pqr*, Nervi maxillares ſuperiores. *s*, The anterior cartilage of the outer ear. *t*, The outer ear.

In the Neck and Trunk.

ab, Inter-vertebrales; *c*, &c *d*, &c. the multifidus of the ſpine; *e*, the elevating muſcle of the tail; *fgh*, the lateral muſcles of the tail or coccyx: *i*, the inter-tranſverſe muſcles of the tail; *k*, the depreſſing muſcle of the tail; *l*, &c. the elevators of the ribs; *m*, arteria cervicalis; *n*, the vertebral vein and artery of the neck; *o*, arteria carotis communis; *p*, the trunk of the eighth pair of nerves; *q*, part of the jugular vein; *r*, arteria mammaris interna.

In the Shoulders and Upper Limbs.

1 2 3 4, Sub-ſcapularis; 5, nervus muſculo-cutaneus; 6, nervus medianus; 7, nervus cubitalis; 8, nervus radialis; 9, nervus axillaris; 10, arteria axillaris; 11, vena axillaris; 12, arteria brachialis; 13, vena cephalica; 14, vena plantaris; 16 16, ligaments which bind together the bones of the carpus; 17 17, &c. articular ligaments; 18 18, cartilages belonging to the coffin bone.

In the Lower Limbs.

aa, Iliacus internus; *b*, interoſſeus, &c; *c*, vena tibialis anterior; *d*, vena ſaphena; *ee*, vena plantaris externa and vena plantaris interna; *f*, a ligament which runs from the aſtragalus to the metatarſal bone; *g g*, &c. articular ligaments; *h*, the outer ſemilunar cartilage in the joint of the knee; *ii*, cartilages belonging to the coffin bone.

PLATE II. — *Figure* 3. — BACK VIEW.

THE EXTERNAL MUSCLES WITH THE MEMBRANA CARNOSA, LIGAMENTS, FASCIA, &c.

In the Head.

A, The outer ear; *ab*, muſcles running from the anterior cartilage to the external ear; 1 2, retrahens; *c*, the ſuperior lateral muſcle of the outer ear; *d*, the lateral muſcle of the anterior cartilage of the outer ear; 3, the inferior lateral muſcle or depreſſor of the outer ear; *e*, the orbicular muſcle of the eye-lids; 4 5 6, part of the latiſſimus colli; *f*, the globe, or ball of the eye; *gh*, depreſſors of the lower lip; *i*, the orbicular muſcle of the mouth; *k*, the elevators of the chin; *l*, caninus, or the elevator of the corner of the mouth; *m*, Zygomaticus; *n*, the lateral dilators of the noſtril and upper lip; *o*, the digaſtric muſcle of the lower jaw; *p*, the inferior maxillary glands; *q*, vena angularis, a branch of the external jugular vein.

In the Neck, Shoulders, and Trunk.

abc, Levator humeri proprius; *def*, the ſuperior part of the trapezius; *g*, the mane; *hiklmnopq*, membrana carnoſa; *r*, the tail.

In the Upper Extremities, or Anterior Limbs.

*abcd*D*efghiklmn*, The membranous continuation of the fleſhy pannicle down the upper limbs; *k*, the internal and external vena plantaris; *mn*, the tendnos of the ſublimis and profundus; *op*, ligamentous fibres which come from the inſide of the radius; *qr*, the horny part of the hoof.

In the Lower or Poſterior Limbs.

AB*abcdefghiklmnopqrstuwxyz*, the membranous continuation of the fleſhy pannicle down the inferior, lower, or poſterior limbs, with the muſculus faſciæ latæ; the faſciæ latæ, and other expanſions of the muſcles, with the muſcles, &c. protuberating under them; 1 2, the horny part of the hoof; 1, the ſuperior part; 2, the ſole or inferior part lying under the coffin bone.

PLATE III. — *Figure* 3. — BACK VIEW.

THE EXTERNAL MUSCLES, WITH THEIR LIGAMENTS, &c. AFTER THE REMOVAL OF THE MEMBRANA CARNOSA.

In the Head.

a, The lateral dilator of the noſtril. *bb*, Muſculi canini. *cdde*, The orbicular muſcle of the mouth. *fgh*, The depreſſor of the lower lip. *i*, Buccinator. *k*, The maſſeter. *l*, Mylohyoideus; *m*, the parotid gland; *n*, the inferior maxillary gland; *o*, branches of the nervus maxillaris inferior; *p*, arteria angularis; *q*, vena angularis; *r*, the ſalivary duct; *st*, vena temporalis; *u*, the outer ear.

In the Neck.

abcd, Coraco-hyoideus: *e*, ſterno-hyoideus: *fg*, ſterno maſtoideus: *h*, rectus internus major capitis: *i*, inter-tranſverſales minores colli: *k*, the tendon of the trachelo-maſtoideus: *lmnop*, ſplenius: *qqrs*, rhomboides: *t*, ligamentum colli: *uwxyz*, ſerratus major anticus: 1, vena jugularis communis: 2, vena jugularis externa anterior: 3, vena jugularis externa poſterior, or ſuperior: 4, arteries coming out of the ſplenius to go to the trapezius and integuments.

In the Shoulder and Trunk.

abcd, Infra-ſpinatus ſcapulæ: *efgh*, teres minor: *ik*, latiſſimus dorſi: I K, triceps brachii; L, part of the pectoralis, which ſends an expanſion down the inſide of the cubit: *lmnop*, obliquus externus abdominis: *q*, the elevating muſcle of the tail: *r*, the lateral muſcle of the tail: *s*, the inter-tranſverſe muſcles of the tail: *t*, the depreſſing muſcle of the tail: *u*, ſphincter externus ani: *w*, acceleratores penis.

In the Upper Limbs.

a, The extenſor digitorum communis: ABCDG*bcddeffg*, an expanſion which ariſes from the articular ligament: E, the tendon of a muſcle: *h*, the tendon of the profundus: *ik*, the tendon of the ſublimis: L, vena cephalica: *m*, vena plantaris externa and vena plantaris interna: *op*, the external articular ligament: *qr*, the internal articular ligament: *st*, a ligament which runs from the os orbiculare to the radius; *uw*, a ligament running from the orbicular bone of the carpus to the falſe metacarpal bone; *uxy*, a ligament which binds down the tendons of the ſublimis and profundus; *z*, a ligament which helps to bind down the tendon of the ſublimis and profundus; 1, a ligament inſerted into the ſeſamoid bones; 2, a ligament ariſing from the upper part of the great paſtern; 3, a ligament which binds the tendon of the profundus to the coronary bone when it is in action; 4 5, the interoſſeus: 6, a ſubſtance reſembling the villous ſurface of a muſhroom.

In the Lower Limbs.

abcd, Gluteus externus: *efg*, gluteus medius; *hik*L*lmnop*, muſculus faſcia lata; OP, the large adductor of the thigh; *qrstuwxyz*, 1 2 3 4 5 6 7 8 9 10 11 12 13, biceps cruris; 14 15 16 17, ſemi-tendinoſus; 18 19 20, the gracilis; 21 7 8, a part of the faſcia lata; 22 23 24 25 26, the tendon of the plantaris; 27, the tendon of the flexor digitorum pedis; 28 29, the tendon of the peroneus; 30, 30, the tendon of the extenſor longus digitorum pedis; 40, extenſor brevis digitorum pedis; 41, Tibialis poſticus; 43, poplitæus, lying under the tendons of the ſartorius and gracilis; 44, ſome of the fleſhy part of flexor digitorum pedis; 45, nerves going to the tibialis anticus; 46, the external nervus plantaris; 47, the internal nervus plantaris; 48, arteria plantaris externa; 49, vena plantaris externa; 50, vena plantaris interna; 51, a ligament which runs from the tibia to the os calcis; it lies over the tendon of the peroneus; 52, the external articular ligament; 53, a ligament which binds together the bones of the tarſus and metatarſus; 54, a burſal ligament; 55, a ſtrong ligament which binds the os calcis to the aſtragalus, os naviculare, oſſa cuneiformia, and ſplint or imperfect metatarſal bone; 56 57, the interoſſeus, &c. 58, a ligament lying over the tendon of the plantaris; 59, a ligament ariſing from the firſt bone of the toe on each ſide; 60, a ligament which binds the tendon of the flexor digitorum pedis; 61, a ſubſtance reſembling the villous ſurface of a muſhroom.

PLATE IV. *Figure* 3.—BACK VIEW.—THE SECOND LAYER OF MUSCLES.

In the Head.

a, Glandulæ labiales: *b*, muſculus caninus: *c*, buccinator: *def*, the depreſſor of the lower lip: *gh*, the orbicular muſcle of the mouth: *i*, the elevators of the chin: *k*, the eye-ball: *l*, muſculus ciliaris: *m*, maſſeter: *n*, branches of the nervus maxillaris inferior: *o*, arteria angularis: *p*, vena angularis: *q*, the ſalivary duct: *rs*, vena temporalis: *t*, the outer ear.

In the Neck.

ab, Coraco-hyoideus: *c*, Sterno-hyoideus: *d* 5, Genio-hyoideus: 6 7, diagaſtricus: *e*, obliquus capitis inferior: *f*, rectus internus major capitis: *ghiklmno* tranſverſalis cervicis: *pq*, trachelo-maſtoidæus, complexus minor, or maſtoidæus lateralis: R *rstuwx*, complexus: *yz*, ligamentum colli; 1, part of the vena jugularis communis: 2, vena jugularis externa anterior: 3, vena jugularis externa poſterior, or ſuperior: 4, branches of the cervical arteries.

In the Trunk.

a, The ſerratus major poſticus; *bcd*, the external inter-coſtals; *e*, fibres which ariſe partly, externally, tendinous, but chiefly fleſhy; *f*, part of the internal inter-coſtals; *g*, fleſhy fibres which run in the ſame direction as the external inter-coſtals; *hiklm*, obliquus internus or aſcendens abdominis; *no*, rectus abdominis; *p*, the elevating muſcle of the tail; *q*, the lateral muſcle of the tail; *r*, the inter-tranſverſe muſcle of the tail; *s*, the depreſſing muſcle of the tail; *t*, the external ſpinctor ani; *u*, acceleratores penis; *w*, glands.

In the Upper Limbs.

ABC, Triceps brachii; *abc*, extenſor digitorum communis; *d*, the tendon of the muſcle, which is analogous to the extenſor minimi digiti in the human body: *defghi*, flexor carpi ulnaris; K *klm*, the profundus; N *no*, the ſublimis; *p*, nervus plantaris; *q*, arteria plantaris; *s*, vena cephalica, it falls into the jugular vein; *t*, vena plantaris externa, and vena plantaris interna; *u*, the burſal ligament; *wx*, the external articular ligament of the carpus; *yz*, the internal articular ligament of the carpus; 1 2, a ligament running from the orbicular bone of the carpus to the ſplint bone; 3 4, interoſſeus.

In the Lower Limbs.

ab, Iliacus internus; *cdefgh*, gluteus medius; AB, gluteus externus; C, gluteus medius; D, pyramidalis; E, muſculus faſcia lata; F, ſartoris; *iklmn* GH, pyramidalis; *o*, triceps ſecundus; *qrst*, triceps tertius; *uw*, gracilis; *xyz*, the inferior part of the ſemi-tendinoſus; 123, ſemi-membranoſus; 45678, veſtus externus; 9, rectus cruris; 10 11 12 13 14 15 16, the gemellus; 18 19, the ſolæus; 20 21 22, the tendon of the plantaris; 23 25 26, flexor digitorum pedis; 27 28 29, peronæus; 30 31, extenſor longus digitorum pedis; 32, extenſor brevis digitorum pedis; 33 34, tibialis poſticus; 35, poplitæus; 36, nervus ſciaticus; 37, nervus ſciatico-curalis; 38, nervus poplitæus; 39, nervus plantaris externus and nervus plantaris internus; 40, a branch ſent from the nervus ſciaticus; 41, nervus ſciatico-peronæus; 42, rami of the ſciatico-peronæus; 43, a branch of the nervus ſciatico-cruralis; 44 45 46, branches of the arteria pudica communis; 46, branches cut off; 47, arteries which go to the biceps cruris; 48, a branch of the arteria poplitæa which goes to the biceps cruris; 49, arteria tibialis anterior; 50, arteria plantaris externa; 51 52 53, branches of the vena hypogaſtrica; 54, a branch of the vena poplitæa; 55, a branch of the vena obturatrix; 56, vena plantaris externa and vena plantaris interna; 57, glandula poplitæa, commonly called the pope's eye; 58 59 60, a ligament running from the ſpines of the os ſacrum to its tranſverſe proceſſes; 61 62, the external articular ligament; 63, a ligament which binds together the bones of the tarſus and metatarſus; 64, a burſal ligament; 65, a ſtrong ligament which binds the os calcis to the aſtragalus; 66 67, interoſſeus.

PLATE V. *Figure* 3.—BACK VIEW. THE THIRD LAYER OF MUSCLES.

In the Head and Wind Pipe.

a, The orbicular muſcle of the mouth: *b*, muſculus caninus, or the elevators of the corner of the mouth and of the cheek: *cd*, the buccinator: *e*, the glandulæ buccales: *fg*, the elevator of the chin: *h*, the globe, or ball of the eye: *n*, arteria temporalis: *o*, arteria angularis: *p*, vena angularis: *qrs*, vena temporalis: *t*, an artery which goes to the glandulæ ſublinguales: *wx*, genio-gloſſus: *yz*, hyothyreoideus: 1 2, the lower conſtrictor of the pharinx: 3 4, hyogloſſus: 5, part of the os hyoides: 6, the outer ear.

In the Neck.

abcdef, Longus colli: *gh*, inter-tranſverſarii poſteriores colli: *ikl*, obliquus capitis inferior; *mn*, obliquus capitis ſuperior: *op*, rectus capitis poſticus major: *q*, rectus capitis poſticus minor, or rather medius: *rstuwx*, the multifidæ of the ſpine: *y*, the intervertebralis: 1, branches of the cervical nerves: 2, branches of the cervical arteries: 3, branches of the cervical veins: 4, part of the vena jugularis communis: 5, vena jugularis externa anterior: 6, vena jugularis externa poſterior or ſuperior: 7 8 9 10, ligamentum colli.

In the Trunk.

a, Semi-ſpinalis dorſi: *bc*, the external inter-coſtals, *de*, &c. the internal intercoſtals: *f*, the elevating muſcle of the tail: *g*, the lateral muſcle of the tail; *h*, the inter-tranſverſe muſcle of the tail: *i*, the depreſſing muſcle of the tail; *klm*, tranſverſalis abdominis: *o*, branches of the nervi coſtales: *p*, branches of the nervi lumbares; *q*, arteries from the intercoſtalis inferior: *r*, the external branch of the outer iliac artery in two ramifications: *s*, the external branch of the outer iliac vein in two ramifications: *t*, the external ſphincter ani: *u*, acceleratores penis.

In the upper Limbs.

abc, Brachialis internus: *defghi*, Profundus, or perforans; *klmn*, The ſublimis or perforatus: *pq*, flexor carpi radialis: *r*, interoſſeus, &c: *s*, Nervus radialis; *t*, vena cephalica: below the carpus it is called vena plantaris: *u*, ligaments which bind the orbicular bone to the radius: *w*, articular ligaments: *x*, the cartilages belonging to the coffin bone.

In the Lower Limbs.

abc, Iliacus internus: *defg*, gluteus internus: *hi*, obturator internus: *kl*, gemini: *m*, obturator externus: *n*, quadratus: *opqrst*, adductor magnus femoris, or triceps femoris: *uwx*, gracilis: *y*, the tendon of the muſculus parvus, in articulatione femoris ſitus: 1 2 3 4 5, cruralis, or cruræus: 6 7 8 10, vaſtus internus: 11, interoſſeus, &c. A, ſartorius: B, triceps ſecundus: C, tranſverſus penis: E, one of the gemini: F, obturator internus: 12 13 14 15 16 17 18 19 20 21, plantaris: 22 23, poplitæus: 24 25 26, tibialis poſticus: 27 28 29 30 31, flexor longus digitorum pedis: 32, branches of the arteria glutæa: 33, the large ſciatic nerve: 34, a branch of the anterior cruralis; 35, arteria poplitæa: 36, arteria obturatrix: 37, nerves going to the tibialis anticus: 38, nervus ſciatico-tibialis internus: 40, &c. articular ligaments: 41, the cartilages belonging to the coffin bone.

PLATE VI.—*Figure* 3.—BACK VIEW. THE FOURTH LAYER OF MUSCLES.

In the Head and Neck.

a, Stylogloſſus: *b*, ſtylopharingæus: *c*, ſtylohyoidæus: *d*, hyogloſſus: *e*, pterygoidæus internus: *f*, pterygoidæus externus: *g*, the middle conſtrictor of the pharinx: *h*, the ſuperior conſtrictor of the pharinx: *i*, crico-arytænoideus: *k*, the poſterior or inferior lateral cartilage: *l*, the elevator of the chin: L, the outer ear: *mn*, &c. inter-vertebrales: *opqr*, ligamentum colli.

In the Trunk.

aa, Multifidi ſpinæ: *b*, the ligament which runs over the ſpines of the os ſacrum: *c*, the elevating muſcles of the tail: *d*, the lateral muſcle of the tail: *e*, the inter-tranſverſe muſcles of the tail: *f*, the depreſſing muſcle of the tail.

In the Upper Limbs.

abcd, Interoſſeus: *e*, vena cephalica: *f*, vena brachialis: *g*, arteria brachialis: *h*, nervus medianus: *i*, ligaments which bind the orbicular bone to the radius: *k*, &c. articular ligaments: *l*, ligaments which bind the ſeſamoid bones to the great paſterns: *m*, cartilages belonging to the coffin bone: *n*, a cartilaginous ligament which ties the two ſeſamoid bones together.

In the Lower Limbs.

ABBC, Iliacus internus: *a*, gemini; *bc*, obturator internus: *de*, obturator exturnus: *fg*, quadratus; *f*, its origin: *g*, its inſertion: *hi*, pectineus: *k*, part of the ſartorius: K, triceps ſecundus: *lmn*, gracilis: *op*, muſculus parvus in articulatione femoris ſitus: *qrs*, the origin of the rectus: *t*, the external ſphinctor ani: *uw*, the internal ſphinctor ani: *xyz*, levator ani: 1, tranſverſus penis: 2, acceleratores penis: 3, one of the erectores penis: 4, arteria ſacra: 5, Iliaca minor: 6, arteria glutæ; of which 7 is a branch: 8, arteria ſciatica: 9, pudica communis: 10, arteria obturatrix: 11, arteria cruralis, of which 12 is a branch: 13, arteria poplitëa: 14, vena poplitëa: 15, arteria tibialis poſterior: 16, arteria peronæa poſterior: 17, the large ſciatic nerve: 18, nervus ſciatico-tibialis internus: 19, nervus plantaris externus and nervus plantaris internus: 20, a ligament which binds the fibula to the tibia: 21, a ſtrong ligament, which binds the os calcis to the ſplint bone; 22, ligaments which bind the bones of the tarſus together: 23 24, interoſſeus: 25 26 27, Ligaments which bind the ſeſamoid bones to the great paſtern: 28, cartilages belonging to the coffin bone: 29, articular ligaments.

PART II.

DISEASES OF HORSES WITH THE METHODS OF CURE.

Before we enter upon theſe particulars we ſhall give

General Directions with regard to the Management of Horſes.

It ought to be laid down as a general rule, to give horſes as few medicines as poſſible; and by no means to comply with the ridiculous cuſtom of ſome, who are frequently bleeding, purging, and giving balls, though their horſes be in perfect health, and have no indication that requires ſuch treatment. Proper management in their feeding, exerciſe, and dreſſing, will alone cure many diſorders, and prevent moſt; for the ſimplicity of a horſe's diet, which chiefly conſiſts of grain and herbage, when good in kind, and diſpenſed with judgment, ſecures him from thoſe complicated diſorders which are the general effects of intemperance in the human body. As hay is ſo material an article in a horſe's diet, great care ſhould be taken to procure the beſt: when it is not extraordinary, the durſt ſhould be well ſhook out before it is put in the rack; for ſuch hay is very apt to breed vermin.

Bran ſcalded is a kind of panada to a ſick horſe: but nothing is worſe than a too frequent uſe of it, either dry or ſcalded; for it relaxes and weakens the bowels too much. Oats, well ripened, make a more hearty and durable diet than barley, and are much better ſuited to the conſtitutions of Britiſh horſes. The ſalt marſhes are good paſture for horſes who have been ſurfeited, and indeed for many other diſorders: they purge more by dung and urine than any other paſture, and make afterwards a firmer fleſh; their water is for the moſt part blackiſh, and of courſe, as well as the graſs, ſaturated with ſalts from the ſea water. A ſummer's graſs is often neceſſary; more particularly to horſes who have been worked hard, and have ſtiff limbs, ſwelled legs, or windgalls. Horſes whoſe feet have been impaired by quittors, bad ſhoeing, or any other accidents, are alſo beſt repaired at graſs. Thoſe lameneſſes particularly require turning out to graſs, where the muſcles or tendons are contracted or ſhrunk; for by the continual gentle exerciſe in the field, with the aſſiſtance of a pattin ſhoe on the oppoſite foot, the ſhortened limb is kept on the ſtretch, the waſted parts are reſtored to their ordinary dimenſions, and the limb again recovers its uſual tone and ſtrength.

Horſes may be kept abroad all the year, where they have a proper ſtable or ſhed to ſhelter them from the weather, and hay at all times to come to. So treated, they are ſeldom ſick; their limbs are always clean and dry; and, with the allowance of corn, will hunt, and do more buſineſs than horſes kept conſtantly within doors. When horſes loſe their fleſh much in ſoiling, they ſhould in time be taken to a more ſolid diet: for it is not in ſoiling as in grazing; where, though a horſe loſes his fleſh at firſt, yet, after the graſs has purged him, he ſoon grows fat. Young horſes who have not done growing, muſt be indulged more in their feeding, than thoſe come to their maturity; but if their exerciſe is ſo little as to make it neceſſary to abridge their allowance of hay, a little freſh ſtraw ſhould conſtantly be put in their racks, to prevent their nibbling the manger, and turning cribbiters; they ſhould alſo be ſometimes ſtrapped back in order to cure them of this habit. It is obvious to every one, what care ſhould be taken of a horſe after violent exerciſe, that he cool not too faſt, and drink no cold water, &c.

When a horſe comes out of a dealer's hands, his cloathing muſt be abated by degrees, and care taken to put him in a moderately warm ſtable; otherwiſe the ſudden tranſition would be attended with the worſt conſequences.

Horſes who ſtand much in ſtable, and are well fed, require bleeding now and then; eſpecially when their eyes look heavy, dull, red, and inflamed; as alſo, when they feel hotter than uſual. Young horſes ſhould be bled when they are ſhedding the teeth, as it takes off thoſe feeveriſh heats they are then ſubject to. But the caſes that chiefly require bleeding, are colds, fevers of moſt kinds, falls, bruiſes, hurts of the eyes, ſtrains, and all inflammatory diſorders, &c. It is right to bleed a horſe, when he begins to grow fleſhy at graſs, or at any other time when he looks heavy: and it is generally proper to bleed before purging. Let your horſe always be bled by meaſure, that you may know what quantity you take away: two quarts are always enough at one time; when you repeat it, allow for the diſorder and the horſe's conſtitution. Let the blood, when cold, be carefully examined, both as to colour and conſiſtence, whether black, florid, ſizey, &c.

Purging is often neceſſary in groſs full horſes, in ſome diſorders of the ſtomach, liver, &c. but ſhould be directed with caution. Before a purge is given to any horſe, it is neceſſary ſome preparation ſhould be made for it, in order to render the operation more ſafe and efficacious: thus a horſe that is full of fleſh ſhould firſt be bled, and at the ſame time have his diet lowered for a week, eſpecially thoſe that have been pampered for ſale; ſeveral maſhes of ſcalded bran ſhould alſo previouſly be given, in order to open the bowels, and unload them of any indurated excrement, which ſometimes proves an obſtacle to the working of the phyſic, by creating great ſickneſs and griping. Let it be remembered, that a horſe is purged with difficulty; that the phyſic generally lies 24 hours in the guts before it works; and, that the tract of bowels it has to paſs through, is above 30 yards; and lying horizontally; conſequently reſinous and other improper drugs may, and often do, by their violent irritations, occaſion exceſſive gripings and cold ſweats, ſhave off the very mucus or lining of the guts, and bring on inflammations, which often terminate in mortifications, and death. It is remarkable too, that the ſtomach and guts of a horſe are but thin, compared to ſome other animals of the ſame bulk, and therefore muſt be more liable to inflammation and irritation. Horſes kept much in the ſtable, who have not the proper benefit of air and exerciſe in proportion to their food, ſhould in ſpring have a mild purge or two after a previous preparation by bleeding, lowering their diet, and ſcalded maſhes. Horſes of a watery conſtitution, who are ſubject to ſwelled legs, that run a ſharp briny ichor, cannot have the cauſes removed any way ſo effectually as by purging. The firſt purge you give to a horſe ſhould be mild, in order to know his conſtitution. It is a miſtaken notion, that if a proper prepared purge does not work to expectation, the horſe will be injured by it, for though it does not paſs by ſtool, its operation may be more efficacious as an alterative to purify the blood, and it may paſs by urine or other ſecretions. Purges ſhould be given early in the morning upon an empty ſtomach: about three or four hours after the horſe has taken it, he ſhould have a feed of ſcalded bran; and a lock or two of hay may then be put into his rack. The ſame day give him two more maſhes; but ſhould he refuſe warm meat, he may be allowed raw bran. All his water ſhould be milk warm, and have a handful of bran ſqueezed in it; but if he refuſes to drink warm water, give it him without bran. During the working, a horſe ſhould drink plentifully; but, if he will not drink warm water, he muſt be indulged with cold, rather than not drink at all.

We ſhall here inſert ſome general forms of purges.

Take ſocotorine aloes ten drams, jalap and ſalt of tartar each two drams, grated ginger one dram, oil of cloves 30 drops; make them into a ball with ſyrup of buckthorn.

Or the following, which has an eſtabliſhed character among ſportſmen.

Take aloes from ten drams to an ounce and an half, myrrh and ginger powdered each half an ounce, ſaffron and oil of aniſeed each half a dram.

Mr. Gibſon recommends the following:

Take ſocotorine aloes ten drams, myrrh finely powdered half an ounce, ſaffron and freſh jalap in powder of each a dram; make them into a ſtiff ball with ſyrup of roſes, then add a ſmall ſpoonful of rectified oil of amber.

The ſocotorine aloes ſhould always be preferred to the Barbadoes or plantation aloes: though the latter may be given to robuſt ſtrong horſes; but even then ſhould always be prepared with the ſalt or cream of tartar, which by opening its parts, prevents its adheſion to the coats of the ſtomach and bowels; from whence horrid gripings, and even death itſelf has often enſued. This caution is well worth remarking, as many a horſe hath fallen a ſacrifice to the neglect of it.

The following purging drink may be given with the utmoſt ſafety; it may be quickened, or made ſtronger by adding an ounce more ſenna, or two drams of jalap.

Take ſenna two ounces; infuſe it in a pint of boiling water two hours, with three drams of ſalt of tartar; pour off, and diſſolve in it four ounces of Glauber's ſalts, and two or three of cream of tartar.

This laſt phyſic is cooling, eaſy, and quick in its operation; and greatly preferable in all inflammatory caſes to any other purge, as it paſſes into the blood, and operates alſo by urine. When horſes loſe their appetites after purging, it is neceſſary to give them a warm ſtomach drink made of an infuſion of camomile flowers, anniſeeds, and ſaffron: or the cordial ball may be given for that purpoſe. Should the purging continue too long, give an ounce of diaſcordium in an Engliſh pint of Port-wine; and repeat it once in 12 hours if the purging continues. Plenty of gum-arabic water ſhould alſo be given; and in caſe of violent gripes, fat broth glyſters, or tripe liquor, ſhould be often thrown up, with 100 drops of laudanum in each.

The arabic ſolution may be thus prepared:

Take of gum arabic and tragacanth of each four ounces, juniper berries and carraway ſeeds of each an ounce, cloves bruiſed half an ounce; ſimmer gently in a gallon of water, till the gums are diſſolved: give a quart at a time in half a pail of water; but if he will not take it freely this way, give it him often in a horn.

When a purge does not work, but makes the horſe ſwell, and refuſe his food and water, which is ſometimes the effect of bad drugs or catching cold, warm diuretics are the only remedy; of which the following are recommended:

Take a pint of white wine, nitre one ounce: mix with it a dram of camphire, diſſolved in a little rectified ſpirit of wine; then add two drams of oil of juniper, and the ſame quantity of unrectified oil of juniper, and the ſame quantity of unrectified oil of amber, and four ounces of honey or ſyrup of marſhmallows.

When a horſe ſwells with much phyſic, do not ſuffer him to be rode about till he has ſome vent; but rather lead him gently in hand till ſome evacuation is obtained. As it is obſerved, that horſes more willingly take ſweet and palatable things than thoſe that are bitter and of an ill taſte, care ſhould be taken that the latter be given in balls, and that their drinks be always contrived to be as little nauſeous as poſſible, and ſweetened either with honey or liquorice. Thoſe that are prepared with groſs powders are by no means ſo agreeable to a horſe, as thoſe made by infuſion; as the former often clam the mouth, irritate the membranes about the palate and throat, and frequently occaſion the cough they are intended to prevent. Balls ſhould be of an oval ſhape, and not exceed the ſize of a pullet's egg: when the doſe is larger, it ſhould be divided into two; and they ſhould be dipt in oil, to make them ſlip down the eaſier. As we have given ſome general forms of purges, we ſhall obſerve the ſame rule in regard to glyſters, with ſome few cautions and remarks. Some writers on this ſubject recommend, previous to the adminiſtration of glyſters in coſtive diſorders, the paſſing of a ſmall hand well oiled up the horſes fundament, in order to bring out any hardened dung, which otherwiſe would be an obſtacle to the glyſter's paſſage. But we do not approve of this practice. A bag and pipe of a proper form is to be preferred to a ſyringe, which throws up the glyſter with ſo much force, that it often ſurpriſes a horſe, and makes him reject it as faſt as it goes in; whereas the liquor, when preſſed gently from the bag, gives him no ſurpriſe or uneaſineſs, but paſſes eaſily up into the bowels, where it will ſometimes remain a long time, and be extremely uſeful, by cooling and relaxing them; and will ſometimes incorporate ſo with the dung, as not eaſily to be diſtinguiſhed from the other contents of the guts.

Purging Glyſter. — TAKE two or three handfuls of marſhmallows, ſenna one ounce, bitter apple half an ounce, bay berries and anniſeeds bruiſed each an ounce, ſalt of tartar half an ounce; boil a quarter of an hour in three quarts of water; pour off, and add four ounces of ſyrup of buckthorn, and half a pint of oil.

This glyſter will purge a horſe pretty briſkly; and may be given ſucceſsfully, when an immediate diſcharge is wanting; eſpecially in ſome fevers with inflamed lungs, or other diſorders, which require ſpeedy relief.

Rowelling. — There ſeems to be no remedy ſo much made uſe of, and ſo little underſtood by farriers in general, as rowels; for which reaſon we ſhall endeavour to ſet the whole affair in a clearer light than hitherto it has appeared in. We ſhall begin, then, by deſcribing rowelling; which is an artificial vent made between the ſkin and fleſh, in order to unload and empty the veſſels in general, and thereby relieve particular parts when too much oppreſſed by a fulneſs or redundancy. The general and abſurd reaſoning of farriers on the effects and uſe of rowelling, in ſome meaſure makes theſe remarks the more neceſſary, as it is too notorious how impertinently they talk on this ſubject: for in ſhort, with them, a rowel is to draw off all the bad and corrupt humours from the blood by a ſort of magic. It is neceſſary to obſerve, that the matter generally diſcharged by a rowel, is nothing more than an ouzing from the extremities of the veſſels divided in the making of it; in fact, then, it is blood, which loſes its colour, by being ſhed out of the veſſels, by the warmth of the part, and by its confinement. If this is granted, it will evidently appear, that the good effects enſuing from this operation muſt be owing to a gradual depletion or emptying of the veſſels in general; by which means the ſurcharge or load on a particular part is taken off and removed, and impurities or bad juices (generally called humours) run off with the good in proportion to their quantity in the blood. Thus, to lean hide-bound horſes, and thoſe of a dry hot conſtitution, the diſcharge, by depriving the conſtitution of ſo much blood and fluids, is daily exhauſting the ſtrength of the animal; and may be productive of bad conſequences, by defrauding the conſtitution of a neceſſary fluid. But in diſorders from fulneſs, attended with acrimony or ſharpneſs of the juices, and with defluxions on the eyes, lungs, or any part of conſequence; the gradual diſcharge, brought on by theſe means, will contribute to leſſen the fulneſs on the parts affected, and give the veſſels an opportunity of recovering their tone, while evacuating and alterative medicines are doing their office. It may be neceſſary, however, to obſerve, that there is a wonderful communication between the veſſels of the cellular membrane under the ſkin, which remarkably appears, by inflating thoſe of ſheep, calves, &c. by the butchers: hence, probably, it is, that ſome diſorders of this integument are ſo apparently relieved by iſſues, or rowels, without our having any recourſe to that general depletion of the veſſels, we have juſt obſerved, to account for it; and hence, alſo, may be deduced their utility, ſometimes in draining off any extravaſated fluids which may lodge between the interſtices of the muſcles, after violent ſtrains of the ſhoulder; alſo in diſcharging ſuch vicious or ſharp fluids as are thrown on the membranes, and occaſion thoſe flying pains and lameneſſes which we find are often removed by this local remedy.

With reſpect to the diſeaſes incident to the horſe, by claſſing together thoſe which bear a reſemblance to each other, and of courſe require a ſimilar mode of treatment, we ſhall preſerve a due order of arrangement, as well as render the ſubject more intelligible to the reader.

CLASS I.

SECT. I. *Strains.*

All violent ſtrains of the ligaments, which connect the bones together, eſpecially thoſe of the thigh, require time, and turning out to graſs, to a perfect recovery. External applications can avail but little here, the parts affected lying too deep, and ſo ſurrounded with muſcles that medicine cannot penetrate to them. The ſooner, in theſe caſes, a horſe is turned out to graſs, the better; as the gentle motion in the field will prevent the ligaments and joint-oil from thickening, and of courſe the joint itſelf from growing ſtiff. When a horſe's ſhoulder is overſtrained, he does not put out that leg as the other; but, to prevent pain, ſets the ſound foot hardily on the ground to ſave the other; even though he be turned ſhort on the lame ſide, which motion tries him the moſt of any. When trotted in hand, inſtead of putting his leg forward in a right line, he forms a circle with the lame leg; and when he ſtands in the ſtable, that leg is advanced before the other. In order to cure this lameneſs, firſt bleed him; and let the whole ſhoulder be well bathed three times a-day with hot verjuice or vinegar, in which may be diſſolved a piece of ſoap; but if the lameneſs continues without ſwelling, or inflammation, after reſting two or three days, let the muſcles be well rubbed for a conſiderable time, to make them penetrate, with good opodeldoch, or either of the following mixture:

TAKE camphorated ſpirit of wine, two ounces; oil of turpentine, one ounce; this proportion will prevent the hair coming off. Or, Take the beſt vinegar, half a pint; ſpirit of vitriol, and camphorated ſpirit of wine, of each two ounces.

When the ſhoulder is very much ſwelled, it ſhould be fomented with woollen cloths (large enough to cover the whole) wrung out of hot verjuice and ſpirit of wine; or a fomentation prepared with a ſtrong decoction of wormwood, bay-leaves, and roſemary, to a quart of which may be added half a pint of ſpirit of wine. Where poultices can be applied, they are at firſt undoubtedly very effectual, after bathing with hot vinegar or verjuice; and are to be preferred greatly to cold charges, which, by drying ſo ſoon on the part, keep it ſtiff and uneaſy: let them be prepared with oatmeal, rye flour, or bran boiled up in vinegar, ſtrong beer or red wine lees, with lard enough to prevent their growing ſtiff; and when by theſe means the inflammation and ſwelling are brought down, bathe the part twice a-day with either of the above mixtures, opodeldoch, or camphorated ſpirit of wine; and roll the part three or four inches, both above and below, with a ſtrong linen roller, of about two fingers width; which contributes not a little to the recovery, by bracing up the relaxed tendon; and perhaps is more to be depended on than the applications themſelves. Strains of the back ſinews are very common; and are eaſily diſcovered by the ſwelling, which extends ſometimes from the back-ſide of the knee down to the heel, but for the moſt part the horſe ſets that foot before the other. The tendon ſhould be well bathed three or four times a-day with hot vinegar; and if much ſwelled, apply the poultices above recommended; and when the ſwelling is down, bathe with the mixtures above, or with camphorated ſpirit of wine and oil of amber, in which is diſſolved as much camphor as the ſpirits will take up; and roll up the tendon with a proper bandage, or laced ſtocking; which laſt, properly fitted to the limb, might be wore to great advantage, not only in theſe ſort of injuries, but in moſt others, where there is a diſpoſition to the greaſe, or other ſwelling of the limbs, from weak and relaxed fibres. Curriers ſhavings wetted with vinegar have been found uſeful for this purpoſe; as have alſo tar and ſpirit of wine; but where the tendons have ſuffered by repeated injuries of this kind, the caſe will demand bliſtering, and proper reſt. Strains of the knees and paſterns ariſe frequently from kicks or blows: if they are much ſwelled, apply firſt the poultices; and when the ſwelling is abated, bathe with the above. Many writers recommend firing in this caſe as well as others. But it is a practice we can by no means approve, as we heartily concur with Mr. Taplin in opinion, that this truly diſagreeable and diſtreſſing alternative ſhould never be adopted, till all the more gentle applications have repeatedly failed in effect.

SECT. II. *Wind-galls.*

A wind-gall is a flatulent ſwelling, which yields to the preſſure of the finger, and recovers its ſhape on the removal thereof: the tumour is viſible to the eye, and often ſeated on both ſides of the back ſinew, above the fetlocks, on the fore-legs, but moſt frequently on the hind-legs; though they are met with in various parts of the body, wherever membranes can be ſo ſeparated, that a quantity of air and ſeroſities may be included within their duplicatures. When they appear near the joints and tendons, they are generally cauſed by ſtrains, or bruiſes on the ſinews, or the ſheath that covers them; which, by being overſtretched, have ſome of their fibres ruptured; whence probably may ouze out that fluid which is commonly found with the included air; though, where theſe ſwellings ſhew themſelves in the interſtices of large muſcles, which appear blown up like bladders, air alone is the chief fluid; and theſe may ſafely be opened, and treated as a common wound. On the firſt appearance of wind-galls, their cure ſhould be attempted by reſtringents and bandage; for which purpoſe, let the ſwelling be bathed twice a-day with vinegar, or verjuice alone; or let the part be fomented with a decoction of oak-bark, pomegranate, and alum boiled in verjuice, binding over it, with a roller, a woollen cloth ſoaked in the ſame. Some, for this purpoſe, uſe red-wine lees, others curriers ſhavings wetted with the ſame, or vinegar, bracing the part up with a firm bandage. If this method, after a proper trial, ſhould not be found to ſucceed, authors have adviſed the ſwelling to be pierced with an awl, or opened with a knife: but mild bliſtering has in general the preference given to theſe methods; the included fluids being drawn off, the impacted air diſperſed, and the tumour gradually diminiſhed.

SECT. III. *Spavins.*

Theſe are of two ſpecies, denominated the blood and the bone ſpavin. A blood-ſpavin is a ſwelling and dilatation of the vein that runs along the inſide of the hough, forming a little ſoft ſwelling in the hollow part, and is often attended with a weakneſs and lameneſs of the hough. The cure ſhould be firſt attempted with the reſtringents and bandage above recommended, which will contribute greatly to ſtrengthen all weakneſſes of the joints, and frequently will remove this diſorder if early applied: but if by theſe means the vein is not reduced to its uſual dimenſions, the ſkin ſhould be opened, and the vein tied with a crooked needle and wax-thread paſſed underneath it, both above and below the ſwelling, and the turgid part ſuffered to digeſt away with the ligatures: for this purpoſe, the wound may be daily dreſſed with turpentine, honey, and ſpirit of wine, incorporated together.

Without entering into the cauſe of the bone ſpavin, which is a bony excreſcence, or hard ſwelling, growing on the inſide of the hough of a horſe's leg, we ſhall content ourſelves with deſcribing the different kinds thereof by their ſymptoms, and then enter on their cure. If a fulneſs on the fore-part of the hock comes upon hard riding, or any other violence, which threatens a ſpavin; in that caſe, ſuch coolers and repellers are proper, as are recommended in ſtrains and bruiſes. Thoſe happening to colts and young horſes are generally ſuperficial, and require only the milder applications; for it is better to wear them down by degrees, than to remove them at once by ſevere means. Various are the preſcriptions for the bliſtering ointment; but the following, on proper experience, ſtands well recommended by Mr. Gibſon.

Take nerve and marſh-mallow ointment, of each two ounces; quickſilver, one ounce, thoroughly broke, with an ounce of Venice turpentine; Spaniſh flies powdered, a dram and a half; ſublimate, one dram; oil of origanum, two drams.

The hair is to be cut as cloſe as poſſible, and then the ointment applied pretty thick over the part; this ſhould be done in the morning, and the horſe kept tied up all day without any litter till night; when he may be untied, in order to lie down; and a pitch or any ſticking plaſter may be laid over it, and bound on with a broad tape or bandage to keep all cloſe. After the bliſter has done running, and the ſcabs begin to dry and peel off, it may be applied a ſecond time, in the ſame manner as before; this ſecond application generally taking greater effect than the firſt, and in colts and young horſes makes a perfect cure. When the ſpavin has been of long ſtanding, it will require to be renewed, perhaps, five or ſix times: but after the ſecond application, a greater diſtance of time muſt be allowed, otherwiſe it might leave a ſcar, or cauſe a baldneſs; to prevent which, once a-fortnight or three weeks is often enough: and it may in this manner be continued ſix or ſeven times, without the leaſt blemiſh, and will generally be attended with ſucceſs. But the ſpavins that put out on older or full-aged horſes are apt to be more obſtinate, as being ſeated more inward; and when they run among the ſinuoſities of the joint, they are for the moſt part incurable, as they then lie out of the reach of applications, and are arrived to a degree of impenetrable hardneſs.

SECT. IV. *Splents.*

Theſe are hard excreſcences that grow on the ſhank bone, and are of various ſhapes and ſizes. Some horſes are more ſubject to ſplents than others; but young horſes are moſt liable to theſe infirmities, which often wear off and diſappear of themſelves. Few horſes put out ſplents after they are ſeven or eight years old, unleſs they meet with blows or accidents. A ſplent that ariſes in the middle of the ſhank bone is not dangerous; but thoſe that ariſe on the back part of this bone, when they grow large and preſs againſt the back ſinew, always cauſe lameneſs or ſtiffneſs, by rubbing againſt it; the others, except they are ſituated near the joints, ſeldom occaſion lameneſs. As to the cure of ſplents, the beſt way is not to meddle with them, unleſs they are ſo large as to disfigure a horſe, or are ſo ſituated as to endanger his going lame. Splents in their infancy, and on their firſt appearance, ſhould be well bathed with vinegar, or old verjuice; which, by ſtrengthening the fibres, often put a ſtop to their growth; for the membrane covering the bone, and not the bone itſelf, is here thickened; and in ſome conſtitutions purging, and afterwards diuretic drinks, will be a great means to remove the humidity and moiſture about the limbs, which is what often gives riſe to ſuch excreſcences. Various are the remedies preſcribed for this diſorder; the uſual way is to rub the ſplent with a round ſtick or the handle of a hammer, till it is almoſt raw, and then touch it with oil of origanum. Others lay on a pitch plaſter, with a little ſublimate, or arſenic, to deſtroy the ſubſtance; ſome uſe oil of vitriol; ſome tincture of cantharides: but Taplin objects to all theſe methods, and obſerves that the only expectation of cure without anxiety and difficulty, is to be careful in obſerving ſuch appearances in their early ſtate; and then ſeeing that friction is uſed twice a day for a conſiderable time, with the utmoſt force of the hand, with a portion of the following liniment, leaving a pledget of tow wet with the ſame, bound on pretty firm, with two yards of wide tape as a roller:

Take camphorated ſpirits of wine and ſpirits of turpentine, of each two ounces (a quarter of a pound) mixt together. Or, oil of origanum and ſpirits of turpentine, each half an ounce; camphorated ſpirits of wine, two ounces.

If theſe repellants fail, he recommends the following method: Procure two ounces of the ſtrongeſt mercurial ointment, and let the ſize of a hazel nut be rubbed in upon the part affected, every night and morning till the whole is conſumed, uſing the roller each night, and taking it off in the morning. He adds, if this does not ſucceed, the beſt and moſt ſpeedy method will be immediate extirpation, by making a longitudinal inciſion (without *bruiſing, hammering*, &c. as recommended by ſome) through the integuments, diſſecting and extracting the ſubſtance, compleating the cure by taking up a couple of ſtitches, and treating it as a ſuperficial wound. The ſame author further obſerves, that Bartlet's ſyſtem of purging balls and diuretic drinks, may be adopted by thoſe whoſe credulity can conceive that a courſe of purgatives and diuretics will contribute to the removal of corns and warts from the feet and hands of the human ſpecies.

CLASS II.

SECT. V. *Greaſe.*

In order to treat this diſorder with ſome propriety, we ſhall conſider it as ariſing from two different cauſes: a fault or relaxation in the veſſels, or a bad diſpoſition in the blood and juices. We muſt here obſerve, that the blood and juices or humours, (for there are always ſome in the beſt ſtate of blood) are brought to the extreme parts by the arteries, and returned by the veins; in which latter, the blood is to riſe in perpendicular columns, to return the circulating fluids from the extremities; hence ſwellings in the legs of horſes may eaſily be accounted for, from a partial ſtagnation of the blood and juices in the finer veſſels, where the circulation is moſt languid; and eſpecially when there is want of due exerciſe, and a proper muſcular compreſſion on the veſſels, to puſh forward the returning blood, and propel the inert and half-ſtagnating fluids through their veſſels; in ſhort, the blood in ſuch caſes cannot ſo readily aſcend as deſcend, or a greater quantity is brought by the arteries than can be returned by the veins. The greaſe then, conſidered in this light, muſt be treated as a local complaint, where the parts affected are alone concerned, the blood and juices being yet untainted, and in good condition: or as a diſorder where they are both complicated; but when it is an attendant on ſome other diſtemper, as the farcy, yellows, dropſy, &c. ſuch diſeaſes muſt firſt be cured before the greaſe can be removed. In the former caſe, moderate exerciſe, proper dreſſing, cleanlineſs, and external application, will anſwer the purpoſe; in the latter, internals muſt be called in to our aſſiſtance, with proper evacuations. When a horſe's heels are firſt obſerved to ſwell in the ſtable, and ſubſide or go down on exerciſe; let care be taken to waſh them very clean every time he comes in, with ſoap-ſuds, chamber-ley, or vinegar and water; which, with proper rubbing, will frequently prevent, or remove, this complaint; or let them be well bathed twice a-day with old verjuice, or the following mixture, which will brace up the relaxed veſſels; and if rags dipped in the ſame are rolled on, with a proper bandage, for a few days, it is moſt likely the ſwellings will ſoon be removed by this method only, as the bandage will ſupport the veſſels till they have recovered their tone. To anſwer this end, alſo, a laced ſtocking made of ſtrong canvas or coarſe cloth, neatly fitted to the part, would be found extremely ſerviceable, and might eaſily be contrived by an ingenious mechanic.

Take rectified ſpirit of wine, four ounces; diſſolve in it half an ounce of camphor; to which add wine-vinegar, or old verjuice, ſix ounces; white vitriol, diſſolved in a gill of water, one ounce; mix together, and ſhake the phial when uſed.

But if cracks or ſcratches are obſerved, which ouze and run, let the hair be clipped away, as well to prevent a lodgment (which becomes ſtinking and offenſive by its ſtay), as to give room for waſhing out dirt, or gravel, which, if ſuffered to remain there, would greatly aggravate the diſorder. When this is the caſe, or the heels are full of hard ſcabs, it is neceſſary to begin the cure with poultices, made either of boiled turnips and lard, with a handfull of linſeed powdered; or oatmeal and rye-flour, with a little common turpentine and hogs lard, boiled up with ſtrong-beer grounds or red-wine lees. The digeſtive ointment being applied to the ſores for two or three days, with either of theſe poultices over it, will, by ſoftening them, promote a diſcharge, unload the veſſels, and take down the ſwellings; when they may be dried up with the following:

Take white vitriol and burnt alum, of each two ounces: Ægyptiacum, one ounce; lime-water, a quart or three pints: waſh the ſores with a ſponge dipped in this, three times a-day; and apply the common white ointment ſpread on tow, to an ounce of which may be added two drams of ſugar of lead.

We would recommend the nitre-balls given to the quantity of two ounces a-day, for a month or ſix weeks, mixed up with honey, or in his feeds; take the following alſo for that purpoſe.

Yellow roſin, four ounces; ſalt of tartar, and ſal prunella, of each two ounces; Venice ſoap, half a pound; oil of juniper, half an ounce; make into balls of two ounce weight, and give one every morning.

If the diuretic balls ſhould not ſucceed, they muſt be changed for the antimonial and mercurial alteratives, but turning a horſe out in a field, where he has a hovel or ſhed to run to at pleaſure, would greatly contribute to quicken the cure, and indeed would in general effect it alone; but if this cannot be complied with, let him be turned out in the day-time. If the horſe is not turned out, a large and convenient ſtall is neceſſary, with good dreſſing and care.

SECT. VI. *Running Thruſhes.*

A Running Thruſh (or Fruſh), is a diſcharge of a fetid, and ſometimes ichorous, matter, from the cleft in the middle of the frog, affecting one, frequently both, and in ſome caſes all the four feet. But, generally, the fore-feet are moſt ſubject to this diſeaſe. To explain this more particularly, there is, in the middle of the frog, a cleft or opening, by which the heels in a natural ſtate have a ſmall degree of contraction and expanſion, eſpecially when the horſe treads or preſſes his heel upon the ground, the frog then expands; when, therefore, a horſe is ſhoed with concave or hollow ſhoes, the heels are deprived of that power of expanſion, being conſtantly confined in a contracted ſtate by the reſiſtance from the outer edges of the concave ſhoe, by which the frog is preſſed or ſqueezed on both ſides, by the cruſt of the heels being brought nearer to or almoſt into contact with one another. Hence pain, inflammation, an obſtruction of the blood, &c. (in the fleſhy ſubſtance of the frog), and of courſe that waſting and rottenneſs of its external covering, which, falling off in pieces, leaves the quick almoſt bare: the new frog, growing in detached pieces, never acquires the ſolidity of the former; and hence that rawneſs and tenderneſs which ever afterwards remain, and that extreme ſenſibility of pain when any hard ſubſtance touches that part of the foot, and of courſe ſubjects the horſe to frequent lameneſs. But in thoſe hoofs which are wide and open at the heels, where the complaint is recent, one or both the fore-feet only being affected, and where there is reaſon to ſuſpect that it proceeds from the uſe of concave or hollow ſhoes, or keeping the hoofs too hot, dry, and hard, it may be compleated with eaſe and ſafety, by laying aſide the uſe of concave ſhoes, waſhing the frogs clean after exerciſe, and dreſſing them with Mel Egyptiacum, made as follows:

Mel Egyptiacum. Verdigris in fine powder, two ounces; honey ſix ounces; vinegar, four ounces; boil them on a gentle fire till they have acquired a reddiſh colour.

But at the ſame time, recourſe muſt be had to internal remedies by way of revulſion, as purging or diuretic medicines, bleeding being firſt premiſed: if the former is made choice of, twice or thrice will be ſufficient, repeated at proper intervals; but if the latter which ſeems preferable, they may be continued for ſometime with great ſafety, without loſing one day's work of the horſe. In horſes of a groſs habit of body, eſpecially the heavy draught kind, running thruſhes ſometimes degenerate into what is commonly called a canker. In this caſe, the horny ſubſtance of the frog is ſoon thrown off; the fleſhy parts grow to an immoderate ſize, the luxuriant ſubſtance or ſpongy fleſh having a great number of papillæ, or tubercles of a pale red, and ſometimes variegated and tinged with blood; attended with a copious diſcharge of a thin ichorous fetid humour, having a moſt offenſive ſmell. If its progreſs be not ſpeedily ſtopt, the fleſhy ſole, from its vicinity, becomes likewiſe affected; the horny ſide rots, decays, and falls off; the whole foot turns into a kind of quag or bog, (in warm weather full of maggots, which it is almoſt impoſſible to prevent, even with the moſt corroſive dreſſings); the tendons become likewiſe affected, the bones carious, the hoof falls off, and the horſe is rendered uſeleſs. As to external applications, the firſt thing neceſſary to be done, is to pare down the cruſt till it is lower than the fungus, or growth of the canker, and to remove any hard pieces of the hoof or ſole wherever it preſſes upon the tender parts; the circular part of the cruſt ſhould be ſurrounded and kept ſoft with an emollient poultice. For dreſſings, the mildeſt eſcharotic powders may be firſt tried, as the following:

Take burnt alum powdered, two ounces; blue vitriol powdered one ounce.

But, when it degenerates into the laſt ſpecies mentioned above, affecting the fleſhy ſole, &c. the ſtrongeſt corroſive applications will then be neceſſary, and ſometimes hardly ſufficient to keep down the luxuriancy of the fungus. The cauſtic oils are found preferable, as ol. vitriol. aqua fortis, butter of antimony: either of theſe may be applied once every day; otherwiſe, if neglected dreſſing too long, or to every other day, which is the common practice, the great humidity and moiſture iſſuing from the fungus ſo weaken the force of the ſtrongeſt oils, that they have little or no effect: when theſe ſharp dreſſings ſeem to gain upon the canker, it may be dreſſed with equal parts of red precipitate and burnt alum pounded and mixed together, till ſuch time as the new ſole begins to grow; the purging or diuretic medicines being given at proper intervals till the cure is compleated.

SECT. VII. *Sand-cracks.*

As ſand and gravel are eaſily admitted into chinks, or cracks; where, being accumulated and pent up, they irritate and inflame the parts, whereby matter is formed underneath the hoof, which cauſes lameneſs, and which not unfrequently breaks out at the coronet, producing the moſt inveterate ulcers, which become extremely difficult to heal, on account of the ſinus or fiſtula branching out in different directions underneath the hoof. Therefore, horſes with this defect ſhould be carefully obſerved, and when the thick hardened edges of the chinks or cracks grow too high, by which it is ſo much the deeper, and, of courſe, lodges the greater quantity of ſand, &c. theſe edges ſhould be raſped, or pared with a crooked knife, till the ſeam diſappears. But wherever there remains a blackneſs, or appearance of gravel, that part muſt be traced farther; always obſerving, if poſſible, to avoid drawing blood. The chink or crack thus made ſmooth and equal, no ſand or gravel can lodge in it; and, as the parts will be tender, it will be neceſſary to apply an emollient poultice for ſome days, till the tenderneſs wear off. If the inflammation has been great, and matter formed in the crack, or the parts wounded by the knife in cutting its hardened edges, proud fleſh may riſe and jet out. In this caſe, the hard parts of the hoof near it are to be removed, a digeſtive poultice applied, and, when the inflammation is abated, the proud fleſh may be touched with the following corroſive powder:

Take blue vitriol burnt, two drams; corroſive ſublimate, one dram; rubbed into powder.

Sand cracks are generally the effect of flight or ſuperficial wounds upon the coronet, and grow gradually downwards towards the baſis of the hoof, and at laſt are cut or raſped off in the ſhoeing: when they occaſion lameneſs from lodging ſand or gravel, they muſt be treated in the manner already mentioned.

SECT. VIII. *Surfeits.*

Surfeits ariſe from various cauſes; but are commonly the effects of ſome diſeaſes not attended to, or that have been ill cured. Taplin, with apparent reaſon, attributes ſurfeits in a great meaſure to ſuffering horſes to drink immoderately of cold water when in a violent perſpiration, and the blood of courſe in the higheſt degree of circulation. A horſe is ſaid to be ſurfeited, when his coat ſtares, and looks ruſty and dirty, though proper means have not been wanting to keep him clean. The ſkin is full of ſcales and dander, and lies thick and meally among the hair, and is conſtantly ſupplied with a freſh ſucceſſion of the ſame, for want of due tranſpiration. Some horſes have hurdles of various ſizes, like peas or tares; ſome have dry fixed ſcabs all over their limbs and bodies; others a moiſture, attended with heat and inflammation; the humours being ſo ſharp, and violently itching, that the horſes rub ſo inceſſantly, as to make themſelves raw. Some have no eruptions at all; but an unwholeſome look, and are dull, ſluggiſh, and lazy: ſome appear only lean and hide bound; others have flying pains and lameneſs, reſembling a rheumatiſm: ſo that in the ſurfeits of horſes, we have almoſt all the different ſpecies of the ſcurvy and other chronical diſtempers. The following method is uſually attended with ſucceſs in the dry ſpecies. Firſt take away three or four pounds of blood, and then give the following mild purge, which will work as an alterative, and ſhould be repeated once a-week or ten days for ſome time.

Take ſocotorine aloes ſix drams or one ounce, gum guaiacum half an ounce, diaphoretic antimony and powder of myrrh, of each two drams; make into a ball with ſyrup of buckthorn.

In the intermediate days, an ounce of the following powder ſhould be given, morning and evening, in his feeds:

Take native cinnabar, or cinnabar of antimony, finely powdered, half a pound; crude antimony, in fine powder, four ounces; make into 16 doſes for eight days.

This medicine muſt be repeated till the horſe coats well, and all the ſymptoms of ſurfeit diſappear. The wet ſurfeit, which is no more than a moiſt running ſcurvy, appears on different parts of the body of a horſe, attended ſometimes with great heat and inflammation; the neck oftentimes ſwells ſo in one night's time, that great quantities of a hot briny humour iſſue forth, which, if not allayed, will be apt to collect on the poll or withers, and produce the poll evil or fiſtula. This diſeaſe alſo frequently attacks the limbs, where it proves obſtinate and hard to cure, and in ſome horſes ſhows itſelf ſpring and fall. In this caſe bleed plentifully, avoid externally all repellers, and give cooling phyſic twice a week; as, four ounces of lenitive electuary, with the ſame quantity of cream of tartar; or the latter, with four ounces of Glauber's ſalts, quickened, if thought proper, with two or three drams of powder of jalap, diſſolved in water gruel, and given in a morning faſting. After three or four of theſe purges, two ounces of nitre made into a ball with honey may be given every morning for a fortnight; and if attended with ſucceſs, repeat it for a fortnight longer. The powders above mentioned may be alſo given with the horſe's corn; or a ſtrong decoction of guaiacum ſhavings or logwood may be given alone to the quantity of two quarts a-day. Theſe, and indeed all alterative medicines, muſt be continued for a long time where the diſorder proves obſtinate. The diet ſhould be cool and opening, as ſcalded bran or barley; and if the horſe is hide bound, an ounce of fenugreek ſeeds ſhould be given in his feeds for a month or longer; and, as this diſorder often proceeds from worms, give the mercurial phyſic too, and afterwards the cinnabar powders, as before directed. But as in general it is not an original diſeaſe, but a ſymptom only of many, in the cure regard muſt be had to the firſt cauſe: thus, as it is an attendant on ſurfeits, fevers, worms, &c. the removal of this complaint muſt be variouſly effected.

SECT. IX. *Mange.*

In a mangy horſe the ſkin is generally tawny, thick, and full of wrinkles, eſpecially about the mane, the loins, and tail; and the little hair that remains in thoſe parts ſtands almoſt always ſtraight out or briſtly; the ears are commonly naked and without hair, the eye and eye-brows the ſame; and when it affects the limbs, it gives them the ſame aſpect: yet the ſkin is not raw, nor peels off, as in the hot inflamed ſurfeit. Where this diſtemper is caught by infection, if taken in time it is very eaſily cured: and we could recommend a ſulphur ointment as moſt effectual for that purpoſe, rubbed in every day. To purify and cleanſe the blood, give antimony and ſulphur for ſome weeks after. There are a great variety of external remedies for this purpoſe.

Take of the weak mercurial ointment half a pound; ſulphur vivum four ounces; white hellebore (in powder) and oil of tartar, each one ounce. To ſoften the ointment add a proper quantity of olive oil. But when this diſorder is contracted by low feeding, and poverty of blood, the diet muſt be mended, and the horſe, properly indulged with hay and corn. The following ointments are effectually uſed for this diſorder rubbed into the parts affected every day:

Take powdered brimſtone, train oil, and tar, of each equal quantities; to which may be added ginger, or white hellebore. Or, Take ſulphur vivum half a pound, crude ſal armoniac one ounce, hogs lard or oil, a ſufficient quantity to form into an ointment.

SECT. X. *The Farcin or Farcy.*

The farcy is properly a diſtemper of the blood veſſels, which generally follows the tract of the veins, and, when inveterate, thickens their coats and integuments, ſo that they become like ſo many chords. At firſt, one or more ſmall ſwellings, or round buds like grapes or berries, ſpring out over the veins, and are often exquiſitely painful to the touch; in the beginning they are hard, but ſoon turn into ſoft bliſters, which when broke diſcharge an oily or bloody ichor, and turn into very foul and ill-diſpoſed ulcers. In ſome horſes it appears on the head only; in ſome on the external jugular; in others on the plate-vein, and runs downwards on the inſide of the fore-arm towards the knee, and very often upwards towards the briſket: in ſome the farcy ſhews itſelf on the hind-parts, about the paſterns, and along the large veins on the inſide of the thigh, riſing upwards into the groin, and towards the ſheath; and ſometimes the farcy makes its appearance on the flanks, and ſpreads by degrees towards the lower belly, where it often becomes very troubleſome. This diſtemper, being of an inflammatory nature, and in a particular manner affecting the blood-veſſels, muſt neceſſarily require large bleeding, particularly where the horſe happens to be fat and full of blood. This always checks the beginning of a farcy, but is of ſmall ſervice afterwards; and if a horſe is low in fleſh, the loſs of too much blood ſometimes proves injurious. After bleeding, let the horſe have four ounces of cream of tartar and lenitive electuary: which may be given every other day for a week, to cool the blood and the body: and then give nitre three ounces a-day for three weeks or a month, and anoint the buds or ſwellings with the following ointment twice a-day:

Take ointment of elder four ounces, oil of turpentine two ounces, ſugar of lead half an ounce, white vitriol powder two drams; mix together in a gally-pot.

When the farcin affects the large blood veſſels, the cure is more difficult; but let it always be attempted early: therefore, on the plate, thigh, or neck veins appearing chorded, bleed immediately on the oppoſite ſide, and apply the following to the corded vein:

Take oil of turpentine in a pint bottle ſix ounces, oil of vitriol three ounces; drop the oil of vitriol into the oil of turpentine by little at a time, otherwiſe the bottle will burſt; when it has done ſmoaking, drop in more oil of vitriol, and ſo on till all is mixed.

This mixture is one of the beſt univerſals in the beginning of a farcy; but where it is ſeated in looſe fleſhy parts, as flanks or belly, equal parts of the oil of vitriol and turpentine are neceſſary. Rub the parts firſt with a woollen cloth, and then apply ſome of the mixture over the buds, and wherever there is any ſwelling, twice a day. Give the cooling phyſic every other day, and then apply ſome of the mixture over the buds, and wherever there is any ſwelling, twice a day. Give the cooling phyſic every other day, and then three ounces of nitre every day for ſome time. The following balls are proper in every ſtate of the farcy; and when the diſtemper has been in its infancy, before the ſkin was much defaced, has often cured it in a week or two, by giving them only once or twice a day: but in an old farcy they ſhould be given for two or three months together.

Take of native cinnabar, or cinnabar of antimony, eight ounces; long bithwort and gum guiacum powdered, of each four ounces: make into a paſte with honey, and form into balls of the ſize of a large walnut, and roll them into liquorice powder.

Before we cloſe this ſection, it is proper to lay down the ſymptoms of an incurable farcy, that the owners of ſuch horſes may ſave themſelves unneceſſary expence and trouble in their endeavours to obtain a cure. When a farcy, by improper applications, or by neglect, has ſpread and increaſed, or after long continuance reſiſted the medicines above recommended; if freſh buds are continually ſpouting forth, while the old ones remain foul and ill-conditioned; if they riſe on the ſpines of the back and loins; if the horſe grows hide-bound, and runs at the noſe; if abſceſſes are formed in the fleſhy parts between the interſtices of the large muſcles; if his eyes look dead and lifeleſs; if he forſakes his food, and ſcours often, and his excrements appear thin and of a blackiſh colour; if the plate or thigh vein continues large and chorded after firing and other proper applications; theſe ſymptoms denote the diſtemper to have penetrated internally, and that it will degenerate into an incurable conſumption: it is moſt probable alſo that the whole maſs of fluids are tainted, and become irremediable by art.

CLASS IV.

SECT. XI. *Poll-Evil.*

The poll-evil is an abſceſs near the poll of a horſe, formed in the ſinuſes between the poll-bone and the uppermoſt vertebræ of the neck. If it proceeds from blows, bruiſes, or any external violence, at firſt bathe the ſwelling often with hot vinegar; and if the hair be fretted off with an ouzing through the ſkin, make uſe of two parts of vinegar, and one of ſpirit of wine; but if there be an itching, with heat and inflammation, the ſafeſt way is to bleed, and apply poultices with bread, milk, and elder flowers: this method, with the aſſiſtance of phyſic, will frequently diſperſe the ſwelling and prevent this evil. But when the tumour is critical, and has all the ſigns of matter, the beſt method then is to forward it by applying ripening poultices, till it comes to maturity, and burſts of itſelf: or if opened with a knife, great care ſhould be taken to avoid the tendinous ligament that runs along the neck under the mane; when matter is on both ſides, the opening muſt be made on each ſide, and the ligament remain undivided. If the matter flows in great quantities, reſembles melted glue, and is of an oily conſiſtence, it will require a ſecond inciſion, eſpecially if any cavities are diſcovered by the finger or probe; theſe ſhould be opened by the knife, the orifices made depending, and the wound dreſſed with the common digeſtive of turpentine, honey, and tincture of myrrh, and, after digeſtion, with the precipitate ointment; or waſh with the following made hot, and fill up the cavity with tow ſoaked in it:

Take vinegar or ſpirit of wine half a pint, white vitriol diſſolved in ſpring-water half an ounce, tincture of myrrh four ounces.

This may be made ſharper by adding more vitriol; but if the fleſh is very luxuriant, it ſhould firſt be pared down with a knife before the application. Taplin reprobates the practice of ſcalding in this diſeaſe, as the farriers term it, with as much ſeverity as he does that of firing in other caſes; and recommends in the firſt ſtage of it, fomentation with warm vinegar, rubbing upon the part affected immediately after about an ounce of camphorated ſpirits of wine, and then bandaging over it, a double flannel dipped in vinegar, warm as bfeore. Should the diſeaſe reſiſt this mode of treatment, he diſſuades from farther attempts by repellents to oppoſe the progreſs of nature; and recommends every means to promote ſuppuration.

SECT. XII. *Fiſtula.*

Bruiſes on the withers frequently impoſthumate, and for want of care turn fiſtulous. They ariſe often from pinches of the ſaddle, and ſhould be treated in their early ſtate with repellers; for this purpoſe bathe the tumour well with hot vinegar three or four time a-day; if that does not ſucceed, an ounce of oil of vitriol may be put to a quart of vinegar, or half an ounce of white vitriol diſſolved in a little water, and added to the ſame quantity. Theſe are generally very effectual repellers for this purpoſe in horſes, and will frequently prevent impoſthumation; when the ſwelling is attended with heat, ſmarting, and little hot watery pimples, the following mixture will then be more proper to bathe with:

Take two ounces of crude ſal ammoniac, boiled in a quart of lime-water; where that cannot be had, a handful of pearl or wood aſhes may be boiled in common water; pour off the decoction when ſettled, and mix with it half a pint of ſpirit of wine; anoint the part afterwards with linſeed oil, or elder ointment, to ſoften and ſmooth the ſkin.

But when the ſwellings are critical, the conſequence of a fever ſettled on this part, you muſt avoid the repelling method, and aſſiſt in bringing the ſwelling to matter, by means of ſuppurating poultices: experienced practitioners adviſe, never to open theſe tumours till they break of themſelves; for if they are opened before they are ripe, the whole ſore will be ſpongy, and diſcharge a bloody ichor, which ſoon degenerates into a ſordid ulcer. But take care to enlarge the openings, and pare away the lips, that your dreſſings may be applied eaſily; and avoid the ligament which runs along the neck to the withers; if a gathering forms on the oppoſite ſide, open it in the ſame manner; but take care they incline downwards, for the ſake of depending orifices, and letting the matter flow off eaſily. For the method of dreſſing, we muſt refer to the preceding Section; and if the bones ſhould be foul, they muſt be dreſſed with tincture of myrrh till they ſcale off; if the fungus is very troubleſome, and the diſcharge oily, yellow, and viſcid, pledgets, ſoaked in the following, made hot, have been found very effectual, bathing the ſwelling round with ſpirit of wine and vinegar.

Take half an ounce of blue vitriol diſſolved in a pint of water; oil of turpentine, and rectified ſpirit of wine, of each four ounces; white-wine vinegar, ſix ounces; oil of vitriol and Ægyptiacum, of each two ounces.

When the cavities are truly fiſtulous, the calloſities muſt be cut out, where it can be done, with a knife: and the remainder deſtroyed by corroſives, viz. precipitate, burnt alum, and white vitriol, as we ſhall obſerve in the following ſection.

SECT. XIII. *Ulcers.*

We ſhall not here enter into a deſcription of each particular ſpecies of ulcers, but only lay down ſome directions for their general treatment; by which means we ſhall avoid the uſual prolixity of authors on this ſubject, and yet give ſo general an idea of the nature of ulcers, as we hope will be ſufficiently inſtructive both of the application, and of the proper remedy to each. It may be neceſſary to obſerve, that we may often in vain purſue the beſt methods of cure by external applications, unleſs we have recourſe to proper internal remedies; for as all ulcers, difficult to heal, proceed from a particular indiſpoſition of the blood and juices, before the former can be brought into any order, the latter muſt be corrected by alteratives and ſweetening medicines. The firſt intention in the cure of ulcers is bringing them to digeſt, or diſcharge a thick matter; which will, in general, be effected by the green ointment, or that with precipitate; but ſhould the ſore not digeſt kindly by theſe means, but diſcharge a gleety thin matter, and look pale, you muſt then have recourſe to warmer dreſſings, ſuch as balſam, or oil of tupentine, melted down with your common digeſtive, and the ſtrong-beer poultice over them; it is proper alſo in theſe kinds of ſores, where the circulation is languid, and the natural heat abated, to warm the part, and quicken the motion of the blood, by fomenting it well at the time of dreſſing; which method will thicken the matter, and rouſe the native heat of the part, and then the former dreſſings may be re-applied. If the lips of the ulcer grow hard or callous, they muſt be pared down with a knife, and afterwards rubbed with the cauſtic. Where ſoft fungous fleſh begins to riſe, it ſhould carefully be ſuppreſſed in time, otherwiſe the cure will go on but ſlowly; if it has already ſprouted above the ſurface, pare it down with a knife, and rub the remainder with a bit of cauſtic; and to prevent its riſing again, ſprinkle the ſore with equal parts of burnt alum and red precipitate; or waſh with the ſublimate water, and dreſs with dry lint even to the ſurface, and then roll over a compreſs of linen as tight as can be borne, for a proper degree of preſſure, with mild applications, will always cauſe theſe ſpongy excreſcences to ſubſide, but without bandage the ſtrongeſt will not ſo well ſucceed. If theſe ſhould not ſucceed, the following, which is of a ſharp and cauſtic nature, is recommended on Mr. Gibſon's experience.

Take of Roman vitriol half an ounce; diſſolve in a pint of water; then decant and pour off gently into a large quart-bottle; add half a pint of camphorated ſpirit of wine, the ſame quantity of the beſt vinegar, and two ounces of Egyptiacum.

This mixture is alſo very ſucceſsfully applied to ulcerated greaſy heels, which it will both cleanſe and dry up. Theſe ſinuſes, or cavaties, frequently degenerate into fiſtulæ, that is, grow pipey, having the inſide thickened, and lined, as it were, with a horny callous ſubſtance. In order to their cure, they muſt be laid open, and the hard ſubſtance all cut away; where this is impracticable, ſcarify them well, and truſt to the precipitate medicine made ſtrong, rubbing now and then with cauſtic, butter of antimony, or equal parts of quickſilver and aquafortis. Where the cure does not properly ſucceed, mercurial phyſic ſhould be given, and repeated at proper intervals: and to correct and mend the blood and juices, the antimonial and alterative powders, with a decoction of guaiacum and lime waters, are proper for that purpoſe.

SECT. XIV. *Wounds in general.*

In all freſh wounds made by cutting inſtruments, there is nothing more required than bringing the lips of the wound into contact by future or bandage, provided the part will allow of it; for on wounds of the hips, or other prominent parts, and acroſs ſome of the large muſcles, the ſtitches are apt to burſt on the horſe's lying down and riſing up in the ſtall. In ſuch caſes, the lips ſhould not be brought cloſe together; one ſtitch is ſufficient for a wound two inches long: but in large wounds, they ſhould be at an inch or more diſtance; and if the wound is deep in the muſcles, care ſhould be taken to paſs the needles proportionably deep, otherwiſe the wound will not unite properly from the bottom. Should the wound bleed much from an artery divided, the firſt ſtep ſhould be to ſecure it, by paſſing a crooked needle underneath, and tying it up with a waxed thread; if the artery cannot be got at this way, apply a button of lint or tow to the mouth of the bleeding veſſels, dipped in a ſtrong ſolution of blue vitriol, ſtyptic water, oil of vitriol, or hot oil of turpentine, powdered vitriol, or colcothar, &c. and remember to apply it cloſe to the mouth of the bleeding veſſels, and take care that it is kept there by proper compreſs and bandage till an eſchar is formed; otherwiſe it will elude your expectations, and frequently alarm you with freſh bleedings. In a memoir preſented to the Royal Academy of Sciences by M. La Foſſe, he gives an account of the ſucceſs he had met with in ſtopping the bleedings of very conſiderable arteries in horſes, by the application of the powder of puff-balls, the arteries cicatrizing by this means only, without any ſucceeding hæmorrhage. The lycoperdon, or puff-ball, was made uſe of for this purpoſe in human ſubjects, about 170 years ago, by Felix Wurtz, a famous old ſurgeon in Germany; but he does not ſeem to have thought of truſting to it in ſuch conſiderable arteries as M. La Foſſe mentions, viz. thoſe of the leg and thigh, the bleedings from which divided veſſels he ſtopt in a few minutes by the uſe of this powder only. The agario of the oak may alſo be uſed for this purpoſe, where it can be retained by a proper bandage. Theſe applications, as indeed all ſtyptics ſeem to act by conſtringing the extremity of the veſſel, or choaking it up, till a grume of blood is formed internally, which plugs up the orifice; and has been found to adhere to it ſo as to conſtitute one body with the veſſel. We avoid ſetting down any famous receipts for freſh wounds, whether ointments, or Friar's balſams; being well aſſured, that, in a healthy ſound conſtitution, nature furniſhes the beſt balſam, and performs herſelf the cure, which is ſo often attributed to the medicine; when it is otherwiſe, and the blood is deprived of its balſamic ſtate, as will appear from the aſpect of the wound and its manner of healing, it muſt be rectified by proper internal medicines, before a good foundation for healing can be laid by any external application whatever. The lips of the wound then being brought together by the needle or bandage, it needs only to be covered with rags dipped in brandy, or a pledget of tow ſpread with the wound ointment; (ſee *Tumours*) the directions in the preceding ſections being obſerved and the wounded part kept as much as poſſible from motion. Punctured wounds from thorns, or any other accidents, ſhould be treated in the ſame manner; applying the beer or bread and milk poultice over the dreſſing, till ſome ſigns of digeſtion appear; and fomenting the part well every day. This method is alſo very ſucceſsfully uſed to thoſe ſwellings which often ariſe on the neck from bleeding; the ſores being ſprinkled with precipitate, and burnt alum powdered, to fetch out the core, or fungus, which choaks up the orifice. The uſual method is to introduce a piece of vitriol, or ſublimate, which often brings on a plentiful diſcharge, fetches out the core, and makes a cure; but it is often with the loſs of the vein, and it ſometimes leaves a large ſwelling and impoſthumation.

CLASS V.

SECT. XV. *Tumours.*

Tumours, or ſwellings, ariſe either from external injuries, or internal cauſes. Swellings cauſed by external accidents, as blows and bruiſes, ſhould at firſt be treated with reſtringents; thus, let the part be bathed frequently with hot vinegar or verjuice; and, where it will admit of bandage, let a flannel wetted with the ſame be rolled on: if by this method the ſwelling does not ſubſide, apply, eſpecially on the legs, a poultice with red wine lees, ſtrong-beer grounds, and oatmeal, or with vinegar, oil, and oatmeal: either of theſe may be continued twice a day, after bathing, till the ſwelling abates; when, in order to diſperſe it entirely, the vinegar ſhould be changed for camphorated ſpirit of wine, to four ounces of which may be added one of ſpirit of ſal armoniac; or it may be bathed with a mixture of two ounces of crude ſal armoniac boiled in a quart of chamber ley twice a-day, and rags dipped in the ſame may be rolled on. Fomentation made by boiling wormwood, bay leaves and roſemary, and adding a proper quantity of ſpirits, are often of great ſervice to thin the juices, and fit them for tranſpiration; eſpecially if the injury has affected the joints. But in bruiſes, where the extravaſated blood will not by theſe means be diſperſed, the ſhorteſt way is to open the ſkin, and let out the grumes. Critical tumours, or ſwellings, which terminate fevers, ſhould by no means be diſperſed; except when they fall on the paſtern or coffin joint, ſo as to endanger them: in this caſe the diſcutient fomentation, under the Article *Strain*, ſhould be applied three or four times a-day, and a cloth or flannel frequently wrung out of the ſame ſhould be bound on, in order to keep the joint continually breathing. But if the ſwelling fixes under the jaws, behind the ears, on the poll, withers, or in the groins and ſheath, &c. it ſhould be encouraged and forwarded by ripening poultices wherever they can be applied; oatmeal boiled ſoft in milk, to which a proper quantity of oil and lard is added, may anſwer this purpoſe; or the poultice recommended in the Section of *Strangles*; theſe muſt be applied twice a-day, till the matter is perceived to fluctuate under the fingers, when it ought to be let out; for which purpoſe, let the tumour be opened with a knife or ſtrong lancet, the whole length of the ſwelling, if it can be done ſafely; for nothing contributes ſo much to a kind healing, as the matter's having a free diſcharge, and the opening's being big enough to dreſs to the bottom. Pledgets of tow, ſpread with black or yellow baſilicon, or the wound ointment, and dipped in the ſame, melted down with a fifth part of oil of turpentine,

pentine, ſhould be applied to the bottom of the ſore, and filled up lightly with the ſame, without cramming: it may be thus dreſſed once or twice a-day, if the diſcharge is great, till a proper digeſtion is procured; when it ſhould be changed for pledgets ſpread with the red precipitate ointment, applied in the ſame manner. Should the ſore not digeſt kindly, but run a thin water and look pale, foment, as often as you dreſs, with the above fomentation; and apply over your dreſſing the ſtrong-beer poultice, and continue this method till the matter grows thick, and the ſore florid. The following ointments will generally anſwer your expectations in all common caſes; and may be prepared without, as well as with, the verdigreaſe.

Take Venice turpentine and bees-wax of each a pound, oil of olives one pound and a half, yellow roſin 12 ounces; when melted together, two or three ounces of verdigreaſe, finely powdered, may be ſtirred in, and kept ſo till cold, to prevent its ſubſiding.

Take of yellow baſilicon or the above ointment, without verdigreaſe, four ounces; red precipitate, finely powdered, half an ounce: mix them together cold with a knife or ſpatula.

It may be neceſſary to obſerve here, that the cures of moſt ſores are effected by the ſimpleſt methods; and that it is often of much more conſequence to know how to dreſs a ſore, than what to dreſs it with. And in this conſiſts indeed the chief art of this branch of ſurgery: for the moſt eminent in that profeſſion have long ſince diſcovered, that variety of ointments and ſalves are unneceſſary in the cure of moſt wounds and ſores; and they have accordingly diſcarded the greateſt part formerly in repute for that purpoſe; repeated obſervations having taught them, that, after the digeſtion, nature is generally diſpoſed to heal up the wound faſt enough herſelf; and that the ſurgeon's chief care is to prevent a luxuriancy, commonly called proud fleſh; which all ointments, wherein lard or oil enters, are but too prone to encourage, as they keep the fibres too lax and ſupple; and which dry lint alone, early applied, as eaſily prevents, by its abſorbing quality, and light compreſſion on the ſprouting fibres. As ſoon then as a good digeſtion is procured (which is known by the thickneſs and whiteneſs of the matter diſcharged, and the florid red colour at the bottom of the ſore) let the dreſſings be changed for the precipitate medicine; or the ſore may be filled up with dry lint, alone, or dipped in lime water with a little honey and tincture of myrrh, or brandy, about a fifth part of the latter to one of the former: a pledget of lint, dipped in this mixture, ſhould alſo be applied to the bottom of the ſore, which ſhould be filled up with others to the ſurface or edges, but not crammed in too hard, as before obſerved, nor yet applied too looſely. By this method, the ſore would incarn, or heal up properly, and ſoft ſpongy fleſh would be prevented or ſuppreſſed in time; whereas when ointments or ſalves are too long continued, a fungus, or proud fleſh, is thereby ſo encouraged in its growth, that it requires ſome time to deſtroy and eat it down again: a proper compreſs of cloth, and a linen roller, is abſolutely neceſſary, both for this purpoſe, and to ſecure on the dreſſings, wherever they can conveniently be applied.

SECT. XVI. *Warbles. Sitfaſt.*

Warbles are ſmall hard tumours under the ſaddle-part of the horſe's back, occaſioned by the heat of the ſaddle in travelling, or its uneaſy ſituation. A hot greaſy diſh-clout, at firſt frequently applied, will ſometimes remove them. Camphorated ſpirits of wine are alſo very effectual for this purpoſe to diſperſe them, to which a little ſpirit of ſal armoniac may be added. The repellers above-mentioned are ſucceſsfully applied in theſe caſes; and if you are obliged to work the horſe, take care your ſaddle is nicely chambered. Mr. Taplin relinquiſhes the idea of applying the hot greaſy diſh-clout, recommended by Bracken, from the difficulty and inconvenience of procuring a piece of fat beef, or gammon of bacon, in ſome countries, and to ſome pockets, and recommends the following ſubſtitute as more eaſily obtained.

Take extract of ſaturn half an ounce; camphorated ſpirits of wine, two ounces; ſoft water, quarter of a pint. Mix the extract with the ſpirits, by ſhaking them well together, and then add the water. Uſe this till the tumour is diſpelled.

A ſit-faſt proceeds generally from a warble, and is the horſe's hide turned horny; which, if it cannot be diſſolved and ſoftened by rubbing with the mercurial ointment, muſt be cut out, and treated then as a freſh wound.

CLASS VI.

SECT. XVII. *Colds.*

By taking cold, we mean that the pores and outlets of the ſkin (which in a natural healthy ſtate of body are continually breathing out a fine fluid, like the ſteam ariſing from hot water, or ſmoke from fire) are ſo far ſhut up, that theſe ſteams, or perſpirable matter, not having a free paſſage through them, are hindered from going off in the uſual manner; the conſequence of which is, their recoiling on the blood, vitiating its quality, overfilling the veſſels, and affecting the head, glands, or kernels of the neck and throat, the lungs, and other principal parts. To enumerate the various cauſes of colds would be endleſs; the moſt uſual are, riding horſes till they are hot, and ſuffering them to ſtand in that condition where the air is cold and piercing; removing a horſe from a hot ſtable to a cold one, and too ſuddenly changing his cloathing, whence it is that horſes often catch ſuch ſevere colds after they come out of dealers hands; and by not being carefully rubbed down when they come in hot off journeys. The ſigns of a horſe's catching cold, are a cough, heavineſs and dullneſs, which affect him more or leſs in proportion to the ſeverity of it; the eyes are ſometimes moiſt and watery, the kernels about the ears and under the jaws ſwell, the noſe gleets, and he rattles in his breathing; and when the cold is violent, the horſe will be feveriſh, his flanks work, and he will both loath his hot meat and refuſe his water. When theſe laſt ſymptoms are attended with a ſlimy mouth, ears, and feet cold, and a great inward ſoreneſs, there is danger of a bad fever. But when the horſe coughs ſtrong, ſnorts after it, is but little off his ſtomach, pricks up his ears, and moves briſkly in his ſtall, dungs and ſtales freely, his ſkin feels kindly, and his coat does not ſtare, he is in no danger, and there will be no occaſion for medicines of any kind; but you ſhould bleed him about two quarts, keep him warm, and give him feeds of ſcalded bran, with as much warm water as he will drink, in order to dilute his blood. If the diſorder ſhould increaſe, the horſe feel hot, and refuſe his meat, bleed him, if ſtrong, two quarts more; and if you are not ſatisfied without giving medicines, avoid, as you would poiſon, a farrier's drench; (which is generally compoſed of ſome hot, nauſeous powders, given in a quantity of ale; which too often increaſes the fever by overheating the blood, and palls the horſe's ſtomach by its loathſomneſs:) and inſtead of it, infuſe two ounces of anniſeed, with a dram of ſaffron, in a pint and a half of boiling water; pour off the clear liquor, and diſſolve in it four ounces of honey, to which may be added four ſpoonfuls of ſallad-oil; this drink may be given every night; or one of the following balls, provided there is no fever, in which caſe it always will be more eligible to give two or three ounces of nitre or ſalt prunella every day in his feeds or water till it is removed; but ſhould the horſe be inclined to coſtiveneſs, remember that his body ſhould be kept open by emollient glyſters, or cream of tartar diſſolved in his water, to the quantity of three or four ounces a-day.

Pectoral Horſe-ball. Take of the freſh powders of anniſeed, elicampane, carraway, liquorice, turmerick, and flour of brimſtone, each three ounces; juice of liquorice four ounces, diſſolved in a ſufficient quantity of mountain; ſaffron powdered half an ounce, ſallad-oil and honey half a pound, oil of anniſeed one ounce; mix together with wheat-flour enough to make them into paſte.

Theſe balls conſiſt of warm opening ingredients; and, given in ſmall quantities, about the ſize of a pullet's egg, will encourage a free perſpiration; but, in caſe of a fever, ſhould be cautiouſly continued. They are much more efficacious, and in all caſes ſuperior to the farriers drenches, if diſſolved in a pint of warm ale. This ſimple method, with good nurſing and hot maſhes, warm water and cloathing, eſpecially about the head and throat, which promotes the running at the noſtrils, will anſwer the moſt ſudden colds; and when the horſe feeds heartily, and ſnorts after coughing, moderate exerciſe every day will haſten his recovery. To a horſe loaded with fleſh, a rowel may ſometimes be neceſſary, as may alſo a gentle purge or two to ſome, when the diſtemper is gone off.

SECT. XVIII. *Cough, and Aſthma.*

The conſequence often of the preceding diſorders injudiciouſly treated, are ſettled habitual coughs; which frequently degenerate into aſthmas and broken wind. Nothing has more perplexed practitioners than the cure of ſettled coughs; the cauſe of which, perhaps, has been their want of attention to the different ſymptoms which diſtinguiſh one cough from another; for without ſtrict obſervance thereof, it is impoſſible to find out the true method of cure. Thus, if a horſe's cough is of long ſtanding, attended with loſs of appetite, waſting of fleſh, and weakneſs, it denotes a conſumption; and that the lungs are full of knotty, hard ſubſtances, called tubercles, which have often been diſcovered on diſſection. If the horſe is full of fleſh, bleed him plentifully; if low in fleſh, more ſparingly; which may occaſionally be repeated, on very great oppreſſions and difficulty of breathing, in proportionate quantities. As mercurial medicines are found remarkably uſeful in theſe caſes, give a mercurial ball, with two drams of calomel, over night, and a common purge next morning: or the following, which his recommended by Mr. Gibſon.

Take gum-galbanum, ammoniacum, and aſafœtida, of each two drams, fine aloes one ounce, ſaffron one dram, oil of anniſeed two drams, oil of amber one dram; with honey enough to form into a ball.

They may be repeated at proper intervals, with the uſual cautions. In the intermediate days, and for ſome time after, the following ball may be given every morning.

Take of the pectoral or cordial ball one pound, balſam of Peru half an ounce, balſam of ſulphur anniſated one ounce, flowers of benjamin half an ounce, honey as much as is ſufficient to form them into a paſte; give the ſize of a pigeon's egg every morning. Exerciſe in a free open air is very ſerviceable, and the diet ſhould be moderate.

The following alſo will be found a uſeful remedy in obſtinate dry coughs.

Take gum ammoniacum, ſquills, and Venice ſoap, of each four ounces ; balſam of ſulphur with anniſeeds one ounce ; beat up into a maſs, and give as the former.

Before we cloſe this ſection, it may be neceſſary to obſerve here, that ſome young horſes are ſubject to coughs on cutting their teeth ; their eyes alſo are affected from the ſame cauſe. In theſe caſes always bleed ; and if the cough is obſtinate, repeat it, and give warm maſhes ; which, in general, are alone ſufficient to remove this complaint.

SECT. XIX. *Broken Wind.*

Thoſe who are acquainted with this diſeaſe muſt own that it may be reckoned among the incurable diſtempers of horſes ; and that all the boaſted pretenſions to cure are vain and frivolous, ſince the utmoſt ſkill can amount to no more than now and then palliating the ſymptoms and mitigating their violence. We ſhall therefore lay down ſuch methods as may probably prevent this diſorder, when purſued in time. But if they ſhould not ſucceed, we ſhall offer ſome remedies and rules to mitigate its force, and make a horſe as uſeful as poſſible under this malady. It is uſual, before a broken wind appears, for a horſe to have a dry obſtinate cough, without any viſible ſickneſs or loſs of appetite ; but, on the contrary, a diſpoſition to foul feeding, eating the litter, and drinking much water. The following balls are to be taken for ſome time, which have been found extremely efficacious in removing obſtinate coughs.

TAKE aurum moſaicum, finely powdered, eight ounces ; myrrh and elicampane, powdered, each four ounces ; anniſeeds and bay berries, each an ounce ; ſaffron, half an ounce ; make into balls with oxymel ſquils.

The aurum moſaicum is made of equal parts of quickſilver, tin, ſal armoniac, and ſulphur. We give this medicine as ſtrongly recommended by Mr. Gibſon ; but how far the aurum moſaicum may contribute to its efficacy, may perhaps be juſtly diſputed : as a ſubſtitute in its room, therefore, for this purpoſe, we recommend the ſame quantity of powdered ſquils, or gum ammoniadum, or equal parts of each. Broken winded horſes ſhould eat ſparingly of hay, which as well as their corn may be wetted ; as this will make them leſs craving after water. The following alterative ball may be given once a-fortnight or three weeks : and as it operates very gently, and requires no confinement but on thoſe days it is given (when warm meat and water are neceſſary), it may be continued for two or three months.

TAKE ſocotorine aloes ſix drams ; myrrh, galbanum, and ammoniacum, of each two drams ; bay-berries half an ounce : make into a ball with a ſpoonful of oil of amber, and a ſufficient quantity of ſyrup of buckthorn.

SECT. XX. *Conſumption.*

When a conſumption proceeds from a defect in a horſe's lungs or any principal bowel, the eyes look dull ; the ears and feet are moſtly hot ; he coughs ſharply by fits ; ſneezes much, and frequently groans with it ; his flanks have a quick motion ; he gleets often at the noſe, and ſometimes throws out a yellowiſh curdled matter, and he has little appetite to hay, but will eat corn, after which he generally grows hot. As to the cure, one of the principal things is bleeding in ſmall quantities (a pint, or pint and half, from ſome horſes is ſufficient), which ſhould be repeated as often as the breath is more than ordinarily oppreſſed. Pectorals may be given to palliate preſent ſymptoms ; but as diſſections have diſcovered both the glands of the lungs and meſentery to be ſwelled, and often indurated, the whole ſtreſs lies on mercurial purges, and the following ponderous alteratives, given intermediately.

TAKE native cinnabar, or cinnabar of antimony, one pound, powdered very fine, and add the ſame quantity of gum guaiacum and nitre ; give the horſe an ounce of this powder twice a day, wetting his feeds.

The ſpring graſs is often extremely ſerviceable ; but the ſalt marſhes are to be preferred, and to be more depended on than medicines ; for great alterations are thereby made in the blood and juices, and no ſmall benefit ariſes from open air and proper exerciſe.

CLASS VII.

SECT. XXI. *Fevers.*

The ſymptoms of a fever are, great reſtleſſneſs ; the horſe ranging from one end of his rack to the other ; his flanks beat ; his eyes are red and inflamed ; his tongue parched and dry ; his breath is hot, and ſmells ſtrong ; he loſes his appetite, and nibbles his hay, but does not chew it, and is frequently ſmelling to the ground ; the whole body is hotter than ordinary, (though not parched, as in ſome inflammatory diſorders ;) he dungs often, little at a time, uſually hard, and in ſmall bits ; he ſometimes ſtales with difficulty, and his urine is high coloured ; and he ſeems to thirſt, but drinks little at a time, and often ; his pulſe beats full and hard, to fifty ſtrokes and upwards in a minute. The firſt intention of cure is bleeding, to the quantity of two quarts, if the horſe is ſtrong and in good condition ; then give him a pint of the following drink, four times a day ; or an ounce of nitre, mixed up into a ball with honey, may be given thrice a day, inſtead of the drink, and waſhed down with three or four horns of any ſmall liquor.

TAKE of baum, ſage, and commomile flowers, each a handful, liquorice-root ſliced half an ounce, ſalt prunel or nitre three ounces ; ſalt of worm-wood half an ounce ; infuſe in two quarts of boiling water ; when cold, ſtrain off, and ſqueeze into it the juice of two or three lemons, and ſweeten with honey.

His diet ſhould be ſcalded bran, given in ſmall quantities ; which if he refuſes, let him have dry bran ſprinkled with water : put a handful of picked hay into the rack, which a horſe will often eat when he will touch nothing elſe ; his water need not be much warmed, but ſhould be given often and in ſmall quantities : his cloathing ſhould be moderate ; too much heat and weight on a horſe being improper in a fever, which ſcarce ever goes off in critical ſweats (as thoſe in the human body terminate), but by ſtrong perſpiration. The various and irregular ſymptoms that attend this ſlow fever, require great ſkill to direct the cure, and more knowledge of the ſymptoms of horſes diſeaſes than the generality of gentlemen are acquainted with. The experienced farrier ſhould therefore be conſulted and attended to, in regard to the ſymptoms ; but very ſeldom as to the application of the remedy, which is generally above their comprehenſion ; though it may be readily ſelected, by duly attending to the above obſervations. The true reaſons, perhaps, why ſo many horſes miſcarry in fevers, are, that their maſters, or doctors, will not wait with patience, and let nature have fair play ; that they generally neglect bleeding ſufficiently at firſt ; and are conſtantly forcing down ſugar ſops, or other food, in a horn, as if a horſe muſt be ſtarved in a few days if he did not eat : then they ply him twice or thrice a day with hot medicines and ſpirituous drinks, which (excepting in a very few caſes) muſt be extremely pernicious to a horſe, whoſe diet is naturally ſimple, and whoſe ſtomach and blood, unaccuſtomed to ſuch heating medicines, muſt be greatly injured, and without doubt are often inflamed by ſuch treatment. Before we cloſe this ſection on fevers, it may be no improper hint to the curious to take notice, that a horſe's pulſe ſhould more particularly be attended to than is cuſtomary, as a proper eſtimate may thereby be made both of the degree and violence of the fever preſent, by obſerving the rapidity of the blood's motion, and the force that the heart and arteries labour with to propel it round. The higheſt calculation that has been made of the quickneſs of the pulſe in a healthy horſe, is, that it beats about forty ſtrokes in a minute ; ſo that in proportion to the increaſe above this number, the fever is riſing, and if farther increaſed to above fifty the fever is very high.

SECT. XXII. *Worms.*

Authors have deſcribed three different ſorts of worms that affect horſes, viz. Botts, which young horſes are often troubled with in the ſpring ; the Rotundi, or thoſe reſembling earth-worms ; and the Aſcarides, or thoſe about the ſize of the largeſt ſewing needle, with flat heads. The ſymptoms of worms are various. The botts that many horſes are troubled with in the beginning of the ſummer, are always ſeen ſticking on the ſtrait gut, and are often thurſt out with the dung ; with a yellowiſh coloured matter, like melted ſulphur ; they are no ways dangerous there ; but are apt to make a horſe reſtleſs and uneaſy, and rub his breech againſt the poſts. For the cure of botts in the ſtomach, calomel ſhould firſt be given in large quantities, and repeated at proper intervals ; Æthiops mineral, or ſome of the under-mentioned forms, may be given afterwards. But botts in the ſtrait gut may be cured by giving the horſe a ſpoonful of ſavin, cut very ſmall, once or twice a-day in his oats or bran, moiſtened ; and three or four cloves of garlick may be added to advantage. Give alſo an aloetic purge between whiles ; the following ſtands recommended.

TAKE fine ſocotorine aloes, ten drams ; freſh jalap, one dram ; ariſtolochia, or birthwort, and myrrh powdered, of each two drams ; oil of ſavin and amber, of each one dram ; ſyrup of buckthorn enough to form into a ball.

As the ſource of worms in general proceeds from a vitiated appetite and a weak digeſtion, recourſe muſt firſt be had to mercurials, and afterwards to ſuch things as are proper to ſtrengthen the ſtomach, promote digeſtion, and, by deſtroying the ſuppoſed ova, prevent the regeneration of theſe animals. Thus, two drams of calomel may be given with half an ounce of diapente, and mixed up with conſerve of wormwood, over-night ; and the next morning the above purge ; theſe may be repeated ſix or eight days. Or the following mercurial purge may be given, which will be leſs troubleſome, and no leſs efficacious.

TAKE crude quick-ſilver two drams, Venice turpentine half an ounce ; rub the quick-ſilver till no gliſtening appears : then add an ounce of aloes, a dram of grated ginger, 30 drops of oil of ſavin, and a ſufficient quantity of ſyrup of buckthorn to make a ball.

One of theſe balls may be given every ſix days, with the uſual precautions in regard to mercurial phyſic ; and the following powder intermediately.

TAKE powdered tin and Æthiops mineral of each half an ounce ; give every night in a maſh, or among his corn.

CLASS VIII.

SECT. XXIII. *Strangles.*

The ſtrangles is a diſtemper to which colts and young horſes are ſubject ; and begins with a ſwelling between the jaw-bones, which ſometimes extends to the muſcles of the tongue ; and is attended with ſo great heat, pain, and inflammation, that ſometimes, till matter is formed, the horſe ſwallows with the utmoſt difficulty.

culty. When it ariſes among the glands, and divides into ſeveral tumours, the cure is generally tedious, as it breaks in different places; and when it forms upwards on the wind-pipe and gullet, there is ſometimes danger of ſuffocation, unleſs the ſwelling ſoon breaks. But the moſt dangerous kind is, when, beſides the above ſymptoms, the horſe runs at the noſe; this is by ſome called the baſtard ſtrangles. As this diſorder ſeems to be critical, the moſt approved method is to aſſiſt nature in bringing the ſwellings to maturity, by keeping them conſtantly moiſt with ointment of marſhmallows, and covering the head and neck with a warm hood. But as all ſwellings in glandular parts ſuppurate ſlowly, the following poultice may be applied hot twice a-day.

> TAKE leaves of marſhmallows ten handfuls, white-lily root half a pound, linſeed and fenugreek-ſeed bruiſed of each four ounces: boil them in two quarts of water till the whole is pulpy; and add four ounces of ointment of marſhmallows, and a ſufficient quantity of hogs-lard, to prevent its growing ſtiff and dry.

In five or ſix days, by theſe means, the matter is generally formed, and makes its way through the ſkin; and if the diſcharge is made freely and with eaſe, the opening need not be enlarged; but ſhould be dreſſed with the following oitment ſpread on tow, ſtill continuing the poultice over it to promote the digeſtion, and prevent any remaining hardneſs.

> TAKE roſin and burgundy pitch of each a pound and a half, honey and common turpentine each eight ounces, yellow wax four ounces, hogs lard one pound, verdigreaſe finely powdered one ounce; melt the ingredients together, but do not put in the verdigreaſe till removed from the fire; and it ſhould be ſtirred in by degrees, till the whole is grown ſtiff and cool.

If the fever and inflammation run high, and the ſwelling be ſo ſituated as to endanger ſuffocation, a moderate quantity of blood muſt be taken away, and the remainder diluted with plenty of water gruel, or warm water, maſhes, &c. The running at the noſe which often attends the ſtrangles is dangerous, eſpecially if it continues after they have ripened and broke, as the horſe will be greatly weakened thereby. To prevent this waſte and decay, give him every day for ſome time an ounce of Jeſuit's bark; or a ſtrong decoction of guaiacum ſhavings, which hath been found extremely beneficial in reſtraining theſe glandular diſcharges when too liberal, and in drying up ulcers of all kinds in horſes. If a hardneſs remains after the ſores are healed up, they may be anointed with the mercurial ointment; and when the horſe has recovered his ſtrength, purging will be neceſſary. The vives or ives differ from the ſtrangles only in this; that the ſwellings of the kernels under the ears of the horſe, (which are the parts at firſt chiefly affected), ſeldom gather, or come to matter, but by degrees perſpire off and diſperſe by warm cloathing, anointing with the marſhmallow ointment, and a moderate bleeding or two. But ſhould the inflammation continue notwithſtanding thoſe means, a ſuppuration muſt be promoted by the methods before recommended in the ſtrangles. When theſe ſwellings appear in an old or full-aged horſe, they are ſigns of great malignity, and often of an inward decay as well as forerunners of the glanders. The mercurial ointment above-mentioned, may be prepared thus:

> TAKE of crude mercury or quickſilver one ounce, Venice turpentine half an ounce; rub together in a mortar till the globules of the quickſilver are no longer viſible; then add two ounces of hogs-lard.

SECT. XXIV. *Glanders.*

The matter, diſcharged from the noſtrils of a glandered horſe, is either white, yellow, or greeniſh, ſometimes ſtreaked or tinged with blood; when the diſeaſe is of long ſtanding, and the bones are fouled, the matter turns blackiſh, and becomes very fetid; and is always attended with a ſwelling of the kernels or glands under the jaws; in every other reſpect the horſe is generally healthy and ſound, till the diſtemper has been of ſome continuance. It is always a bad ſign when the matter ſticks to the inſide of the noſtrils like glue or ſtiff paſte; when the inſide of the noſe is raw, and looks of a livid or lead colour; when the matter becomes bloody, and ſtinks, and when it looks of an aſh-colour. But when only a limpid fluid is firſt diſcharged, and afterwards a whitiſh matter, the gland under the jaw not increaſing, and the diſorder of no long continuance, we may expect a ſpeedy cure; for in this caſe, which ariſes from taking cold after a horſe has been overheated, the pituitary membrane is but ſlightly inflamed, the lymph in the ſmall veſſels condenſed, and the glands overloaded, but not yet ulcerated. But Mr. De la Foſſe, the king of France's Farrier, after examining by diſſection the carcaſes of glandered horſes, and making a ſtrict ſcrutiny into the ſtate of the viſcera, aſſiſted for that purpoſe by ingenious and expert anatomiſts, for ten years together, affirms this diſeaſe to be altogether local; and that the true ſeat of it is in the pituitary membrane which lines the partition along the inſide of the noſe, the maxillary ſinuſes or cavities of the cheek bones on each ſide the noſe, and the frontal ſinuſes or cavities above the orbits of the eyes. But on nicely examining the heads of ſuch horſes, he found the cavities above mentioned more or leſs filled with a viſcous ſlimy matter, and the membrane which lines both them and the noſtrils inflamed, thickened, and corroded with ſordid ulcers, which in ſome caſes had eat into the bones. He obſerves, that when glandered horſes diſcharged matter from both noſtrils, both ſides of the membrane and cavities were affected; but when they ran at one noſtril only, that ſide only was found diſtempered. It is remarked by La Foſſe, that the ſublingual glands, or the kernels ſituated under the jaw-bone, which are always ſwelled in this diſtemper, do not diſcharge their lymph into the mouth, as in man, but into the noſtrils; and that he conſtantly found their obſtruction agreed with the diſcharge: if one gland only was affected, then the horſe diſcharged from one noſtril only; but if both were, then the diſcharge was from both. He alſo adopts the plan of trepanning theſe cavities, and taking out a piece of bone, by which means the parts affected may be waſhed with a proper injection, and in fine the ulcers deterged, healed, and dried up. There are different ſpecies of the glanders, ſo the cure of the middle kinds may firſt be attempted by injections and fumigations: thus, after taking cold, ſhould a horſe for 15 or 20 days diſcharge a limpid fluid or whitiſh matter from one or both noſtrils, the glands under the jaw rather growing harder than diminiſhing, we may expect it will degenerate into a true glanders. To prevent which, after firſt bleeding, and treating him as we have directed for a cold, let an emollient injection, prepared with a decoction of linſeed, marſhmallows, elder, camomile flowers, and honey of roſes, or ſuch like, be thrown up as faſt as poſſible with a ſtrong ſyringe, and repeated three times a day; ſhould the running not leſſen or be removed in a fortnight by the uſe of this injection, a reſtringent one may now be prepared with tincture of roſes, lime water, &c. and the noſtrils fumigated with the powders of frankincenſe, maſtich, amber, and cinnabar, burnt on an iron heated for that purpoſe; the fume of which may eaſily be conveyed through a tube into the noſtrils.

M. de la Foſſe, to whoſe opinion much deference has been paid by ſucceeding writers, diſtinguiſhes ſeven different kinds of glanders; and in order to ſupport this doctrine, cites a variety of ſymptoms, though the diſeaſe ariſes from one general cauſe, which is purulent corroſive matter diſcharged from the noſtrils, which, by being ſuffered to continue for a conſiderable time, brings ulceration on the parts where it is lodged. So that we cannot acquieſce with M. de la Foſſe's opinion in this particular, any more than in that of trepanning, which is not only a moſt painful operation, but alſo attended with ſuch trouble and expence; that admitting recovery, it muſt be an extraordinary horſe to compenſate the account. And we cannot but agree with Taplin in opinion, that when the diſeaſe is arrived to ſuch a pitch, that notwithſtanding every medicinal effort, the whole carcaſe is emaciated, and the frame ſinking under univerſal depreſſion, the firſt loſs will be ultimately beſt in a reſignation of the hide to the collar-maker, and the remains to the hounds. Nor can we refrain from concurring with the very facetious remark of that author; on the cruelty of dooming three horſes to death which had been trepanned, ſyringed, and completely cured by M. La Foſſe, "in twenty-ſix days," unleſs we are to conceive the poſſibility of "putting them to death" on the twenty-ſixth day, to avoid their natural diſſolution on the twenty-ſeventh.

SECT. XXV. *Staggers, and Convulſive Diſorders.*

FARRIERS generally include all diſtempers of the head under two denominations, viz. ſtaggers and convulſions, wherein they always ſuppoſe the head primarily affected. But in treating theſe diſorders, we ſhall diſtinguiſh between thoſe that are peculiar to the head, as having their ſource originally thence; and thoſe that are only concomitants of ſome other diſeaſe. In an apoplexy a horſe drops down ſuddenly, without other ſenſe or motion than a working at his flanks. All that can be done is to empty the veſſels as ſpeedily as poſſible, by ſtriking the veins in ſeveral parts at once, bleeding to three or four quarts; and to raiſe up the horſe's head and ſhoulders, ſupporting them with plenty of ſtraw. If he ſurvives the fit, cut ſeveral rowels; give him night and morning glyſters prepared with a ſtrong decoction of ſenna and ſalt, or the purging glyſter mentioned in the directions; blow once a-day up his noſtrils a dram of powder of aſarabacca, which will promote a great diſcharge; afterwards two or three aloetic purges ſhould be given; and to ſecure him from a relapſe, by attenuating and thinning his blood, give him an ounce of equal parts of antimony and crocus metallorum for a month; or, which is preferable, the ſame quantity of cinnabar of antimony and gum guaiacum. As to the other diſorders of the head, ſuch as lethargy or ſleeping evil, epilepſy or falling-ſickneſs, vertigo, frenzy, and madneſs, convulſions, and paralytical diſorders, as they are moſt of them to be treated as the apoplexy and epilepſy, by bleeding and evacuations, with the alteratives there directed, we ſhall wave treating of them ſeparately, but mention ſome particular rules to diſtinguiſh them, according to the plan we laid down, and then offer ſome general remedies for the ſeveral purpoſes.

In an epilepſy, or falling ſickneſs, the horſe reels and ſtaggers, his eyes are fixed in his head, he has no ſenſe of what he is doing, he ſtales and dungs inſenſibly, he runs round and falls ſuddenly; ſometimes he is immoveable, with his legs ſtretched out as if he was dead, except only a quick motion of his heart and lungs, which cauſes a violent working of his flanks; ſometimes he has involuntary motions, and ſhaking of his limbs, ſo ſtrong, that he has not only beat and ſpurned his litter, but the pavement with it; and with theſe alternate ſymptoms a horſe has continued more than three hours, and then has as ſurpriſingly recovered: at the going off of the fit, he generally foams at the mouth, the foam being white and dry, like what comes from a healthful horſe when he champs on the bit. But in all kinds of gripes, whether they proceed from diſorders in the guts, or retention of urine, a horſe is often up and down, rolls and tumbles about; and when he goes to lie down, generally makes ſeveral motions with great ſeeming carefulneſs, which ſhews he has a ſenſe of his pain; and if he lays ſtretched out for any time, it is generally but for a ſhort ſpace.

The lively deſcription of that univerſal cramp or convulſion, called by ſome the ſtag-evil, which ſeizes all the muſcles of the body at once, and locks up the jaws, ſo that it is impoſſible almoſt to force them open is thus deſcribed. When a horſe is ſeized, his head raiſed with his noſe towards the rack, his ears pricked up, and his tail cocked, looking with eagerneſs as an hungry horſe when hay is put down to him, or like a high ſpirited horſe when he is put upon his mettle; inſomuch that thoſe who are ſtrangers to ſuch things, when they ſee a horſe ſtand in this manner, will ſcarce believe any thing of conſequence ails him: but they are ſoon convinced, when they ſee other ſymptoms come on apace, and that his neck grows ſtiff, cramped, and almoſt immoveable: and if a horſe in this condition lives a few days, ſeveral knots will ariſe on the tendinous parts thereof, and all the muſcles both before and behind will be ſo much pulled and cramped, and ſo ſtretched, that he looks as if he was nailed to the pavement, with his legs ſtiff, wide, and ſtradling; his ſkin is drawn ſo tight on all parts of the body, that it is almoſt impoſſible to move it; and if trial be made to make him walk, he is ready to fall at every ſtep, unleſs he be carefully ſupported; his eyes are ſo fixed with the inaction of the muſcles, as give him a deadneſs in his looks; he ſnorts and ſneezes often, pants continually with ſhortneſs of breadth; and this ſymptom increaſes continually till he drops down dead; which generally happens in a few days, unleſs ſome ſudden and very effectual turn can be given to the diſtemper. In all theſe caſes the horſe ſhould firſt be bled plentifully, unleſs he is low in fleſh, old, or lately come off any hard continued duty; then you muſt be more ſparing of his blood: afterwards give the following ball.

Take aſa fœtida half an ounce, Ruſſia caſtor powdered two drams, valerian root powdered one ounce; make into a ball with honey and oil of amber.

This ball may be given twice a day at firſt; and then once waſhed down with a decoction of miſletoe or valerian ſweetened with liquorice or honey: an ounce of aſa fœtida may be tied up in a piece of ſtrong coarſe linen rag, and put behind his grinders to champ on. The laxative purges and emollient glyſters ſhould be given intermediately to keep the body open; but when the former balls have been taken a week or ten days, the following may be given once a day with the valerian decoction.

Take cinnabar of antimony ſix drams; aſa fœtida half an ounce, ariſtolochia, myrrh, and bay berries, of each two drams; make into a ball with treacle and oil of amber.

Repeated frictions are extremely ſerviceable in all convulſive diſorders, and often prevent their being jaw ſet; they ſhould be applied with unwearied diligence every two or three hours, where-ever any ſtiffneſs or contractions in the muſcles appear; for a horſe in this condition never lies down till they are in ſome meaſure removed. In paralytic diſorders, where the uſe of a limb or limbs is taken away, the internals above recommended ſhould be given, in order to warm, invigorate, and attenuate the blood; and the following ſtimulating embrocation ſhould be rubbed into the parts affected.

Take oil of turpentine four ounces, nerve ointment and oil of bays of each two ounces, camphor rubbed fine one ounce, rectified oil of amber three ounces, tincture of cantharides one ounce.

With this liniment the parts affected ſhould be well bathed for a conſiderable time, to make it penetrate; and when the hind parts chiefly are lame, the back and loins ſhould be well rubbed with the ſame. To the medicines above recommended, may be added ſnake root, contrayerva, muſtard feed, horſe radiſh root ſteeped in ſtrong beer, or wine where it can be afforded.

CLASS IX.

SECT. XXVI. *Colics, or Gripes.*

There ſeems to be no diſtemper ſo little underſtood by the common farriers, as the colic or gripes in horſes, one general remedy or method ſerving them in all caſes: but as this diſorder may be produced by very different cauſes, the method of cure muſt alſo vary: otherwiſe the intended remedy, injudiciouſly applied, will not only aggravate the complaint, but make it fatal. We ſhall divide this diſorder into three different ſpecies; the flatulent or windy, the bilious or inflammatory, and the dry gripes; each of which we ſhall diſtinguiſh by their different ſymptoms, and then point out the proper remedies. The flatulent or windy colic is thus known. The horſe is often lying down, and as ſuddenly riſing; when the gripes are violent, he will have convulſive twitches, his eyes are turned up and his limbs ſtretched out as if dying, his ears and feet being alternately very hot and cold; he falls into profuſe ſweats, and turns his head frequently to his flanks; falls down, rolls about and often turns on his back. This laſt ſymptom proceeds from a ſtoppage of urine that almoſt always attends this ſort of cholic, which may be increaſed by a load of dung preſſing on the neck of the bladder. Theſe are the general ſymptoms of cholic and gripes from wind, drinking cold water when hot, and when the perſpirable matter is retained, or thrown on the bowels by catching cold; in all which caſes they are violently diſtended. Cribbing horſes are more particularly ſubject to this complaint, by reaſon they are conſtantly ſucking in great quantities of air. The following ball and glyſter ſeldom fail of giving relief in theſe caſes.

Take Straſburgh or Venice turpentine, and juniper-berries pounded, of each half an ounce; ſalt-prunella or ſalt-petre, an ounce; oil of juniper, one dram; ſalt of tartar, two drams; make into a ball with any ſyrup: it may be given whole, and waſhed down with a decoction of juniper-berries, or a horn or two of ale.

If the horſe does not break wind, or ſtale plentifully, he will find no relief: therefore in an hour or two give him another ball, and add to it a dram of ſalt of amber; which may be repeated a third time, if found neceſſary. During the fit the horſe may be walked and trotted gently; but ſhould by no means be harraſſed beyond his ability, or dragged about till he is jaded. The following glyſter may be given, between the balls, or alone, and repeated occaſionally.

Take camomile flowers two handfuls; anniſe, coriander, and fennel ſeeds, of each an ounce; long pepper half an ounce; boil in three quarts of water to two; and add Daffy's elixir, or gin, half a pint; oil of amber half an ounce, and oil of camomile eight ounces.

The next ſpecies of colic we ſhall deſcribe, is the bilious or inflammatory; which beſides moſt of the preceding ſymptoms, is attended with a fever, great heat, panting, and dryneſs of the mouth; the horſe alſo generally throws out a little looſe dung, with a hot ſcalding water; which, when it appears blackiſh, or of a reddiſh colour, and fetid ſmell, denotes an approaching mortification. In this caſe the horſe ſhould immediately have an emollient glyſter, with two ounces of nitre diſſolved in it, thrown up twice a-day, to cool the inflamed bowels; plenty of gum-arabic water ſhould be taken, and a pint of the following drink given every two or three hours till ſeveral looſe ſtools are procured, and then it ſhould be given only night and morning till the diſorder is removed.

Take ſenna three ounces, ſalt of tartar half an ounce: infuſe in a quart of boiling water an hour or two; then ſtrain off, and add two ounces of lenitive electuary, and four of Glauber's ſalts.

If this diſorder is not removed by theſe means, but the inflammation and fever increaſe, attending with a diſcharge of the fleſh coloured water above deſcribed, the event will moſt probably be fatal: and the chief thing to be depended on now, muſt be a ſtrong decoction of Jeſuit's bark, given to the quantity of a pint every three hours, with a gill of red port wine. A quart of the ſame may be uſed for a glyſter, with two ounces of Venice turpentine, diſſolved with the yolks of two eggs, an ounce of diaſcordium, and a pint of red wine, and given twice a day: if the horſe recovers, give two or three mild rhubarb purges. The laſt we ſhall deſcribe is the dry gripes, or the cholic, which ariſes often from coſtiveneſs; it is diſcovered by the horſe's frequent and fruitleſs motion to dung, the blackneſs and hardneſs of the dung, the frequent and quick motion of his tail, the high colour of his urine, and his great reſtleſſneſs and uneaſineſs. An emollient glyſter ſhould be thrown up twice a day; and the above purging drink given, till the bowels are unloaded, and the ſymptoms removed. The diet for a horſe in the gripes, ſhould be ſcaled bran, warm water-gruel, or white water, made by diſſolving four ounces of gum-arabic in a quart of water, and mixing it with his other water. From this diviſion of gripes and colics, with their different treatment, it appears how abſolutely neceſſary it is they ſhould be well underſtood, in order to be managed ſkilfully; it is plain too, that violent hot medicines ſhould in every ſpecies of this diſorder be guarded againſt, and given with great caution and diſcretion, even in the firſt kind of flatulent colic, where indeed they can only be wanted; yet too often, when prepared by the farriers with oil of turpentine, geneva, pepper, brine, &c. they even increaſe that diſorder, by ſtimulating the neck of the bladder, too forcibly heating the blood, and inflaming the bowels, till a mortification is brought on them. Theſe are, in general, the conſtant appearances of horſes that die of this diſorder; whoſe bowels being examined for that purpoſe, have been found inflamed, full of red and livid ſpots, ſometimes quite black, criſped with extreme heat, and rotten.

SECT. XXVII. *Scouring and Looſeneſs.*

It is ſometimes a nice matter to form a proper judgment when to controul or encourage a looſeneſs; but theſe general rules may be a direction: if a healthy full horſe, on taking cold, or upon hard riding, overfeeding, eating unwholeſome food, or in a ſlight fever, ſhould have a moderate purging, by no means think of ſtopping it; but rather encourage it with an open diet and plenty of warm gruel; but if it continues long, with gripings, the mucus of the bowels coming away, and the horſe loſing his appetite and fleſh, it is then high time to give him proper medicines: if he voids great quantities of ſlime and greaſy matter, give him the following drench, and repeat it every other day for three times.

TAKE lenitive electuary and cream of tartar of each four ounces, yellow roſin finely powdered one ounce; and four ounces of ſweet oil: mix with a pint of water-gruel.

The following alterative ball alone has been found ſucceſsful for this purpoſe when given twice a-week, with ſcalded bran and warm gruel.

TAKE ſocotorine aloes half an ounce, diapente one ounce; make into a ball with the juice of Spaniſh liquorice diſſolved in water, and a ſpoonful of oil of amber.

To this may be added two drams of myrrh, and a dram of ſaffron, and (where it can be afforded) half an ounce of rhubarb. When the purging is attended with a fever, rhubarb ſhould firſt be given to the quantity of half an ounce, with an ounce and half of lenitive electuary; at night, after the working, give half an ounce or more of diaſcordium in a pint of red wine mulled with cinnamon; and repeat it every day, and the rhubarb-ball once in two or three. But if the diſtemper increaſes, the horſe's flanks and belly looks full and diſtended, and he appears griped and in pain; let this glyſter be given, and this quantity of diaſcordium increaſed an ounce in his night-drink.

TAKE camomile flowers one handful, red roſes half a handful, pomegranate and baulauſtines of each an ounce; boil in two quarts of water to one; ſtrain off, and diſſolve in it two or three ounces of diaſcordium, and one of mithridate; to which may be added a pint of port-wine: repeat it once a-day.

If the flux continues violent, give an ounce of rock-alum, with an ounce and a half of bole, twice a-day; or, diſſolve double this quantity with two ounces of diaſcordium, and the cordial ball, in two quarts of hartſhorn drink; to which may be added a pint of port: and give the horſe, three or four times a-day a pint of this drink. For this purpoſe alſo a ſtrong decoction of oak-bark may be given, with either of the above remedies, and to the ſame quantity; even by itſelf, it will be found on trial no inconſiderable remedy. The bloody-flux is a diſtemper horſes are not very ſubject to; however, as it ſometimes does occur, whenever blood is diſcharged, attended with gripings and great pain in the bowels, if the flux is not ſpeedily reſtrained, the horſe probably may be ſoon loſt; we recommend therefore the following glyſter and drink for that purpoſe.

TAKE oak-bark four ounces, tormentil-root two ounces, burnt hartſhorn three ounces: boil in three quarts of forge-water to two; ſtrain off, and add two ounces of diaſcordium, four ounces of ſtarch, and half a dram of opium.

SECT. XXVIII.

Diſorders of the Kidneys, Bladder, Strangury, &c.

The ſigns of the kidneys being hurt or affected are, a weakneſs of the back and loins, difficulty of ſtaling, faintneſs, loſs of appetite, and deadneſs in the eyes; the urine is thick, foul, and ſometimes bloody, eſpecially after a violent ſtrain. A horſe diſeaſed in his kidneys can ſeldom back, that is, move ſtraight backwards, without pain, which is viſible as often as he is put to the trial: the ſame thing is obſervable indeed in horſes whoſe backs have been wrung and wrenched; but with this difference, that in the latter there is ſeldom any defect or alteration in the urine, except that it is higher coloured. Bleeding is the prime remedy, and that plentifully, in order to prevent inflammation; and the more ſo, if a fever attends a difficulty in ſtaling, for then we may ſuſpect the kidneys already inflamed. A rowel in the belly has been found uſeful; and the following balls may be given twice or thrice a-day, with a pint of marſhmallow decoction, in which half an ounce of gum arabic is diſſolved, with an ounce of honey.

TAKE Locatellus-balſam one ounce, ſpermaceti ſix drams, ſal prunella half an ounce; mix into a ball with honey: if the urine is bloody, add half an ounce of Japan earth.

Should the fever continue, bleed largely, give emollient glyſters, and the cooling opening drink. If the urine paſſes with difficulty and pain, notwithſtanding theſe means, give this ball, and repeat it twice or thrice a day till the horſe ſtales freer and without pain, his urine become of a right conſiſtence, and free from any purulent ſediment.

TAKE balſam of capivi or Straſburg turpentine, and Venice ſoap, of each one ounce, nitre ſix drams, myrrh powdered two drams; make into a ball with honey, and waſh it down with the marſh-mallow decoction.

As a ſuppreſſion of urine ariſes ſometimes from an inflammation of the kidneys, ſo at others, from a paralytic diſorder, diſabling them in their office of ſeparating the urine from the blood: in this latter caſe, the bladder is uſually empty, ſo that a horſe will make no motion to ſtale; and if he continues a few days in this condition, his body will ſwell to a great degree, break out in blotches all over, and death will ſoon cloſe the ſcene. If the complaint is not removed by thoſe means, rub the horſe's reins well with two parts of oil of turpentine, and one of oil of amber; and apply a poultice of garlic, horſe radiſh, muſtard ſeed, camphor, and green ſoap, ſpread on thick cloth over them. Give the horſe alſo two drams of calomel over night, and a moderate purge the next morning. Theſe perhaps are the chief and beſt remedies that can be given in this generally fatal diſorder. When the ſtrangury in a horſe does not ariſe from wind, or dung preſſing on the neck of the bladder (as was obſerved in the ſection on Cholics), the cauſe is from inflammation, or too long a retention of the urine. Such horſes make frequent motion to ſtale, ſtand wide and ſtraddling, are full, and have their flanks diſtended. In this caſe bleed largely; give the following drink, and repeat it every two hours, for two or three times, till the horſe is relieved.

TAKE Venice turpentine, broke with the yolk of an egg, one ounce, nitre or ſal prunella ſix drams, half a pint of ſweet oil, and a pint of wine.

If this drink ſhould not have the deſired effect, the diuretic ball above mentioned may be given in the ſame manner, omitting the myrrh. Give the horſe plenty of the marſhmallow decoction: in a quart of which diſſolve an ounce of nitre and gum arabic, and two of honey. Horſes ſubject to a diabetes, or profuſe ſtaling, if old, or of a weak conſtitution, are ſeldom cured; they ſoon loſe their fleſh and appetite, grow feeble, their coat ſtaring, and they die rotten. Of a young horſe there are more hopes; but he muſt not be indulged with too much water, or moiſt food.

CLASS XI.

SECT. XXIX. *Diſeaſes of the Eyes.*

In order to make the diſorders of the eyes well underſtood, we ſhall conſider them as ariſing from different cauſes; external injuries affecting the globe of the eye; and from internal cauſes affecting the humours within the globe. We ſhall conſider alſo the eye as naturally weak from a bad conformation.

In all recent diſorders of the eye from external injuries, ſuch as blows, bites, &c. attended with a ſwelling of the lid, and a running from the eye, you muſt firſt ſponge the part often with cold ſpring-water and vinegar; and if much ſwelled, bleed immediately, and apply over it a poultice made of the pulps of roaſted or boiled apples, cleared from their ſeeds and huſks; or of conſerve of roſes and vinegar, with a little bole, and the white of an egg. When the ſwelling is abated, either of the following waſhes will complete the cure.

TAKE white vitriol half an ounce, ſugar of lead two drams; diſſolve in a pint of ſpring water; to which may occaſionally be added, when the rheum is very great, and inflammation removed, half an ounce of tutty or compound powder of ceruſs.

Let the eye and eyelid be bathed three or four times a day with a clean ſponge dipped in this waſh; or it may be applied with a feather, leaving a few drops on the eye. When the veins under the eye have been turgid, opening them with a lancet has often been found ſucceſsful. Mr. Gibſon, from his own experience, recommends the following, with which alone he has ſucceeded in many caſes.

TAKE two drams of roſe-buds, infuſe them in half a pint of boiling water: when cold, pour off the infuſion, and add to it twenty grains of ſugar of lead.

This is to be uſed as the former, but the quantity of ſugar of lead may occaſionally be increaſed. Sometimes from the violence of the inflammation, repeated blows, and external injuries, the coats of the eye ſhall loſe their tranſparency, thicken and turn white or of a dead-colour; in the latter caſe, the horſe has ſome glimmering of light; in the former, he is blind while the eye continues in this ſtate. If the horſe be fleſhy and of a groſs conſtitution, bleeding may be repeated; let his diet be ſcalded bran or barley: avoiding for ſome days oats, beans, or any thing hard to chew. A cooling opening drink, ſhould be given every other day, which will anſwer better than aloetic purges. Let it be remembered, it has long been obſerved in practice, that the eye in its firſt ſtate of inflammation is ſo very tender, that the eye-waters prepared with tutty and other powders aggravate the diſorder; conſequently, during this ſtate, the tinctures of vegetables and ſolutions of ſalts are greatly preferable. When the humours of the eye are thickened, and the diſorder is within the globe, ſharp external applications are not only uſeleſs, but extremely detrimental by the irritation they occaſion, and conſequently ſhould be avoided. In all caſes of this ſort, whether moon-eyes, which are only cataracts forming, or in confirmed ones attended with a weeping; general evacuations, with internal alteratives, can only take place.

In order to render this Syſtem as complete as poſſible, ſix plates are introduced. The firſt contains the Oſteology; the ſecond repreſents in three figures the external muſcles, with the membrana carnoſa, ligaments, &c. The four laſt contain the firſt, ſecond, third and fourth Layers of Muſcles. I have made the anatomical deſcriptions as copious as the limits of the work would admit. The methods of treatment and recipes are chiefly ſelected from the works of Bartlet, Bracken, Gibſon, La Foſſe and Taplin, which I have attentively peruſed, and in ſome inſtances altered, excepting thoſe of Taplin, which appeared to me too judicious to admit of emendation. Thoſe who wiſh to inveſtigate the ſubject ſtill further, I cannot refer to a better guide than that author.

JOHN ROBERTS,
Surgeon and Apothecary.

ACTON.

Previous to the author's commencement of this Syſtem, at his deſire I took a review of all the works upon Farriery, illuſtrated with plates and anatomical deſcriptions, but could only find thoſe of Snape and Gibſon; which were ſo indifferent, that I could not introduce them; and being unwilling that a ſubject of ſuch importance ſhould be paſſed over unnoticed, have cauſed ſix plates *to be engraved from accurate and maſterly deſigns, which I truſt will do me credit, and give ſatisfaction to my ſubſcribers.*

C. COOKE.

FARTHING, a ſmall Engliſh copper coin, amounting to one fourth of a penny. It was anciently called fourthing, as being the fourth of the integer or penny.

FASCE', in heraldry, the ſame as BARRY.

FASCETS, in glaſs making, the irons thruſt into the mouths of the bottles when made to remove into the annealing tower.

FASCIA, in architecture, a broad liſt, fillet, or band, particularly uſed in architraves and pedeſtals. See FILLET in Syſtem of *Architecture*, on the principles of the Art.

FASCIA *Lata*, in anatomy, a muſcle of the leg, called alſo muſculus membranoſus, for which ſee Syſtem of ANATOMY, Part III. Sect. XIII.

FASCIALIS, in anatomy, a muſcle of the leg, called alſo SARTORIUS; for which ſee Syſtem of ANATOMY, Part III. Sect. XIII.

FASCINATION denotes a ſort of witchcraft, ſuppoſed to operate by the influence either of the eye or the tongue.

FASCINES, in fortification, faggots, are ſmall branches of trees, or bavins, bound up in bundles, which, being mixed with earth, ſerve to fill up ditches, to ſcreen the men, make the parapets of trenches, &c. Some of them are dipped in melted pitch or tar; and, being ſet on fire, ſerve to burn the enemy's lodgments, or other works.

FASHION. The word is French, *façon*, which ſignifies *making*. Faſhion is particularly uſed among artificers, for the trouble, time, and labour, employed in a piece of work, particularly of ſilver or gold.

FAST, a ſpace of time wherein a perſon takes little or no food. For the advantages of faſting with regard to health, ſee ABSTINENCE. The Bramins never bleed their ſick, but make them faſt.

FAST, is peculiarly uſed for an abſtinence on account of religion, or a ſpace of time wherein the church prohibits the uſe of food, or at leaſt reſtrains it to certain kinds, and to certain hours. Faſting has been practiſed by moſt nations from the remoteſt antiquity. The Jews obſerved faſts from their firſt eſtabliſhment. Moſes appointed one ſolemn faſt before the feaſt of expiation; and others were inſtituted by ſeveral prophets on different occaſions. The Egyptians, Phoenicians, and Aſſyrians, neighbours to the Jews, had their faſts, as alſo the Greeks. The faſt of the Ninivites, occaſioned by the preaching of the prophet Jonas, is too well known to be inſiſted on.

Faſting muſt have been very ſacred at Rome, ſince we find it practiſed by kings and emperors. Numa Pompilius, Julius Cæſar, Auguſtus, Veſpaſian, and others, we are told, had their ſtated faſt days; and Julian the Apoſtate was ſo exact in this obſervance as even to outdo the prieſts themſelves, and the moſt rigid philoſophers. In a word, every country, nation, and religion, have had at all times their prieſts, druids, gymnoſophiſts, and philoſophers, who diſtinguiſhed themſelves by their frugality, auſterity, and abſtinence.

The Turks are ſo ſcrupulous on the point of faſting, that they will not at thoſe times ſo much as take the ſmell of any perfume by the noſe. They hold that odours themſelves break faſt. If they bathe, it is forbid to put the head under water for fear of ſwallowing any of it; and as for women, they are forbid to bathe at all on faſt-days, for a reaſon peculiar to the ſex.

Though faſting is not poſitively enjoined by Chriſt or his apoſtles, a practice prevailed among the firſt Chriſtians of joining abſtinence with their prayers, eſpecially when they were engaged in affairs of extraordinary importance. But in the moſt ancient times we find no mention of any public and ſolemn faſts, except upon the anniverſary of Chriſt's crucifixion. However, in proceſs of time, days of faſting were gradually introduced, firſt by cuſtom, and afterwards by poſitive appointment; though it is not certain what thoſe days were, nor whether they were obſerved in the firſt century.

The ancient catholics allowed of no obligatory or commanded faſts beſide that preceding Eaſter, ſince called Lent; the terms of which were to forbear eating till the evening. The other faſts obſerved were only of devotion; ſuch were the fourth and ſixth feriæ; i. e. Wedneſdays and Fridays. This Lent faſt was called ſtation. Beſides theſe, there were occaſionally faſts enjoined by the biſhops, &c. See ABSTINENCE and LENT.

FAST *Days* are thoſe appointed by public authority, to be obſerved by faſting and humiliation.

FASTI, in antiquity, the Roman calendar; wherein the ſeveral days of the years, with their feaſts, games, and other ceremonies were expreſſed. The Romans had their greater and leſſer faſti. The great faſti were called the faſti of the magiſtrates; and the leſſer, the faſti calendares.

FAT, in an animal body, a white, oily, concrete ſubſtance, collected in little membranous loculi or cells in divers parts of the body, ſerving to keep the parts warm, to ſoften and temper the acids of the aliments in the maſs of blood, and probably for the nouriſhment and reparation of the human body. See Syſtem of ANATOMY, Part I. Sect. VII.

Too much fat is uſually attended with heavineſs and drowſineſs, not only from the unwieldineſs of an overgrown body, but from the ſtuffing of the cavities and thorax alone, which ſometimes obſtructs the expanſion of the diaphragm and lungs, and produces a dyſpnoea, or an orthopnoea; and it is likewiſe probable that the abundance of fatty or oily particles returned into the blood, and implicating the more ſubtle and active parts, may hinder the neceſſary ſecretions of the brain. See CORPULENCY.

FATE, *fatum*, denotes an inevitable neceſſity depending upon a ſuperior cauſe. The word is formed *a fando*, from ſpeaking; and primarily implies the ſame with *effatum*, viz. a word or decree pronounced by God; or a fixed ſentence whereby the Deity has preſcribed the order of things, and allotted to every perſon what ſhall befall him. The Greeks called it ειμάρμενη, as it were a chain or neceſſary ſeries of things indiſſolubly linked together. It is alſo uſed to expreſs a certain unavoidable deſignation of things, by which all agents, both neceſſary and voluntary, are ſwayed and directed to their ends. The Rev. Mr. Madan introduces the following remarks on this ſubject, in the notes on his book of Hymns, page 140.

"We are glad of an opportunity to reſcue this ſignificant word out of the hands of the Infidels, who uſe it together with luck, fortune, chance, deſtiny, to promote their favourite ſcheme of excluding the particular providence of the wiſe diſpoſer of all events from the government of the affairs of men. But the word Fate (Fatum) ſignifies what is ſpoken, from the Latin word Fari to ſpeak. Fate then eminently relates to what has been ſpoken by the moſt High God: So *Minutius Felix*, that able lawyer and great ſcholar in St. Cyprian's time, ſays, *Nihil aliud eſt Fatum quam quod de unoquoque Noſtrum Deus Fatus eſt*. Fate is nothing elſe than what God hath ſpoken, concerning every one of us. Even the Heathens had this idea of it; for, ſays Statius, *Fatum eſt quod Dii Fantur*. Fate is that which the gods ſpeak."

FATHER, a term of relation denoting a perſon who hath begot a child. See PARENT and CHILD.

Natural FATHER, is he who has illegitimate children.

FATHER, in theology, is uſed in ſpeaking of the Firſt Perſon of the Trinity.

FATHER is alſo uſed in ſpeaking of ſpiritual and moral things. Thus, Abraham is called the "father of the faithful."

FATHER, in church hiſtory, is applied to ancient authors who have preſerved in their writings the traditions of the church. Thus St. Chryſoſtom, St. Baſil, &c. are called Greek fathers, and St. Auguſtine and St. Ambroſe, Latin fathers. No author who wrote later than the 12th century is dignified with the title of father.

FATHER, is alſo a title of honour given to prelates and dignitaries of the church, to the ſuperiors of convents, to congregations of eccleſiaſtics, and to perſons venerable for their age or quality. Thus we ſay, the right reverend father in God, the father-general of the Benedictines, the fathers of the council of Nice, father of his country, &c.

FATHOM, a long meaſure containing ſix feet, taken from the utmoſt extent of both arms when ſtretched into a right line. The fathom is uſed at ſea in eſtimating the length of cables and other ſhip ropes, with the depths and ſoundings of the ſea; as alſo in mines, quarries, wells, and works of fortification.

FATNESS. See CORPULENCY. It is obſerved, that for one fat perſon in France or Spain, there are an hundred in England and Holland. This is ſuppoſed to be from the uſe of new malt liquors, more than from the difference of climates or degrees of perſpiration. Indolence may cauſe fatneſs in ſome few conſtitutions: but, in general, thoſe who are diſpoſed to this habit will be fat in ſpite of every endeavour to the contrary, but that of deſtroying health.

FAUNS, FAUNI, among the ancients, were a ſpecies of demi gods inhabiting the foreſts; called alſo *Sylvans*, *Sylvani*, and little differing from the Satyrs.

FAWN, among hunters, is a buck or doe of the firſt year, or the young one of the buck's breed in its firſt year.

FEAL was anciently uſed for faithful; hence the tenants by knights ſervice uſed to ſwear to their lords to be feal and leal; that is, *faithful* and *loyal*.

FEALTY, an oath formerly taken at the admittance of every tenant, to be true to his lord, while he holds his land.

Fealty ſpecial was with us performed either by freemen or villains. By 17 Ed. II. ſtat. 2. the form of this oath is appointed, and as now obſerved it is as follows: "I A B. will be to you "my lord C. true and faithful, and bear to you fealty and faith for "the lands and tenements which I hold of you; and I will "truly do and perform the cuſtoms and ſervices that I ought to "do to you. So help me God."

FEAR, in ethics, is the apprehenſion of ſome evil likely to befal us, attended with a deſire of avoiding it. This paſſion has been found to leſſen perſpiration and urine.

FEAST, or FESTIVAL, in a religious ſenſe, is a day of feaſting and thankſgiving. Among the ancients, feaſts were inſtituted upon various accounts, but eſpecially in memory of ſome favourable interpoſition of providence. Thus, the Jews had their feaſt of paſſover, pentecoſt, and tabernacles; the Greeks their cerealia, panathenæa, &c. and the Romans their ſaturnalia, ambarvalia, &c. See PASSOVER, CEREALIA, &c.

In the ancient Chriſtian church, beſides the high feſtivals of Chriſtmas, Eaſter, Pentecoſt, Annunciation, &c. there were others inſtituted in honour of the apoſtles and martyrs: all which are retained by the church of England. See the articles CHRISTMAS, EASTER, &c. In the church of Rome, there are double, half-double, and ſimple feaſts almoſt without number. The name of double feaſts is given to ſuch whoſe ſervice is fuller and more ſolemn than the reſt, which likewiſe conſtitutes the difference between the others; the churches being embelliſhed, and the altars adorned, according to the rank which each ſaint holds in his reſpective church. All high feſtivals have an octave, conſiſting of the feaſt itſelf, and the ſeven following days. In Italy, certain feſtivals are celebrated ſolely by lovers. When a lover wants to give his miſtreſs the higheſt teſtimony of his gallantry, he immediately makes her the idol of his devotion: procuring veſpers, and even maſſes, to be ſaid to her honour. For this purpoſe he makes choice of the feſtival of ſome ſaint whoſe name ſhe bears; and though the ſaint has the ſame name, they manage matters ſo, that the devotion of the feſtival is plainly relative to the lover's miſtreſs. The four quarterly feaſts, or ſtated times, whereon rent on leaſes is uſually reſerved to be paid, are Lady-day, or the annunciation of the bleſſed virgin Mary, the 25th of March; the nativity of St. John the Baptiſt, held on the 24th of June; the feaſt of St. Michael the arch-angel, on the 29th of September; and Chriſtmas, or rather on St. Thomas the Apoſtle, on the 21ſt of December.

FEAST is alſo uſed for a banquet, or a ſumptuous meal, without any immediate view to religion. It has been often obſerved by authors, that there is no nation in the world comes near the Engliſh in the magnificence of their feaſts. Thoſe made at our coronations, inſtallments, conſecrations, &c. tranſcend the belief of all foreigners; and yet it is doubted whether thoſe now in uſe are comparable to thoſe of our forefathers. The Perſians never diſcourſe and deliberate on their moſt important affairs but in the middle of their feaſts.

FEATHER, in phyſiology, a general name for the covering of birds: it being common to all the animals of this claſs to have their whole body, or at leaſt the greateſt part of it, covered with feathers or plumage. Feathers make a conſiderable article of commerce. Thoſe from Somerſetſhire are eſteemed the beſt, and thoſe from Ireland the worſt. Eider is imported from Denmark, the ducks that ſupply it being inhabitants of Hudſon's bay, Greenland, and Norway. Our own Iſlands weſt of Scotland breed numbers of theſe birds, and might turn out a profitable branch of trade to the poor inhabitants. Hudſon's bay alſo furniſhes very fine feathers, ſuppoſed to be of the gooſe kind. The down of the ſwan is brought from Dantzic. The ſame place alſo ſends us great quantities of the feathers of the cock and hen. The London poulterers ſell a great quantity of the feathers of thoſe birds, and of ducks and turkies: thoſe of ducks being a weaker feather, are inferior to thoſe of the gooſe; and turkies feathers are the worſt of any. The beſt method of curing feathers is to lay them in a room, in an expoſure to the ſun: and when dried, to put them in bags, and beat them well with poles to get the dirt off.

Geeſe are plucked in ſome parts of Great Britain five times in the year; the firſt plucking is at Lady-day for feathers and quills; and the ſame is renewed for feathers only four times more between that and Michaelmas.

Feathers ſeem to be only productions and expanſions of the laſt extreme fibrillæ of the cutis; and hence, upon ſtripping off the cutis, the feathers are likewiſe always taken away; juſt as the leaves and fruit follow, upon peeling the bark of a tree: add, that feathers as well as hairs ariſe out of pores in the cutis: which pores are not merely apertures or foramina, but a kind of vaginulæ, wove of the fibres of the ſkin, which terminate in the oſcula or anaſtomoſes of the internal fibres of the feather.

Dr. Derham has ſeveral obſervations on the mechaniſm of the vanes or webs of the feathers as they preſent themſelves to the microſcope by which the wonderful care and accuracy of the Creator in ſo ſmall a part are excellently illuſtrated.

FEAZING, at ſea, is the ravelling out of the cable or any great rope at the ends.

FEBRIFUGE, an appellation given to ſuch medicines as mitigate or remove a fever.

FEBRUARY, in chronology, the ſecond month of the year, reckoning from January, firſt added to the calendar of Romulus by Numa Pompilius. February derives its name from *Februa*, a feaſt held by the Romans in this month, in behalf of the manes of the deceaſed: at which ceremony ſacrifices were performed, and the laſt offices were paid to the ſhades of the defunct. February, in a common year, conſiſts only of 28 days: but in the Biſſextile year, it has 29, on account of the intercalary day added that year.

FECULENT, or FÆCULENT, is applied to the blood and other humours, when they abound in fæces or dregs, or have not the proper and uſual degree of purity.

FECUNDITY, or FOECUNDITY, fertility, or that quality of a thing which denominates it fruitful. The fecundity of divers plants is very extraordinary. M. Dodart has an expreſs diſcourſe on this ſubject, in the Memoirs of the Academy of Science; wherein he ſhews, that at a moderate computation, an elm, one year with another, yields 329,000 grains or ſeeds, each of which, if properly lodged, would grow up into a tree: now an elm ordinarily lives 100 years, conſequently, in the courſe of its life it produces near 33,000,000 ſeeds, all which ariſe from one ſingle ſeed. He ſhews farther, that the ſame elm by frequently cutting off its head, &c. might be brought to produce 15,840,000,000 ſeeds, and conſequently, that there are ſo many actually contained in it.

FEE, FEUD, FEUDUM, FEODUM, or FIEF, an eſtate, land, tenement, lordſhip, or the like, held of a ſuperior lord, on condition of fealty, homage, or other acknowledgment. The term fee is properly applied to lands and tenements, which we hold in perpetual right, on condition of an acknowledgment of ſuperiority in a higher lord. See TENURE. The writers on this ſubject divide all lands and tenements wherein a man has a perpetual eſtate to him and his heirs into allodium and feudum.

Allodium is defined to be a man's own land, which he poſſeſſes merely in his own right, without acknowlegement of any ſervice or payment of any rent to another; and this is his property in the higheſt degree.

The origin of fees in England, Camden carries as far back as the time of Alexander Severus. That prince having built a wall in the North of England to prevent the incurſions of the Picts, he ſome time after began to neglect the defence thereof, and gave, as Lampridius, in Vita Alex. Severi, aſſures us, the lands conquered from the enemy to thoſe of his captains and ſoldiers, whom that author calls *limitarios duces, & milites*; i. e. captains and ſoldiers of the frontiers; but it was on this condition, that their heirs ſhould continue in the ſervice, and that the lands ſhould never deſcend to private perſons; i. e. to ſuch as did not bear arms. That prince's reaſon was, that people, who in ſerving defended their own, would ſerve with a great deal more zeal than any others. Such, according to Camden, was the riſe of fees in our nation, Britan. p. 651. However, the feudal polity originally derived from the northern nations, and gradually eſtabliſhed on the continent of Europe, was not univerſally received in England, though ſome traces of it may be diſcerned in the times of the Saxons, who were firmly ſettled in this iſland, as early as the year 600, and incorporated with the national conſtitution till the reign of William the Norman; and this was done not by the mere arbitrary will and power of the conquerory but by the univerſal conſent of the common council of the kingdom, in the ſame principle of ſelf-ſecurity which had before induced the other nations of Europe to adopt it. The æra of formally introducing the feudal tenures by law was probably the latter end of the year 1086, when the king was attended by all his nobility at Sarum, and all the principal land-holders ſubmitted their lands to the yoke of military tenure, became the king's vaſſals, and did homage and fealty to his perſon. This ingraftment of the feudal tenures and other cuſtoms of Normandy upon the ancient Saxon laws of Edward the Confeſſor produced a different political ſyſtem in this country, and changed both power and property in many reſpects; for thoſe hereditary eſtates of the Saxon nobility and gentry which were allodial, and not ſubject to any feudal ſervice, were converted into feuds, and other lands, which were of a feudal nature, and holden by military ſervice, having been granted only at will, or for a certain number of years, or at moſt for life or lives, and the grants of which were called benefices, were made hereditary fiefs. The feudal rights claimed in conſequence of this eſtabliſhment by the king over his tenants, and by them over theirs, were conſiderably mitigated by the charter of Henry II. See MAGNA *Charta*. Lord Littleton's Hiſt. of King Henry II. vol. i. p. 59. &c. vol. iii. p. 97, &c. Blackſtone's Comm. vol. ii. chap. 4.

It ſhould be obſerved, that our Engliſh lawyers do very rarely (of late years eſpecially) uſe the word fee in this its primary original ſenſe in contradiſtinction to allodium or abſolute property, but generally uſe it to expreſs the continuance or quantity of an eſtate; ſo that a fee in general ſignifies an eſtate of inheritance, being the higheſt and moſt extenſive intereſt that a man can have in a feud. Blackſtone's Comm. vol. ii. p. 106.

In the ſtat. 37 Hen. VIII. cap. 16. *fee* is alſo uſed for lands veſted in the crown; but it is from ignorance of the import of the word; for fee cannot be without fealty ſworn to a ſuperior; but the king owns fealty to no ſuperior but God alone. Fee is divided in our laws into *fee-abſolute*, called alſo *fee-ſimple*, and *fee-conditional*, alſo called *fee-tail*.

FEE *Simple*, *feudum ſimplex*, is that whereof we are ſeiſed to us and our heirs for ever. Or it denominates an abſolute inheritance, clear of any condition, limitation, or reſtriction to particular heirs, but deſcendible to the heirs general, whether male or female, lineal or collateral. It is a general rule, that the word *heirs* is neceſſary in the grant or donation, in order to make a fee or inheritance: but this rule does not extend to deviſes by will, nor to fines and recoveries conſidered as a ſpecies of conveyance, nor to creation of nobility by writ, though in creations by patent, the word *heirs* muſt be inſerted; nor to grants of lands to ſole corporations and their ſucceſſors; nor finally, to the caſe of the king, in whom a *fee-ſimple* will veſt, without the words heirs or ſucceſſors in the grant.

FEE *Tail*, *feutum taliatum*, is that whereof we are ſeiſed with limitation to us and the heirs of our body. *Fee-tail* is of two kinds, *general* and *ſpecial*. *Fee-tail general*, is where lands and tenements are given to a man and the heirs of his body begotten. So that if a man ſeiſed of ſuch land by ſuch gift may marry one or more wives, and have no iſſue by them, and at length marry another, by whom he hath iſſue, this iſſue ſhall inherit the land. *Fee tail ſpecial*, is where a man and his wife are ſeiſed of lands to them and the heirs of their two bodies; where, in caſe the wife die without iſſue, and he marry another by whom he have iſſue, this iſſue cannot inherit the land, and therefore it is called ſpecial tail. This *fee-tail ſpecial* has its origin from the ſtat. in Weſtm. 2. 13 Edw. I. cap. 1. Before that ſtatute, all land given to a man and his heirs, either general or ſpecial, was reputed in the nature of a fee; and therefore ſo firmly held to him, that, any limitation notwithſtanding, he might alienate it at pleaſure: for redreſs of which inconvenience the ſtatute provides, that if a man gives lands in fee, limiting the heirs to whom it ſhall deſcend, with a reverſion to himſelf and his heirs for default of ſuch former heirs, the form and meaning of the gift ſhall be obſerved.

Fee alſo ſignifies a reward or ordinary due given a perſon for the execution of his office, or the performance of his part in his reſpective art or ſcience. Thus, the lawyer, barriſter, and phyſician, are ſaid to have their fees; i. e. conſiderations for the pains taken with the client or patient. If a perſon refuſe to pay an officer his due fees, the court will grant an attachment againſt him, to be committed till the fees are paid: and an attorney may bring an action of the caſe for his fees againſt the client that retained him in his cauſe. Fees alſo denote ſettled perquiſites or allowances paid to public officers by perſons who have buſineſs with them.

FEELERS, antennæ, in natural hiſtory, are the horns, as they are uſually called, upon the heads of inſects. See Syſtem of Entomology. Scientific Deſcription.

FEELING, touching, one of the external ſenſes, whereby we acquire the ideas of ſolid, hard, ſoft, rough, hot, cold, wet, dry, or other tangible qualities; as alſo of diſtance, itching, pain, &c. Feeling is the groſſeſt, but at the ſame time the moſt extenſive of our ſenſes, having more objects than all the reſt taken together: and ſome even reduce all the other ſenſes to this one of feeling.

Some naturaliſts will have it in all the parts that have nervous fibres, which extends it to the ſkin, fleſh, muſcles, membranes, and parenchymas; others reſtrain it to the ſkin or cutis; it being obſerved, that only thoſe parts covered with a cutis have properly the faculty of touching, or perceiving tangible qualities. But what part of the cutis to aſſign immediately for this office is again diſputed. Some will have it the membranous parts; others the carnous; and others the medullary part, derived from the nerves. Malpighi, and after him all our lateſt and beſt authors, hold the immediate organ of the ſenſe of feeling to be the pyramidal papillæ under the ſkin.

Theſe papillæ are little, ſoft, medullary, nervous prominences, lodged every where immediately under the cuticula. They are formed of the ſubcutaneous nerves, which, for this purpoſe, firſt lay aſide their outer membrane, and are left exceedingly ſoft and ſenſible; are continually moiſtened by a thin ſubtle humor, and only covered over and defended by the cuticle or ſcarf- ſkin.

Feeling, then, is thus affected: the tip of the finger for inſtance, being applied to an object to be examined, by that intention of the mind the papillæ are emitted or elevated, and being lightly rubbed over the ſurface of the object, a motion is impreſſed on them, which being thence propagated by the nerves communicating with them to the common ſenſory, excites the perception of heat, cold, hardneſs, or the like. Hence we ſee why feeling becomes painful when the cuticle is worn off, burn, macerated, &c. and why, when the cuticle becomes thick, hard, callous, or cicatrized, &c. the ſenſe of feeling is loſt; elſe whence the numbneſs impreſſed by the torpedo? why that exquiſite painfulneſs under and at the roots of the nails? &c.

FEINT, in fencing, a falſe attack, or a ſhew of making a ſtroke or puſh in one part, with deſign to bring the enemy to guard that part, and leave ſome other part unguarded where the ſtroke is really intended. Feints are either ſingle or double, high or low, without or within, &c. in prime, in tierce, in quart, in demi, and in the whole circle; of one, two, or three meaſures. The ſimple feint is a mere motion of the wriſt, without ſtirring the foot, &c. See Treatiſe on the Art of Fencing.

FELIS, the cat, a genus of quadrupeds belonging to the order of feræ, the characters of which are theſe: the fore-teeth are equal: the molares or grinders have three points: the tongue is furniſhed with rough ſharp prickles, and pointing backwards; and the claws are ſheathed, and retractile. This genus comprehends ſeven genera, viz. The *leo*, or loin. The largeſt lions are from eight to nine feet in length, and from four to ſix feet high: thoſe of a ſmaller ſize are generally about 5½ feet long, and about 3½ high. A lion taken young, and brought up among domeſtic animals, will eaſily be accuſtomed to live and ſport with them: that he is mild and careſſing to his maſter, eſpecially when he is young, and that, if his natural ferocity ſometimes breaks out, it is rarely turned againſt thoſe who have been kind to him. But, as his paſſions are impetuous and vehement, it is not to be expected that the impreſſions of education will at all times be ſufficient to balance them; for this reaſon it is dangerous to let him ſuffer hunger long, or to vex him by ill-timed teazings; bad treatment not only irritates him, but he remembers it long, and meditates revenge. On the other hand, he is exceedingly grateful, and ſeldom forgets benefits received. He has been often obſerved to diſdain weak or inſignificant enemies, to deſpiſe their inſults, and to pardon their offenſive liberties. When led into captivity, he will diſcover ſymptoms of uneaſineſs, without anger or peeviſhneſs: on the contrary, his natural temper ſoftens, he obeys his maſter, careſſes the hand that gives him food, and ſometimes gives life to ſuch animals as are thrown to him alive for prey: by this act of generoſity he ſeems to conſider himſelf as for ever bound to protect them: he lives peaceably with them; allows them a part, and ſometimes the whole, of his food; and will rather ſubmit to the pangs of hunger, than fill his ſtomach with the fruit of his beneficence. We may likewiſe obſerve, that the lion is not a cruel animal; he kills rather from neceſſity than choice, never deſtroying more than he eats; and whenever his appetite is ſatisfied, he is mild and peaceable.

The aſpect of the lion does not detract from the noble and generous qualities of his mind. His figure is reſpectable; his looks are determined; his gate is ſtately; and his voice is tremendous. In a word, the body of the lion appears to be the beſt model of ſtrength joined to agility. The force of his muſcles is expreſſed by his prodigious leaps and bounds, often 20 feet at once; by the briſk motion of his tail, a ſingle ſweep of which is ſufficient to throw a man to the ground; by the eaſe with which he moves the ſkin of his face, and particularly of his forehead; and, laſtly, by the faculty of erecting and agitating the hair of his main when irritated.

Lions are very ardent in their amours; when the female is in ſeaſon, ſhe is often followed by eight or ten males, who roar inceſſantly, and enter into furious engagements, till one of them completely overcomes the reſt, takes peaceable poſſeſſion of the female, and carries her off to ſome ſecret receſs. The lioneſs brings forth her young in the ſpring, and produces but once every year.

All the paſſions of the lion, the ſoft paſſion of love not accepted, are exceſſive; the love of offspring is extreme: the lioneſs is naturally weaker, leſs bold, and more gentle than the lion; but ſhe becomes perfectly rapacious and terrible when ſhe has young. Then ſhe exhibits more courage than the male; ſhe regards no danger; ſhe attacks indifferently men and all other animals, kills them, and carries them to her young ones, whom ſhe thus early inſtructs to ſuck their blood and tear their fleſh. She generally brings forth in the moſt ſecret and inacceſſible places: and, when afraid of a diſcovery, ſhe endeavours to conceal the traces of her feet, by returning frequently on her ſteps, or rather by effacing them with her tail; and, when the danger is great, ſhe carries off her young, and conceals them ſomewhere elſe. But, when an actual attempt is made to deprive her of her young, ſhe becomes perfectly furious, and defends them till ſhe be torn to pieces.

The lion ſeldom goes abroad in the middle of the day; he goes in the evening and night, in queſt of prey. He is afraid of fire, and never approaches the artificial fires made by the ſhepperds for the protection of their flocks; he does not trace other animals by the ſcent, but is obliged to truſt to his eyes. Many hiſtorians have even miſrepreſented him as incapable of finding out his prey; but that he is obliged to the jackal, an animal of exquiſite ſcent, in order to provide for him, and that this animal either accompanies or goes before him for this purpoſe. The jackal is a native of Arabia, Libya, &c. and, like the lion, lives upon prey: perhaps ſometimes he follows the lion, but it is with a view to pick up what he leaves behind, not to provide for him; for, being a ſmall and feeble animal, he ought rather to fly from than to ſerve the lion.

The lion, when hungry, will attack any animal that preſents itſelf: but he is ſo very formidable, that all endeavour to avoid his rencounter; this circumſtance often obliges him to conceal himſelf, and lie in wait till ſome animal chances to paſs. He lies ſquat on his belly in a thicket; from which he ſprings with ſuch force and velocity, that he often ſeizes them at the firſt bound. He endures hunger longer than thirſt; he ſeldom paſſes water without drinking, which he does by lapping like a dog. For his ordinary ſubſiſtance, he requires about 15 pounds of raw fleſh each each day. They put a live animal above a deep pit covered with light ſubſtances, and thus decoy him into the ſnare.

The tiger is more ferocious, cruel, and ſavage than the lion. Although gorged with carnage, his thirſt for blood is not appeaſed; he ſeizes and tears in pieces a new prey with equal fury and rapacity, the very moment after devouring a former one; he lays waſte the country he inhabits; he neither dreads the aſpect nor the weapons of men; puts to death whole troops of domeſtic animals; and attacks young elephants, rhinoceros, and ſometimes even braves the lion himſelf. The tiger ſeems to have no other inſtinct but a conſtant thirſt after blood, a blind fury which knows no bounds or diſtinction, and which often ſtimulates him to devour his own young, and to tear the mother in pieces for endeavouring to defend them. He lies in wait on the banks of rivers, &c. where the heat of the climate obliges other animals to repair for drink. Here he ſeizes his prey, or rather multiplies his maſſacres; for he no ſooner kills one animal, than he flies with equal fury upon the next, with no other view but to plunge in his head into their bodies and drink their blood. However, when he kills a large animal, as a horſe or a buffalo, he ſometimes does not tear out the entrails on the ſpot; but, to prevent any interruption, he drags them off to the wood, which he performs with incredible ſwiftneſs. This is a ſufficient ſpecimen of the ſtrength of this rapacious animal.

Neither force, reſtraint, nor violence, can tame the tiger. He is equally irritated with good as with bad treatment: he tears the hand which nouriſhes him with equal fury as that which adminiſters blows: he roars and his enraged at the ſight of every living creature. Almoſt every natural hiſtorian agrees in this horrible character. The Pardus, or Panther, is about the ſize of a large dog, and has a great reſemblance to a domeſtic cat. The tongue is rough, and remarkably red; the teeth are ſtrong and ſharp; the ſkin is exceedingly beautiful, being of a yellow colour, variegated with roundiſh black ſpots, and the hair is ſhort.

The panther inhabits Africa, from Barbary to the remoteſt parts of Guinea. It has a cruel and ferocious aſpect; his motions are briſk and lively. He is not ſo perfectly ungovernable as the tiger; but, notwithſtanding all attempts to render him obedient and tractable, he may rather be ſaid to be ſubdued than tamed; for he never entirely loſes his natural ferocity. The panther, according to Buffon, is no where to be found but in Africa, and the regions of the Indies.

The onca, or once, is leſs than the panther; the tail is longer; the hair is likewiſe longer, and of a whitiſh grey colour. The once is eaſily tamed; he lies in wait for the approach of animals, and then darts upon them unawares. He leaps ſo nimbly, that he eaſily clears a ditch or a wall ſeveral feet high; beſides, he often climbs trees, waits till ſome animal paſſes, and inſtantly leaps upon them. This method of catching their prey, is practiſed by the panther and leopard, as well as by the once. The once inhabits Barbary, Perſia, Hyrcania, and China; from which laſt place the ſkins are brought into Ruſſia, and ſold for 20s. a piece.

The pardalis, or leopard, differs from the panther and the once, in the beauty of his colour, which is a lively yellow, with ſmaller ſpots than thoſe of the two latter, and diſpoſed in groups. He is larger than the once, and leſs than the panther. The leopard inhabits the Eaſt Indies; one kept ſome years ago in the Tower, ſeemed a good natured animal.

The lynx is about 2½ feet long and 15 inches high. He has a great reſemblance to the cat; but his ears are longer, and his tail is much ſhorter; his hair is ſtreaked with yellow, white, and black colours. The lynx is an inhabitant of Muſcovy, Poland, Canada, &c. His eyes are brilliant, his aſpect is ſoft, and his air is gay and ſprightly: like the cat, he covers his urine with earth; he howls ſomething like the wolf, and is heard at a conſiderable diſtance; he does not run like the dog or wolf, but walks and leaps like a cat, he purſues his prey even to the tops of the trees; neither wild cats nor ſquirrels can eſcape him; he lies in wait for ſtags, goats, hares, &c. and darts ſuddenly upon them.

The Catus, or cat, wild, and domeſtic. The cat in its ſavage ſtate is three or four times as large as the houſe cat; the head larger, and the face flatter. The teeth and claws are tremendous: its muſcles very ſtrong, as being formed for rapine: the tail is of a moderate length, but very thick, marked with alternate bars of black and white, the end always black: the hips and hind part of the lower joints of the leg, are always black: the fur is very ſoft and fine. The general colour of theſe animals is of a yellowiſh white, mixed with a deep grey: theſe colours, though they appear at firſt ſight confuſedly blended together, yet on a cloſe inſpection will be found to be diſpoſed like the ſtreaks on the ſkin of the tiger, pointing from the back downwards, riſing from a black liſt that runs from the head along the middle of the back to the tail. The tame or domeſtic cat is ſo well known, that it does not require deſcription.

The cat is found in almoſt every country in the world; and all the varieties in their appearance may be reaſonably enough attributed to the climates which produce them. The cat of Angora, is a variety with long hair, of a ſilvery whiteneſs, and ſilky texture; very long, eſpecially about the neck, where it forms a fine ruff: the hair on the tail very long and ſpreading: it is a large variety, found about Angora, the ſame country which produces the fine haired goat. It degenerates after the firſt generation in this climate.

FELLING *of Timber*. Many circumſtances are well known and conſtantly obſerved in the felling of timber for building, which, though to a haſty obſerver they might appear trifling, yet prove, on experience, to be of the utmoſt conſequence. One thing obſerved by Mr. De Buffon, which very greatly increaſes the ſolidity and ſtrength of timber, is, that the trees intended to be felled for ſervice ſhould firſt be ſtripped of their bark, and ſuffered to ſtand and die upon the ſpot before the cutting. The ſappy part or blea of the oak, becomes by this means as hard and firm as the heart; and the real ſtrength and denſity of the wood has been proved, by many experiments, to be greatly increaſed by it: nor is this a practice of any detriment to the proprietor, ſince the remaining ſtumps of theſe trees ſend up their young ſhoots as vigorouſly as if they had been cut down in their natural condition.

When any tree is to be cut down for timber, the firſt thing to be taken care of is a ſkilful diſbranching of ſuch limbs as may endanger in its fall; many trees are utterly ſpoiled for want of a previous care of this kind. In arms of timber that are very great, it is always neceſſary to chope or ſink in them cloſe to the bole, and then, meeting it with downright ſtrokes, it will be ſevered from the tree without ſplitting. In felling the tree, take care always to cut it as cloſe to the ground as poſſible, unleſs it is intended to be grubbed up: and the doing that is of advantage both to the timber, and to the wood; for timber is never ſo much valued, if it be known to grow of old ſtocks.

FELLOWSHIP, *Company*, or *Partnerſhip*, in arithmetic, is a rule of great uſe in balancing accounts amongſt merchants, and owners of ſhips; where a number of perſons putting together a general ſtock, it is required to give every one his proportional ſhare of loſs, or gain. See Syſtem of ARITMETIC, Article XIV.

FELO *de ſe*, is he that commits felony, by willingly and deliberately killing himſelf. See SELF-*Murder*.

FELONY, in common law, any capital offence, perpetrated with an evil intention. Though capital puniſhment does by no means enter into the true idea and definition of felony, the true criterion of which is forfeiture; for in all felonies which are puniſhable with death, the offender loſes all his lands in fee-ſimple, and alſo all his goods and chattels; but in ſuch as are not ſo puniſhable, his goods and chattels only. In a ſtricter ſenſe, felony denotes all capital crimes below treaſon. Felony includes ſeveral ſpecies of crimes, whoſe puniſhment is the ſame, viz. death; ſuch as petit-treaſon, murder, theft, homicide, ſodomy, rape, wilful burning of houſes, receiving of ſtolen goods; breach of priſon, reſcue and eſcape, after one is arreſted or impriſoned for felony, and divers others found in the ſtatutes, which are daily making crimes felony, that were not ſo before. Felony by the common law is againſt the life of a man, as murder, manſlaughter, felo de ſe, ſe defendendo, &c. againſt a man's goods, ſuch as larceny and robbery; againſt his habitation, as arſon and burglary; and againſt public juſtice, or breach of priſon. Piracy, robbery, or murder upon the ſeas, are felonies puniſhable by the civil law, and alſo by ſtatute.

Felony is eaſily diſtinguiſhed from treaſon. From leſſer crimes it is diſtinguiſhed by this, that its puniſhment is death, though not univerſally; for petty-larceny, i. e. ſtealing of a thing under the value of twelve-pence, is felony, according to Brook, though the crime be not capital, but only a loſs of goods. The reaſon Brook gives for its being felony is that the indictment runs, *felonice capit.*

FELT, a kind of ſtuff, either of wool alone, or of wool and hair; neither ſpun, croſſed, nor woven, but deriving all its conſiſtence from its being wrought, and fulled with lees and ſize, and afterwards faſhioned on a block or mould, by help of fire and water. Caſtors, camels, and coneys hair, lambs, and ſheeps wool, &c. are the moſt uſual ingredients of felts; and hats of all kinds are the works they are chiefly employed in. The felt intended for a hat, being ſufficiently fulled, and prepared, is reduced into one piece, ſomewhat in the figure of a large funnel; in which ſtate it remains ready to be put into form, and become a hat.

FEMALE, FÆMINA, a term peculiar to animals, ſignifying that ſex which conceives and generates its young within itſelf. See SEX and GENERATION.

FEMALE is alſo applied, figuratively, to things without life, from the reſemblance they bear to the females of animals. Thus we ſay: *Female-ſcrew*, *female-flower*, *female-plant*.

FEMININE, or FOEMININE, in grammar, one of the genders of nouns. The feminine gender is that which denotes the noun or name to belong to a female. In the Latin, the *feminine* gender is formed of the maſculine, by altering its termination, particularly by changing *us* into *a*. Thus, of the maſculine *bonus equus*, *a good horſe*, is formed the *feminine*, *bona equa*, *a good mare*; ſo, of *parvus homo*, *a little man*, is formed *parva fæmina*, *a little woman*, &c. In French the *feminine* gender is expreſſed, not by a different termination, but a different article: thus, *le* is joined to a male, and *la* to a female.

In Engliſh, we are generally more ſtrict, and expreſs the difference of ſex, not by different terminations, nor by different particles, but different words; as *boar* and *ſow*, *boy* and *girl*, *brother* and *ſiſter*, &c. though ſometimes the *feminine* is formed by varying the termination of the male into *eſs*; as in *abbot*, *abbeſs*, &c.

FEMME *Covert*, in law, a married woman. See COVERTURE.

FEMME *Sole*, an unmarried woman, whoſe debts, contracted before marriage, become thoſe of her huſband after it. A femme ſole merchant, is where a woman, in London, ſues a trade alone, without her huſband; on which account ſhe ſhall be charged without him.

FEMUR, or OS FEMORIS, in anatomy the thigh-bone. See Syſtem of ANATOMY, for deſcription Part II. for repreſentation ſee Plate of OSTEOLOGY *Fig.* 1. letter *a*.

FEN, a kind of wet land, or rather moraſs. Fens are of two ſorts: the firſt of a boggy conſiſtence, compoſed of water and earth intermixed; ſcarce firm enough to ſuſtain the tread of a man. See DRAINING, Sect. XIX. Syſtem of *Agriculture*.

FENCE, in agriculture, is a hedge, ditch, walk, or bank, made round fields, woods, gardens, &c.

FENCING, the art of making a proper uſe of the ſword; as well for attacking the enemy as for ſelf-defence.

TREATISE ON THE ART OF FENCING.

WHEN the Goths had introduced the cuſtom of ſingle combat, the art of defence became a neceſſary ſtudy: it was confined to certain rules, and academies were inſtituted to train up youth in the practice of them. Of late years it has been highly eſteemed throughout Europe; and to ſuch a degree of eminence has it attained in the Eaſt Indies, that Pyrard aſſures us none but princes and noblemen are allowed to teach it. They wear a badge of cognizance on their right arms, called in their language *eſaru*; which is put on with great ceremony, like the badges of our orders of knighthood, by the kings themſelves. This accompliſhment is now in higher repute in England than ever; where it is univerſally admitted an eſſential part of polite education, and a generous ardour prevails amongſt the youth of the higheſt rank, to excel in the cultivation of it.

Notwithſtanding the prejudices which ſome have imbibed againſt it, liberal minds can never view it in a diſadvantageous light, but on the contrary, when the many advantages to be derived from it are duly conſidered, muſt eſteem the theory and practice of it objects worthy their purſuit. It produces an eaſy and graceful deportment, a bold and martial air; and inſpires a manly confidence and animation. Every exerciſe in general has it's advantages, and concurs in accompliſhing one general effect. But none can give elegance and freedom in a greater degree than that of fencing, becauſe in it every part of the body is continually in action, and to crown all, it brings and confirms health, the moſt invaluable bleſſing of life. It alſo enables thoſe who practice it to purſue other exerciſes with greater facility. Though the cuſtom of deciding points of honour is not ſo frequent in this country, as in moſt foreign parts, men of faſhion, ſoldiers, and travellers of every denomination, find many advantages from the cultivation and acquiſition of this art, particularly in foreign countries, where the horrid practices of aſſaſſination are frequently committed. In fine, it has, among many others, two inſeparable qualities, the agreeable and the uſeful; the former, as it affords gentlemen a manly and diſtinguiſhed amuſement: the latter, as it forms their body, and furniſhes them with the faculty of defence, whether it be of their honour or their life, when the one or the other is brought into queſtion by any diſagreeable accident, or attacked by thoſe turbulent and dangerous perſons, whoſe correction is of ſervice to ſociety in general.

Mr. M'Arthur, author of a Treatiſe on the Theory and Practice of Fencing, regrets that a method is not adopted in our royal navy (to which that gentleman belongs) of exerciſing the ſhip's company of frigates, and ſuch ſmall veſſels of war as are liable to be boarded with ſimple Fencing, in the ſtile of broad-ſword play; as it would be of the utmoſt utility in the offenſive and defenſive attacks of boarding. He adds, that this might eaſily be accompliſhed by making it a branch of the duties of a maſter at arms, qualified to exerciſe the crew, or ſuch of them as might be allotted for boarding, in the rudiments of the art, and from the ſpirit of emulation prevailing among them, they would ſoon make themſelves proficients by a little practice.

To acquire a proficiency in any art or ſcience, a competent knowledge of theory muſt be judiciouſly applied to practice. Hence a theory, founded on juſt principles, digeſted and combined by practical experience, is neceſſary to the attainment of the art of fencing, as well as every other military art and ſcience.

In forming this Treatiſe, we have in general adopted the plan of Mr. Angelo from the reputation he has ſo juſtly acquired in the art, to which the French Encyclopædia bears teſtimony in the following words, under the article ESCRIME (*Fencing*).

"This article is entirely taken out of a Treatiſe publiſhed in
" London, by Mr. ANGELO; we are indebted to him both for
" the diſcourſes and plates. Had we known of any work more
" perfect in it's kind, we ſhould have made uſe of it."

Since the publication of Mr. Angelo's work, Mr. Olivier has introduced a new treatiſe on the ſubject, in which he has pointed out ſeveral novel remarks to ſimplify the practice of the Art: we have therefore made ſuch extracts from Mr. Olivier, as we preſume will conduce to render the Treatiſe more compleat.

How to hold the Sword.

Mr. Olivier obſerves, that in order to hold the ſword well, the hilt muſt be flat in the hand, the thumb ſtretched at an inch from the ſhell, the pummel under the wriſt. The ſword ſhould never be kept faſt in the hand but to parry or thruſt. For if it is always held with ſtrength, the muſcle of the thumb will ſoon grow ſtiff.

Method and effectual Means to render a Fencer active and firm on his Legs, and to ſhew him how to recover after the Delivery of a Thruſt, either Carte, or Tierce.

You ought to practice not only to make your thruſts with great quickneſs and vivacity, but alſo to deliver them with an elaſtic diſengagement and diſpoſition; and the motion of the body ſhould appear like divers ſprings throughout the whole frame. It is very eſſential to recover from your thruſts in the ſame lively manner, to enable you to parry in caſe of a return, or repoſte. To this effect, as ſoon as the ſcholar is able to thruſt with firmneſs of body and legs, inſtead of coming to his regular guard, he muſt carry his right foot to the left, and alſo the left to the right; and, in order that the ſcholar execute this well, the fencing maſter is to give his aſſiſtance for that purpoſe, till he is able to execute the ſame with eaſe himſelf. The carte ſhould be thruſt without the aſſiſtance of the plaſtroon, and, inſtead of recovering to your natural guard, you ſhould, with great agility and eaſe, carry the point of your right foot to your left heel, keeping your body erect, the head alſo, and the knees ſtrait. The ſecond motion is the moſt difficult: you muſt, after having made your thruſt in tierce, inſtead of the uſual recovery to your guard, carry the point of your left foot before the right, your left heel to your right toe. This ſhould be done with great eaſe and lightneſs, to bring you immediately on your legs: and it will enable you to come to a guard, by carrying the right foot forward, or the left foot back. You muſt obſerve, in either of theſe laſt motions, to move but one leg. The maſter, in order to aſſiſt his ſcholar when he is on the longe, ſhould keep up his right, with his left hand, till he brings him to a firm poſition of body and legs; this will facilitate his recovery to a guard with eaſe and quickneſs, and will diſpoſe him to the motions of the paſſes which are to be made, and of which we ſhall hereafter give an explanation. The beat on the ſword is done by engaging the blade either in tierce or in carte, or carte over the arm; you muſt leave the blade about four inches, and beat on it in a ſmart and lively manner, and thruſt firm, and ſtrait to the body. The appel, or attack, is made by raiſing the foot above two inches from the ground, ſetting it ſmartly down again, and thurſting directly at the body. The ſliding, or glizade, on the blade, is done by firmly engaging the ſword, bending the elbow, and raiſing the point, to gain the adverſary's feeble; bringing your wriſt about a foot forward, to put by his point, by a preſs on his blade, and a thruſt firm and ſtrait to the body. The ſimple diſengage is done when you are engaged in tierce or carte, by quitting the blade to the reverſe ſide, without touching it, and thruſting ſtrait to the body. The diſengage with the beat of the foot is done at once, and the ſame time you diſengage you muſt join the blade of the adverſary, make your attack, and thruſt ſtrait forward to the body. You muſt obſerve that theſe three different motions, viz. the diſengage, the attack, and the thruſt, ſhould be executed as quick as you may ſay—one, two.

The Salute in Fencing.

The ſalute is an uſage eſtabliſhed in all the fencing ſchools, in order to preſerve the politeneſs that we owe to one another. When you have drawn your ſword, put yourſelf in guard on tierce. Make two appels with the right foot. Bring your left hand to your hat and take it off with a grace. Afterwards paſs your right foot behind the left as far as the buckle; raiſe your right hand above the head, ſtretching your arm and turning the nails well upward. Let the hand that holds the hat be ſtretched along the flank, at the ſame time you paſs your foot and raiſe the right hand. Make two other appels with the right foot. Bring your left foot again by the buckle of the right, covering your head directly, put yourſelf on your firſt guard. Let all theſe motions be well joined to one another, and be made with grace, nobleneſs, and eaſe. The ſalute before you puſh tierce and carte (or to thruſt at the wall) is moſt uſed; for you muſt never fence with any one without doing it. Being in guard on the outſide, make a round with the wriſt, preſenting your body uncovered to your adverſary; then make him the compliment of thruſting firſt at you. If you are to puſh firſt, longe out as if you were to thruſt carte, preſenting the point of your foil at a little diſtance from your antagoniſt's body. Afterwards recover, bringing the right heel by the other, both hams well ſtretched; and ſalute in carte and in tierce, as aforeſaid, and then forming a ſmall circle with the wriſt, put yourſelf on guard.

Of the Simple Parades.

Each thruſt hath its parry, and each parry its return. To be a good fencer, it will not be ſufficient to ſtand gracefully on your guard, nor even to thruſt with great ſwiftneſs and exactneſs; the chief point is to be well ſkilled in the defenſive part, and to know how to parry all the thruſts that ſhall be attempted to be made at you. When you are compleat in the defenſive part, you will ſoon be able to tire your adverſary, and often find an opening to plant a thruſt. You ſhould apply yourſelf to make your parades cloſe, and firm in the line, by holding your ſword light, from the gripe to the point. The body ſhould be profile, or ſingled out to the left ſide: and the wriſt and the elbow ſhould be the chief actors.

Poſition for the Guard in Carte.

In order to acquire this poſition, the left knee muſt be bent, and at two feet diſtance from the right; the left heel in a ſtraight line with the right heel, and the point of the foot perpendicular to the knee: you muſt obſerve that the bend on the left ſide ſhould not in the leaſt take off from that eaſe with which the body ought to be ſupported; and, to render yourſelf firm, bend the right knee a little, but not too much, for, if it is too much bent, the body might fall forward, and if not bent at all, neither the thigh, nor the leg, would be flexible, and you would, conſequently, not have ſufficient elaſticity nor ſtrength to longe, nor agility to advance or retire. The Guard in carte is the moſt advantageous, and the moſt elegant poſition in Fencing.

To get within, or without Diſtance.

In order to come to our former poſition of the guard, it is very neceſſary to know what is meant by diſtance. To get within diſtance, is called advancing on the adverſary, when he is at too great a diſtance from the point of your ſword; to be without diſtance, is to retire when your adverſary's point is too near. To get within diſtance, of your adverſary without altering the regular poſition of your Guard, you muſt raiſe your right foot juſt above the ground, and carry it about a foot forward, in a ſtrait line with your left heel, bending your knee a little, and at the ſetting down of the foot, you muſt follow with the left leg in the ſame manner and diſtance keeping your left leg well bent, to ſupport the body entirely on that ſide. To get out of diſtance you muſt retire with the left foot, and follow regularly with the right foot, keeping always two feet diſtance (more or leſs according to your ſize) from one heel to another: you muſt be very cautious not to loſe your perpendicular poſition of body and guard, elſe, by the diſorder which your adverſary could cauſe in your legs, the body would no more be firm, neither would the wriſt be able to execute with advantage when occaſion ſhould require it.

Poſition for the Guard in Tierce.

To execute the tierce (as before mentioned) your nails muſt be downward, and engaging your adverſary's ſword, touch his blade; you muſt engage your point from inſide to outſide, by changing the poſition of your wriſt; ſo that when your wriſt is turned in carte, on the inſide of your adverſary's blade, you muſt, by a motion of the wriſt, drop your point cloſe to his blade, turning your nails downwards; which is diſengaging from carte to tierce. Being in tierce, you muſt likewiſe drop your point, turning your wriſt with your nails upward, and cloſe your adverſary's blade; which is diſengaging from tierce to carte. You muſt make frequent diſengagements in this manner, in a firm poſition, till your adverſary retires, at which time you muſt diſengage, and advancing, cloſe his blade, with your point in a line to his body, always ſteady on your guard. When you have thus diſengaged, and advanced on your adverſary, in theſe two poſitions, you muſt retire, and every time he diſengages, you muſt turn your wriſt on the ſide you are engaged; this will teach you to compleat your parades, in which the wriſt is only to act: you muſt always oppoſe your adverſary's ſword ſufficiently to cover the ſide he attacks, and you muſt nevertheleſs obſerve, that, when you cover one ſide, you do not uncover the other ſide or the lower parts.

Poſition for the Inſide Guard called Carte, and the Inſide Thruſt, called the Thruſt in Carte. Figure 1. Plate I.

To execute this thruſt well, three motions of the wriſt are to be made at once; which are, to turn the wriſt and nails upward, raiſe the wriſt, and oppoſe; and in theſe motions the arm ſhould be ſtraitened, and the wriſt raiſed above the head, and the point dropt in a line to the adverſary's breaſt; being thus ſituated, you muſt throw your wriſt forward, ſtepping immediately, or longe about two feet beyond your guard; the left heel, and knee, ſhould be in a perpendicular line, the point of the foot in a line to the knee, and the right heel in a line to the left; the left foot ſhould be plumb to the ground, and not move, heel or toe. And obſerve, that when the arm ſtretches forth in order to thruſt, the foot muſt follow at the ſame time; the body ſhould be very upright, the left leg ſtretched, and the left hand ſhould hang down in a line with the left thigh, about one foot diſtance, with the hand open, nails downward, and fingers cloſe. Obſerve well, that the body be firm, the head kept up, the left ſide from the hip well turned in, the ſhoulder eaſy, and the wriſt oppoſed to the ſword; that the pummel be directed in a line with your left temple, to prevent a counter thruſt from the adverſary's inſide, which will certainly happen without this oppoſition. The thruſt being made, the recovery to the guard muſt immediately follow, with the ſword in a ſtrait line with the adverſary's body. You cannot practice this thruſt too much, it being the moſt eſſential and the moſt ſhining one that is made in fencing.

Poſition for the outſide Guard called Tierce, and the Thruſt in Tierce. Figure 13. Plate II.

To deliver this thruſt, your wriſt muſt be turned with the nails downward, aud in the ſame height as in carte; the head muſt be covered by the oppoſition of the wriſt, though not in a line with the face; the inſide of the arm in a line with the right temple, the left arm to fall down about a foot from the thigh, the nails upward. Obſerve, that at all times when the right arm is turned with your nails down, that the left ſhould be the ſame, and at the ſame diſtance from the thigh as in carte.

Poſition for the outſide Guard, called Tierce, and the Thruſt on the ſame Side, with the Wriſt reverſed in Carte, called Carte over the Arm. Figure 2. Plate I.

This thruſt muſt be delivered on the outſide of the adverſary's ſword, with the nails upwards as in carte, but in the tierce line, plunging the point to the adverſary's body; the wriſt ſhould be ſtrait, neither inclined to the outſide or the inſide, but raiſed, that the wriſt and pummel may come in a line with your right temple, the thumb and nails, and the flat of your blade in one line, and the other parts in the ſame poſition as in the thruſt in carte.

Poſition of the Outſide Guard called Tierce, and the Thruſt from the Outſide under the Wriſt, called Seconde. Figure 3. Plate I.

This thruſt doth not differ from the tierce; but, becauſe it is delivered under the wriſt quite along the elbow, therefore the adverſary's ſword ſhould be engaged in tierce, dropping the point with the wriſt in tierce, directing it between the adverſary's arm-pit and his right breaſt; here the body ſhould be more bent forward, than what is mentioned in the former thruſts.

Poſition of the Inſide Guard called Carte, and of the Thruſt under the Wriſt on the ſame Side, called Low Carte. Figure 14. Plate II.

To deliver this thruſt well, you muſt engage the adverſary's ſword in carte, dropping your point under his wriſt, in a line to his elbow, and in thruſting, not only fix your point in his flank, but ſtrait traverſe the line about a foot outward, without turning the foot to the right or to the left: forming an angle from the wriſt to the blade, the body as much bent as in the thruſt called Seconde, and the hand as much raiſed as in the carte thruſt: by this manner the oppoſition will be formed to cover the body and the face.

Poſition of the Inſide Carte, called Carte, and the Thruſt given on the outſide Flank, called Flanconade. Figure 4. Plate I.

To execute this thruſt well, the ſword of the adverſary muſt be engaged in carte, the point fixed in the flank of the adverſary, and, binding his blade, carried behind his wriſt, under his elbow. In this operation you muſt gain his feeble, and, without quitting his blade, plunge your point under his elbow to his flank, your wriſt turned nails upward, forming an angle from the wriſt to the point. In the execution of your thruſt, obſerve alſo, that the left hand ſhould drop under the right, and that too, form an angle, from the left elbow to the wriſt, with your hand open, to prevent being hit on the parade of this thruſt, by the adverſary's turning his wriſt in tierce, and by thus reverſing his edge he would throw the point on you. In the defenſive part of this parade we ſhall explain this oppoſition.

Of the Inſide Parade, called Carte, and the Thruſt in Carte. Figure 5. Plate I.

This parade of carte within the blade, is made by a dry beat on the adverſary's blade, with the fort of your blade, and your inſide edge. You muſt throw your body back in a ſtrait line with his, and let your oppoſition to his blade be about four inches wide to the left; your arm ſhould be a little contracted, and the moment you have parried preſent your point firm in a line to his breaſt, to enable you to make a return, or repoſte, quickly.

Of the Outſide Parade, called Tierce, and the Tierce Thruſt, called the Outſide Thruſt. Figure 6. Plate I.

This outſide thruſt, called tierce, is parried by the inſide edge, and the turning of the wriſt to an outſide with a ſtretched arm, oppoſing the blade with the wriſt; without leaving the ſtrait line, you muſt lower your point towards the adverſary's body, to enable you to return the thruſt on the ſame ſide. You muſt alſo parry this thruſt, by bending your arm, and oppoſing your wriſt, and by keeping your point to your adverſary's right ſhoulder. By this means you will be able to return the thruſt under his wriſt, called the thruſt in ſeconde.

Of the Outward Thruſt, with the Nails upward, commonly called the Feather Parade, againſt the Outward Thruſt, Nails upward, called the Carte over the Arm. Figure 15. Plate II.

In order to parry this thruſt on the outſide of your blade, you muſt oppoſe with your outward edge, the wriſt as in carte, nails upward, and your wriſt in a line with your right ſhoulder, and, with a ſtrait arm, oppoſe the adverſary's blade with the heel, or forte of your ſword. This thruſt may be parried alſo, by drawing in your arm, holding your wriſt a little outward, with your point raiſed; which being done, you muſt ſlide, and preſs from the feeble to the forte of his blade, by which you will not only put by his point, but have a great chance to fling his ſword out of his hand.

Of the Outſide Parade, for the Thruſt under the Wriſt, called the Thruſt in Seconde. Figure 7. Plate I.

You muſt parry this thruſt with the inſide edge, and raiſe your wriſt, in ſeconde, to the height of your right ſhoulder, your point low, and well maintained from forte to feeble, directing your point between the arm pit and right breaſt of the adverſary; and alſo keep a ſtrait arm, in order to throw off his point.

Of the Half Circle Parade, or the Parry againſt the Inſide Thruſt under the Wriſt, called the Low Carte. Figure 16. Pate II.

This parry of the half circle ſhould be made within the ſword, by a ſmart beat on the feeble of the adverſary's blade with your inſide edge; your nails muſt be upward, your arm ſtrait, your wriſt raiſed to the height of your chin, and the point low, but well oppoſed from forte to feeble.

Of the Parade againſt the Binding of the Sword, from the Inſide, to Thruſt in the Flank, called Flanconade; by reverſing the Edge of the Sword to an Outſide, called Cavez; and an Explanation of another Parade for the ſame Thruſt, by binding the Sword. Figure 8. Plate I.

The reverſing the edge from an inſide to an outſide, called cavé, is a parade where you muſt, with great ſwiftneſs, turn your inſide edge to an outſide, at the very time the adverſary gains your feeble, by his binding, to direct his point in your flank, called flanconade, you muſt form an angle from your wriſt to your point, by which you will throw off the thruſt, and the point of your ſword will be in a line to the adverſary. You muſt keep a ſtrait arm, and maintain, with firmneſs, your blade, from fort to feeble. The ſecond parade mentioned, called the binding of the blade, is made at the time the adverſary attempts to thruſt his flanconade. In order to this, you muſt yield your point, and

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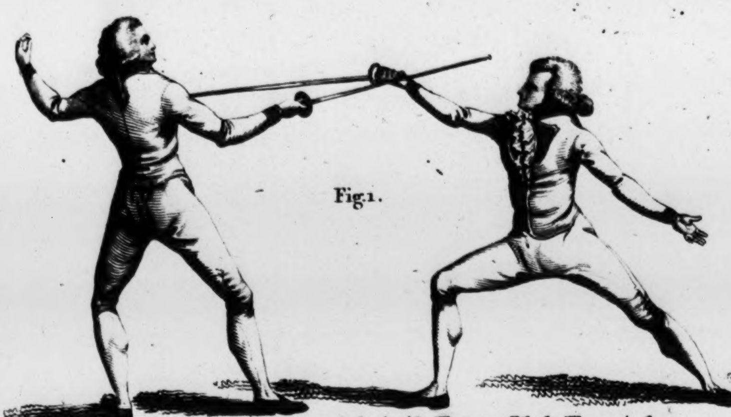
Fig.1.

Position for the inside Guarde call'd Carte and the inside Thrust call'd the Thrust in Carte.

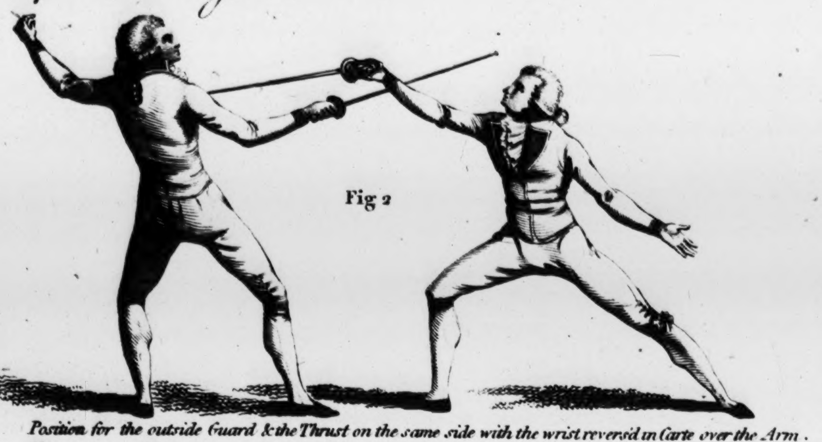
Fig.2

Position for the outside Guard & the Thrust on the same side with the wrist revers'd in Carte over the Arm.

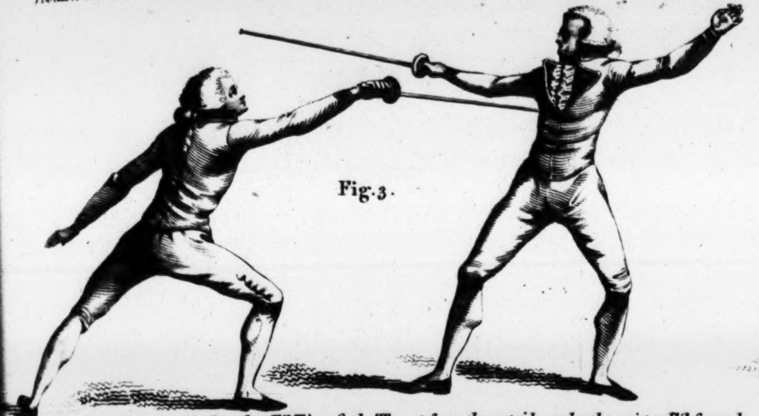
Fig.3.

Position of the outside Guard call'd Tierce & the Thrust from the outside under the wrist call'd Seconde.

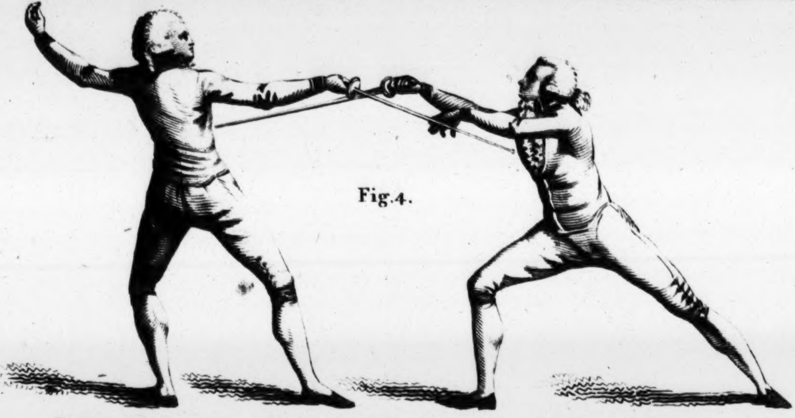
Fig.4.

Position of the inside Carte, call'd Carte, & the Thrust given on the outside Flank, call'd Flanconade.

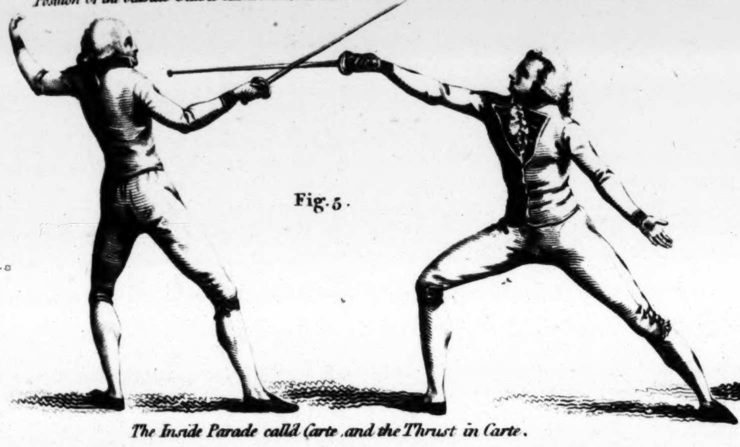
Fig.5.

The Inside Parade call'd Carte, and the Thrust in Carte.

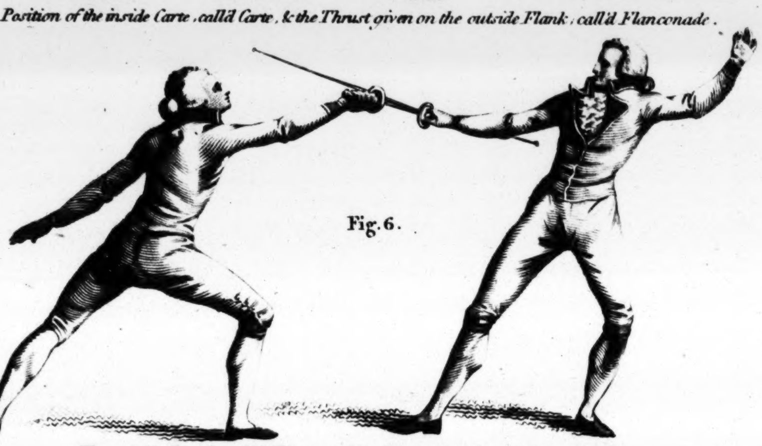
Fig.6.

The outside Parade call'd Tierce and the Tierce Thrust, call'd outside Thrust.

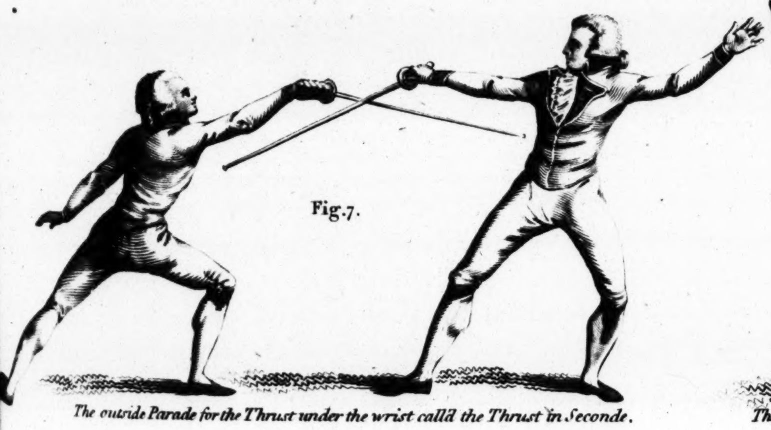
Fig.7.

The outside Parade for the Thrust under the wrist call'd the Thrust in Seconde.

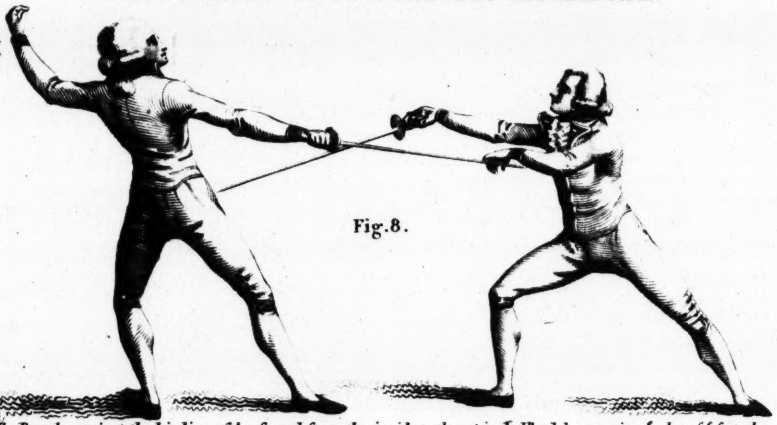
Fig.8.

The Parade against the binding of the Sword from the inside to thrust in the Flank by reversing ye edge of ye Sword

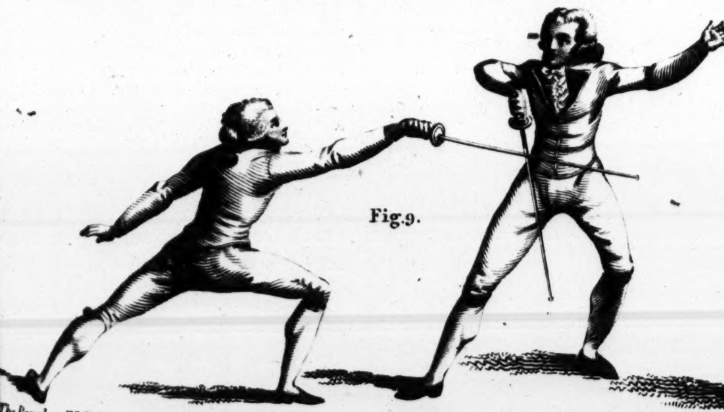
Fig.9.

The Parade call'd Prime & call'd the St. George Guard against the outside thrust under the wrist call'd Seconde.

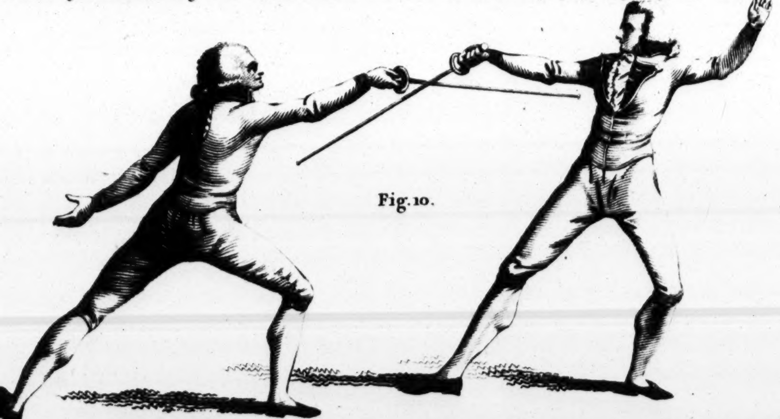
Fig.10.

The Parade call'd Quinte, the point low & wrist rais'd against the outside Thrust under the wrist call'd Quinte Thrust.

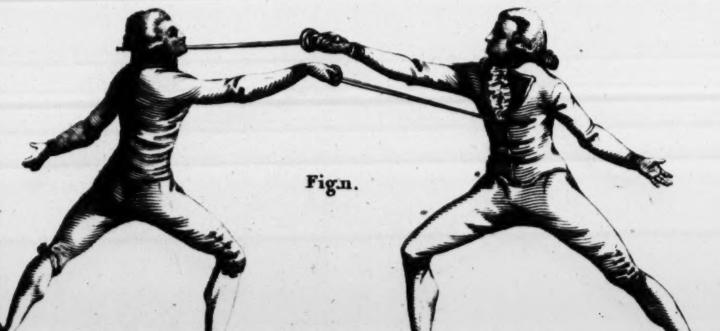
Fig.11.

The return in Carte, after the Carte Parry.

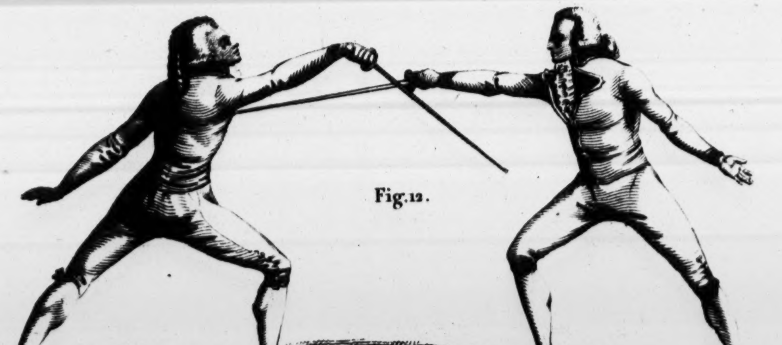
Fig.12.

The return in Tierce, after the Tierce thrust.

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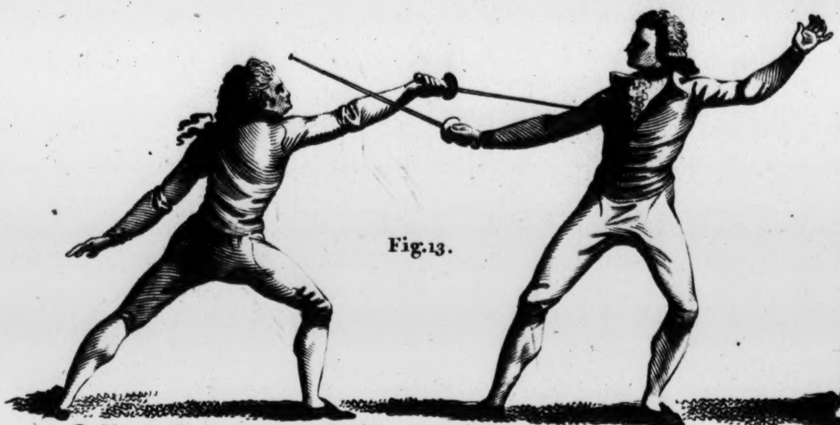
Fig.13.

Position for the outside Guard call'd Tierce, and the Thrust in Tierce.

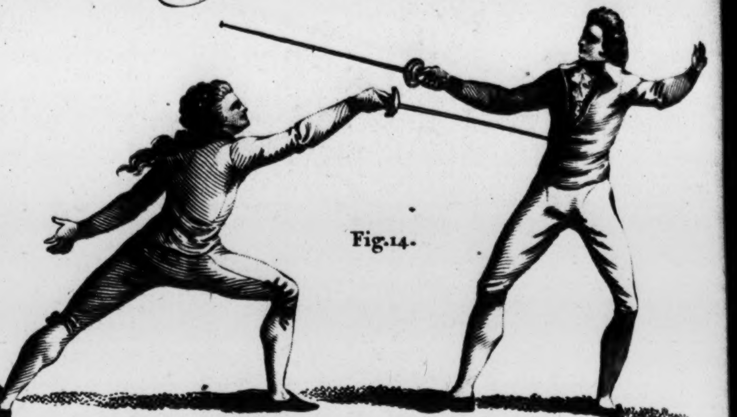
Fig.14.

Position of the inside Guard call'd Carte & of the Thrust under the wrist on the same side call'd Low Carte.

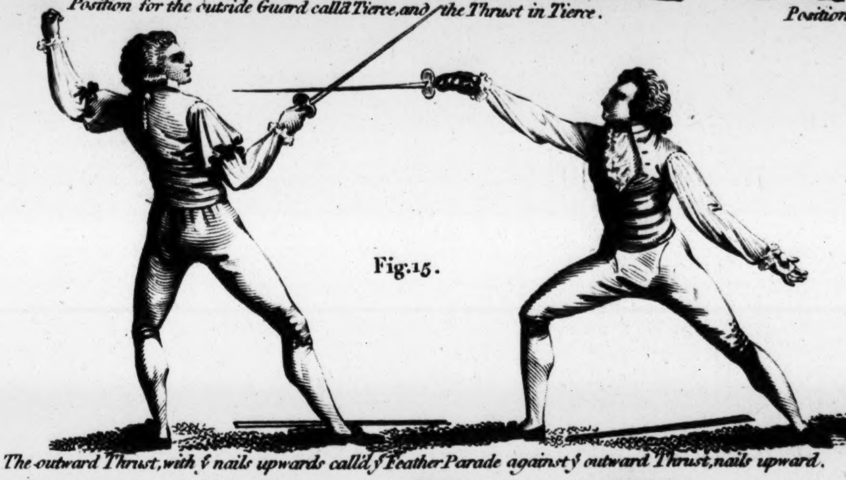
Fig.15.

The outward Thrust, with y^e nails upwards call'd y^e Feather Parade against y^e outward Thrust, nails upward.

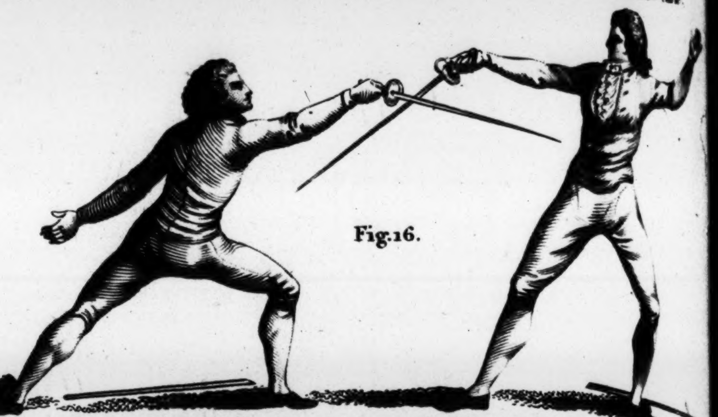
Fig.16.

The half Circle Parade, or the parry against the inside Thrust under y^e wrist call'd y^e low

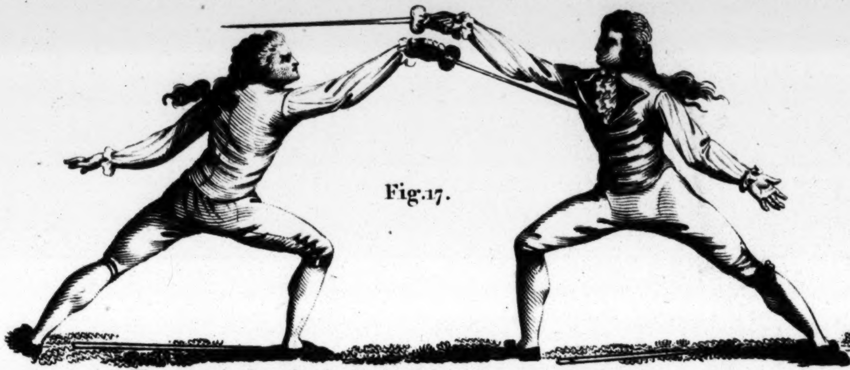
Fig.17.

The return in Seconde after having Parried Carte over the Arm.

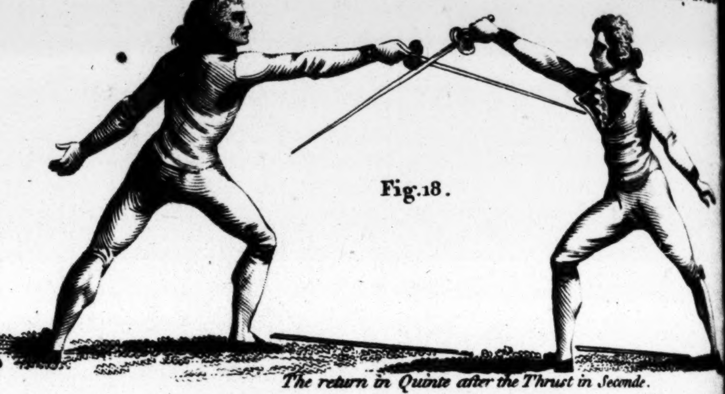
Fig.18.

The return in Quinte after the Thrust in Seconde.

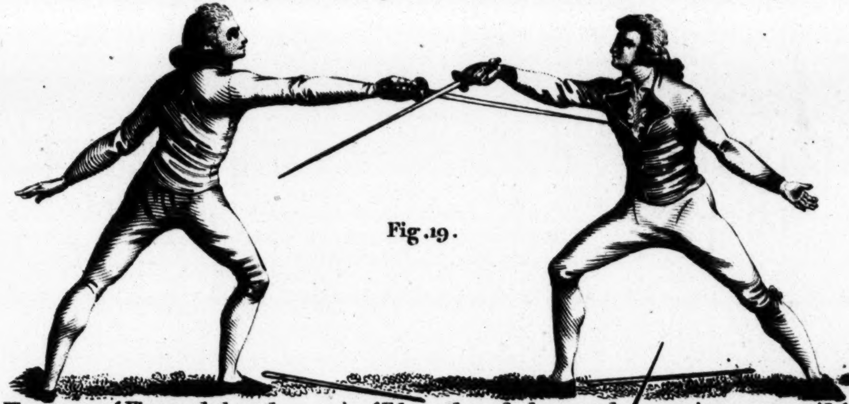
Fig.19.

The return on y^e Flanconade thrust by reversing y^e Edge, to those who have not the precaution to oppose with y^e left hand.

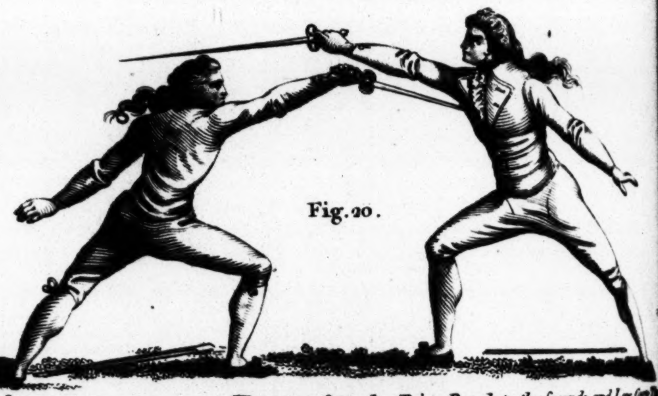
Fig.20.

The return from the Prime Parade to the Seconde and Low

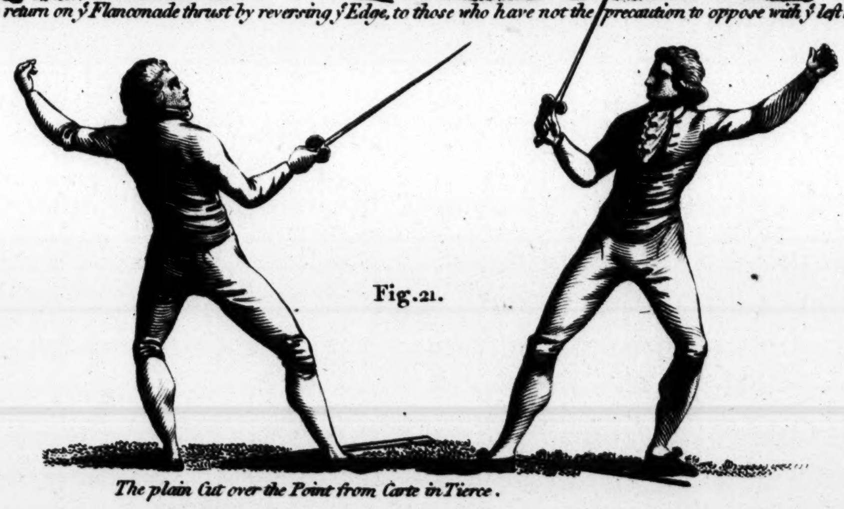
Fig.21.

The plain Cut over the Point from Carte in Tierce.

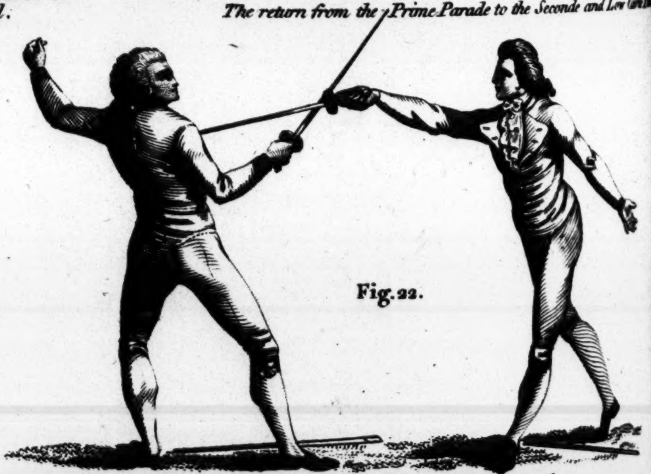
Fig.22.

The Pass on the Sword in Carte over the Arm.

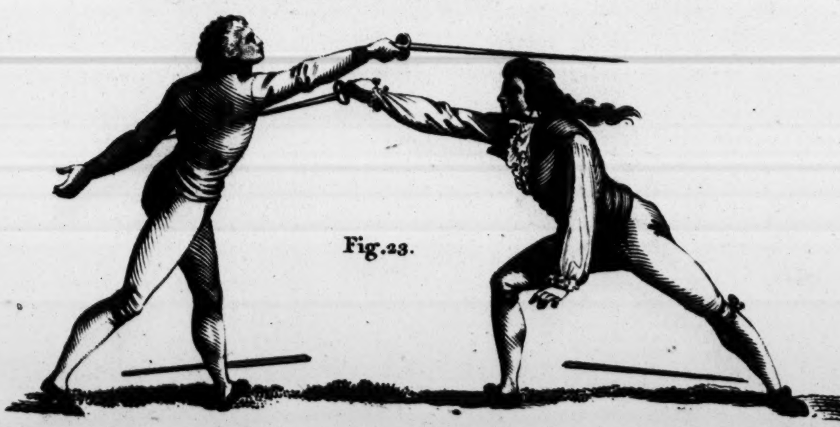
Fig.23.

An Evasion by the removal of the left Legg backward, at the time the Adversary makes his pass on the outside of y^e Sword.

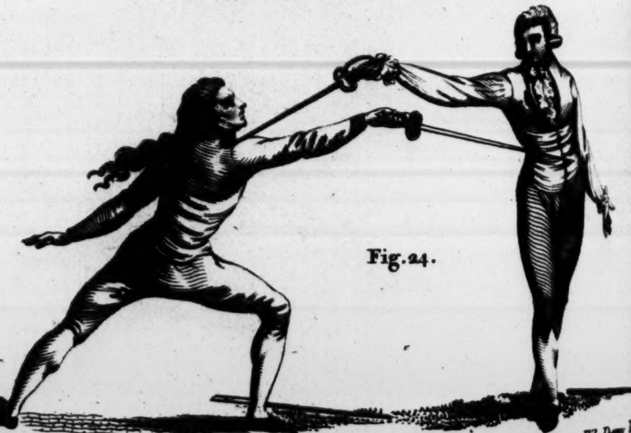
Fig.24.

The Half Round or bounding turn of the Body call'd Demy

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ſuffer your feeble to be taken, ſo as to let your point paſs under his wriſt, without quitting his blade in the leaſt, that your ſword may form a demi-circle; and, gathering his blade in carte, you will find that the two ſwords, and wriſts, are in the ſame poſition as when the attack began, with only this difference, that the wriſts will be a little lower than in the ordinary guard.

Of the Parade called Prime, derived from the Broad Sword, and called the St. George Guard, againſt the Outſide Thruſt under the Wriſt, called Seconde. Figure 9. Plate I.

In order to parry this outſide thruſt under the wriſt, called ſeconde, with this prime parade, you muſt, at the time your adverſary thruſts under the wriſt, paſs your point over his blade, and lower it to the waiſt, keeping your wriſt as high as your mouth, turning your nails downward, your elbow bent, your body kept back as much as poſſible, and give an abrupt cloſe beat on his blade with your outward edge; as you are then ſituated, you may, by way of precaution, hang down your left hand, as before mentioned in the flanconade, and in the ſame manner, or ſtep out of the line. This oppoſition is made at the time you parry, and very cloſe, to avoid the adverſary's point, if you ſhould want to thruſt in a ſtrait line. To ſtep out of the line, muſt be done at the time you parry the thruſt, by carrying your right foot, flat and plump, about ſix inches out of the line to the right, the left foot alſo to be carried to the ſame line about a foot, which will throw you further from the centre.

Of the Parade called Quinte, the Point low, and Wriſt raiſed, againſt the Outſide Thruſt under the Wriſt, called Quinte Thruſt. Figure 10. Plate I.

The thruſt in quinte is made by making a feint on the half circle parade, having your wriſt in carte. You muſt diſengage your point over the adverſary's blade, at the time he parries with the half circle, or prime parade, and thruſt directly at his flank. This thruſt is parried by holding your wriſt in high carte, with a low point and by oppoſing from the forte of your outſide edge, to put by the adverſary's point; by a wriſt well maintained from forte to feeble, and a very ſtrait arm, having the body entirely ſupported by the left hip.

An Explanation of the various Thruſts that may be parried with the following Parades.

All parades are made in general in the advance, the retreat, or by ſtanding your ground. With the carte, by holding your wriſt low, you parry the low carte and the ſeconde; by raiſing your wriſt, you parry all the cuts over the point on the inſide of the ſword and the flanconade. With the tierce you parry the carte over the arm; in raiſing your wriſt, you parry the cuts over the arm, carte over the arm or tierce. With the feather parade, that is, with your outward edge when your wriſt is turned in carte on the tierce line, you parry the tierce thruſt; in raiſing your wriſt, you parry the cuts over the point on that ſide. With the parade of ſeconde, you parry all the lower thruſts, both inſide and outſide; ſuch as low carte, ſeconde and flanconade. With the half circle parade, you parry carte, tierce, carte over the arm and ſeconde. With the prime parade, you parry carte, low carte, and ſeconde. With the quinte parade, you parry ſeconde and flanconade.

Obſervations on the Parades in general.

A good parade is as neceſſary and uſeful when well executed, as it is dangerous and fatal if done without judgment, and made wide and rambling. To parry well, will prevent your being hit; therefore you ſhould obſerve, when you are defending the place in which you are attacked, that you do not give an opening on the contrary ſide, which would give more eaſe to your adverſary to throw in a thruſt; for which reaſon you ſhould not flutter, or ſhew the leaſt concern, by any motion he may make, either with the body, his foot, or the point of his ſword. There is not the leaſt doubt but you have a great advantage in forcing your adverſary to be on the defenſive, becauſe at this time it will be impoſſible for him to attack; and by this you will certainly find your account, by the openings he may through ignorance, or inadvertency give. And it is alſo very certain, that, by being able to baffle his attacks, by a cloſe parade, your repoſtes, or returns, will be ſafe and quick, and according to the rules of fencing.

Of the Return, or Repoſte, after the Parry.

Every parry hath its return; you will be reckoned a good fencer, when you parry with judgment, and return with a lively exactneſs. There are in fencing two ways of returning a thruſt; the one is, when the adverſary thruſts; and the other, when he is on his recovery to his guard. The firſt of theſe is for thoſe only who are well ſkilled in this exerciſe, becauſe it requires a moſt exact preciſion, a quick ſight, and a deciſive parade; ſince the adverſary ought to receive the thruſt, before he has finiſhed and executed his; which is termed, in fencing, a return from the wriſt. The ſecond, which is on the adverſary's recovery to his guard, is done by hitting him before he has ſet his right foot to the ground again, thruſting out with great celerity and reſolution, in order to execute well. The return, called the return of the wriſt, ſhould hit the adverſary at the very time he longes out to thruſt. This method muſt be executed with the greateſt quickneſs poſſible. In order to ſucceed, you muſt be firm on your legs, and, after having parried with the fort of your ſword, in a dry and abrupt manner, you muſt ſtraiten your arm, and bring your body a little forward on the right leg, remarking, attentively, that your wriſt direct your point to the adverſary's body; as you may obſerve in Figure 12. Plate I. Figure 17. and 18. Plate II.

Of the Return in Carte, after the Carte Parry. Figure 11. Plate I.

At the very time the adverſary delivers his carte thruſt, you muſt parry with the heel of your blade, and inſtantly return the thruſt within the ſword, and return to your guard as quick, according to the rules already explained. If the adverſary ſhould in the leaſt raiſe his wriſt on his recovery, you may return a low carte, and recover with your wriſt in tierce, or demi-circle.

Of the Return in Tierce, after the Tierce Thruſt. Figure 12. Plate I.

At the time that you parry the tierce with a ſtrait arm, and your point a little lowered to the adverſary's body, you muſt return the ſame thruſt, only your wriſt a little inclined to the outſide. Take great care that the hand moves firſt, and oppoſe his blade well, from feeble to fort; recover to your guard in prime, or demi-circle parade. You may alſo, after your tierce parry, return the thruſt in ſeconde, and recover in ſeconde, demi-circle, or in tierce.

Of the Return in Seconde, after having parried Carte over the Arm. Figure 17. Plate II.

After your parry carte over the arm, you may return the ſame thruſt, by holding your wriſt nails upward, thruſting and oppoſing with your outward edge, and plunging your point to his body, with your recovery to a half-circle parade. If you ſhould return a ſeconde thruſt, you ſhould, the moment you have parried carte over the arm, drop your point along the outſide of his wriſt and elbow. This return is eaſier to be made than the aforementioned; your recovery is a half-circle, ſeconde or tierce.

Of the Return in Quinte, after the Thruſt in Seconde. Figure 18. Plate II.

Having parried the thruſt in ſeconde with the quinte parade, you muſt return the thruſt without altering your wriſt. If you parry with the parade in ſeconde, you muſt return in ſeconde, recover ſwiftly with your wriſt in ſeconde, and bind the blade in carte, after the recovery, without leaving it.

Of the Return on the Flanconade Thruſt, by reſerving the Edge to thoſe who have not the Precaution to oppoſe with the Left Hand. Figure 19. Plate II.

At the time the adverſary thruſts the flanconade, you muſt parry, by raiſing and turning your wriſt in tierce, without leaving his blade, forming an angle from wriſt to point, ſteadily directed to his body. In this return there is no occaſion to thruſt out the right leg; you muſt only bring your body forward, and ſtretch out your left leg. The angle which is formed in turning the wriſt is quite ſufficient to keep off and return the thruſt; this done, you muſt recover your guard in prime, or half circle. If you parry the flanconade, by binding the ſword, as we have before mentioned, you may return the thruſt ſtrait in carte; and if, on the adverſary's recovery, he ſhould in the leaſt drop his point, you may return a flanconade; if, on the contrary, he ſhould raiſe his wriſt or his point, you muſt return a low carte, and recover by a circle, joining his blade.

Of the Return from the Prime Parade, to the Seconde and Low Carte Thruſts. Figure 20. Plate II.

As ſoon as you have parried the ſeconde, or the low carte thruſts with the prime parade; ſtepping out of the line with the right foot (as explained in the parades thereof) you muſt return the thruſt in prime, holding your wriſt in a line with your left ſhoulder; by this means you will form an oppoſition which will cover your body and face; after which you muſt recover in the ſame poſition of prime, or in the half circle.

Of the Parade by a Counter Diſengage.

This parade is made at the time the adverſary delivers his thruſt, by diſengaging carte or tierce, or carte over the arm: therefore, to execute this parade well, you muſt, the moment he diſengages to thruſt, diſengage alſo, very cloſely to his blade, and, having formed your parade, which ought to be done with the greateſt preciſion and quickneſs that is poſſible, ſupport your blade from fort to feeble.

Obſervation on this Parade.

As a quick wriſt and a light point might eaſily deceive this laſt counter diſengage; that is to ſay, if the adverſary ſhould continue his diſengages often, and quicker than you can follow him, in ſuch a caſe, to ſtop his career, you muſt have recourſe to the circle parade, which will certainly ſtop the progreſs of his point.

Of the Half Circle Parade.

This parade, which is the chief defenſive parade of the ſword, parries not only all the thruſts, but alſo obſtructs all the feints that can be made; and, to execute it well, you ſhould ſtraiten your arm, keep your wriſt in a line with your ſhoulder, your nails upward, and, by a cloſe and quick motion of the wriſt, the point ſhould form a circle from the right to the left, large enough to be under cover from the head to the knee; in this manner, by doubling your circle till you have found the adverſary's blade, your parade will be formed. And, now, in order to ſtop this circle parade, notwithſtanding its being redoubled with great vivacity, you may ſtop his blade ſhort, by keeping your wriſt the height of your ſhoulder, and lowering your point, as in the quinte parry; and, recovering, bind and gather his blade in carte. You ſhould exerciſe and practiſe theſe circle parades, from the counter diſengages to the circle, and from the circle to the counter diſengage. You may practice this leſſon yourſelf, either with ſword or foil: this will ſtrengthen and ſupple your wriſt, and will inſenſibly procure great eaſe and readineſs to defend yourſelf upon all occaſions.

Method of thruſting and parrying Tierce and Carte, called thruſting at the Wall.

It is called thruſting at the wall, becauſe the perſon who parries is not to move his body nor his legs from where he ſtands; it is only his wriſt which is to perform his parades. In order to execute this leſſon well, we ſhall explain the poſition in which he that parries is to ſtand. To parry at the wall, you muſt place yourſelf ſo that the left foot may not be able to ſtir further; you muſt ſingle your ſhoulder, hold your head erect, pull off your hat, and open with your right arm, ſo as to carry your point to the right, that your adverſary may take a proper meaſure, or diſtance, for his longe; after which you put on your hat, and carry your left hand back to the ſmall of your back, and giving an opening, either in tierce or carte, you muſt be ready to parry (in this attitude) with quickneſs, all the adverſary's thruſts.

To thruſt againſt the wall, you muſt place yourſelf ſtraight on your legs, and, coming to your guard, pull off your hat with a pleaſant countenance, and deliver a gentle thruſt in carte towards the adverſary, gently touching your button to his breaſt, to take your diſtance; you muſt then recover to your guard, and put your hat on, making, by way of ſalute, the two motions of the wriſt, in tierce and carte, being the uſual way. Thus, thruſting againſt the wall accuſtoms the ſcholar to thruſt with quickneſs, and to parry ſo likewiſe; it gives an exactneſs and eaſe, as well as a knowledge of diſtance, and is more uſeful, as in fencing with various perſons you will meet with people of different make and ſize.

Method how to thruſt at the Wall with Swiftneſs.

There are three different ways of thruſting at the wall. The firſt is, by engaging the fort of the adverſary's blade, and holding a looſe point, you muſt diſengage lightly, and thruſt ſtrait at his body, ſeeking his blade. The ſecond is, by engaging from the point to his blade, with a bent arm, diſengage, and thruſt ſtrait to the body; which is called thruſting from point to point. The third is, by delivering ſtrait thruſts to the inſide and to the outſide of the adverſary's body; in this latter you need neither engage the blade, nor diſengage. The Italian maſters make much uſe of this laſt, as it gives great ſwiftneſs, and uſes the wriſt to execute firſt, and alſo looſes the ſhoulder completely.

Rules to be obſerved in Thruſting at the Wall.

When you have taken your dimenſions or diſtance, as before mentioned, you ought in no way to ſtir your left foot, nor the body, make no motions or feints whatſoever, but thruſt according to rule, either inſide or outſide, by diſengagements, or by thruſting to the blade ſtraight forward; and if you make any feints it muſt be with the mutual conſent of each other.

Explanation of what is called Feints.

A feint is, to ſhew the appearance of a thruſt on one ſide, and execute it on the other. In this you ſhould lead the adverſary's wriſt ſo much aſtray as to obtain an opening ſufficient to throw in the thruſt you have premeditated. You muſt be very cautious not to uncover yourſelf in making a feint; for, inſtead of ſucceeding in your project, you will give the adverſary an opportunity of a wide opening, and induce him to throw in a ſtraight thruſt: therefore it is abſolutely neceſſary, in making a diſengage in order to feint, to oppoſe the fort of your blade, and, with great ſubtilty, make the motion of your point near enough to his fort, that you may the more eaſily hit him. All feints may be executed ſtanding ſtill, or in moving; you may make them after an appel, or attack of the foot, after a beat on the blade, or at the time the adverſary forces your blade; or at his diſengaging. You muſt obſerve that, when you feint, your wriſt is the height of your ſhoulder, your elbow a little bent, that your wriſt may be more flexible, and your point lighter. If you are engaged in carte, diſengage carte over the arm, near the adverſary's fort, bring your point back in its carte poſition, thruſt ſtraight forward, and recover to carte, or in the demi-circle. If engaged in carte over the arm, you muſt diſengage in carte, and thruſt carte over the arm, and recover in tierce, or in half circle; and if the thruſt is parried, you muſt treble the feint, and thruſt within the ſword. If engaged in tierce, you muſt mark your feint below the wriſt in ſeconde, thruſt in tierce, and recover to your ſword in ſeconde, or a half-circle. If engaged in tierce, you may alſo feint in carte, keeping your point in the adverſary's face, thruſt a low carte, and recover to the ſword by a circle. To feint on any diſengagement of the adverſary, you muſt force or lean on his blade a little, to oblige him to ſlip, or diſengage; and at that very time you muſt, with quickneſs and preciſion, feint on his motion, and thruſt ſtrait at him.

Defence or Parade againſt all Feints.

The ſureſt defence againſt feints, is to get at the adverſary's blade by a counter diſengage, or by a circle; for if you offer to ſeek the blade by a ſimple parade, it will be impoſſible to get at it, ſince he can redouble his feints at pleaſure; wherefore, by the parades, you immediately ſtop the adverſary's point, and you oblige him to change his intention and idea.

Obſervations on the Feints, and at what Time they are good and bad.

There are fencers who, when they feint, make large motions of their body, of their points, or violent attacks of the foot, in order to precipitate their adverſary's defence, thinking to take advantage of the large openings he may on ſuch occaſions give; all theſe attempts, which are falſe, cannot ſucceed againſt any but thoſe who are timid, and not ſtaunch in their guards; but, againſt a man who is ſkilful and cool, and who keeps his point cloſe in the line to his adverſary, and who ſeeks his blade with the wriſt cloſely, according to the rules of fencing, whatever motions may be made by feints will prove ineffectual. There are others who make feints by advancing their ſword, and when the parry is attempted, drawing and changing the point from its ſituation, thruſt out: theſe three motions are contradictions to each other, and are ſo ſlow, that, if the adverſary was to thruſt at the time they draw in, they would infallibly be hit before they had finiſhed their feint and intent. You ſhould, as much as poſſible, make all feints in proper diſtance, that you may be enabled to accompliſh your thruſt with ſwiftneſs. You may alſo make the feints out of diſtance; but you muſt continue them at the time you advance to get into diſtance, and change your idea, if the adverſary ſhould come to join your blade. You ought to cover yourſelf well in making theſe motions, for the adverſary might thruſt ſtraight forward at the time you advance, or ſtop your feint by any other motion. You are not always to hope or expect your feints ſhould be anſwered, for by this you may eaſily be baulked; but, knowing the adverſary has power to attack, and keeping yourſelf on your guard, you will be more ready to defend yourſelf. You will alſo be the more ſure that your feint will beſt ſucceed while the adverſary's wriſt is in motion; at that time ſeizing the opportunity to make your feint, he will become apt to fly to the defenſive with more irregularity; and not only will give openings, but you are ſure he cannot attack: and conſequently you will be apt to hit him with more eaſe, and without riſque.

Of the Motions made on the Blade ſtanding ſtill called Glizades, and the Glizade from Carte over the Arm, to Thruſt Carte.

If you are engaged in carte, and are in diſtance, you muſt have a flexible arm, your body ſingled, and entirely on the left hip; in this poſition you muſt make a beat on the adverſary's blade, with an intent to ſtir his wriſt; if he ſhould come to the ſword, you muſt diſengage lightly carte over the arm, with your wriſt high, and your point in a line to his face; and, the moment he cloſes the blade, diſengage in carte, and thruſt directly ſtrait. If, after this, he ſhould not return, but only force your blade, you may reiterate a ſecond thruſt, by turning your wriſt in tierce, on the blade, without leaving it, and recover to his ſword in carte.

Of the Glizade from Carte, to Thruſt Carte over the Arm.

If you are engaged in tierce, or carte over the arm, you muſt diſengage in carte, keeping your point forward in a line to the adverſary's body; at the ſame time make an attack with the foot, and when you find he forces your blade, ſlip, or diſengage quickly in carte over the arm, and thruſt out, and redouble the thruſt in ſeconde, recovering ſwiftly to the ſword in tierce, or in demi-circle.

Of the Glizade from Tierce, to thruſt the Seconde.

If you are engaged on the tierce ſide, after beating on the blade, and an appel, you muſt diſengage to tierce, with your point advanced to the enemy's face, and the moment he feels the blade, parry, either by tierce, or the wriſt turned in carte over the arm, you muſt drop your point under his wriſt, and thruſt ſeconde, recovering your ſword in tierce, or the half circle.

The binding and croſſing the Blade.

Very few maſters teach the croſſing of the blade; this operation is the more neceſſary, being not only uſeful to put the adverſary's blade by from the wriſt to the knee, but will often throw his ſword out of his hand. If he ſhould preſent himſelf in diſtance, having his arm ſtraight and his point alſo, you ſhould incline your body entirely on the left ſide, and engage his ſword in carte, turning your nails a little more upward than in the ordinary guard, and engage your fort about a foot from the feeble, directing your point to the left; in this poſition you muſt ſwiftly turn your wriſt in tierce, holding your ſword firm, and paſſing your point over his arm, without quitting his blade, ſtop your ſword from fort to point, holding your hand the height of your ſhoulder, and the point as low as his wriſt; this croſſing being made, thruſt out at full length in tierce, and recover your ſword by a circle.

The Manner to ſhun theſe Croſſings of the Sword.

As every thruſt has its defence, it is neceſſary we ſhould explain them in the cleareſt manner; there needs only a due attention, a quick eye, and judgment, to ſhun all thruſts. You muſt give way with your point by a diſengage to a ſtrait line, at the time the adverſary wants to croſs your blade; by this means, as he will find no blade, you will evade it. It might happen, even that when he finds no blade, and conſequently no reſiſtance to his blade, he may fling his own ſword away, inſtead of his adverſary's if he ſhould not maintain his point to the waiſt and hold it very faſt.

Of

Of the Beat on the Tierce Thruſt to fling down the Sword of the Adverſary.

If the adverſary ſhould make a full thruſt in tierce, you muſt diſengage nimbly in carte, have your body well on the left hip, and draw in your arm a little more than in the ordinary guard, with your point high: this done, before he recovers to his guard you muſt make a ſmart beat with your foot on his feeble; which will open his fingers and throw down his ſword.

Another Way to beat the Sword out of the Adverſary's Hand.

If the adverſary thruſts in tierce, you muſt parry with the prime parade; when parried, raiſe your point lightly to the left, and with the carte, or inſide edge of the fort of the blade, beat ſmartly and ſtrong on the feeble of his blade.

Of the Beat on the Sword in Carte over the Arm.

If the adverſary preſents himſelf, having his wriſt turned in carte, with a ſtraight arm, and his point in the ſame line, you ſhould make a cloſe feint toward his fort; if that ſhould not move his point, you muſt diſengage in carte over the arm, with your arm contracted, and your point high, and with the fort of your blade beat ſmartly on his feeble; ſtraighten your arm immediately, and thruſt firm and ſtraight carte over the arm. If his ſword does not drop by this beat, you will at leaſt find opening enough to throw in your thruſt; this done, recover quickly to your guard by the circle parade. To ſhun this beat you muſt, the moment you have made your thruſt, recover to the adverſary's blade by the circle parade; for this beat on the blade is only made uſe of againſt thoſe who, when they have thruſt either in tierce or carte, within or without the blade, do not recover immediately to their guard; or when they are in guard, keep their arm ſtraight, and the point of their ſword in a direct line with their arm. If the adverſary ſhould attempt to beat when you are firm on your legs, and in guard, you muſt ſlip his beat, and with ſubtilty hinder him from touching your blade, and at that very moment go on with your thruſt ſtraight forward.

Of the Plain Cut over the Point from Carte, in Tierce. Figure 21. Plate II.

After a thruſt made in carte, if your adverſary parries with the feeble of his ſword, you muſt, on your recovery, draw in your arm, keep a ſtraight blade from fort to point, and paſs it over his point; your wriſt being turned in tierce, you muſt raiſe it inſtantly, and plunging your point to his body, you muſt make a full thruſt in tierce, and recover to the ſword in the line. This cut over the point is alſo made after having parried a carte thruſt, if the adverſary is fearful of a return on that ſide, and therefore forces your blade in his recovery, you ſhould, in ſuch caſe, execute the cut over, ſmartly to an outſide, either in tierce or carte over the arm. You may alſo execute the ſame cut over the point, in carte over the arm, after you have made a carte thruſt, if the adverſary ſhould force your blade ſtanding on his guard. Obſerve well, that all theſe cuts over the point are not made uſe of but where the adverſary parries from the half ſword to the point, called the feeble, or when he forces your blade out of the line in the ſame manner.

Of the Plain Cut over the Point, from Tierce to Carte.

If you are engaged in tierce, you muſt make an attack with the foot, and execute a half thruſt to the ſword; and at the time the adverſary comes to this parade in tierce, you muſt draw in your arm, keeping a ſtraight point, and cut over his point in carte, your wriſt turned in carte, dropping your point a little, and make a full thruſt in carte; the thruſt made, recover ſtraight in a line to the adverſary's ſword, with an oppoſed wriſt, and your point to his body.

Cut over the Point from Tierce to Carte, to thruſt Carte over the Arm.

If you are engaged on the outſide of the ſword, turn your wriſt as in carte over the arm, attack ſmartly with the appel of the foot, and at the adverſary's coming to a parry, cut over the point to the inſide, with your wriſt high in carte, and your point ſtraight to his body, as if you intended to thruſt there; and as ſoon as he comes cloſe to your blade, diſengage lightly, and thruſt a full carte over the arm, by ſending your wriſt firſt, with a ſufficient oppoſition, as before mentioned in the rules of fencing; the thruſt made, recover to a guard with your ſword before you, and the point to the adverſary's body.

Of the Definition of the Wriſt, after the Thruſt made in Carte.

This definition of the wriſt is not made uſe of but to thoſe who do not return from the thruſts made at them, either to the inſide or outſide; to execute this, you muſt engage the adverſary's ſword in tierce, make an appel of the foot, and as ſoon as he cloſes your blade, diſengage lightly near his fort, and thruſt in carte; the moment your thruſt is made, ſeem to recover to a guard, by bringing up your right foot about a foot back, keeping a ſtraight, and yet a flexible arm, and at the very moment he lifts up his right foot to cloſe in, if even he ſhould force your blade, you muſt take the opportunity, and turning your wriſt ſwiftly in tierce, thruſt in this manner to his blade, forcibly and well maintaining your wriſt; this is called cavé; the thruſt finiſhed, you muſt recover to the ſword in a ſtraight line.

Of the Definition of the Wriſt, in Carte over the Arm, after the Thruſt in Tierce.

If you are engaged within the ſword, you muſt make an attack of the foot, and a beat on the blade. If the adverſary comes to the blade, diſengage nimbly to an outſide, with your wriſt turned in tierce, and deliver your thruſt in tierce; the thruſt made, immediately recover to your guard about a foot, and the moment he lifts up his foot to advance, you muſt ſeize that moment, and turning your wriſt on his blade, nails upward, thruſt carte over the arm; the thruſt made, you muſt recover to the ſword in tierce, or in half circle.

Of the Paſs on the Sword, in Carte over the Arm. Figure 22. Plate II.

If you find the adverſary engaged in tierce, with a bent elbow and a high point, you muſt recal him by an attack of the foot, and make a half thruſt to his ſword; if, after this he ſhould not anſwer your motion by coming to your ſword, then without altering the poſition of your right foot, bring up your left foot, and paſs it before the right, about two feet forward, the point of the foot a little outward, and raiſe the heel of your right foot a little, ſtretch out both knees, and let the weight of the body be on the left leg; and obſerve, that when you paſs your left leg forward, you turn your wriſt in carte over the arm, and with a ſtraight arm thruſt firm to the body; the moment you have made your thruſt, you muſt recover your guard in tierce, carrying, at the ſame time, your left leg, your body and arm to the firſt poſition, and ſeek his ſword with a circle parade.

Of the Paſs in Tierce on the Outſide of the Sword.

If the adverſary is engaged in carte, you make a ſtrong beat with your fort on his blade, and if, after you have put by his blade, he comes to a forced parry, diſengage ſubtilly to his outſide, with your wriſt raiſed in tierce, and the point plunged to his body; and at the very time of your diſengaging, bring up your left foot before the right about two feet, keeping the knees ſtraight, and the body reſting on the left leg; the thruſt made, recover to the ſword in tierce, throwing your body well back in a ſtraight line with that of the adverſary, and ſupporting it on your left ſide.

Of the Paſs in Carte, after the Feint in Carte over the Arm.

If you are engaged in carte, you muſt make an attack with the foot, and diſengage nicely; holding your wriſt in carte over the arm, make a half thruſt, by advancing your right foot about ſix inches, your wriſt well raiſed, and the point of your ſword firm in a line with your adverſary's face; and at the time he comes to join your blade to parry, you muſt ſurprize him by diſengaging artfully in carte, and make the paſs of the left leg forward, oppoſing your ſword to his, and keeping your wriſt high, and your point in a line to his; this done, recover, and ſeek his blade with a circle parade.

Of the Paſs in Carte over the Arm, after the Feint in Carte.

If the adverſary is engaged on the outſide of the ſword, you muſt make a half thruſt on the blade with an appel of the foot, and at the time that you feel him join and force your blade, feint on the inſide of the ſword, ſubtilly diſengage on the outſide, making your paſs with the left leg, and thruſt carte over the arm, according to the rules of this paſs before mentioned. You ſhould obſerve, that all the paſſes made on the outſide of the ſword, are parried with a high wriſt in tierce; and thoſe on the inſide are parried by the prime, or a high wriſt in carte, the wriſt being always in a line with the face.

An Evaſion, or Subterfuge, by the Removal of the left Leg backward, at the Time the Adverſary makes his Paſs on the Outſide of the Sword. Figure 23. Plate II.

You muſt give opening ſufficient on the outſide to encourage your adverſary to make a paſs, either in tierce or carte over the arm; and you muſt not ſtir or move by any attacks of the foot, or half thruſts, which he may make, but ſtill leave an opening to the outſide, to determine him to execute his thruſt, and at the time he makes his paſs with the left foot, drop your point in ſeconde, with the wriſt in tierce, without ſeeking his blade, and carry back your left foot, to its full extent of a ſtraight knee; nor ſtir the right foot, but keep the right knee bent as on a thruſt, having your body a little lower than in the ſeconde thruſt, your right arm very ſtraight, the wriſt up, and oppoſed to the face, the left arm falling perpendicularly between the two thighs, the palm of the hand open, facing the ground, for fear of a ſlip of the left foot backward, (which would make you loſe your centrical poſition,) and to enable you to keep up the body, by the aſſiſtance of the hand, in ſuch a caſe. This operation being performed, you muſt recover to a garde, and ſeek the blade by a circle.

Of the Seizing of the Sword after the Paſs on the Outſide of the Sword.

After having made the paſs, either in tierce or carte over the arm, if the adverſary parries the thruſt, and reſiſts to the blade, you muſt with agility and ſubtleneſs, ſeize the guard of his ſword with your left hand, that inſtant paſſing your right foot before your left, with your heels in a line, bending the knee a little, and ſtraightening the left knee; by this poſition you will be able to oppoſe his defence; if he ſhould take hold of your blade with his left hand, you ſhould immediately draw in your right, and preſent your point to his belly, holding faſt the ſhell of his ſword, to oblige him to give it up.

Of the Counter Diſengage on the Inſide of the Sword, ſtanding Still.

If you are engaged within the ſword, you ſhould bear a little on the adverſary's blade, to induce him to diſengage, and at the time of his diſengaging, either in tierce or in carte, to join your blade, you muſt ſeize that moment to time his motion by a counter diſengage, before he touches your blade, and thruſt a well oppoſed thruſt in carte; the thruſt made, recover immediately to the ſword in carte.

Of the Counter Diſengage on the Outſide of the Sword ſtanding Still.

You muſt engage the adverſary on the outſide, with the wriſt turned carte over the arm, the wriſt and point being in a line with the ſhoulder, the arm flexible, and you muſt bear on his blade to determine him to diſengage; and at the time he diſengages to join your blade on the outſide, diſengage ſubtilly with him before he joins your blade, and thruſt a full carte over the arm, oppoſing your wriſt and ſword according to the rules explained; the thruſt being made, recover quickly to the ſword, and redouble a thruſt in ſeconde.

Of the Counter to the Counter Diſengage, ſtanding Still.

If the adverſary ſhould offer to parry with a counter diſengage the thruſts above-mentioned, you ſhould, without ſeeking his blade, double your diſengage with ſpirit, and ſhunning his blade, thruſt with a ſtraight point at his body, and recover to the ſword by the circle parade.

Of the Counter Diſengage on the Time, and of the Counter to the Counter, when the Adverſary advances.

You muſt get out of diſtance about a foot, without leaving the adverſary's ſword; and at the time he advances, ſeize the opportunity, without ſeeking his blade, diſengage, and thruſt ſtraight at him; if he ſhould parry with a counter diſengage, you ſhould redouble the diſengage without ſeeking his blade, and thruſt out fully at him, having your body firm, and an oppoſite wriſt, according to the rules mentioned before: the thruſt being made, recover to a guard by a circle.

Of a Strait Time Thruſt, upon any low Feint.

If you are in diſtance with your wriſt turned in carte to the height of the ſhoulder, the point a little lower than the wriſt, and firm on your legs, you ought not by any means to be flurried, or ſtir, by any motion of the adverſary, either by appels or half thruſts; but be watchful to take advantage of any opening he may give at the time he lowers his wriſt and point, and makes low feints; at that inſtant, without ſeeking his blade, thruſt ſtraight forward in carte, with a well oppoſed wriſt, according to the rules; the thruſt made, recover, and ſeek the blade by a circle. You execute this ſame time thruſt alſo after having retired about a foot, by obſerving, the moment the adverſary lifts up the foot to come in diſtance, to leave his blade, and, if in the leaſt his wriſt ſhould be low, and you ſee opening enough, thruſt ſtraight at him, without ſeeking his blade, or heſitating in the leaſt. If he ſhould uncover the lower parts of the body at the time he comes in diſtance, you muſt time him, and thruſt a low carte with a well oppoſed and maintained wriſt, and recover to the ſword in tierce. If you are engaged on the outſide of the ſword, with the wriſt in tierce, you ſhould retire about a foot, and at the time the adverſary advances, giving the leaſt opening, you may thruſt carte over the arm; if he ſhould bear, and force your blade in the advance, you ſhould diſengage, and ſtop him by a carte within the blade. Nothing is more difficult than to thruſt with exactneſs and preciſion; the above-mentioned time thruſt cannot be performed well but by thoſe who have acquired, by practice and experience, theſe quick requiſites of the eye and wriſt to execute with. To ſhun the conſequences which might ariſe from theſe time thruſts; you ſhould be very attentive to hold your ſword well before you, nor give any openings by the feints you make, nor bear too much on the enemy's ſword in the attacks, either ſtanding ſtill or marching; and be always ready with a counter diſengage, cloſe and quick, or a circle; and never form an idea of giving a thruſt, without that of recovering quickly to a guard.

The Half Round, or Bounding Turn of the Body, called Demi-Volte. Figure 24. Plate II.

When you are in diſtance, you muſt engage the ſword in tierce, having the arm flexible, your body well on the left hip, and give your adverſary opening ſufficient on your outſide to engage him to thruſt; and at the time he forces your blade, either in tierce or carte over the arm, you muſt ſubtilly diſengage your point under the mounting of his ſword, with your wriſt as in carte, well oppoſed, and direct your point to his right breaſt; at the ſame time carry your left foot near the right, that the point of your left foot be about two inches behind the right heel, the two feet forming an angle; to complete this poſition, you ought to keep your knees ſtraight, your head erect and in a line with the right ſhoulder, and the left ſhoulder well turned out, with a ſtretched out arm, as in the carte thruſt. It is impoſſible to complete this volte, or turn of the body, with that vivacity and exactneſs it requires, without turning the point of the right foot inward, and lifting it up from the ground a little, and turning upon the heel your leg and thigh, as on a pully, that the body may be more thrown back in a ſtraight line with that of the antagoniſt, in order to ſhun the enemy's point; this done, you muſt recover with your left foot back, and come to a guard, according to the rules explained, with the circle parade. This ſame demi-volte may be made at the time the adverſary advances and forces your blade: the complete executing of this thruſt conſiſts in taking the juſt time.

Of the Flanconade Thruſt, having parried this Bounding Turn, called Demi-volte.

You muſt force the adverſaries blade on the outſide, to engage him to thruſt within; and if he ſhould make this demi-volte, you ſhould parry the thruſt, with the fort on his feeble, and binding the ſword, return a flanconade, with the oppoſition of the left hand, as before explained; this done, recover your ſword in carte.

The whole Round or Turn called the Volte, at the Time the Adverſary diſengages to Thruſt in Carte.

At the time the adverſary diſengages within, and thruſts carte, you muſt raiſe the wriſt to the height of your face, with your nails upward, and with ſwiftneſs and agility perform this turn of the body called volte; fixing your point to his right breaſt, ſtraighten your legs at the time you paſs with the left foot behind the right, which diſtance ſhould be about a foot; your left ſhoulder ſhould be turned outward, to form a complete ſide front or profile, to your adverſary, your head in a line with your ſhoulder and arm, to enable you to direct your point forward in that line. The thruſt being made, recover your guard with your wriſt in tierce, and beat ſmartly, with the fort of your tierce edge, on the feeble of his ſword, raiſing your wriſt and lowering your point.

Of the whole Turn called Volte, on the Paſs made in Tierce, or in Carte over the Arm. Figure 25. Plate III.

At the time the adverſary makes the paſs on the outſide of the ſword, you muſt paſs your point under his arm, and turn your wriſt in carte to the height of the face, paſs the left foot behind the right, about a foot diſtance, and fix your point to his right breaſt, ſtraightening both legs; at the very time you paſs the left foot, be careful that your left ſhoulder be well turned out, ſo as to be with your back half turned to the adverſary, holding your head in a line to the right ſhoulder and arm, in order to carry the point directly forward: this thruſt being executed, recover your guard by a circle, and keep your body very ſtaunch on the left ſide.

A Diſarm, after having parried the Carte Thruſt. Figure 26. Plate III.

If the adverſary is irregular and careleſs when he thruſts a carte, you ſhould parry him with the carte parade, by a dry, ſmart beat with your fort, at the ſame time advancing your right foot about a foot, and ſtraightening your left leg, you muſt ſeize the ſhell of his ſword with your left hand, and holding it faſt, preſent your point to his body under his arm; if he ſhould make any reſiſtance, and not ſurrender his ſword, you ſhould immediately bring up your left leg to the right, and with the fort of your ſword bear ſtrong on his blade, which will oblige him to open his fingers, and drawing in your arm, ſtill holding his ſword faſt, you will become maſter thereof; the diſarm being made, carry your left foot two feet back, with a ſtraight knee, and preſent the two points at him, as in Figure 27, Plate III.

Of the Diſarm on the Thruſt in Tierce, or Carte over the Arm. Figure 28. Plate III.

If the adverſary makes a thruſt in tierce, or carte over the arm, and abandons his body in a careleſs manner, you muſt parry him by a dry ſmart beat with the edge of your fort traverſing the line of the blade, and force or bear his wriſt upwards, at the ſame time paſſing the left foot about a foot before the right: if he ſhould reſiſt, or bring up his left foot to cloſe in and ſeize your blade; in ſuch a caſe, ſtill holding faſt his ſword, you ſhould throw his arm outward to the right, and carry your left foot forward about two feet, bending your right knee a little, and ſtraightening the left, preſent the point of your ſword to his face, raiſing your wriſt and arm to the height of your face, as you may obſerve in Figure 29, Plate III.

Of the Diſarm on the Carte or Seconde Thruſt, after having parried with the Prime Parade. Figure 30. Plate III.

If you are engaged in tierce, make an attack of the foot, and force the enemy's blade on the outſide, to excite him to thruſt; and at the time he thruſts either carte or ſeconde, parry quickly with the prime; and inſtead of traverſing the line to the right, as we have before mentioned in the articles of the parades, you muſt advance about half a foot, and with ſwiftneſs paſs your right arm over the fort of his blade; by this means, by drawing in your body and your left arm, he will be forced to quit his ſword: as ſoon as the diſarm is made, preſent your point, and paſs ſwiftly back, with your right foot at two feet diſtant from the left, as you will ſee in Figure 31, Plate III.

Of the Diſarm after the Parade on the Outſide of the Sword.

If you are engaged on the outſide, either in tierce or carte over the arm, you muſt make an appel of the foot, and force or bear a little on his blade, to excite him to thruſt a carte within the ſword. At the time he diſengages and thruſts out, you muſt counter-diſengage and parry, forcing his blade upward with the fort of yours: you are to paſs your left foot before the right, about the diſtance of a foot, and with livelineſs and reſolution, with your left hand, ſeize the ſhell of his ſword; and as in defending himſelf he might bring up his left leg, and throw himſelf forward on the blade; to hinder his ſeizing it, you ſhould inſtantly throw your right ſhoulder and arm back, and carry your right foot behind the

Various Positions of Disarms — See the Art of Fencing.

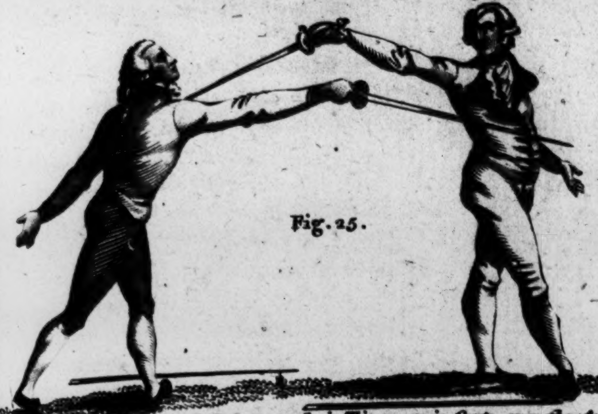
Fig. 25.

e whole turn calld Volte on the Pass, made in Tierce, or in Carte over the Arm.

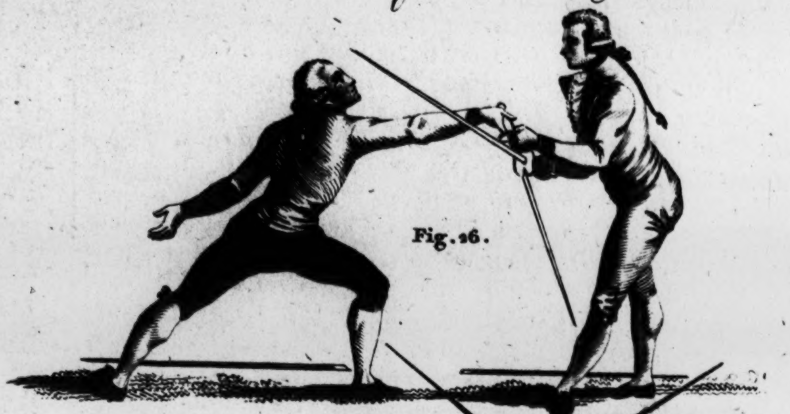
Fig. 26.

A Disarm after having parried the Carte Thrust.

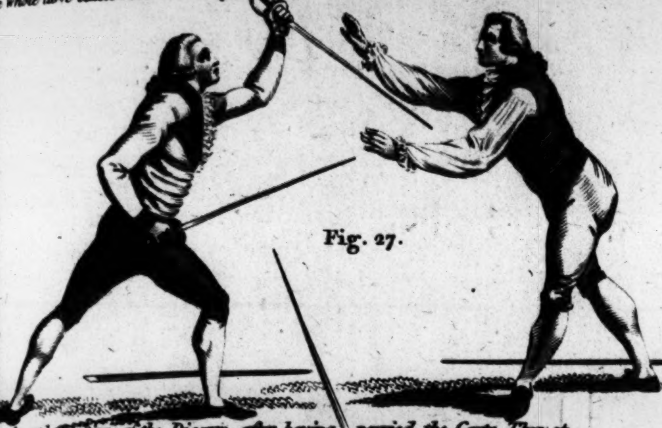
Fig. 27.

Second Position of the Disarm after having parried the Carte Thrust.

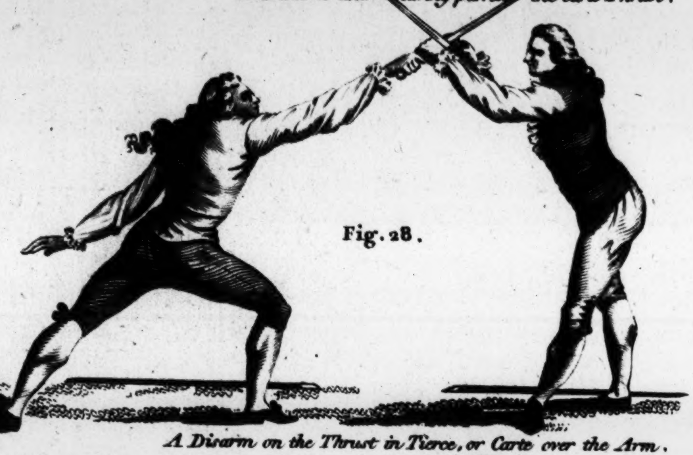
Fig. 28.

A Disarm on the Thrust in Tierce, or Carte over the Arm.

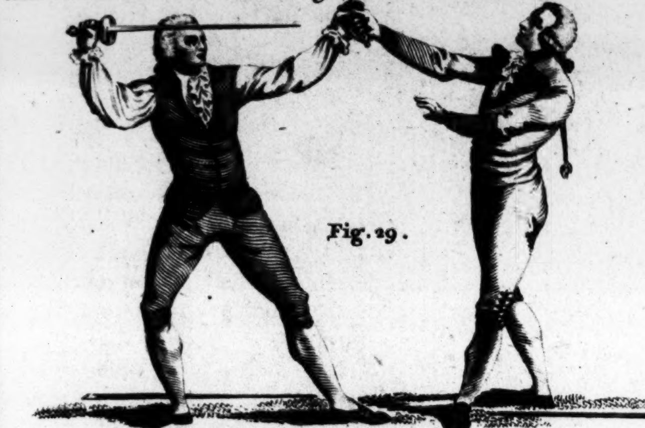
Fig. 29.

The Second Position of the Disarm after having parried the Thrust in Tierce.

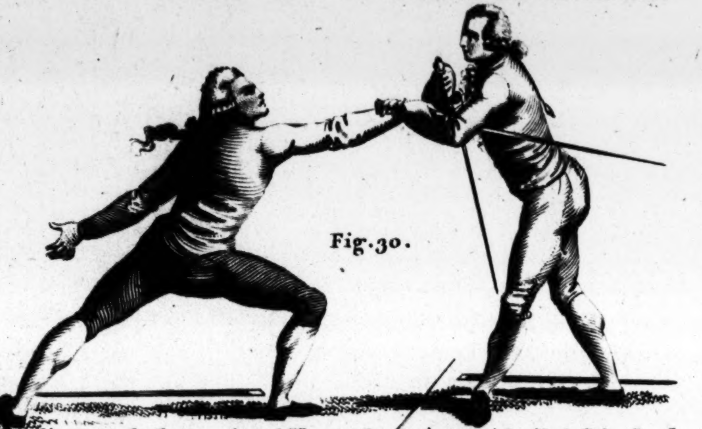
Fig. 30.

The disarm on the Carte or Second Thrust, after having parried with the Prime Parade.

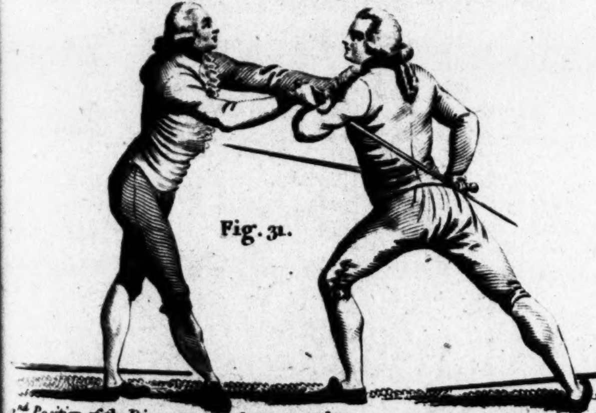
Fig. 31.

2d. Position of the Disarm on the Carte or 2nd. Thrust after having parried with ye prime Parade.

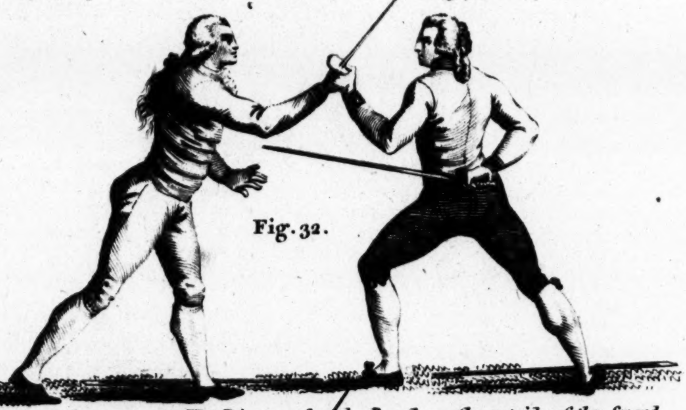
Fig. 32.

The Disarm after the Parade on the outside of the Sword.

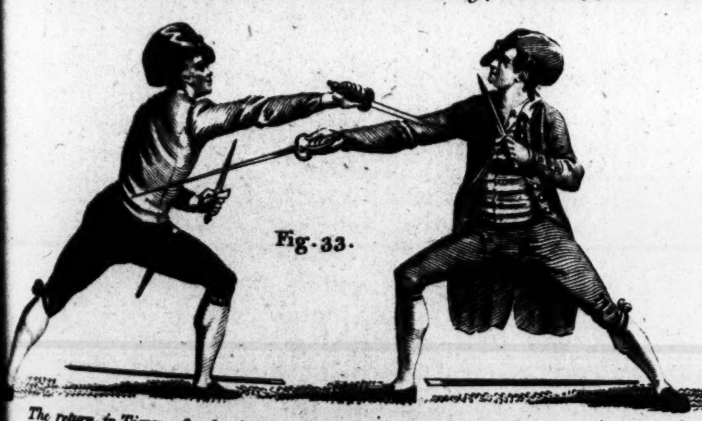
Fig. 33.

The return in Tierce after having parried with the Poignard

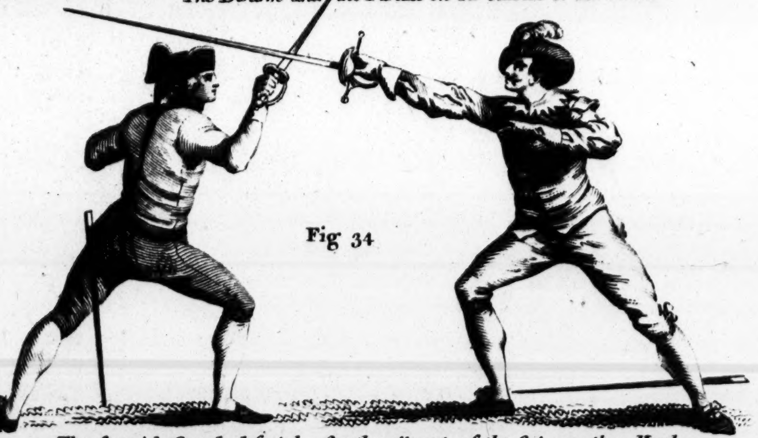
Fig 34

The Spanish Guard defeated, after the attempt of the Cut on the Head

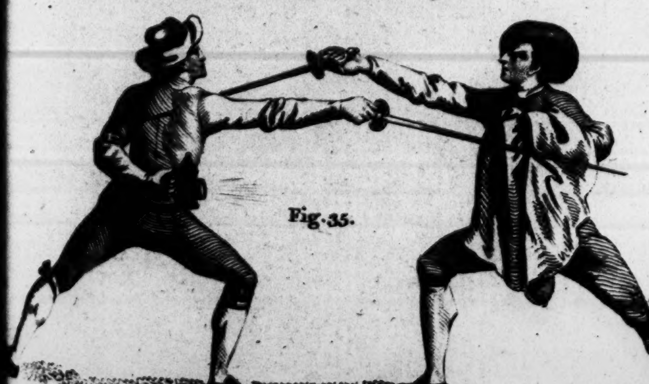
Fig. 35.

The Guard of the Sword and Lanthorn oppos'd by the Sword and Cloak

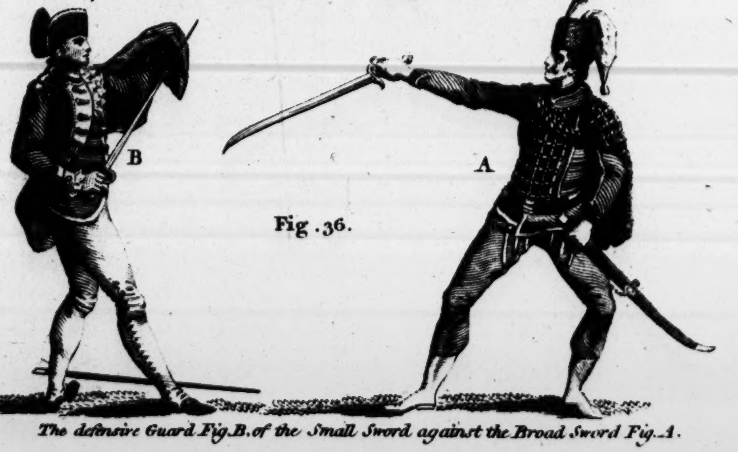

Fig. 36.

The defensive Guard Fig. B. of the Small Sword against the Broad Sword Fig. A.

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the left about a foot, and turning the point of your left foot facing his knee, and paſſing your ſword behind your back, leaning your wriſt againſt your loins, preſent the point of your ſword to his belly. You muſt always obſerve that, in all diſarms, you are never to ſeize the adverſary's arm, nor his blade, with your left hand; for in ſeizing his arm he may again recover his ſword, by ſhifting or throwing it from the right to the left, and having caught hold of it by the gripe, or by the fort of his blade, he may with a drawn in arm ſtab you; and was you to ſeize his blade, he might alſo draw in his arm, and draw it through your hand in a fatal manner. In my opinion, all thoſe diſarms which we have explained, are more brilliant and fine in a fencing ſchool, with a foil in hand, when very well executed, with the utmoſt preciſion and judgement than they are uſeful ſword in hand; nevertheleſs, they may be made uſe of againſt thoſe who abandon their bodies after they thruſt, and who do not recover with that quickneſs and care which is neceſſary. Sword in hand, we prefer the bindings and croſſings of the blade, or the ſmart dry beat with the fort on the feeble of the adverſary; by all theſe you run no riſque; for if you do not beat the ſword out of the hand, you will always get opening thereby to throw in a thruſt if you deſign it.

The Italian Guards with the Sword and Dagger.

This exerciſe of ſword and dagger is only made uſe of in Italy. When the ſcholar has learnt to handle his ſword well, he is afterwards inſtructed how to uſe the ſword and dagger: the Italians ſeldom go out at night without theſe two weapons. The right handed man carries his dagger by the ſide of his right thigh, and the left handed man by his left: they draw this weapon the moment they have ſword in hand. Naples is the city where theſe are moſt commonly uſed, and with moſt dexterity. Though there is no uſe made of the ſword and dagger in this country, we thought it neceſſary to give an explanation thereof, that gentlemen may know how to defend themſelves if they ſhould travel in countries where they are uſed, and not be embarraſſed when they ſee two points at once before them. We ſhall therefore give two different guards, which are the moſt made uſe of in this exerciſe; and will afterwards explain the manner in which a ſingle ſword is to defend itſelf againſt the ſword and dagger. You muſt place yourſelf in guard, with the dagger and arm ſtretched out, and at ſome diſtance from the hilt of your ſword, to execute and form the parades as cloſe as poſſible; which is very difficult with a ſtraight arm. You muſt obſerve that, in covering one ſide, you do not uncover another. In this guard there is no ſingling the body, for the left ſhoulder projects more than the right; and though the right arm covers the outſide of the ſword, it ought to be contracted. When in this poſition you can form your parades well, you will put yourſelf in guard, your ſword arm ſtraight but not ſtiff, and your left drawn in, having the point of your dagger near the right elbow. The principal point is not to flutter, or ſtir at any motion made by the adverſary; if he ſeeks his ſword with his, you muſt ſlip him, unleſs you find yourſelf firm enough to oppoſe him therewith, cloſing in about ſix inches, and without quitting his ſword, ſtrive to get his feeble on the fort of your dagger, and quitting his ſword, it will be eaſy to deceive his dagger, and hit him. In this operation, you muſt not quit his blade with your dagger, and the longer his ſword is, the greater will be your advantage, and alſo on any parade made with the dagger, you ought not to quit the blade, if you have a mind to return the thruſt. The Italians frequently parry with the dagger, therefore it is evident, that he who can parry with two blades has a great advantage, provided it be done without hurry, and with judgment, for otherwiſe he would only leave himſelf continually open. You ſhould baulk your adverſary at the time he makes an attack, or half thruſts, by not ſtirring your ſword, but make ſome wide motions with the dagger, to engage him to thruſt, and as ſoon as he delivers his thruſt, parry with your dagger; cloſe at the ſame time in with him, make a feint with your ſword toward his face, and thruſt at the body, as you ſee in

Figure 33. Plate III.

The Italians defend all the inſide, and the lower part of the body with the dagger, and as they depend entirely on this parade, they lower the outſide with the point of their ſwords.

The ſingle Sword, againſt the Sword and Dagger.

As all the thruſts which the ſingle ſword makes on the inſide, againſt the ſword and dagger, may eaſily be parried; the return of the adverſary's point would infallibly hit, therefore you ſhould act with great judgment and attention. You muſt come to a garde, with your wriſt turned between tierce and carte, and a little lower than the ordinary garde, fixing the point to the adverſary's right ſhoulder, you muſt not engage his ſword, but make frequent beats on his outſide, and attacks with the foot, always directing your point to his face, to oblige him to raiſe his wriſt, which time you muſt ſeize with preciſion, and with ſwiftneſs and vivacity, deliver your thruſt in ſeconde, and return as quick to the prime parry or circle. If he ſhould be in guard with the point in a line with his ſhoulder, you ſhould feint on his inſide, and return with a beat on the outſide, from your fort on his feeble, and deliver a thruſt carte over the arm. If he ſhould hold his point lower than his wriſt, you ſhould place yourſelf ſo likewiſe on his inſide, and making a half thruſt on the inſide, immediately bind is blade ſmartly, and thruſt a flanconade. You may alſo after the half thruſt, croſs bind his ſword, and make your thruſt in tierce; we would not adviſe any body to thruſt on the inſide, becauſe the dagger will be very apt to parry, and thereby you would be liable to the return of the ſword, but when the adverſary is not ſtaunch in his parades, and flutters, ſeeking to parry with his ſword the attack you make on him; in ſuch a caſe, after having made a half thruſt on the inſide, and on the outſide of the dagger, deliver a low thruſt in carte; recover to a guard in tierce, oran half circle.

Of the Spaniſh Guard defeated, after the Attempt of the Cut on the Head. Figure 34. Plate III.

If you make uſe of a ſword of common length, and if you can but ſtand the firſt attack, you will eaſily defend yourſelf againſt a Spaniard, and will be very little embarraſſed by his play or method. You ought to put yourſelf in guard out of diſtance, with your wriſt turned in tierce, holding it a little higher than in the ordinary guard, with great coolneſs, nor anſwer any motion he may make or attempt. If he ſhould attempt the cut on the head, you ſhould parry it with a high tierce, ſtill raiſing your wriſt and bending your body, and cloſe in about a foot or more; after which briſkly return a full ſtretched out thruſt in ſeconde, with your point lower than common in that thruſt, that he may not be able to parry it with his left hand. The thruſt being made, recover inſtantly to a tierce, and traverſing the line to the right, with a forcibly oppoſed wriſt, ſeek his ſword again; at the ſame time bring up your right foot to your left, to throw off his point: ſo will you be enabled to get ground to advantage with the left foot. If the adverſary makes a thruſt to the face or body, you muſt parry it by diſengaging from tierce to carte, keeping your wriſt in a line with the ſhoulder, and at the ſame time cloſe in a full foot, to get within his blade as much as poſſible, and to be able to return a thruſt in carte. If he wants to parry with his left hand, you muſt feint on it, making at the ſame time an appel of the foot, to baulk his left handed parade, and finiſh his thruſt according to the forementioned rules; recover quickly your ſword, with your point to his face, and redouble a low carte. This done, recover to a guard, carrying your right foot behind your left. Though it ſeems eaſy for the ſhort ſword to diſarm the long ſword after you have the advantage of getting within his blade, we would nevertheleſs adviſe not to attempt it, for fear you ſhould not be able to reach the ſhell of his ſword, or for fear of having your fingers cut by the edges of it. We alſo would not adviſe any body to croſs or bind, or to beat on their blades, becauſe the Spaniards, when they draw their ſwords, paſs the two firſt fingers through two ſmall rings which are near the ſhell, and with the two others and the thumb they have a faſt hold of their gripe: therefore it is evident that none of theſe laſt mentioned operations would be ſucceſsful.

Explanation of the Guard called Sword and Dark Lanthorn.

Figure 35. Plate III.

Though there are ſevere puniſhments inflicted on thoſe who are found ſword in hand with a dark lanthorn, yet there are ſome to be met with form time to time; therefore we think it neceſſary to ſhew the manner of defence againſt it. Thoſe who uſe the dark lanthorn commonly hide it under their clothes or cloak; and when they attack any body they open it before they draw their ſword, and preſent it before them either above their head, or behind them, by turning the hand behind their back; and change the poſition thereof as the adverſary changes his poſition. If they hold their lanthorn before them, and one is provided with a good ſword, one ought to cover the inſide well with the cloak, and give a ſmart beat on the inſide of their blade, and redouble it with a back handed blow in tierce on the wriſt which holds the lanthorn: this blow ought to come from the right to the left, and it ought to be executed from the half arm only to the wriſt, that the whole arm go not aſtray too much by it, and that one may be able to return a thruſt with the wriſt in the ſame ſituation, covering the inſide of the body with the cloak. If he ſhould preſent the lanthorn over his head, you ſhould traverſe to the right, and get the advantage of the outſide of his ſword, making half thruſts to the face. If he raiſes his point you ſhould cloſe in diſtance, holding both hands high, and keeping the blade over the left wriſt and cloak, and make a paſs with the left foot without leaving his ſword, and aſſiſting with the cloak, draw in the right arm a little, to diſentangle your point, and in the poſition your wriſt finds itſelf ſituated at that time, thruſt with ſpirit and agility directly at the adverſary. If he preſents the lanthorn by the ſide, with his arm turned behind him, you muſt traverſe the line to the inſide, holding your hand and cloak in the line with your right breaſt, turning your right hand in tierce, the point of your ſword directly to his belly; and the moment he delivers his thruſt, inſtead of parrying it with your ſword, ſtretch out your left arm and cover his blade with your cloak, at the ſame time thruſting at the body, as you ſee in this Figure. If the adverſary ſhould be garniſhed (that is, ſtuffed with ſomething within his clothes, to prevent a thruſt going through to the body) which you will find out by the thruſt being planted at his body without effect; in ſuch a caſe, you muſt thruſt at the throat or at the face, or at the lower part of the waiſt; for it is ſuppoſed that the man who will make uſe of ſo unlawful means as a dark lanthorn in any particular combats, will not ſcruple to uſe the means of garniſh, as before mentioned.

FENCING.

Explanation of the Defenſive Guard of the Small Sword againſt the Broad Sword. Figure 36. Plate III.

The guard of the ſmall ſword marked B, againſt the broad ſword marked A, which we have placed here, is the moſt ſafe, and the moſt ſheltered guard for defence. The chief point will be, to know your diſtance: in whatever poſition the broad ſword man may put himſelf, you muſt place yourſelf out of diſtance, and bring neither your wriſt nor your ſword, nor your right foot forward: but the moment you draw your ſword, you muſt, with your left hand, take up the ſkirts of your coat, keeping your left hand to the height of your ear, in order occaſionally to parry the cuts of the broad ſword on the inſide, either at the head, face, or the lower part of the body. The blow at the head may likewiſe be parried with the fort of your blade, having the wriſt in tierce, and oppoſing the blade almoſt croſſing the line; but your point ſhould be a little higher than the mounting of your ſword: the moment the blow is parried, you muſt cloſe in about a foot, and bending the body a little, return a thruſt in ſeconde, and redouble the thruſt before you recover your guard. Parry the cut on the outſide of the blade to the face with the fort of your blade, and your wriſt turned half way to tierce with a ſtraight point. The blow being parried, you muſt return a thruſt to the face in carte over the arm, and redouble the ſame with a ſeconde. The cut at the belly on the outſide of the ſword, is to be parried by turning your wriſt to a ſeconde, and returning on the ſame ſide. If you parry the inſide cuts which may be made at you with your blade, you ſhould parry them with the prime parade, at the ſame time traverſing the line to the outſide, and return a thruſt in prime. The ſafeſt and ſureſt defence againſt the broad ſword (in our opinion) is not to be fluttered or moved at any motion, ſham blows, or attacks; and if his motions are wide, you muſt reſolve to cloſe in, covering yourſelf as much as poſſible with your ſword and the lap of your coat, and deliver your thruſt where you ſee an opening to hit him. If the ground ſhould not be level enough to tire him, you ſhould, by turning to the right or to the left, and by retreating, take a favourable and exact juſt time for thruſting, inſtead of throwing the thruſt at random. There are ſome broad ſword men who intermix their play with thruſts (which is called counter point) they feign to give a cut, and finiſh it with a thruſt; and ſometimes, after having parried, according to the opening they find, they will return either a cut or a thruſt. The ſword called cut and thruſt is very different from the broad ſword, becauſe it is much lighter, it carries a ſtraight point, and not a raiſed one, as the ſabres or cutting ſwords commonly have; for which reaſon they are obliged to make the hilts heavy, to render the point light. The half cut and thruſt ſword is preferable to the broad ſword, provided it be made uſe of with judgment. This weapon is the beſt for horſemen, when they charge their enemy ſword in hand.

Obſervations on Left Handed Fencers.

It often happens that the right handed fencer is much embarraſſed in defending himſelf againſt a left handed one, occaſioned by the conſtant habit of fencing always with right handed fencers, which gives the left handed fencer a conſiderable advantage. You ſeldom have occaſion to fence with a left handed man, becauſe the number of theſe is but ſmall; and for the ſame reaſon, when two left hands meet, they are equally at a loſs with one another. To obviate this inconveniency, we are of opinion, that a fencing maſter ſhould accuſtom his ſcholars to fence with both hands; that is to ſay, that when the pupil has learnt to handle his foil well with the right hand, he ſhould be exerciſed with the left hand. This practice will be found hard to every body, but with a good will, and by taking pains, you may attain to a degree of perfection which will be advantageous to yourſelf, and will do honour to him that teaches. The maſter ſhould not only uſe his ſcholars to take leſſons with both hands, but ſhould likewiſe uſe them to fence looſe, calling aſſaulting; this method would enable them to defend themſelves with both hands, and they would never be at a loſs againſt an adverſary who might preſent himſelf to them in a different poſition than their own. When a right handed and a left handed fencer are together, they ought to be attentive, both of them, to keep the outſide of the ſword; this ſide being the weakeſt, they have both of them the facility of beating, or making a glizade or preſs on the outſide of the blade. If the beat is given properly, it is almoſt impoſſible that the ſword doth not drop out of the hand, except the adverſary takes the preciſe time of the beat, either by diſengaging, or by turning his wriſt in tierce. You muſt obſerve alſo, that the right handed fencer ought to thruſt carte inſtead of tierce, to the left handed one, and tierce inſtead of carte; that is to ſay, that he ought to thruſt all the outward thruſts within, and the inner thruſts outward. The ſame rules alſo are for the left hand to the right handed fencer; by this means the hand will always be oppoſed to the ſword, and the body and face will always be covered.

The following is an extract from Mr. Olivier's Treatiſe on Fencing, with additions, never before in print, which the publiſher was favoured with by that gentleman.

Of Judgment.

Nothing is ſo neceſſary in fencing as judgment; it enables us to face all ſorts of methods with advantage, to foreſee the thruſts of an adverſary, and to judge of his parades in order to elude them; it is by judgment alone that we are capable of arranging our parades and directing our thruſts; therefore maſters cannot too ſoon implant it in the minds of their ſcholars; for they ſhould never teach them a parade, without telling them by what feint they may deceive it, and explaining to them the various changes to which each thruſt is ſubject. To make it more clear, the maſter ſhould in his leſſon reaſon with his ſcholar in the following manner:

Dialogue between the Maſter and the Scholar.

M. When you perceive that I am about to parry your thruſt over the arm with the ſimple parade of tierce, what are you to do to avoid my parade? — *S.* I make the feint une-deux in carte within the arm? — *M.* If I had made uſe of the counter in carte? — *S.* I Should have avoided your counter in carte by changing twice round over the arms, what we call doubling? — *M.* What parade muſt I take to prevent your doubling? — *S.* Having parried with the counter in carte, miſſing the blade, you ſtop my doubling with the parade of tierce or ſemi-circle? — *M.* When I parry feint une-deux, over the arms with the counter in carte, what are you to do to avoid my parade? — *S.* I make the feint une-deux, and ſeize the time of your round parade to puſh double carte over the arms? — *M.* When I parry the feint une-deux in carte with the parade of ſemi-circle, what are you to do to deceive that parade? — *S.* I make the feint une-deux, and as ſoon as you form the parade of ſemi-circle, I go round your blade and puſh low carte? — *M.* If I had parried with the circle? — *S.* I ſhould have been twice round, and puſhed double carte within the arms? *M.* When you fence with an adverſary who keeps a ſtraight guard what are you to do? — *S.* I am to make ſeveral beats with the right foot upon the ground, if that does not put him in diſorder, I am to give him a dry beat upon the foible of his ſword in order to throw it away, then I am to puſh a ſtraight thruſt?

M. What is the moſt proper time to attack one's adverſary? — *S.* When the leaſt motion puts him in diſorder, or when he breaks ground? — *M.* Do not you fear his retreat is but a ſnare to take the time? — *S.* In cloſing on him I make ſure of his ſword, and know by the feel of it whether he has a mind to thruſt or parry? — *M.* When you have to deal with an adverſary that does not feel your blade, and puts himſelf in an open guard with the point of his ſword downwards, what will you do? — *S.* I am to make falſe attacks to oblige him to take a proper guard and only thruſt when he anſwers them? — *M.* Which are the beſt parades in fencing? — *S.* The counter parades and the circles, becauſe they baffle all the feints? — *M.* How can you tell when your adverſary will make uſe of them? — *S.* In diſengaging ſlightly on one ſide to the other, or by the feel of his ſword? — *M.* What are the beſt thruſts in fencing? — *S.* The ſtraight thruſt puſhed with ſwiftneſs; they are the only ones we ought to thruſt when in reach, becauſe they expoſe the leaſt? — *M.* Which is the way to acquire ſwiftneſs? — *S.* It is to puſh frequently tierce and carte; for by that exerciſe only you gain ſwiftneſs, firmneſs, and exactneſs, &c. *M.* How many guards are there in ſmall ſword play? — *S.* Two, called tierce and carte. — *M.* How many engagements are there in fencing? — *S.* Two, called alſo carte and tierce (engagement is a ſynonimous term with guard.) — *M*, How many parades are there, and how are they divided? — *S.* Six ſimple parades and ſix compound, they are divided in carte, tierce, ſemicircle, octave, prime, ſeconde, or quinte; carte ſemicircle and prime, are the inward parades, and tierce octave and ſeconde or quinte are the outward parades. — *M.* Which is the beſt method to form the defence? — *S.* The counter parades in carte, tierce, the circle, octave, carte, and the counter parades in carte again: what we call the ſucceſſion of parades, to form a regular defence, in order to baffle all feints. — *M.* Can you confine your defence in fewer parades? — *S.* The counter parade of carte, the circle, and from the circle to the double counter in carte, obſerving to make the counter parades and circles ſmall from the wriſt, but wide from the point, in order to cover all the body from any wide or low thruſt, taking particular care to bring the point of the ſword in a line with the adverſary's body after the parades. — *M.* What is the beſt method to begin an attack? — *S.* By making an extenſion of the arm, either in carte or tierce, to oblige the adverſary to open his guard, and in the moment that he does ſo, ſeize the advantage it will give, by throwing a thruſt accordingly.

This Treatiſe is principally formed from the works of Meſſrs. Angelo and Olivier. The deſcriptions which illuſtrate the plates, are taken from Mr. Angelo; as he has been more copious, and introduced a greater variety of poſitions and engagements than any other writer on the ſubject. For many of the other parts I am indebted to Mr. Olivier, who has greatly ſimplified the manner, and rendered it more eaſy to the young practitioner in the art. I cannot but obſerve, in juſtice to the latter, that his method of teaching is far ſuperior to that adopted in any of the ſchools wherein I have practiſed: nor can I permit this opportunity to paſs without expreſſing my acknowledgment to that gentleman, for the conſiderable aſſiſtance he has afforded me in compoſing this Treatiſe. Thoſe who wiſh to attain a proficiency in the practical part of the art, I cannot recommend to a better maſter than Mr. Olivier, whoſe terms of teaching may be known by referring to the wrapper, No. 73, of this work.

C. COOKE.

PATER-NOSTER ROW.

FENDUE *en pal*, in heraldry, a French phraſe, applied to a croſs, to denote it cloven down from top to bottom and the parts ſet at ſome diſtance from one another.

FENNEL, in botany. See ANETHUM.

FEODAL, *Feodalis*, or *Feudalis*, of or belonging to a feud, or fee. Hence feudal ſervices, &c. See FEE.

FELÆ, in the Linnæan ſyſtem, one of the orders of animals, of the claſs of mammalia; the characters of which are, that they have ſharp teeth; the upper four-teeth are ſix in number, and the canine or dog teeth longer than the reſt. Of this order are the bear, the lion, the tyger, the cat, the weaſel, the ferret, the didelphis or philander, the otter, the ſea-calf, the dog, the badger, the hedge-hog, the mole, and the bat, which this author makes not a bird, but a quadruped, with its fore-feet expanded into a ſort of wings, &c. For the claſſification ſee MAMMALIA or Syſtem of QUADRUPEDS.

FERIÆ, among the Romans, were holy-days, or days wherein they abſtained from work. The *feriæ*, or *dies ferati*, were obſerved and diſtinguiſhed chiefly by reſt; whereas the *feaſts*, or *dies feſti*, beſide a ceſſation from labour, were celebrated with ſacrifices and games; ſo that there were *feriæ*, which were not feaſt days; though authors frequently confound the *feriæ* and *feſti*.

FERMENT, any body which, being applied to another, produces fermentation. Ferments are either matters already in the act of fermentation, or that ſoon run into this act. Of the firſt kind are the flowers of wine, yeaſt fermenting beer, or fermenting wine, &c. and of the ſecond are the new expreſſed vegetable juices of ſummer-fruit. Among diſtillers, ferments are all thoſe bodies which, when added to the liquor, only correct ſome fault therein, and, by removing ſome obſtacle to fermentation, forward it by ſecondary means: as alſo ſuch as, being added in time of fermentation, make the liquor yield a larger proportion of ſpirit, and give it a finer flavour.

FERMENTATION may be defined a ſenſible internal motion of the conſtituent particles of a moiſt, fluid, mixed, or compound body: by the continuance of which motion, theſe particles are gradually removed from their former ſituation or combination, and again, after ſome viſible ſeparation is made, joined together in a different order and arrangement, ſo that a new compound is formed, having qualities very ſenſibly different from thoſe of the original fluid. Fermentation, properly ſo called, is confined to the vegetable and animal kingdoms; for the efferveſcences between acids and alkalies, however much they may reſemble the fermentation of vinous liquors, are nevertheleſs exceedingly different. It is divided into three kinds; or rather, there are three different ſtages of it, viz. the vinous, the acetous, and the putrefactive. Of the firſt, vegetables alone are ſuſceptible; the fleſh of young animals is in ſome ſlight degree ſuſceptible of the ſecond; but animal ſubſtances are particularly ſuſceptible of the third, which vegetables do not ſo eaſily fall into without previouſly undergoing the firſt and ſecond. The produce of the firſt ſtage is wine, or ſome other vinous liquor; of the ſecond, vinegar; and of the third, volatile alkali. See BREWING, VINEGAR, &c. Fermentation is one of the moſt obſcure proceſſes in nature, and no attempt has been made to ſolve it with any degree of probability. All that we know with regard to it is, that the liquor, however clear and tranparant at firſt, no ſooner begins to ferment, than it becomes turbid, depoſits a ſediment, emits a great quantity of fixed air, and throws up a ſcum to the top, acquiring at the ſame time ſome degree of heat. The heat of the vinous ſtage, however, is but moderate, ſeldom or never exceeding that of the human body. The heat of the acetous is conſiderably greater; and that of the putrefactive is the greateſt of all, inſomuch that putrefying ſubſtances, when heaped together in great quantities, will ſometimes break forth into actual flame. From theſe phenomena, fermentation ſhould ſeem to be a proceſs ultimately tending to the entire diſſolution of the fermenting ſubſtance, and depending upon the action of the internal heat, etherial fluid, or whatever elſe we pleaſe to call it, which pervades, and makes an eſſential ingredient in, the compoſition of all bodies. From ſuch experiments as have been made upon this ſubject, it appears, that whether fixed air is the bond of connection between the particles of terreſtrial bodies or not, yet the emiſſion of it from any ſubſtance is always attended with a diſſolution of that ſubſtance. We cannot, however, in the preſent caſe, ſay that the emiſſion of the fixed air is the cauſe of the fermentation. It is in fact otherwiſe. Fixed air hath no tendency to fly off from terreſtrial ſubſtances with which it is united; on the contrary, it will very readily leave the atmoſphere, after it hath been united with it, to join itſelf to ſuch terreſtrial ſubſtances as are capable of abſorbing it. The emiſſion of it, therefore, muſt depend upon the action of ſome other fluid; moſt probably the fire or heat, which is diſperſed through all ſubſtances in a latent ſtate, and in the preſent caſe begins ſenſibly to manifeſt itſelf. But from what cauſe the heat originally begins to operate in this manner, ſeems to be entirely unknown and inexplicable, except that it appears ſomehow or other to depend on the air; for, if that is totally excluded, fermentation will not go on.

FERN, FELIX, in botany. See FILICES. Fern is very common in dry and barren places. It is one of the worſt weeds for lands, and very hard to deſtroy where it has any thing of a deep ſoil to root in. In ſome grounds, the roots of it are found to the depth of ſix feet. One of the moſt effectual ways to deſtroy it is, often mowing the graſs; and, if the field is ploughed up, plentiful dunging thereof is very good. In ſome places of the north, the inhabitants mow it green; and, burning it to aſhes, make thoſe aſhes up into balls with a little water. They then dry them in the ſun, and make uſe of them to clean their linen with; looking upon it to be near as good as ſoap for that purpoſe. It is ſaid, that the frequent treading them down by ſheep, while that ſort of cattle feed upon them, is an infallible method of killing them. The ancients uſed the root of the fern and the whole plant, in decoctions and diet drinks, in chronic diſorders of all kinds ariſing from obſtructions of the viſcera, particularly in hypochondriac caſes, and in obſtructions of the ſpleen and pancreas. There are not wanting modern authors who give it as high a character in theſe caſes as the ancients have done; but it is an ill taſted medicine, and in no great uſe in the ſhops. The country people eſteem it as a ſovereign remedy for the worms; and they give it as a powder, after drying it in an oven. As aperients and anthelmintics, the roots have been in high eſtimation with ſome; and Simon Pauli tells us, that they have been the grand ſecret of ſome empirics againſt the broad worm, called tænia. In the Medical Commentaries, vol. vi. p. 307. are given ſome inſtances of the ſucceſs of this remedy, by Dr. Duncan of Edinburgh.

FERRET, an animal of the Muſtella or Weazel kind. See MUSTELLA.

FERRETTO, in the glaſs-trade, a ſubſtance which ſerves to colour glaſs. This is made by a ſimple calcination of copper, but it ſerves for ſeveral colours. There are two ways of making this; the firſt is as follows; take thin plates of copper, and lay them on a layer of powdered brimſtone, in the bottom of a crucible: over theſe lay more brimſtone and over that another layer of the plates, and ſo on alternately till the pot is full. Cover the pot, lute it well, place it in a wind-furnace, and make a ſtrong fire about it for two hours. When it is taken out and cooled, the copper will be found ſo calcined that it may be crumbed to pieces between the fingers like a friable earth; it will be of a reddiſh, and in ſome parts a blackiſh colour. This muſt be powdered and ſifted fine for uſe. Neri's Art of Glaſs, p. 30. The other way is leſs eaſy, but it makes a more valuable ferretto. It is this; make a number of ſtratifications of plates of copper and powdered vitriol alternately in a crucible, which place on the floor of the glaſs-furnace near the eye, and let it ſtand there three days; then take it out, and make a new ſtratification with more freſh vitriol, and calcine it again as before: repeat this operation ſix times, and a moſt valuable ferretto is produced.

FERRUGINOUS, denotes a thing to partake of the nature of iron, or to contain particles of that metal. It is particularly applied to certain mineral ſprings, whoſe water in their paſſage along the ſtrata of the earth meets with the ore of this metal, or with pyritæ containing it, part of which they waſh off, and carry with them; and thus become impregnated with the principles thereof. Such are what we call chalybeat waters. The waters of Tunbridge, thoſe of Forges, and of the iron ſpring at Bourges, and many others, are ferruginous.

FERRUGO, the ruſt of iron, or a kind of calx found on the ſurface thereof. The ruſt of iron is a reſtringent; applied by way of peſſary, it repreſſes the fluor uterinus; and drank, prevents conception; it cures the eryſipelas, and exanthematous eruptions. It is of good uſe in a paronychia, roughneſs of the eye-lids, and a condylema. It alſo ſtrengthens the gums, relieves under the gout, being rubbed on the part affected, and makes the hair grow after an alopecia. Wine or water, in which red hot iron has been quenched, being drank, is good for the cœliac paſſion, dyſentery, diſorders of the ſpleen, cholera morbus, and relaxations of the ſtomach.

FERRY, a liberty by preſcription to have a boat for paſſage upon a river, for the carriage of horſes and men for a reaſonable toll; it is uſually to croſs a large river.

FERTILITY, fruitfulneſs, that quality which denominates a thing fertile or prolific. Nothing can produce fertility in either ſex but what promotes perfect health; nothing but good blood, ſpirits, and perfect animal functions, that is, high health, can beget perfect fecundity; and therefore, according to Dr. Cheyne, all means and medicines, all noſtrums and ſpecifics to procure fertility, different from thoſe which procure good blood and ſpirits, are arrant quackery and cheating. He ſays, that water-drinking males are very rarely infertile; and that if any thing in nature can prevent infertility, and bring fine children, it is a milk and ſeed-diet, perſevered in by both parents. To increaſe the fertility of vegetables, ſays lord Bacon, we muſt not only increaſe the vigour of the earth and of the plant, but alſo preſerve what would otherwiſe be loſt: whence he infers, that there is much ſaved by ſetting, in compariſon of ſowing. It is reported, continues he, that if nitre be mixed with water to the thickneſs of honey, and after a vine is cut, the bud be anointed therewith, it will ſprout within eight days. If the experiment be true, the cauſe may be in the opening of the bud, and contiguous parts, by the ſpirit of the nitre; for nitre is the life of vegetables. How far this may be true, is not perhaps ſufficiently ſhewn, notwithſtanding the experiments of Sir Kenelm Digby and M. Homberg. Conſult Mr. Evelyn's Sylva, the Philoſophical Tranſactions, the French Memoirs, and Dr. Stahl's Philoſophical Principles of Chymiſtry: but a proper ſet of accurate experiments ſeems ſtill wanting in this view.

FERULÆ, among ſurgeons, called alſo ſplinters, are little chips of different matter; as of wood, bark, leather, paper, &c. applied to bones that have been disjointed when they are ſet again.

FESSE, in heraldry, one of the nine honourable ordinaries of the eſcutcheon, which it divides horizontally in the middle, and ſeparates the chief from the point. It is ſuppoſed to repreſent a broad girdle or belt of honour, ſuch as thoſe with which knights at arms weje anciently girded.

FESSE *Point*, is the exact centre of the eſcutcheon. It is thus called, as being the point through which the feſſe line is drawn from the two ſides: and accordingly it divides the eſcutcheon into two equal parts when the eſcutcheon is parted *per feſſe*.

FESTI *Dies*, among the ancients, were feaſt-days or holidays.

FESTOON, in architecture and ſculpture, is a decoration in form of a garland or cluſter of flowers. The word is French, *feſton*, which ſignifies a *garland*, formed of the Latin, *feſtum*, *feaſt*. It conſiſts of a ſtring or collar of flowers, fruits, and leaves, tied together, ſomewhat biggeſt in the middle, and ſuſpended by the two extremes; from which, beſide the main part which falls down in an arch, two leſſer parts hang perpendicularly. This ornament is made in imitation of the feſtoons or long cluſters of flowers, hung by the ancients on the doors of their temples, &c. on feſtival occaſions. Feſtoons are now chiefly uſed in freezes, tablets, and other vacant places, required to be filled up and adorned. They are ſometimes uſed over or under a niche.

FET-*Lock*, a tuft of hair growing behind the paſtern joint of horſes. Hence, the joint where it grows is called the fet-lock joint.

FEUD, FEODUM, the ſame with fief or fee. Eſtates in land were originally at will, and then they were called *munera*; afterward they were for life, and then they were called *beneficia*; and for that reaſon the livings of clergymen are ſo called at this day; and afterward they were made hereditary, when they were called *feoda*, and in our law fee-ſimple. When Hugh Capet uſurped the kingdom of France, about the year 947, to ſupport himſelf in ſuch uſurpation, he granted to the nobility and gentry, who till then generally enjoyed their honours for life, or at will only, that they ſhould from thence-forth hold them to them and their heirs. However, under the reign of Ludovicus Pius, who ſucceeded his father A. D. 814. grants of hereditary fiefs were frequent in France. Dr. Robertſon obſerves, that a character of King Robert of France, A. D. 1008, is the earlieſt deed in which he has met with the word *feudum*. Hiſt. Ch. V. vol. i. p. 269. This was imitated by William, called the Conqueror, upon his acceſſion to the crown of England; for till his reign feuds or fees were not hereditary, but only for life, or for ſome determinate time. See FEE.

FEUD is alſo uſed in our ancient cuſtoms for a capital quarrel or enmity, not to be ſatisfied but with the death of the enemy; and thence uſually called deadly feud.

FEUDAL, or FEODAL, of, or belonging to a feud or fee. We ſay, a feudal matter, feudal juriſprudence, feudal ſeiſure, &c. A feudal lord, in default of fealty and homage from his vaſſal, may ſeize the fruits of the fee. See FEE.

FEVER, FEBRIS, in medicine, a diſeaſe, or rather claſs of diſeaſes, whoſe characteriſtic is a preternatural heat felt through the whole body, or, at leaſt, the principal parts thereof, attended with other ſymptoms. See Syſtem of MEDICINE.

FIAT, in law, a ſhort order or warrant ſigned by a judge, for making out and allowing certain proceſſes.

FIBRARIÆ, a claſs of foſſils, naturally and eſſentially ſimple, not inflammable nor ſoluble in water; and compoſed of parallel fibres, ſome ſhorter, others longer; their appearance being bright, and in ſome degree tranſparant: add to this, that they never give fire wih ſteel, nor ferment with or are ſoluble in acid menſtrua.

FIBRE, in anatomy, a perfectly ſimple body, or at leaſt as ſimple as any thing in the human ſtructure; being fine and ſlender like a thread, and ſerving to form other parts. Hence ſome fibres are hard, as the boney ones; and others ſoft, as thoſe deſtined for the formation of all the other parts.

The fibres are divided alſo, according to their ſituation, into ſuch as are ſtraight, oblique, tranverſe, annular, and ſpiral; being found arranged in all theſe directions in different parts of the body. Fibre is alſo uſed to denote the ſlender filaments which compoſe toher bodies, whether animal, vegetable, or mineral; but more eſpecially, the capillary roots of plants.

FIBROSE, ſomething conſiſting of fibres, as the roots of plants.

FIBULA, in anatomy, one of the bones of the leg, called alſo *perone*, *ſura*, and *focile minus*. See Syſtem of ANATOMY, Part II. Sect. XII, Plate I. Oſteology, Fig. I, Letter *h*.

FICTION, See FABLE.

FICUS, the fig-tree; a genus of the trioecia order, belonging to the polygamia claſs of plants. There are ten ſpecies, of which the following are the moſt remarkable.

1. The carica, or common fig, with an upright ſtem branching 15 or 20 feet high, and garniſhed with large palmated or hand-ſhaped leaves. Of this are a number of varieties; as the common fig, a large, oblong, dark purpliſh blue fruit; which ripens in Auguſt either on ſtandards or walls, and the tree carries a great quantity of fruit. The brown or cheſnut fig; a large, globular, cheſnut-coloured fruit, having a purpliſh delicious pulp, ripening in July and Auguſt. The black iſchia fig; a middle-ſized, ſhortiſh, flat-crowned, blackiſh fruit, having a bright pulp; ripening in the middle of Auguſt. The green iſchia fig; a large, oblong, globular-headed, greeniſh fruit, ſlightly ſtained by the pulp to a reddiſh-brown colour; ripens in the end of Auguſt. The brown iſchia fig; a ſmall, pyramidal, browniſh-yellow fruit, having a purpliſh very rich pulp; ripening in Auguſt and September. The Malta fig; a ſmall flat-topped brown fruit, ripening in the middle of Auguſt or beginning of September. The round brown Naples fig; a globular, middle-ſized, light-brown fruit, and browniſh pulp; ripe in the end of Auguſt. The long, brown, Naples fig; a long dark-brown fruit, having a reddiſh pulp; ripe in September. The great blue fig; a large blue fruit, having a fine red pulp. The black Genoa fig; a large, pear-ſhaped, black-coloured fruit, with a bright red pulp; ripe in Auguſt.

2. The ſycamorus, or ſycamore of ſcripture. According to Mr. Haſſelquiſt, this is a huge tree, the ſtem being often 50 feet round. The tree is very common in the plains and fields of Lower Egypt. It buds in the latter end of March, and the fruit ripens in the beginning of June. It is wounded or cut by the inhabitants at the time it buds; for without this precaution, they ſay, it would not bear fruit.

3. The religioſa, or banian tree, is a native of ſeveral parts of the Eaſt Indies. It hath a wooden ſtem, branching 20 or 30 feet high, with heart-ſhaped entire leaves, ending in acute points. I is called by the Dutch, *devil's tree*; and by the inhabitants of Ceylon, *budughaha*, and *budughas*. *Buddu*, according to the tradition of theſe countries, was the name of the prophet who firſt taught the Indians under the grateful ſhade of this tree: for this reaſon, they not only give this ſpecies of fig a name commemorative of their prophet, but likewiſe pay it a particular veneration, by celebrating all their ſacrifices under its ſhade.

Culture. The carica is the ſpecies moſt frequently cultivated in this country, and the only one which does not require to be kept in a ſtove. It may be propagated either by ſuckers ariſing from the root, by layers, or by cuttings. The ſuckers are to be taken off as low down as poſſible; trim off any ragged part at bottom, leaving the tops entire, eſpecially if for ſtandards; and plant them in nurſery lines at two or three feet diſtance from each other, or they may at once be planted where they are to remain; obſerving, that if they are deſigned for walls or eſpaliers, they may be headed to ſix or eight inches in March, the more effectually to force out lateral ſhoots near the bottom; but, if intended for ſtandards, they muſt not be topped, but trained with a ſtem, not leſs than 15 or 18 inches for dwarf ſtandards, a yard for half-ſtandards, and four, five, or ſix feet for full ſtandards. Then they muſt be ſuffered to branch out to form a head; obſerving, that, whether againſt walls, eſpaliers, or ſtandards, the branches or ſhoots muſt never be ſhortened unleſs to procure a neceſſary ſupply of wood: for the fruit is always produced on the upper parts of the young ſhoots; and if theſe are cut off, no fruit can be expected. The beſt ſeaſon for propagating theſe trees by layers is in autumn; but it may be alſo done any time from October to March or April. Chooſe the young pliable lower ſhoots from the fruitful branches: lay them in the uſual way, covering the body of the layers three or four inches deep in the ground, keeping the top entire, and as upright as poſſible; and they will be rooted and fit to ſeparate from the parent in autumn; when they may be planted either in the nurſery, or where they are to remain, managing them as above directed. The time for propagating by cuttings is either in autumn at the fall of the leaf, or any time in March: chooſe well ripened ſhoots of the preceding ſummer; ſhort, and of robuſt growth, from about 12 to 15 inches long; having an inch or two of the two years wood at their baſe, the tops left entire; and plant them ſix or eight inches deep, in a bed or order of good earth, in rows two feet aſunder: and when planted in autumn, it will be eligible to protect their tops in time of hard froſt, the firſt winter, with any kind of long looſe litter.

Uſes. Figs are a conſiderable article in the materia medica, chiefly employed in emollient cataplaſms and pectoral decoctions. The beſt are thoſe which come from Turky. Many are alſo brought from the ſouth of France, where they prepare them in the following manner. The fruit is firſt dipped in ſcalding hot ley made of the aſhes of the fig tree, and then dried in the ſun. Hence theſe figs ſtick to the hands, and ſcour them like lixivial ſalts; and for the ſame reaſon they excite to ſtool, without griping. They are moderately nutrimental, grateful to the ſtomach, and eaſier to digeſt than any other of the ſweet fruits. They have been ſaid to produce lice, when eaten as a common food; but this ſeems to be entirely without foundation. The reaſon of this ſuppoſition ſeems to be, that in the countries where they grow naturally, they make the principal food of the poor people, who are generally troubled with theſe vermin. The wood of the ſycamore is not ſubject to rot; and has therefore been uſed for making of coffins, in which embalmed bodies were put. Mr. Haſſelquiſt affirms, that he ſaw in Egypt, coffins made of this kind of wood, which had been preſerved ſound for 2000 years.

FIDDLE. See VIOLIN.

FIDES, or FAITH, one of the virtues, deified by the Pagans. She had a temple near the capitol, founded by Numa Pompilius; but no animals were offered, or blood ſpilt, in her ſacrifices. During the performance of her rites, her prieſts appeared in white veſtments, with their heads and hands covered with linen, to ſhew that fidelity ought to be ſecret.

FIELD, in agriculture, a piece of ground incloſed, whether for tillage or paſture.

FIELD, in heraldry, is the whole ſurface of the ſhield, or the continent, ſo called becauſe it containeth thoſe atchievements anciently acquired in the field of battle. It is the ground on which the colours, bearings, metals, furs, charges, &c. are repreſented. Among the modern heralds, field is leſs frequently uſed in blazoning than ſhield or eſcutcheon. See the article SHIELD, &c.

FIELD *Book*, in ſurveying, that wherein the angles, ſtations, diſtances, &c. are ſet down.

FIELD *Colours*, in war, are ſmall flags of about a foot and half ſquare, which are carried along with the quarter-maſter general, for marking out the ground for the ſquadrons and battalions.

FIELD *Fare*, in ornithology. See TURDUS.

FIELD *Officers*, in the art of war. See OFFICER.

FIELD *Pieces*, ſmall cannons, from three to twelve pounders, carried along with an army in the field.

FIELD *Staff*, a weapon carried by the gunners, about the length of a halbert, with a ſpear at the end; having on each ſide ears ſcrewed on, like the cock of a match lock, where the gunners ſcrew in lighted matches, when they are upon command; and then the field ſtaffs are ſaid to be armed.

FIELD *Works*, in fortification, are thoſe thrown up by an army in beſieging a fortreſs, or by the beſieged to defend the place. Such are the fortifications of camps, highways, &c.

FIERI *Facias*, in law, a judicial writ, which lies at all times within the year and day, for him that hath recovered in an action of debt and damages: it is directed to the ſheriff, commanding him to levy the debt and damages on him, againſt whom the recovery was had.

FIFE, in muſic, a ſort of wind inſtrument, being a ſmall pipe.

FIFTH, in muſic, one of the harmonical intervals, or concords. See Syſtem of MUSIC.

FIG *Tree Cloth of Otaheite*, in the ſouth ſea, is a coarſe and harſh cloth, of the colour of the darkeſt brown paper, made of the bark of a tree which reſembles the wild fig-tree of the Weſt Indies. This cloth has the quality of reſiſting water; and the greater part of it is perfumed, and worn by the chiefs as a morning dreſs. For the method of manufacturing and colouring this cloth, ſee AOUTA. Hawksworth's Voyag. vol. ii. p. 210, &c.

FIGWORT, a plant, called by the botaniſts, Scrophularia.

FIGURATIVE, that which has a relation to figure, or that teaches under ſome obſcure reſemblance. Thus a figurative ſtyle is that which abounds in figures. The figurative ſtyle, F. Bouhours obſerves, is neither the moſt juſt, nor the beſt. For this reaſon Cicero directs us to the ancients, who not having yet bethought themſelves to uſe figurative expreſſions, but keeping to the moſt proper and natural way, have almoſt all wrote well. *Sunt enim illi veteres, qui nondum ornare poterant ea, que dicebant omnes prope præclare locuti.* Long uſe, ſay the grammarians, renders that proper in all languages, which at firſt was figurative. The ſame thoughts appear more lively when expreſſed by a figure, than when in ſimple terms. The reaſon is, that figurative expreſſions denote not only the principal matter, but alſo the emotion and paſſion of the perſon who ſpeaks.

FIGURATIVE is alſo much uſed in ſpeaking of the myſteries and figures of the old law. In this ſenſe manna is ſaid to be figurative of the euchariſt.

FIGURATIVE is alſo uſed in the Greek grammar for what we otherwiſe call characteriſtic, viz. a letter that characterizes certain tenſes of the Greek verbs; or that diſtinguiſhes and ſpecifies them. In the firſt conjugation of the Barytonous verbs, the φ is characteriſtic, or figurative of the præter tenſe, and the ψ of the future.

FIGURE, FIGURA, in a general ſenſe, denotes the ſurface or terminating extremes of a body. All bodies have ſome figure; whence, figurability is generally ranked among the eſſential properties of body or matter. A body without figure, would be an infinite body. The corpuſcular philoſophers account for every thing from the figure, bulks, and motions of the atoms, or primary corpuſcles of bodies. For the figures of bodies, conſidered as objects of ſight, ſee VISION.

FIGURES, in architecture and ſculpture, denote repreſentations of things made in ſolid matters; ſuch as ſtatues, &c. We ſay figures of braſs, of marble, of ſtucco, of plaiſter, &c. But in this ſenſe too, the term is more uſually applied to human repreſentations than to other things. Thus we ſay, an equeſtrian figure for a man on horſeback.

FIGURES, in arithmetic, are the numerical characters or the characters whereby numbers are expreſſed or written. Thus the number of four hundred and fifty is written, or expreſſed, by three figures, 450. The figures in arithmetic are the nine digets; 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. See Syſtem of ARITHMETIC, Article I.

FIGURE, in dancing, denotes the ſeveral ſteps which the dancers make in order, and cadence; conſidered as they mark certain figures on the floor,

FIGURES, in fencing, are the divers guards, poſtures, attitudes or diſpoſitions, of the body, arm, or ſword. See Treatiſe on the Art of FENCING.

FIGURE, in fortification, is the plan of any fortified place; or interior polygon, &c. When the ſides and angles are equal, it is called a regular; when unequal, an irregular figure. See Treatiſe on the Art of FORTIFICATION.

FIGURE, in geometry, denotes a ſurface incloſed, or circumſcribed with one or more lines. Such are triangles, ſquares, polygons, circles, elipſes, &c. See Syſtem of GEOMETRY.

FIGURE, in grammar, is an expreſſion that deviates from the common and natural rules of grammar: either for the ſake of elegance or brevity.

The beſt grammarians only reckon four figures; the ELIPSIS, PLEONASM, SYLLEPSIS, and HYPERBATON. Others add: two more; viz. ANTIPTOSIS, and ENALAGE.

FIGURE, in compoſition. See ORATORY; alſo ALLEGORY, APOSTROPHE, HYPERBOLE, METAPHOR, PERSONIFICATION.

A FIGURE, *the Means or Inſtrument conceived to be the Agent.* When we ſurvey a number of connected objects, that which makes the greateſt figure employs chiefly our attention; and the emotion it raiſes, if lively, prompts us even to exceed nature in the conceptions we form of it.

A FIGURE, *which, among related Objects, extends the Properties of one to another.* This figure is not dignified with a proper name, becauſe it has been overlooked by writers. It merits, however, a place in this work; and muſt be diſtinguiſhed from the others elſewhere treated, as depending on a different principle. *Giddy brink, jovial wine, daring wound*, are examples of this figure. Here are adjectives that cannot be made to ſignify any quality of the ſubſtances to which they are joined: a brink, for example, cannot be termed giddy in a ſenſe, either proper or figurative, that can ſignify any of its qualities or attributes. When we examine attentively the expreſſion, we diſcover, that a brink is termed giddy from producing that effect in thoſe who ſtand on it: in the ſame manner, a wound is ſaid to be daring, not with reſpect to itſelf, but with reſpect to the boldneſs of the perſon who inflicts it: and wine is ſaid to be jovial, as inſpiring mirth and jollity. Thus the attributes of one ſubject are extended to another with which it is connected; and the expreſſion of ſuch a thought muſt be conſidered as a figure, becauſe the attribute is not applicable to the ſubject in any proper ſenſe.

How are we to account for this figure, which we ſee lies in the thought, and to what principle ſhall we refer it? Have poets a privilege to alter the nature of things, and at pleaſure to beſtow attributes upon a ſubject to which they do not belong? It is obſerved, that the mind paſſeth eaſily and ſweetly along a train of connected objects; and, where the objects are intimately connected, that it is diſpoſed to carry along the good or bad properties of one to another; eſpecially when it is in any degree inflamed with theſe properties. From this principle is derived the figure under conſideration. Language, invented for the communication of thought, would be imperfect, if it were not expreſſive even of the ſlighter propenſities and more delicate feelings: but language cannot remain ſo imperfect among a people who have received any poliſh; becauſe language is regulated by internal feeling, and is gradually improved to expreſs whatever paſſes in the mind. Thus, for example, when a ſword in the hand of a coward is termed a coward ſword, the expreſſion is ſignificative of an internal operation; for the mind, in paſſing from the agent to its inſtrument, is diſpoſed to extend to the latter the properties of the former. Governed by the ſame principle, we ſay liſtening fear, by extending the attribute liſtening of the man who liſtens, to the paſſion with which he is moved. In the expreſſion, *bold deed*, or *audax facinus*, we extend to the effect what properly belongs to the cauſe. But not to waſte time by making a commentary upon every expreſſion of this kind, the beſt way to give a complete view of the ſubject, is to exhibit a table of the different relations that may give occaſion to this figure. And in viewing the table, it will be obſerved, that the figure can never have any grace but where the relations are of the moſt intimate kind.

1. An attribute of the cauſe expreſſed as an attribute of the effect.

Audax facinus.
Of yonder fleet a *bold* diſcovery make.
An impious mortal gave the *daring* wound.
——————To my *advent'rous* ſong,
That with no middle flight intends to ſoar. *Paradiſe loſt.*

2. An attribute of the effect expreſſed as an attribute of the cauſe.

Quos periiſſe ambos *miſero* cenſebam in mari. *Plautus.*
No wonder, fallen ſuch a *pernicious* height. *Paradiſe loſt.*

3. An effect expreſſed as an attribute of the cauſe.

Jovial wine, Giddy brink, Drowſy night, Muſing midnight, Panting height, Aſtoniſh'd thought, Mournful gloom.

Caſting a dim *religious* light. MILTON, *Comus.*
And the *merry* bells ring round,
And the *jocund* rebecks ſound. MILTON, *Allegro.*

4. An attribute of a ſubject beſtowed upon one of its parts or members.

Longing arms.
It was the nightingale, and not the lark,
That pierc'd the *fearful* hollow of thine ear. *Romeo & Juliet, act* 3 *ſc* 7
——————Oh, lay by
Thoſe moſt ungentle looks and angry weapons;
Unleſs you mean my griefs and killing fears
Should ſtretch me out at your *relentleſs* feet. *Fair Penitent, act* 3.
——————And ready now
To ſtoop with *wearied* wing, and *willing* feet,
On the bare outſide of this world. *Paradiſe loſt, b.* 3.

5. A quality of the agent given to the inſtrument with which it operates.

Why peep your *coward* ſwords half out their ſhells?

6. An attribute of the agent given to the ſubject upon which it operates.

High-climbing hill. *Milton.*

7. A quality of one ſubject given to another.

Icci, *beatis* nunc Arabum invides
Gazis. *Horat. Carm. l.* 1. *ode* 29.
When ſapleſs age, and weak unable limbs,
Should bring thy father to his *drooping* chair. *Shakeſpear.*
Then, nothing loath, th' enamour'd fair he led,
And ſunk tranſported on the *conſcious* bed. *Odyſſey* viii. 337.

8. A circumſtance connected with a ſubject, expreſſed as a quality of the ſubject.

Breezy ſummit.
'Tis ours the chance of *fighting* fields to try. *Iliad* i. 301.
Oh! had I dy'd before that *well-fought* wall. *Odyſſey* v. 395.

From this table it appears, that the adorning a cauſe with an attribute of the effect, is not ſo agreeable as the oppoſite expreſſion. The progreſs from cauſe to effect is natural and eaſy: the oppoſite progreſs reſembles retrograde motion; and therefore *painting height*, *aſtoniſh'd thought*, are ſtrained and uncouth expreſſions, which a writer of taſte will avoid. It is not leſs ſtrained, to apply to a ſubject in its preſent ſtate, an epithet that may belong to it in ſome future ſtate:

Submerſaſque obrue puppes. *Æneid* i 73.
And mighty *ruins* fall. *Iliad* v. 411.
Impious ſons their *mangled* fathers wound.

Another rule regards this figure, That the property of one ſubject ought not to be beſtowed upon another with which that property is incongruous:

K. Rich.——————How dare thy joints forget
To pay their *awful* duty to our preſence? *Richard* III. *act* 3. *ſc.* 6.

The connection between an awful ſuperior and his ſubmiſſive dependent is ſo intimate, that an attribute may readily be transferred from the one to the other: but awfulneſs cannot be ſo transferred, becauſe it is inconſiſtent with ſubmiſſion.

Figure *of ſpeech*, as peculiarly diſtinguiſhed from the above and from thoſe firſt referred to.] Under the article **Metaphor** *and* **Allegory**, a figure of ſpeech is defined, "The uſing a word in a ſenſe different from what is proper to it;" and the new or uncommon ſenſe of the word is termed *the figurative ſenſe*. The figurative ſenſe muſt have a relation to that which is proper; and the more intimate the relation is, the figure is the more happy. How ornamental this figure is to language, will not be readily imagined by any one who hath not given peculiar attention; and therefore we ſhall endeavour to unfold its capital beauties and advantages. In the firſt place, a word uſed figuratively, or in a new ſenſe, ſuggeſts at the ſame time the ſenſe it commonly bears: and thus it has the effect to preſent two objects; one ſignified by the figurative ſenſe, which may be termed *the principal object*; and one ſignified by the proper ſenſe, which may be termed *acceſſory*: the principal makes a part of the thought; the acceſſory is merely ornamental. In this reſpect, a figure of ſpeech is preciſely ſimilar to concordant ſounds in muſic, which, without contributing to the melody, make it harmonious.

To explain the matter by examples. *Youth*, by a figure of ſpeech, is termed *the morning of life*: This expreſſion ſignifies *youth*, the principal object which enters into the thought, it ſuggeſts, at the ſame time, the proper ſenſe of *morning*: and this acceſſory object, being itſelf beautiful, and connected by reſemblance to the principal object, is not a little ornamental. *Imperious ocean* is an example of a different kind, where an attribute is expreſſed figuratively: Together with *ſtormy*, the figurative meaning of the epithet *imperious*, there is ſuggeſted its proper meaning, viz. the ſtern authority of a deſpotic prince; and theſe two are ſtrongly connected by reſemblance. Upon this figurative power of words, Vida deſcants with elegance, *Poet. lib.* iii. 44.

In the next place, this figure poſſeſſes a ſignal power of aggrandiſing an object, by the following means. Words, which have no original beauty but what ariſes from their ſound, acquire an adventitious beauty from their meaning: a word ſignifying any thing that is agreeable, becomes by that means agreeable; for the agreeableneſs of the object is communicated to its name. This acquired beauty, by the force of cuſtom, adheres to the word even when uſed figuratively; and the beauty received from the thing it properly ſignifies, is communicated to the thing which it is made to ſignify figuratively. Conſider the foregoing expreſſion *Imperious ocean*, how much more elevated it is than *Stormy ocean*.

Thirdly, This figure hath a happy effect by preventing the familiarity of proper names. The familiarity of a proper name, is communicated to the thing it ſignifies by means of their intimate connection; and the thing is thereby brought down in our feeling. This bad effect is prevented by uſing a figurative word inſtead of one that is proper; as, for example, when we expreſs the ſky by terming it *the blue vault of heaven*; for though no work of art can compare with the ſky in grandeur, the expreſſion however is reliſhed, becauſe it prevents the object from being brought down by the familiarity of its proper name.

Laſtly, By this figure, language is enriched, and rendered more copious; in which reſpect, were there no other, a figure of ſpeech is a happy invention. This property is finely touched by Vida; *Poet. lib.* iii. 90. The beauties we have mentioned belong to every figure of ſpeech. Several other beauties peculiar to one or other ſort, we ſhall have occaſion to remark afterward. Not only ſubjects, but qualities, actions, effects, may be expreſſed figuratively. Thus, as to ſubjects, *the gates of breath* for the lips, *the watery kingdom* for the ocean. As to qualities, *fierce* for ſtormy, in the expreſſion *Fierce winter*; *altus* for profundus, *Altus puteus*, *Altum mare*; *breathing* for perſpiring, *breathing plants*. Again, as to actions, The ſea *rages*, Time will *melt* her frozen thoughts, Time *kills* grief. An effect is put for the cauſe, as *lux* for the ſun; and a cauſe for the effect, as *boum labores* for corn. The relation of reſemblance is one plentiful ſource of figures of ſpeech; and nothing is more common than to apply to one object the name of another that reſembles it in any reſpect: Height, ſize, and worldly greatneſs, reſemble not each other; but the emotions they produce reſemble each other, aud promoted by this reſemblance, we naturally expreſs worldly greatneſs by height or ſize.

For epitomiſing this ſubject, and at the ſame time giving a clear view of it, we ſhall add a liſt of the ſeveral relations upon which figures of ſpeech are commonly founded. This liſt we ſhall divide into two tables; one of ſubjects expreſſed figuratively, and one of attributes.

TABLE I. *Subjects expreſſed figuratively.*

1. A word proper to one ſubject employed figuratively to expreſs a reſembling ſubject. There is no figure of ſpeech ſo frequent, as what is derived from the relation of reſemblance. Youth, for example, is ſignified figuratively by the morning of life. The life of a man reſembles a natural day in ſeveral particulars; the morning is the beginning of a day, youth the beginning of life; the morning is cheerful, ſo is youth, &c. By another reſemblance, a bold warrior is termed the thunder-bolt of war; a multitude of troubles, a ſea of troubles. This figure, above all others, affords pleaſure to the mind by variety of beauties. Beſides the beauties above-mentioned, common to all ſorts, it poſſeſſes in particular the beauty of a metaphor or of a ſimile: a figure of ſpeech built upon reſemblance, ſuggeſts always a compariſon between the principal ſubject and the acceſſory; whereby every good effect of a metaphor or ſimile, may, in a ſhort and lively manner, be produced by this figure of ſpeech.

2. A word proper to the effect employed figuratively to expreſs the cauſe.

Lux for the ſun; *Shadow* for cloud. A helmet is ſignified by the expreſſion *glittering terror*; a tree by *ſhadow* or *umbrage*. Hence the expreſſion:

Nec habet Pelion umbras. *Ovid.*
Where the dun umbrage hangs. *Spring, l.* 1023.

A wound is made to ſignify an arrow:

Vulnere non pedibus te conſequar. *Ovid.*

There is a peculiar force and beauty in this figure: the word which ſignifies figuratively the principal ſubject, denotes it to be a cauſe by ſuggeſting the effect.

3. A word proper to the cauſe, employed figuratively to expreſs the effect. *Boumque labores* for corn. *Sorrow* or *grief* for tears.

Again Ulyſſes veil'd his penſive head;
Again unmann'd, a ſhower of *ſorrow* ſhed.
Streaming *Grief* his faded cheek bedew'd.

There is a peculiar energy in this figure, ſimilar to that in the former: the figurative name denotes the ſubject to be an effect, by ſuggeſting its cauſe.

4. Two things being intimately connected, the proper name of the one employed figuratively to ſignify the other. *Day* for light. *Night* for darkneſs; and hence, A ſudden night. *Winter* for a ſtorm at ſea:

Interea magno miſceri murmure pontum,
Emiſſamque Hyemem ſenſit Neptunus. *Ænied.* i. 128.

This laſt figure would be too bold for a Britiſh writer, as a ſtorm at ſea is not inſeparably connected with winter in this climate.

5. A word proper to an attribute, employed figuratively to denote the ſubject. *Youth* and *beauty* for thoſe who are young and beautiful.

Youth and beauty ſhall be laid in duſt.

Majeſty for the king:

What art thou, that uſurp'ſt this time of night,
Together with that fair and warlike form
In which the *Majeſty* of buried Denmark
Did ſometime march? *Hamlet, act* 1. *ſc.* 1.
———Or have ye choſen this place
After the toils of battle, to repoſe
Your weari'd *virtue*. *Paradiſe loſt.*

Verdure for a green field. *Summer, l.* 301.

Speaking of cranes,

The pigmy nations wounds and death they bring,
And all the *war* deſcends upon the wing. *Iliad* iii. 10.
Cool *age* advances venerably wiſe. *Iliad* iii. 149.

The peculiar beauty of this figure ariſes from ſuggeſting an attribute that embelliſhes the ſubject, or puts it in a ſtronger light.

6. A complex term employed figuratively to denote one of the component parts. *Funus* for a dead body. *Burial* for a grave.

7. The name of one of the component parts inſtead of the complex term. *Tæda* for a marriage. The *Eaſt* for a country ſituated eaſt from us. *Jovis veſtigia ſervat* for imitating Jupiter in general.

8. A word ſignifying time or place, employed figuratively to denote what is connected with it. *Clime* for a nation, or for a conſtitution of government: hence the expreſſion, *Merciful clime, Fleecy winter* for ſnow, *Seculum felix.*

9. A part of the whole. The *head* for the perſon.

Triginta minas pro *capite* tuo dedi. *Plautus.*
Thy growing virtues juſtify'd my cares,
And promis'd comfort to my *ſilver hairs* *Iliad* ix. 616.

The peculiar beauty of this figure conſiſts in marking that part which makes the greateſt figure.

10. The name of the container, employed figuratively to ſignify what is contained. *Grove* for the birds in it, Vocal *grove. Ships* for the ſeamen, Agonizing *ſhips. Mountains* for the ſheep paſturing upon them, Bleating *mountains. Zacynthus, Ithaca,* &c. for the inhabitants. *Ex mæſtis domibus,* Livy.

11. The name of the ſuſtainer, employed figuratively to ſignify what is ſuſtained. *Altar* for the ſacrifice. *Field* for the battle fought upon it, Well-fought *field.*

12. The name of the materials, employed figuratively to ſignify the things made of them. *Ferrum* for *gladius.*

13. The names of the Heathen deities, employed figuratively to ſignify what they patroniſe. *Jove* for the air, *Mars* for war, *Venus* for beauty, *Cupid* for love, *Ceres* for corn, *Neptune* for the ſea, *Vulcan* for fire. This figure beſtows great elevation upon the ſubject; and therefore ought to be confined to the higher ſtrains of poetry.

TABLE II. *Attributes expreſſed figuratively.*

When two attributes are connected, the name of the one may be employed figuratively to expreſs the other. Purity and virginity are attributes of the ſame perſon: hence the expreſſion, *Virgin* ſnow, for pure ſnow.

2. A word ſignifying properly an attribute of one ſubject, employed figuratively to expreſs a reſembling attribute of another ſubject. *Tottering* ſtate. *Imperious* ocean. *Angry* flood. *Raging* tempeſt. *Shallow* fears.

My ſure divinity ſhall bear the ſhield,
And edge thy ſword to *reap* the glorious field. *Odyſſey* xx. 61.

Black omen, for an omen that pretends bad fortune.

Ater odor *Virgil.*

The peculiar beauty of this figure ariſes from ſuggeſting a compariſon.

3. A word proper to the ſubject, employed to expreſs one of its attributes. *Mens* for *intellectus. Mens* for a reſolution:

Iſtam, oro exue mentem.

4. When two ſubjects have a reſemblance by a common quality, the name of the one ſubject may be employed figuratively to denote that quality in the other: *Summer* life for agreeable life.

5. The name of the inſtrument made to ſignify the power of employing it.

———Melpomene, cui liquidam pater
Vocem cum *cithara* dedit.

The ample field of figurative expreſſion diſplayed in theſe tables, affords great ſcope for reaſoning. Several of the obſervations relating to metaphor, are applicable to figures of ſpeech: theſe ſhall be ſlightly retouched, with ſome additions peculiarly adapted to the preſent ſubject.

1. As the figure under conſideration is built upon relation, we find from experience, and it muſt be obvious from reaſon, that the beauty of it depends on the intimacy of the relation between the figurative and proper ſenſe of the word. A ſlight reſemblance, in particular, will never make this figure agreeable: the expreſſion, for example, *Drink down a ſecret,* for liſtening to a ſecret with attention, is harſh and uncouth, becauſe there is ſcarce any reſemblance between *liſtening* and *drinking.* The expreſſion *weighty crack,* uſed by Ben Johnſon for *loud crack,* is worſe if poſſible: a loud ſound has not the ſlighteſt reſemblance to a piece of matter that is weighty.

Phemius! let acts of gods, and heroes old,
What ancient bards in hall and bow'r have told,
Attemper'd to the lyre, your voice employ,
Such the pleas'd *ear will drink* with ſilent joy. *Odyſſey* i. 433.

The following figures of ſpeech ſeem altogether wild and extravagant, the figurative and proper meaning having no connection whatever. *Moving* ſoftneſs, freſhneſs *breathes, Breathing* proſpect, *Flowing* ſpring, *Dewy* light, *Lucid* coolneſs, and many others of this falſe coin, may be found in Thomſon's *Seaſons.*

2. The proper ſenſe of the word ought to bear ſome proportion to the figurative ſenſe, and not ſoar much above it, nor ſink much below it. This rule, as well as the foregoing, is finely illuſtrated by Vida, *Poet.* iii. 148.

3. In a figure of ſpeech, every circumſtance ought to be avoided that agrees with the proper ſenſe only, not with the figurative ſenſe; for it is the latter that expreſſes the thought, and the former ſerves for no other purpoſe but to make harmony:

Zacynthusgreen with ever-ſhady groves,
And Ithaca, preſumptuous boaſt their loves;
Obtruding on my choice a ſecond lord,
They preſs the Hymenean rite abhorr'd. *Odyſſey,* xix. 152.

Zacynthus here ſtanding figuratively for the inhabitants, the deſcription of the iſland is quite out of place: it puzzles the reader, by making him doubt whether the word ought to be taken in its proper or figurative ſenſe.

———Write, my queen,
And with mine eyes I'll drink the words you ſend,
Though ink be made of gall. *Cymbeline, act* 1. *ſc.* 2.

The diſguſt one has to drink ink in reality, is not to the purpoſe where the ſubject is drinking ink figuratively.

4. To draw conſequences from a figure of ſpeech, as if the word were to be underſtood literally, is a groſs abſurdity; for it is confounding truth with fiction:

Be Moubray's ſins ſo heavy in his boſom,
That they may break his foaming courſer's back,
And throw the rider headlong in the liſts,
A caitiff recreant to my couſin Hereford. *Richard* II. *act* 1. *ſc.* 3.

Sin may be imagined heavy in a figurative ſenſe: but weight in a proper ſenſe belongs to the acceſſory only; and therefore to deſcribe the effects of weight, is to deſert the principal ſubject, and to convert the acceſſory into a principal:

Cromwell. How does your Grace?
Wolſey. Why, well;
Never ſo truly happy, my good Cromwell.
I know myſelf now, and I feel within me
A peace above all earthly dignities,
A ſtill and quiet conſcience. The King has cur'd me,
I humbly thank his Grace; and, from theſe ſhoulders,
Theſe ruin'd pillars, out of pity, taken
A load would ſink a navy, too much honour. *Henry* VIII. *act* 3. *ſc.* 6.

How long a ſpace, ſince firſt I lov'd, it is!
To look into a glaſs I fear,
And am ſurpris'd with wonder, when I miſs,
Grey hairs and wrinkles there. *Cowley, vol.* 1. *p.* 86.

I choſe the flouriſhing'ſt tree in all the park,
With freſheſt boughs, and faireſt head:
I cut my love into his gentle bark,
And in three days behold 'tis dead;
My very written flames ſo violent be,
They've burnt and wither'd up the tree. *Cowley, vol.* 1. *p.* 136.

Such a play of words is pleaſant in a ludicrous poem.

Almeria. O Alphonſo, Alphonſo!
Devouring ſeas have waſh'd thee from my ſight,
No time ſhall raſe thee from my memory;
No, I will live to be thy monument:
The cruel ocean is no more thy tomb:
But in my heart thou art interr'd. *Mourning Bride, act* 1. *ſc.* 1.

This would be very right, if there were any inconſiſtence, in being interred in one place really, and in another place figuratively. From conſidering, that a word uſed in a figurative ſenſe ſuggeſts at the ſame time its proper meaning, we diſcover a fifth rule, That we ought not to employ a word in a figurative ſenſe, the proper ſenſe of which is inconſiſtent or incongruous with the ſubject; for every inconſiſtency, and even incongruity, though in the expreſſion only, and not real, is unpleaſant:

Interea genitor Tyberini ad fluminis undam
Vulnera *ſiccabat* lymphis———

The foregoing rule may be extended to form a ſixth, That no epithet ought to be given to the figurative ſenſe of a word that agrees not alſo with its proper ſenſe:

Parcus deorum cultor, et infrequens,
Inſanientis dum ſapientiæ
Conſultus erro. *Horat Carm. l.* 1. *ode* 54.

Seventhly, The crowding into one period or thought different figures of ſpeech, is not leſs faulty than crowding metaphors in that manner: the mind is diſtracted in the quick tranſition from one image to another, and is puzzled inſtead of being pleaſed:

I am of ladies moſt deject and wretched,
That ſuck'd the honey of his muſic vows. *Hamlet.*
My bleeding boſom ſickens at the ſound. *Odyſſey* i. 439.

Eighthly, If crowding figures be bad, it is ſtill worſe to graft one figure upon another; For inſtance,

While his keen falchion drinks the warriors lives. *Iliad.* xi. 211.

A falchion drinking the warriors blood is a figure built upon reſemblance, which is paſſable. But then in the expreſſion lives is again put for blood; and by thus grafting one figure upon another, the expreſſion is rendered obſcure and unpleaſant.

Ninthly, Intricate and involved figures, that can ſcarce be analyſed, or reduced to plain language, are leaſt of all tolerable:

Votis incendimus aras. *Æneid.* iii. 279.
Elſe ſhall our fates be number'd with the dead. *Iliad* v. 294.
Commutual death the fate of war confounds. *Iliad* viii. 85.

Speaking of Proteus.

Inſtant he wears, eluſive of the rape,
The mimic force of every ſavage ſhape. *Odyſſey* iv. 563.
Rolling convulſive on the floor, is ſeen
The piteous object of a proſtrate queen. *Ibid.* iv. 652.

In the tenth place, When a ſubject is introduced by its proper name, it is abſurd to attribute to it the properties of a different ſubject to which the word is ſometimes applied in a figurative ſenſe:

Hear me, O Neptune! thou whoſe arms are hurl'd
From ſhore to ſhore and gird the ſolid world. *Odyſſey* ix. 617.

Neptune is here introduced perſonally, and not figuratively for the ocean; the deſcription therefore, which is only applicable to the latter, is altogether improper. It is not ſufficient, that a figure of ſpeech be regularly conſtructed, and be free from blemiſh: it requires taſte to diſcern when it is proper, when improper; and taſte perhaps is our only guide. One, however, may gather from reflections and experience, that ornaments and graces ſuit not any of the diſpiriting paſſions, nor are proper for expreſſing any thing grave and important. In familiar converſation, they are in ſome meaſure ridiculous; Proſpero, in the *Tempeſt*, ſpeaking to his daughter Miranda, ſays,

> The fringed curtains of thine eyes advance,
> And ſay what thou ſeeſt yond.

No exception can be taken to the juſtneſs of the figure: and circumſtances may be imagined to make it proper; but it is certainly not proper in familiar converſation. In the laſt place, Though figures of ſpeech have a charming effect when accurately conſtructed and properly introduced, they ought, however, to be ſcattered with a ſparing hand: nothing is more luſcious, and nothing conſequently more ſatiating, than redundant ornaments of any kind.

Figure, in painting and deſigning, denotes the lines and colours, which form the repreſentation of a man, or other animal. But the term figure is in a more immediate and peculiar manner underſtood of human perſonages: thus, a painting is ſaid to be full of figures, when it abounds with repreſentations of men.

Figure is alſo applied to repreſentations, or images of things in prints, &c. Some readers chuſe to have the figures, eſpecially the mathematical ones, in wood, for the convenience of having them immediately annexed to the matter they refer to: others rather chuſe to be at the pains of turning over, and having recourſe to another part of the book, that they may have the figures more neat and accurate on copper. **Figure**, in rhetoric, is a phraſe, or turn of ſpeech or diſcourſe, more beautiful and emphatical than what is uſed in common or ordinary ſpeaking.

Figures *of Sentences*, ſome are principally adapted for reaſoning and inſtruction, and others to move the paſſions. Among the ancients, Demoſthenes is moſt celebrated for expreſſing the force and energy of the former, and Iſocrates excelled in the beauties and delicacies of the latter. Cicero lays ſo great ſtreſs on theſe figures, that he repreſents them as the brighteſt parts of oratory; and makes the power and efficacy of the art to depend in a great meaſure on a thorough knowledge and application of them.

Figure is uſed, in theology, for the myſteries repreſented or delivered obſcurely to us under certain types or actions in the Old Teſtament. Thus manna is held a figure or type of the eucharist; and the death of Abel a figure of the ſuffering of Chriſt. Many divines and critics contend, that all the actions, hiſtories, ceremonies, &c. of the Old Teſtament, are only figures, types, and prophecies, of what was to happen under the New. The Jews are ſuppoſed to have had the figures or ſhadows, and we the ſubſtance.

FIGURED, in general, ſomething marked with figures. The term figured is chiefly applied to ſtuffs, whereon the figures of flowers, and the like, are either wrought or ſtamped.

FILAMENT, in anatomy, natural hiſtory, &c. a term uſed in the ſame ſenſe with fibre, for thoſe fine threads whereof the fleſh, nerves, ſkin, plants, roots, &c. are compoſed.

Vegetable **Filaments** form a ſubſtance of great uſe in the arts and manufactures; furniſhing thread, cloth, cordage, &c. For theſe purpoſes the filamentous parts of the cannabis and linum, or hemp and flax, are employed among us. But different vegetables have been employed in different countries for the ſame uſes. Putrefaction deſtroys the pulpy or fleſhy matter, and leaves the tough filaments entire: by curiouſly putrefying the leaf of a plant in water, we obtain the fine flexile fibres, which conſtituted the baſis of the ribs and minute veins, and which now form as it were a ſkeleton of the leaf. Alkaline lixivia, in ſome degree, produce ſimilar effects to putrefaction.

The ſieur de Flacourt, in his hiſtory of Madagaſcar, relates, that different kinds of cloth are prepared in that iſland, from the filaments of the bark of certain trees boiled in ſtrong ley; that ſome of theſe cloths are very fine, and approach to the ſoftneſs of ſilk, but in durability come ſhort of cotton; that others are coarſer and ſtronger, and laſt thrice as long as cotton; and that of theſe the ſails and cordage of his veſſel were made. The ſame author informs us, that the ſtalks of nettles are uſed for the like purpoſes in his own country, France. And Sir Hans Sloane relates, in one of his letters to Mr. Ray, that he has been informed by ſeveral, that muſlin and callico, and moſt of the Indian linens, are made of nettles.

In ſome of the Swediſh provinces, a ſtrong kind of cloth is ſaid to be prepared from hop-ſtalks: and in the tranſactions of the Swediſh academy for the year 1750, there is an account of an experiment made in conſequence of that report. Of the ſtalks, gathered in autumn, about as many were taken, as equalled in bulk a quantity of flax that would have produced a pound after preparation. The ſtalks were put into water, and kept covered therewith during the winter. In March they were taken out, dried in a ſtove, and dreſſed as flax. The prepared filaments weighed nearly a pound, and proved fine, ſoft, and white: they were ſpun and woven into ſix ells of fine ſtrong cloth. The author, Mr. Shiſler, obſerves, that hop-ſtalks take much longer time to rot than flax; and that, if not fully rotted, the woody part will not ſeparate, and the cloth will neither prove white nor fine. Hemp, flax, and all other vegetable filaments, and thread or cloth prepared from them, differ remarkably from wool, hair, ſilk, and other animal productions, not only in the principles into which they are reſoluble by fire, but likewiſe in ſome of their more intereſting properties, particularly in their diſpoſition to imbibe colouring matters; ſundry liquors, which give a beautiful and durable dye to thoſe of the animal, giving no ſtain at all to thoſe of the vegetable kingdom.

Many other inſtances of this kind are known too well to the callico printer; whoſe grand deſideratum it is, to find means of making linen receive the ſame colours that wool does. The phyſical cauſe of the difference is wholly unknown; and indeed, of the theory of dyes in general, we know as yet extremely little. There are many inſtances of a like diverſity, even in the metallic kingdom, where a mechanical difference in texture can ſcarcely be preſumed to be the cauſe: thus ſilver receives a deep ſtain from ſulphureous or putrid vapours, or the yolk of a boiled egg, which have no effect upon tin.

Filaments, among botaniſts, particularly ſignify the ſtamina.

FILAZER, **Filacer**, **Filizer**, an officer in the court of common pleas, ſo called becauſe he files the writs whereon he makes out proceſs. Of theſe there are ſixteen in the ſeveral diviſions and counties of England.

FILBERT, or **Filberd**, the fruit of the corylus, or hazel. See **Corylus**.

FILE, among mechanics, a tool uſed in metal, &c. in order to ſmooth, poliſh, or cut. This inſtrument is of iron or forged ſteel, cut in little furrows, with chiſſels and a mallet, this and that way, and of this or that depth, according to the grain or touch required. After cutting the file, it muſt be tempered with a compoſition of chimney-ſoot, very hard and dry, diluted and wrought up with urine, vinegar, and ſalt; the whole being reduced to the conſiſtence of muſtard. Tempering the files conſiſts in rubbing them over with this compoſition, and covering them in loam; after which they are put in a charcoal fire, and taken out by that time they have acquired a cherry colour, which is known by a ſmall rod of the ſame ſteel put in along with them. Being taken out of the fire, they are thrown into cold ſpring water: and when cold, they are cleaned with charcoal and a rag; and being clean and dry, are kept from ruſt by laying them up in wheat bran. Iron files require more heating than ſteel ones. Files are of different forms, ſizes, cuts, and degrees of fineneſs, according to the different uſes and occaſions for which they are made. See **Filing**.

File, in law, a thread, ſtring or wire, upon which writs and other exhihits in courts and offices are faſtened or filed, for the more ſafe keeping, and ready turning to the ſame. A file is a record of the court; and the filing of a proceſs of a court makes it a record of it. An original writ may be filed after judgment given in the cauſe, iſſued forth before; declarations, &c. are to be filed, and affidavits muſt be filed, ſome before they are read in court, and ſome preſently when read in court. Before filing a record removed by certiorari, the juſtices of B. R. may refuſe to receive it, if it appears to be for delay, &c. and remand it back for the expedition of juſtice: but if the certiorari be once filed, the proceedings below cannot be revived. An indictment, &c. cannot be amended after it is filed.

File, in a military ſenſe, is a row of men ſtanding one behind or below another from front to rear. Or, file is a line or ſeries of ſoldiers, placed one before another, and thus compoſing the depth of a battalion or ſquadron. The files which bind the right and left are called the flanks. They ſay, *cloſe the files*; that is, bring the men nearer each other. *Double the files*; that is double the depth of the battalion, and diminiſh its breadth or front by one half. The laſt or hindermoſt perſon is ſaid *to bring up the file*. *To file off*, is to wheel off from marching in a ſpacious front, and to march in length by files.

FILIAL, ſomething belonging to the relation of a ſon. The divines uſually diſtinguiſh between a ſervile and a filial fear. The moſt abandoned have a ſervile fear of God, ſuch as that of a ſlave to his maſter; but not a filial fear, i. e. a fear reſulting from love and reſpect.

FILICES, (from *filum*, a thread, *quaſi filatim inciſa*), Ferns; one of the ſeven tribes or families, of the vegetable kingdom, according to Linnæus, by whom it is thus characterized: "having their fructification on the back ſide of the frondes." They conſtitute the firſt order in the claſs cryptogamia; and conſiſt of 16 genera, which are divided into *fructificationes ſpicatæ*, *frondoſæ*, *&* *radicales*. See Syſtem of **Botany**, Plate VI. Claſs 24. Order I.

FILING, one of the principal operations in ſmithery, &c. ſucceeding to forging. The coarſer cut files are always to be ſucceeded by finer; and in all the kinds the rule is tolean heavy on the file in thruſting it forward, becauſe the teeth of the file are made to cut forwards; but in drawing the file back again for a ſecond ſtroke, it is to be lightly lifted juſt above the work, becauſe it cuts not coming back. The rough or coarſe toothed file (which, when large, is called a rubber) ſerves to take off the unevenneſſes of the work left by the hammer in forging. The baſtard toothed file is to take out the too deep cuts and file ſtrokes made by the rough file; the fine toothed file takes out the cuts or file ſtrokes the baſtard file made; and laſtly, the ſmooth file thoſe left by the fine file. In this order the files of ſeveral cuts are to ſucceed each other till the work is as ſmooth as it can be filed; after which it may be made yet ſmoother with emery, tripoli, &c. See POLISHING.

To FILL, in the ſea-language, is to brace the ſails in ſuch a manner, that the wind entering their cavities from behind, dilates them, ſo as to advance the ſhip in her courſe, after the ſails had been for ſome time ſhivering or braced back.

FILLET, or FILET, in architecture, denotes a little ſquare member or ornament uſed in divers places and on divers occaſions, but generally as a ſort of corona over a greater moulding.

FILLET, *teniola*, in heraldry, a kind of orle or bordure, containing only a third or fourth part of the breadth of the common bordure. It is ſuppoſed to be withdrawn inwards, and is of a different colour from the field. It runs quite round near the edge, as a lace over a cloak.

FILLIGREE *Work*, a kind of enrichment on gold or ſilver, wrought delicately, in manner of little threads or grains, or both intermixed. We have vaſes, &c. of filligree work. The term has been lately applied, to ornamental works, formed, as fancy directs, of ſtrips of paper, differently coloured, rolled into various figures, and artfully combined.

FILLY, a term among horſe-dealers, to denote the female or mare colt. See FOAL.

FILM, a thick ſkin or pellicle. In plants it is often uſed for that thin woody ſkin which ſeparates the ſeeds in the pods, and keeps them apart.

FILM, or HUMOUR, in the eye of a horſe. For the cure, ſee Syſtem of FARRIERY, Claſs XI, Sect. XXIX.

FILTER, or FILTRE, in chymiſtry, &c. a piece of woollen cloth, linen, paper, or other matter, ſome of which are in the form of hollow inverted cones, uſed to filtrate or ſtrain liquors through.

FILTRATION, the act of paſſing any liquor through a filtre, called alſo *colature*, *percolation*, and *tranſcolation*. See Syſtem of CHYMISTRY, Part II.

FILTRUM, in natural hiſtory, the name of a ſtone much in uſe in the eaſtern parts of the world, and ſometimes with us for the filtrating of water intended for drinking. The Japoneſe are extremely fond of this ſtone, and impute their uninterrupted health, and particularly their being always free from the ſtone and gravel, to their drinking the water thus cleared of all its heterogeneous and miſchievous particles. The people of this, and many other places thereabouts, have a ſettled opinion, that moſt diſeaſes ariſe from impurities of water, and are well aſſured, that theſe impurities are all lodged in the ſtone filtre, and left behind by the water in its paſſage. The manner of uſing the ſtone is this; they form a ſort of mortars with very thick bottoms out of the largeſt pieces of it, and the water is poured into theſe, and the ſtone being of a very lax and ſpungy texture, it ſoon makes its way through, and is received into a veſſel placed underneath for that purpoſe. It being found, therefore, an eaſy thing for us to have our water filtered in the ſame manner that the Japoneſe have, it remains to try whether it will have all thoſe ſalutary effects which the people of that part of the world give it; and this ſeems not to be imagined from reaſon and analogy. We very well know that water is frequently impregnated with ſaline particles, and that it alſo frequently diſſolves by this means earthly and other matters which it otherwiſe could not do. But we alſo know, that ſalts diſſolved in water are not to be ſeparated by filtration; and it is equally certain, that earthy, ſparry, or other matter, that is ſuſpended in water when clear, will in like manner paſs through the filtre with it. Upon the whole, we are happy enough to have no occaſion for filtering ſtones, ſince our ſprings and rivers afford us water already pure enough to our hands; and in places where this is not the caſe, it is always poſſible to ſave rain water, which will keep a long time with proper management, and is much purer than all the art in the world can make ſuch as has once been foul. Valentini Muſæum Muſæorum, lib. i. cap. 22. The only inſtance in which a filtering ſtone can be of real uſe, is, when there is no water to be had but that of ſome muddy river; in this caſe, the mud being a foreign body not diſſolved in, but only floating among the water, it will be left behind in its paſſing the cloſe ſtructure in the filtre; but this is always to be as well obtained by letting it ſtand a while to ſubſide.

FIMBRIATED, a term in heraldry, ſignifving that an ordinary is edged round with another of a different colour. Thus, he beareth, or, a croſs-pattee gules, fimbriated ſable.

FIN, in natural hiſtory, a well known part of fiſhes, conſiſting of a membrane ſupported by rays, or little bony or cartilaginous oſſicles. The office of the fins has commonly been ſuppoſed to be analogous to that of the feathers in fowls; and to aſſiſt the fiſh in its progreſſive motion, or ſwimming: but the latter naturaliſts find this a miſtake. The tail is a great inſtrument of ſwimming: the fins only ſerve to keep the fiſh upright, and prevent vacillation or wavering.

Whale FINS, are commonly taken for that part of the whale which the populace call whale bone; but whence the miſtake ſhould ariſe is not eaſy to determine. Theſe whale fins, as ſome have erroneouſly called them, are the moſt valuable part of the animal. See *Whale* FISHERY and WHALE *Bone*.

FINAL, that which terminates or comes laſt in any thing, as a final judgment, final ſentence, &c.

FINAL *Cauſe*, is the end for which the thing is done. The final cauſe is the firſt thing in the intention of a perſon who does a thing; and the laſt, in the execution.

FINAL *Letters* are thoſe which cloſe words. The Hebrews have five final letters, which when at the end of a word have a different figure from what they have at the beginning or in the middle thereof. Theſe are the ך, ם, ן. ף. ץ, *caph*, *mem*, *nun*, *pe*, *tſade*, which every where but at the end of words, are wrote כ, מ, נ, פ, צ.

FINANCES, in the French polity, denote the revenues of the king and ſtate; much the ſame with the treaſury or exchequer of the Engliſh, and the fiſcus of the Romans.

Council of the FINANCES, correſponds to our lords commiſſioners of the treaſury; the comptroller general of the finances, to our lord high treaſurer, &c.

FINANCES *Britiſh*. See FUND.

FINCH, in ornithology, the Engliſh name of a ſpecies of birds, belonging to the genus fringilla. See FRINGILLA.

FINE, in law, hath divers applications. Sometimes it is uſed for a formal conveyance of lands or tenements, or of any thing inheritable, being *in eſſe temporis finis*, in order to cut off all controverſies. Others define it to be a final agreement between perſons concerning any lands or rents, &c. of which any ſuit or writ, is depending between them in any court.

FINE, ſometimes ſignifies a ſum of money paid for entering lands or tenements let by leaſe; and ſometimes a pecuniary mulct for an offence committed againſt the king and his laws, or againſt the lord of the manor.

FINES *for Alienation*, in feodal law. One of the attendants or conſequences of tenure by vaſſalſhip. *Knight ſervice*, was that of fines due to the lord for every alienation, whenever the tenant had occaſion to make over his land to another. See FEE.

FIR *Tree*, in botany. See ABIES.

FIRE is that ſubtile, inviſible, ſubſtance, by which all bodies are expanded, or enlarged in their dimenſions, and then become hot to the touch; fluid ſubſtances of every kind are carried off in vapour; ſolid bodies become luminous, and are likewiſe diſſipated in vapour, or, if incapable of being evaporated, become fluid, and at laſt are converted into glaſs. It ſeems likewiſe to be the chief agent in nature, on which animal and vegetable life have an immediate dependence, and without which it doth not appear that the ſyſtem of nature itſelf could ſubſiſt a ſingle moment.

No queſtion in natural philoſophy ſeems more difficult to be reſolved than that concerning the nature of fire, and none has been more agitated. One ſet of philoſophers, amongſt whom are Lord Bacon, Sir Iſaac Newton, &c. aſſert, that fire is not any ſubſtance of itſelf diſtinct from terreſtrial bodies, but that it conſiſts only in a vehement vibratory motion of their parts. Hence lord Bacon defines heat, by which he means fire itſelf, to be "an expanſive undulatory motion in the minute particles of a body, whereby they tend with ſome rapidity towards the circumference, and at the ſame time tend a little upwards." From this he infers, that if in any natural body you can excite a motion whereby it ſhall expand or dilate itſelf, and can repreſs and direct this motion upon itſelf in ſuch a manner that the motion ſhall not proceed uniformly, but obtain in ſome parts and be checked in others, you will generate heat, or fire.

Sir Iſaac Newton conjectures, that the ſun and ſtars are only great earths vehemently heated: for large bodies, he obſerves, preſerves their heat the longeſt, their parts heating one another; and why may not great, denſe and fixed bodies, when heated beyond a certain degree, emit light ſo copiouſly, as by the emiſſion and reaction thereof, and the reflections and refractions of the rays within the pores, to grow continually hotter, till they arrive at ſuch a period of heat as is that of the ſun? Their parts may be further preſerved from fuming away, not only by their fixity, but by the vaſt weight and denſity of the atmoſphere incumbent on them, ſtrongly compreſſing them, and condenſing the vapours and exhalations ariſing from them. Thus we ſee, that warm water, in an exhauſted receiver, ſhall boil as vehemently as the hotteſt water open to the air; the weight of the incumbent atmoſphere, in this latter caſe, keeping down the vapours, and hindering the ebullition, till it has received its utmoſt degree of heat. So alſo a mixture of tin and lead, put on a red hot iron *in vacuo*, emits a fume and flame; but the ſame mixture in the open air, by reaſon of the incumbent atmoſphere, does not emit the leaſt ſenſible flame." Agreeable to this, Sir Iſaac is of opinion, that "groſs bodies may be converted into light, by the agitation of their particles; and light, again, into groſs bodies, by being fixed therein;" and he defines fire to be "a body heated ſo hot, as to emit light copiouſly; for what, (ſays he,) is a red hot iron, but fire?"

By others, fire is conſidered as a fluid *ſui generis*, an original element, which " exiſts in all bodies, and may be ſeparated or procured from them by rubbing them againſt each other, and thus putting their fire in motion. But this motion by no means generates the fire." This is the account given by Dr. Graveſande; with whom Lemery agrees, and endeavours to prove, that it is equally diffuſed through all ſpace, is preſent in all places, in the void ſpaces between bodies, as well as the inſenſible interſtices between their parts: of which opinion alſo was Dr. Boerhaave.

The firſt hypotheſis having been adopted by ſuch an eminent philoſopher as Sir Iſaac Newton, hath from thence received very conſiderable weight, and been generally received by the philoſophers in this country, it is, nevertheleſs, preſſed with almoſt inſurmountable difficulties. It can by no means be explained upon the principles of mechaniſm, becauſe it directly contradicts them. It is certain, that if one body gives motion to another that reſiſts it, the quantity of motion produced will be leſs than that of the firſt body; becauſe as much will be taken off as the reſiſtance of the firſt body was equal to. Thus, ſuppoſe a body moves in ſuch a manner as to be able to raiſe 12 pounds, if it meets with an obſtacle equivalent to ſix pounds, it will not after driving it out of the way, be able to raiſe any more than ſix pounds. The ſame rule muſt hold equally, whether we ſuppoſe the parts of matter in motion to be large or ſmall. In the above example, if we take ounces inſtead of pounds, we cannot ſuppoſe that the effect will be in the leaſt diſproportionate. If inſtead of ounces we take grains, or half grains, or the minuteſt particles, the effect muſt ſtill be the ſame.

To obviate in ſome meaſure objections of this kind, Sir Iſaac Newton ſeems to have ſuppoſed, that every particle of matter is endowed with a ſphere of attraction, and beyond that with a ſphere of repulſion. Hence, as ſoon as two particles of matter get without the ſphere of one another's attraction, they begin to repel each other very ſtrongly: and hence, ſays he, " as in algebra, where affirmative quantities ceaſe, negative ones begin; ſo in mechanics, where attraction ceaſes, there the repelling power muſt ſucceed."

Upon this principle of repulſion alone it is that the mechanical origin of heat is tenible: for if the minute particles of any body have a force impreſſed upon them, in ſuch a manner as to put them without the ſphere of each other's attraction, and then they begin to repel one another ſtrongly, it may be ſuppoſed, that putting the parts of other matter in a ſimilar ſituation, and theſe again acting upon others in a like manner, a large maſs of matter might be reſolved into its minuteſt particles, and theſe ſcattered to an immenſe diſtance by the mutual repelling power between them, and thus produce the phenomena of heat and light.

Even this will be found quite unſatisfactory, if attentively examined; for the repelling power with which theſe particles are ſuppoſed to be endowed, will have as great a tendency to drive them back upon the body from whence they came, as to drive them away from it. To help our conceptions in this matter, let us ſuppoſe, that the repulſive ſphere round each of the minute particles is an inch in diameter. Let us alſo ſuppoſe, that this repulſive force is ſufficiently great to throw the particle to the diſtance of 1000 miles, when it comes within the repulſive power of another. If, therefore, a particle is driven off from any hard ſubſtance, ſuppoſe iron, it will indeed drive another before it, which is already in the way, but will as certainly drive back upon the iron thoſe which are ſhaken off from it afterwards: for re-action is always equal to action; and if we ſuppoſe a number of ſuch particles extricated from the body, their mutual action and reaction being always equal, the motion among them muſt very ſoon ceaſe.

Upon this principle, however, the Newtonians explain the emiſſion of light from luminous bodies. "A ray of light (ſays Sir Iſaac), as ſoon as it is caſt off from the luminous body by the vibrating motion of its parts, and is got out of the ſphere of its attraction, is propelled with an immenſe velocity." Now, with all due ſubmiſſion to ſuch a great name as that of Sir Iſaac Newton, what he advances here is utterly impoſſible. All the parts of the ſun have a mutual attraction towards one another, by which they are kept together; and it is impoſſible that a particle of matter can be both attracted and repelled at the ſame moment by one body. It is indeed inconceivable, how the particles of matter can be endowed with two ſuch contrary powers, and yet remain together in one maſs: for though thoſe which lie contiguous to one another may mutually attract, yet they muſt alſo repel, and be repelled by thoſe which lie at a greater diſtance; and from ſuch a mixture of contrary forces, it does not ſeem that any body could ſolidly cohere together.

In ſupport of this hypotheſis, we may however ſuppoſe, that the vibratory motion of the parts of the ſun is ſo great, that the particles of light are thrown off by it an immenſe way beyond the orbit of Saturn. But granting this, no ſooner would they come within the ſphere of one another's repulſion, than ſome of them would be thrown back with violence towards the ſun; and, in their return, would meet with others, to which they would give a like direction; and in this they would be aſſiſted by the attractive force of the ſun himſelf, by which means the force with which the light was emitted, muſt at firſt be reſiſted, and at laſt entirely deſtroyed. But, whatever might be the caſe with the ſun, the vibratory force of whoſe parts we may ſuppoſe to be inconceivably great, it is impoſſible that upon this principle any fire could be kindled by man; for the vibratory motion induced among the particles of any body by him, could never be greater than the force originally applied; and thus muſt unavoidably decay, on account of the continual reſiſtance met with in ſetting the particles of other matter in the like motion.

To theſe objections we may alſo add, that, upon this hypotheſis, fire ought to burn beſt *in vacuo*; becauſe there the preſſure of the atmoſphere is taken off, and there ſhould be the leſs reſiſtance to the vibrations of the ſmall particles. We find, however, that fire, ſo far from burning beſt *in vacuo*, is immediately extinguiſhed; and that a free circulation of air is abſolutely neceſſary to preſerve it. Profeſſor Hamilton, indeed, of the univerſity of Dublin, endeavours to account for this, by ſaying, that air is neceſſary only to blow off the aſhes, &c. which would prevent the continuance of the motion. But if there were no other occaſion for air than this, fixed or phlogiſticated air would anſwer the ſame purpoſe; and both of theſe are found to extinguiſh fire. See Aerology.

" Air (ſays he) is not leſs neceſſary for the ſupport of fire than of animal-life; for fire will not long continue to burn without a circulation of air. Now, I ſuppoſe, this happens, not from its adding any thing to the pabulum of fire, (for fire ſeems to be otherwiſe ſufficiently provided with pabulum), but rather on this account, That the air immediately about a body on fire is heated, and made ſpecifically lighter than the air at ſome diſtance from it. This hot air, therefore, muſt aſcend, and carry with it all thoſe minute particles of different kinds which are thrown off from the burning body, and which would otherwiſe reſt upon its ſurface, and thereby clog and ſtop the ſubtile vibrations of the burning matter, in which the nature of fire partly conſiſts. If, therefore, fire be confined in a cloſe place, where there can be no circulation of air, the air about it, being ſoon ſaturated with the particles ariſing from the burning matter, will not be able to take up any more of them; and therefore the fire muſt go out, ſmothered, as it were, with ſuch particles as are no longer combuſtible. Hence it is that fire burns faſter when air is ſtrongly blown upon it; for then the aſhes are carried off as faſt as they are formed on the ſurface of the burning body; and thereby the particles that have juſt taken fire, are kept quite free from every thing that can impede or clog their vibratory motion. The air in this caſe alſo will ſpread the fire quickly through the fuel, by blowing the particles that are already kindled, among thoſe that are not; and perhaps the motion of the air in this caſe may promote the ſubtile vibrations in the burning matter by which the fire is propagated through its parts. As the air contains many ſubtile particles in the inflammable kind, it is not improbable, that theſe, mixing with the groſs burning matter, may help to preſerve and enliven the fire: but I think it moſt probable, that air ſupports fire chiefly by carrying off ſuch particles as are burned out, and would therefore obſtruct the progreſs of the fire; becauſe we find, that the ſtrong elaſtic ſteam of water driven violently out of the pipe of an æolipile, which will carry off thoſe particles, will alſo blow up and increaſe the fire as well as air driven from the bellows, although the ſteam does not contain any inflammable particles."

Here we have no reaſon given in ſupport of this hypotheſis, than that fire may be blown up by the ſteam iſſuing violently from an æolipile; but this reaſon is founded on a deception. This ſteam only blows up the fire by occaſioning a violent motion in the air through which it paſſes; and thus forcibly drives it on the fuel, at the ſame time that it enters along with it; and thus is, in ſome meaſure, ſimilar to the blowing up of a large fire by a ſteam of water, which is uſed in ſome places inſtead of bellows. Nevertheleſs, if the ſteam of the æolipile is only admitted to the fire, and the air totally excluded from it, the fire will be as effectually extinguiſhed as if the ſteam of water employed to force the air into a large furnace was itſelf directed on the fuel. Beſides, on the Doctor's hypotheſis, fixed, and many other kinds of air ought to be equally efficacious in preſerving flame, as already obſerved; which are yet found to extinguiſh it as effectually, if not more ſo than water.

Among other hypotheſes, it may not be amiſs to mention the almoſt forgotten and exploded one publiſhed by Mr. Hutchinſon, and by him pretended to be plainly revealed in the ſacred writings. According to this gentleman, the nature of fire, of light, and air, are all at bottom the ſame, being only three different modifications of the ſame fluid. When air is blown upon a fire, then the groſſer fluid is immediately reduced to its fineſt parts, and attains the utmoſt degree of poſſible fluidity, by the vehement attrition of its own particles, and thoſe of the fire already kindled, againſt one another. Being continually preſſed upon in this ſtate by the ſurrounding groſs air, it is ſent out on all ſides in ſtreams of light, which being detained among the particles of the atmoſphere, and having their motion ſtopped, become part of the air itſelf, and are again ready to reaſſume their luminous and fiery appearance on proper occaſions.

Setting aſide the pretended authority of revelation, many people have been of opinion, that this hypotheſis might be ſupported by very ſtrong arguments drawn from matter of fact. The principal are the following.

1. It is well known, that in all mixtures of different kinds of fluids, thoſe which are rareſt, and conſequently leſs acted upon by

the force of gravity than others, will raiſe to the top, and occupy the uppermoſt place in the mixture. Thus, if water and oil are mixed together, they will ſoon ſeparate themſelves, and the oil will ſwim at the top. This ſeparation happens in conſequence of their different degrees of denſity, by which the oil is leſs affected by the force of gravity than the water; not through any principle of innate levity, or any power of repulſion between this fluid and the bottom of the veſſel. In like manner, when we ſee any other two fluids mixed, and one of them aſcends, we ought not to conclude, that there is any unknown power of repulſion in that which aſcends, more than in the other. If only one of the two fluids is viſible, and that happens to be the aſcending one, we ought not therefore to ſeek for the cauſe of its aſcent in unknown and imaginary repulſions and vibrations, but rather to conclude that it is preſſed upwards by the tendency of an inviſible fluid of greater denſity downwards. In moſt caſes this is allowed by all philoſophers to hold good. The ſmoke of a fire, for inſtance, does not aſcend from it, on account of any principle of poſitive levity, or on account of a repulſive power betwixt it and the fire from which it aſcends, but from the greater tendency of the air downwards; in conſequence of which, it is driven upwards with a force equivalent to the difference of their ſpecific gravities. By analogy, (ſay they) we ought to apply this to the emiſſion of light itſelf. We have no other proof of a repulſive power between the particles of this ſubſtance, than its conſtant aſcent from a luminous body; and invent it in order to ſolve this phenomenon, when the ſame thing may be done with a much greater degree of probability, and more agreeable to the known laws of nature in other caſes, by ſuppoſing the deſcent of a denſer, though inviſible, fluid towards that body.

2. The phenomena of electricity ſhow, that there is preſent between the groſſer parts of bodies an inviſible ſubtile fluid, of exceeding great power, which on certain occaſions becomes viſible, and then diſcovers itſelf to be the real element of fire itſelf. It always appears to our eyes as a ſtream of ſubtile fire, emitting a very perceptible light. It will kindle inflammable ſubſtances; melt the moſt difficultly fuſed metals, platina itſelf not excepted; and even turn gold into glaſs, which hath never yet been done either by the fierceſt furnace or the ſtrongeſt burning mirror.

Though this hypotheſis has been laid down in its moſt diſtinct and plauſible form by Hutchinſon, or rather ſome of his followers, it appears very little if at all different from that of Boerhaave and others who maintain the impoſſibility of generating fire, and affirm it to be a fluid *ſui generis*. A direct proof of this, however, as well as of other ſuppoſitions concerning the nature of fire, is attended with great difficulties. Were we able to convert fire by itſelf into air, and convert air by itſelf into fire, the point would indeed be gained. But though we blow ever ſo much air into a fire, unleſs we continually add new fuel, it will ſoon be extinguiſhed. But this ought not to be the caſe on the Hutchinſonian hypotheſis: for one quantity of air being reduced to its utmoſt degree of fluidity, ought to reduce to the ſame ſtate every ſucceeding quantity which mixed itſelf with it; and not only would fire be kept up without any groſs fuel, but there might be ſome danger of ſetting the whole atmoſphere in a blaze at once. Thus, while one party is at a loſs to account for the uſefulneſs of air in ſupporting fire, the other is no leſs diſtreſſed with the groſs fuel, ſuch as wood, coals, &c. which ſeem to be equally neceſſary with the air itſelf for the ſupport of our fires. The Hutchinſonians, indeed, find no other uſe for the fuel but to keep off too great a quantity of air, which would oppreſs and extinguiſh a ſmall fire; but this purpoſe might be equally well anſwered by pieces of brick or ſtone; yet theſe will effectually put out a fire. The uſe of the fuel, therefore, which is continually to be added to our common fires, cannot be explained on the Hutchinſonian hypotheſis. The diſcoveries of Dr. Prieſtley, however, have put the matter beyond a doubt with reſpect to air. He hath made it apparent, that terreſtrial ſubſtances are neceſſary ingredients in the compoſition of air much purer than what we breathe, and much more capable of ſuſtaining flame; ſo that it is now an abſurdity to talk of fire and air being convertible into one another. The great proof on the Hutchinſonian ſide, and which they look upon as abſolutely unanſwerable, is the increaſe of weight in metalline calces when expoſed to the action of a ſtrong fire. This increaſe is found to be owing to air, as we have already mentioned: and though it ſhould by no means be found either fit for reſpiration, or for the purpoſes of ſupporting flame; yet it will be ſufficient for their purpoſe to prove, that the element of fire is capable of being converted into a gravitating ſubſtance; which, when diſengaged, appears in the form of a permanently elaſtic fluid, and thus becomes a certain ſpecies of air. That it really doth ſo, however, is very dubious: for it is certain that metals cannot be calcined without the free acceſs of air; and therefore it cannot certainly be known whether the air in the calx comes from the fixation of the fire, or whether it is attracted from the ſurrounding atmoſphere, eſpecially if, as ſome alledge, the calx receives no increment in weight while kept hot.

Dr. Prieſtley has made experiments on metallic calcinations; and acquaints us, that if a metal is calcined over lime-water, it doth not become turbid; becauſe, though the calcareous earth attracts the fixed air, yet the metallic calx doth it much more ſtrongly, and conſequently no precipitation can enſue. The ſame reaſon he gives why metals cannot be calcined in nitrous air; namely, that there is then no fixed air with which the metallic calx may combine, and upon which the calcination ſeemed to him to depend; nevertheleſs, the metals fumed copiouſly, though the phlogiſton was not ſeparated. Theſe experiments ſeem totally unanſwerable by the Hutchinſonians. It is well known, that fixed air is one of the component parts of our atmoſphere; and from Dr. Prieſtley's experiments, it would ſeem impoſſible to deprive a metal of its phlogiſton, but by allowing the calx to combine with fixed air; and as the fire, though conſtantly applied is not able to produce this fixed air, but muſt have the aſſiſtance of the common atmoſphere, this ſeems a demonſtration, that fire is not convertible into an elaſtic fluid of any kind. The only reply which the Hutchinſonians can give to this is, that metals will be increaſed in weight though kept over the fire in cloſe veſſels. But this may very reaſonably be ſuppoſed to proceed from the ſmall quantity of air contained in the veſſels where they are put, or from ſome inaccuracy in cloſing them, ſo that there may be ſome communication between the metals and the external air. To make theſe experiments perfect, the glaſſes ought firſt to be well exhauſted of their air, and then hermetically ſealed.

It doth not appear, therefore, that ever the element of fire hath been by human art converted into a groſſer fluid of any kind; and conſequently the only reſource left the Hutchinſonians is in arguments drawn from the ſimilarity of the electric fluid and the ſubſtance of light or fire. The late diſcoveries in electrity, indeed, have thrown ſo much light upon that ſubject, that there are now but few who deny the exiſtence of fire as a diſtinct element. It doth not, however, appear, that this element can ever be converted into any other fluid of a groſſer nature, as the Hutchinſonians affirm. The electric fluid ſeems to be equally ſubtile, and equally penetrating, with fire or light; and though it ſhould remain ever ſo long at reſt, it doth not appear that its fluidity is thereby loſt in the ſmalleſt degree. But for a full account of the experiments moſt likely to aſcertain the identity of elementary and electric fire, ſee the articles ELECTRICITY, HEAT, IGNITION, LIGHT, &c.

Wild FIRE, a kind of artificial or factitious fire, which burns even under water, and that with greater violence than out of it. It is compoſed of ſulphur, naphtha, pitch, gum, and bitumen; and is only extinguiſhable by vinegar mixed with ſand and urine, or by raw hides. Its motion or tendency is contrary to that of natural fire, and always follows the direction in which it is thrown.

Machine for Preſerving People from FIRE. This machine, conſiſts of a pole, a rope, and a baſket. The pole is of fir, or a common ſcaffold pole of any convenient length from 36 to 46 feet; the diameter at bottom, or greateſt end, about five inches: and at the top, or ſmalleſt end, about three inches. At three feet from the top is a mortiſe through the pole, and a pulley fixed to it of nearly the ſame diameter with the pole in that part. The rope is about three quarters of an inch diameter, and twice the length of the pole, with a ſpring hook at one end, to paſs through the ring in the handle of the baſket when uſed; it is put through the mortiſe over the pulley, and then drawn tight on each ſide to near the bottom of the pole, and made faſt there till wanted. The baſket ſhould be of ſtrong wicker-work, three feet and a half long, two feet and a half wide, rounded off at the corners, and four feet deep, rounding every way at the bottom. To the top of the baſket is fixed a ſtrong iron curve or handle, with an eye or ring in the middle; and to one ſide of the baſket, near the top, is fixed a ſmall cord, or guide rope, of about the length of the pole. When the pole is raiſed, and ſet againſt a houſe over the window from which any perſons are to eſcape, the manner of uſing it is ſo plain and obvious, that it needs not to be deſcribed. The moſt convenient diſtance from the houſe, for the foot of the pole to ſtand, where practicable, is about 12 or 14 feet. If two ſtrong iron ſtraps, about three feet long, rivetted to a bar croſs, and ſpreading about 14 inches at the foot, were fixed at the bottom of the pole, this would prevent its turning round or ſlipping on the pavement. And if a ſtrong iron hoop, or ferule, rivetted (or welded) to a ſemi-circular piece of iron ſpreading about 12 inches, and pointed at the ends, were fixed on at the top of the pole, it would prevent its ſliding againſt the wall. When theſe two laſt mentioned irons are fixed on, they give the pole all the ſteadineſs of a ladder; and becauſe it is not eaſy, except to perſons who have been uſed to it, to raiſe and ſet upright a pole of 40 feet or more in length, it will be convenient to have two ſmall poles, or ſpars, of about two inches diameter, fixed to the ſides of the great pole at about two or three feet above the middle of it, by iron eyes rivetted to two plates, ſo as to turn every way; the lower end of theſe ſpars to reach within a foot of the bottom of the great pole, and to have ferules and ſhort ſpikes to prevent ſliding on the pavement, when uſed occaſionally to ſupport the great pole, like a tripod. There ſhould be two ſtrong aſh trundles let through the pole, one at four feet and one at five feet from the bottom, to ſtand out about eight inches on each ſide, and to ſerve as handles, or to twiſt the rope round in lowering a very heavy weight. If a block and pulley were fixed at about the middle of the rope, above the other pulley, and the other part of the rope made to run double, it would diminiſh any weight in the baſket nearly one half, and be very uſeful in drawing any perſon up, to the aſſiſtance of thoſe in the chambers,

bers, or for removing any effects out of a chamber, which it might be dangerous to attempt by the ſtairs.

It has been proved, by repeated trials, that ſuch a pole as we have been ſpeaking of, can be raiſed from the ground, and two or three perſons taken out of the upper windows of an houſe, and ſet down ſafely in the ſtreet, in the ſpace of 35 ſeconds, or a little more than half a minute. Sick and infirm perſons, women, children, and many others, who cannot make uſe of a ladder, may be ſafely and eaſily brought down from any of the windows of an houſe on fire by this machine, and, by putting a ſhort pole through the handles of the baſket, may be removed to any diſtance without being taken out of the baſket. The pole muſt always have the rope ready fixed to it, and may be conveniently laid up upon two or three iron hooks, under any ſhade or gateway, and the baſket ſhould be kept at the watch-houſe. When the pole is laid up, the two ſpars ſhould always be turned towards the head of it. The baſket ſhould be made of peeled rods, and the pole and ſpars painted of a light ſtone-colour, to render it more viſible when uſed in the night.

Godfrey's Machines for Extinguiſhing FIRE. Of theſe the following account is given by Mr. Ambroſe Godfrey, grandſon to the inventor. "The machine to be employed, conſiſts of a ſmall portion of gunpowder cloſely confined; which, when animated by fire, acts by its elaſtic force, upon a proper medium, and not only divideth it into the minuteſt atoms, but diſperſeth it alſo in every direction, ſo as immediately to extinguiſh any fire within a certain diſtance. This medium is a liquor ſtrongly impregnated with a preparation of antiphlogiſtic principles, which, by their action upon burning materials, extinguiſh the flames, and reduce them in general to a ſtate of black coal; and by its oppoſite nature to fire, hinders the remaining ſparks, notwithſtanding the admiſſion of the air, from kindling the flames afreſh. By this means, the great point is obtained, in giving ſufficient time for totally extinguiſhing any remains of fire.

"They who preſume that water only will perform this, will find themſelves greatly miſtaken, as the draught of air will certainly rekindle the neighbouring materials, which are very fit to receive a freſh flame, the fire not being extinguiſhed by the quantity of water, but rather by the expanſion and rarefaction of its particles. There are ſeveral ſizes of theſe machines, from five to fifty pounds weight, in a portable and rather ſmall compaſs, and may generally be carried to any place where a man can go himſelf.

"But though theſe machines will prevent great fires by a timely application, they will not extinguiſh them after they have reached a frightful height, and ſeveral houſes, perhaps near a whole ſtreet, are in flames. The floors muſt be ſtanding, and acceſs to the building ſafe, otherwiſe no perſon can be ſuppoſed to approach near enough to apply them in a proper manner. Every fire has its beginning, for the moſt part, in ſome apartment; and as ſoon as diſcovered, the family, inſtead of loſing all preſence of mind, ſhould immediately apply one or more of theſe machines, which will then fully anſwer the intention. The proper time of applying them, ſuppoſes that they are ready at hand. It will be in vain to think of fetching them from any conſiderable diſtance, as it will then be too late for them to perform any important ſervice; except indeed being the probable means of ſaving ſome adjacent houſe, by extinguiſhing the flames as often as they break out, till the building firſt on fire is totally conſumed, and, by falling into ruins, leaves the other in perfect ſafety."

On the 19th of May 1761, at noon, Mr. Godfrey's experiment for extinguiſhing fire, was tried in an houſe erected for that purpoſe, near Mary-le-bone. Their royal highneſſes the duke of York, prince William Henry, prince Henry Frederic, a great number of perſons of rank and diſtinction, and many of the learned world, gave their attendance on this ſingular occaſion. The houſe, which is of brick, conſiſts of three rooms, one above another, a ſtair caſe, chimney, lath and plaſter ceilings, and a kind of wainſcotting round the rooms, of rough deal. Exactly at 12 o'clock the ground room, and that up one pair of ſtairs, were ſet on fire, by lighting the faggots and ſhavings laid in there for that purpoſe: in about 15 minutes the wainſcot of the under room was thought to be ſufficiently in flames, and three of the machines were thrown in; which by almoſt immediate and ſudden exploſions, inſtantaneouſly extinguiſhed the flames, and the very ſmoak in that apartment in a few minutes totally diſappeared. By this time, the firemen, &c. who had the care of throwing in the machines, gave an alarm that the ſtaircaſe had taken fire, and that it was neceſſary directly to go to work upon the next room; which was accordingly done, and with the ſame effect.

The experiment however, hitherto did not univerſally ſatisfy: in the laſt inſtance eſpecially it was thought to be too haſtily put in execution; and the populace, without ſide the pailing, who were ſuppoſed to amount to near 20,000, and whoſe curioſity, from the very nature of their ſituation, remained much diſſatisfied, began to grow rather riotous, and talked of a ſecond bottle-conjuror. For the ſake of the experiment, therefore, and to remove all manner of doubt, Mr. Godfrey conſented to a third experiment in the upper room, which was entirely of wood. The flames were now ſuffered to get to a conſiderable height, and even the window frames deſtroyed, before the machines were thrown in: which, however, anſwered exactly as the former had done; and, being quite in ſight of the out-ſtanders, met with univerſal approbation.

In the year 1734, the ſtates of Sweden offered a premium of 20,000 crowns for the beſt method of ſtopping the progreſs of accidental fires; when one Mr. Fuches, a German phyſician, made a preparation for that end, and the experiment was made on a houſe built on purpoſe, of dry fir, at Legard iſland. In the buildings were placed ſeveral tubs of tar and pitch, and a great quantity of chips, all which were ſet on fire; flames iſſuing through the top of the houſe, windows, &c. when he threw in one of the barrels containing the preparation, which immediately quenched the flames; a ſecond barrel entirely cleared the ſmoke away; and the whole was executed to the ſatisfaction of the ſpectators, and to the no ſmall ſatisfaction of the inventor, who was about to return home, when unexpectedly the flames broke out again, ſuppoſed to be occaſioned by a ſmall quantity of combuſtible matter being introduced and ſet on fire ſecretly by ſome malicious perſon. Upon this the wrong-headed mob fell upon Mr. Fuches, and beat him moſt unmercifully, ſo that he narrowly eſcaped with his life. He ſoon after left the country, and never could be prevailed on (though ſtrongly perſuaded by ſome of the moſt eminent citizens) to return. It is ſaid, another experiment of the ſame kind was tried in the year 1761 in Holland; but rendered abortive through the perverſeneſs of the populace. Theſe machines of Mr. Godfrey's, it is evident, would be of great uſe in extinguiſhing fires on ſhipboard; and might be conſidered as a no leſs neceſſary part of a ſhip's lading, than her ſtores or ammunition. Theſe machines, however, are found to be only ſerviceable in the beginning of a fire. When the roof had fallen in, they had no effect.

Water-Engine for Extinguiſhing FIRE. See HYDROSTATICS.

In uſing this machine we have the following improvement by Dr. Hoffman, which promiſes to be of great efficacy. As ſoon as the engine is in readineſs to work, ſtir into the water that immediately is to be diſcharged, ſeven or eight pounds of pearl-aſhes in powder, and continue to add it in this manner as occaſion requires; taking care that it be directed againſt the timber or wainſcot, &c. juſt beginning to burn; and not waſted againſt the brickwork: or, where time will admit, diſſolve any quantity of pearl-aſhes in a copper with water, and as faſt as it diſſolves, which will be in a few minutes, mix a pailful with the water in the engine, pretty often; and whatever burning wood it is played upon, will be extinguiſhed as if it was dipped in water, and will not burn afreſh in the part extinguiſhed.

FIRE *Ball*, a compoſition of meal-powder, ſulphur, ſalt-petre, &c. about the bigneſs of a hand-grenade, coated over with flax, and primed with the ſlow compoſition of a fuze. This is to be thrown into the enemy's works in the night-time, to diſcover where they are; or to fire houſes, galleries, or blinds of the beſiegers; but they are then armed with ſpikes or hooks of iron, that they may not roll off, but ſtick or hang where they are deſired to have any effect.

FIRE *Flies*, a ſpecies of flies common in Guiana, of which there are two ſpecies. The largeſt is more than an inch in length, having a very large head connected with the body by a joint of a particular ſtructure, with which at ſome times it makes a loud knock, particularly when laid on its back. The fly has two feelers or horns, two wings, and ſix legs. Under its belly is a circular patch, which, in the dark, ſhines like a candle; and on each ſide of the head near the eyes, is a prominent, globular, luminous body, in ſize about one third larger than a muſtard ſeed. Each of theſe bodies is like a living ſtar, emitting a bright, and not ſmall, light; ſince two or three of theſe animals, put into a glaſs-veſſel, afford light ſufficient to read without difficulty, if placed cloſe to the book. When the fly is dead, theſe bodies will ſtill afford conſiderable light, though it is leſs vivid than before; and if bruiſed and rubbed over the hands or face, they become luminous in the dark, like a board ſmeared over with Engliſh phoſphorous. They have a rediſh-brown or cheſnut colour; and live in rotten trees in the day, but are always abroad in the night. The other kind is not more than half as large as the former: their light proceeds from under their wings, and is ſeen only when they are elevated, like ſparks of fire appearing or diſappearing at every ſecond. Of theſe the air is full in the night, though they are never ſeen in the day. They are common not only in the ſouthern, but in the northern parts of America, during the ſummer.

FIRE *Pots*, in the military art, ſmall earthen pots, into which is put a charged grenade, and over that powder enough till the grenade is covered: then the pot is covered with a piece of parchment, and two pieces of match acroſs lighted: this pot being thrown by a handle of matches where it is deſigned, it breaks and fires the powder, and burns all that is near it, and likewiſe fires the powder in the grenade, which ought to have no fuſe, to the end its operations may be the quicker.

FIRE *Ship*, an old veſſel filled with combuſtible materials, and fitted with grappling irons to hook, and ſet fire to the enemies ſhips in battle, &c. See NAVAL *Affairs*.

FIRE *Works*, or *Artificial* FIRES, are preparations made of gunpowder, ſulphur, and other inflammable and combuſtible ingredients, uſed on occaſion of public rejoicing and other ſolemnities. See PYROTECHNY.

FIRING, in the military art, denotes the diſcharge of the fire-arms; and its object is to do the utmoſt execution to the enemy. See Military Affairs.

Firing *Iron*, in farriery, a piece of copper or iron, about a foot long, one end of which is made flat, and forged like a knife; the back of it being half an inch thick, and the fore edge about the fifth or ſixth part of this. When the farrier has made his firing iron red hot in his forge, he applies the thinneſt part to the horſe's ſkin, and ſo gives the fire to ſuch places as ſtand in need of it.

FIRKIN, an Engliſh meaſure of capacity, for things liquid; containing the fourth part of the barrel. The firkin of ale contains eight gallons; and that of beer nine; two firkins of beer, make the kilderkin; two kilderkins the barrel; and two barrels the hogſhead. The firkins of ſoap and butter are on the footing of the firkins of ale; viz. a gallon per firkin leſs than that of beer.

FIRMAMENT, in the ancient aſtronomy, the eighth heaven, or ſphere; being that wherein the fixed ſtars were ſuppoſed to be placed. It is called the eighth, with reſpect to the ſeven heavens or ſpheres of the planets, which it ſurrounds. It was ſuppoſed to have two motions; a diurnal motion, given it by the primum mobile, from eaſt to weſt, about the poles of the ecliptic; and another oppoſite motion, from weſt to eaſt; which laſt it finiſhes, according to Tycho, in 25412 years; according to Ptolemy, in 36000; and according to Copernicus, in 25800; in which time the fixed ſtars return to the ſame preciſe points wherein they were at the beginning. This period is commonly called Plato's year, or the great year. In divers places of Scripture the word firmament is uſed for the middle region of the air. Many of the ancients allowed, with the moderns, that the firmament is a fluid matter; though they, who gave it the denomination of firmament, muſt have taken it for a ſolid one.

FIRMNESS, in philoſophy, denotes the conſiſtence of a body; or that ſtate, wherein its ſenſible parts cohere, or are united together, ſo that the motion of one part induces a motion to the reſt. In which ſenſe, firmneſs ſtands oppoſed to fluidity.

FIRST *Fruits*, annates or primitiæ, the profits of a benefice for the firſt year after avoidance. The firſt fruits were formerly eſtimated according to a rate or valor made under the direction of pope Innocent IV. by Walter biſhop of Norwich, in 38 Hen. III. and afterwards advanced in value by commiſſion from pope Nicholas III. A. D. 1292, 20 Edw. I. which valuation of pope Nicholas is ſtill preſerved in the exchequer; and the tenths or decimæ were the tenth part of the annual profit of each living by the ſame valuation; claimed by the holy ſee on the authority of the precept recorded in Numb. xviii. 26. Theſe papal uſurpations were firſt introduced into this kingdom by Pandulph the pope's legate, during the reigns of king John and Henry III. in the ſee of Norwich, and afterwards attempted to be made univerſal by pope Clement V. about the beginning of the fourteenth century. Theſe claims were often oppoſed by the Engliſh parliament; but they continued till the reformation in the reign of Hen. VIII. at which period it was computed, that in the compaſs of 50 years 800,000 ducats had been ſent to Rome for firſt fruits only. This revenue was annexed to the crown by 26 Hen. VIII. cap. 3. confirmed by 1 Eliz. cap. 4. and a new *valor beneficiorum* was then made, by which the clergy are at preſent rated. By theſe ſtatutes all vicarages under ten pounds a year, and all rectories under ten marks, are diſcharged from the payment of firſt fruits; and if the incumbent lives but half a year, he ſhall pay only one quarter of his firſt fruits; if one whole year, half of them; if a year and a half, three quarters; and if two years the whole. By ſtat. 27 Hen. VIII. cap. 8. no tenths are due to be paid for the firſt year; and by other ſtatutes of queen Anne, in the fifth and ſixth years of her reign, if a benefice be under fifty pounds per annum, clear yearly value, it ſhall be diſcharged of the payments of firſt fruits and tenths. Queen Anne granted her royal charter, confirmed by ſtat. 2 Ann. cap. 11. whereby the whole revenue of firſt fruits and tenths is veſted in truſtees for ever, to form a perpetual fund for the augmentation of poor livings, uſually called queen Anne's bounty. Blackſt. Comm. vol. i. p. 284, &c. Office of Firſt-fruits is kept in the temple, under the direction of a remembrancer, receiver, and comptroller, and their deputies and clerks.

FISC, Fiscus, in the civil law, the treaſury of a prince, or ſtate; or that to which all things due to the public fall. The word is derived from the Greek Φισκος, *a great baſket*, uſed when when they went to market. By the civil law, none but a ſovereign prince has a right to have a fiſc, or public treaſury. See Ærarium.

FISCAL, ſomething relating to the pecuniary intereſt of the king, the public, or a private perſon. The emperor Adrian erected the office of fiſcal advocate in the Roman empire.

FISH, in natural hiſtory, the fourth claſs of animals, including four orders, viz. *apodes*, *jugulares*, *thoracica* and *abdominales*. For the deſcription, ſee the reſpective names; for the claſſification, ſee the Syſtem of Ichthyology.

FISHERY, a place where great numbers of fiſh are caught. The principal fiſheries for ſalmon, herring, mackerel, pilchards, &c. are along the coaſts of Scotland, England, and Ireland; for cod, on the banks of Newfoundland; for whales, about Greenland; and for pearls, in the Eaſt and Weſt Indies.

Fishery denotes alſo the commerce of fiſh, more particularly the catching them for ſale. Were we to enter into a very minute and particular conſideration of fiſheries, as at preſent eſtabliſhed in this kingdom, this article would ſwell beyond its proper bounds; becauſe, to do juſtice to a ſubject of ſuch concernment to the Britiſh nation, requires a very ample and diſtinct diſcuſſion. We ſhall, however, obſerve, that ſince the Divine Providence hath ſo eminently ſtored the coaſts of Great Britain and Ireland with the moſt valuable fiſh; and ſince fiſheries, if ſucceſsful, become permanent nurſeries for breeding expert ſeamen; it is not only a duty we owe to the Supreme Being, not to deſpiſe the wonderful plenty he hath afforded us, by neglecting to extend this branch of commerce to the utmoſt; but it is a duty we owe to our country, for its natural ſecurity, which depends upon the ſtrength of our royal navy. No nation can have a navy, where there is not a fund of buſineſs to breed and employ ſeamen without any expence to the public; and no trade is ſo well calculated for training up theſe uſeful members of ſociety, as fiſheries.

The ſituation of the Britiſh coaſts is the moſt advantageous in the world for catching fiſh; the Scottiſh iſlands, particularly thoſe to the north and weſt, lie moſt commodious for carrying on the fiſhing trade to perfection: for no country in Europe can pretend to come up to Scotland in the abundance of the fineſt fiſh, with which its various creeks, bays, rivers, lakes, and coaſts, are repleniſhed. King Charles I. was ſo ſenſible of the great advantage to be derived from fiſheries, that he began the experiment, together with a company of merchants; but the civil wars ſoon occaſioned that project to be ſet aſide. King Charles II. made a like attempt; but his preſſing wants made him withdraw what money he had employed that way, whereupon the merchants that joined with him did the ſame. Since the union, ſeveral attempts have been made to retrieve the fiſheries, and a corporation ſettled to that effect, entitled the Royal Britiſh Fiſhery.

Cod Fishery. There are two kinds of cod fiſh; the one green or white cod, and the other dried or cured cod: though it is all the ſame fiſh, (ſee Gadus,) differently prepared; the former being ſometimes ſalted and barrelled, then taken out for uſe; and the latter, having lain ſome competent time in ſalt, dried in the ſun or ſmoak.

Green Cod Fishery. The chief fiſheries for green cod are in the bay of Canada, on the great bank of Newfoundland, and on the iſle of St. Peter, and the iſle of Sable; to which places veſſels reſort from divers parts both of Europe and America. They are from 100 to 150 tons burden, and will catch between 30,000 and 40,000 cod each. The moſt eſſential part of the fiſhery is, to have a maſter who knows how to cut up the cod, one who is ſkilled to take off the head properly, and above all a good ſalter, on which the preſerving of them, and conſequently the ſucceſs of the voyage, depends. The beſt ſeaſon is from the beginning of February to the end of April; the fiſh, which in the winter retire to the deepeſt water, coming then on the banks, and fattening extremely. What is caught from March to June keeps well; but thoſe taken in July, Auguſt, and September, when it is warm on the banks, are apt to ſpoil ſoon. Every fiſher takes but one at a time: the moſt expert will take from 350 to 400 in a day; but that is the moſt, the weight of the fiſh and the great coldneſs on the bank fatiguing very much. As ſoon as the cod are caught, the head is taken off; they are opened, gutted, and ſalted; and the ſalter ſtows them in the bottom of the hold, head to tail, in beds a fathom or two ſquare; laying layers of ſalt and fiſh alternately, but never mixing fiſh caught on different days. When they have lain thus three or four days to drain off the water, they are replaced in another part of the ſhip, and ſalted again; where they remain till the veſſel is loaded. Sometimes they are cut in thick pieces, and put in barrels for the conveniency of carriage.

Dry Cod Fishery. The principal fiſhery for this article is, from Cape Roſe to the Bay des Exports, along the coaſt of Placentia, in which compaſs there are divers commodious ports for the fiſh to be dried in. Theſe, though of the ſame kind with the freſh cod, are much ſmaller, and therefore fitter to keep, as the ſalt penetrates more eaſily into them. The fiſhery of both is much alike; only this latter is moſt expenſive, as it takes up more time, and employs more hands, and yet ſcarce half ſo much ſalt is ſpent in this as in the other.

There are four kinds of commodities drawn from cod, viz. the zounds, the tongues, the roes, and the oil extracted from the liver. The firſt is ſalted at the fiſhery, together with the fiſh, and put in barrels from 600 to 700 pound. The tongues are done in like manner, and brought in barrels from 400 to 500 pounds. The roes are alſo ſalted in barrels, and ſerve to caſt into the ſea to draw fiſh together, and particularly pilchards. The oil comes in barrels, from 400 to 520 pounds, and is uſed in dreſſing leather. In Scotland, they catch a ſmall kind of cod on the coaſts of Buchan, and all along the Murray frith on both ſides; as alſo in the frith of Forth, Clyde, &c. which is much eſteemed. They ſalt and dry them in the ſun upon rocks, and ſometimes in the chimney. They alſo cure ſkait, and other ſmaller fiſh in the ſame manner; but moſt of theſe are for home-conſumption.

Herring FISHERY. Our great ſtations for this fiſhery are off the Shetland and Weſtern iſles, and off the coaſt of Norfolk; in which the Dutch alſo ſhare. There are two ſeaſons for fiſhing herring: the firſt from June to the end of Auguſt; and the ſecond in Autumn, when the fogs become favourable for this kind of fiſhing.

Mr. Anderſon in his Hiſtory of Commerce, gives to the Scots a knowledge of great antiquity in the herring fiſhery. He ſays that the Netherlanders reſorted to theſe coaſts as early as A. D. 836, to purchaſe ſalted fiſh of the natives; but, impoſing on the ſtrangers, they learned the art, and took up the trade, in after times, of ſuch immenſe emolument to the Dutch.

Sir Walter Raleigh's obſervations on that head, extracted from the ſame author, are extremely worthy the attention of the curious, and excite reflections on the vaſt ſtrength reſulting from the wiſdom of well applied induſtry. In 1603, remarks that great man, the Dutch ſold to different nations, as many herrings as amounted to £. 1,759,000 ſterling. In the year 1615, they at once ſent out 2000 buſſes, and employed in them 37,000 fiſhermen. In the year 1618, they ſent out 3000 ſhips, with 50,000 men to take the herrings, and 9000 more ſhips to tranſport and ſell the fiſh; which by ſea and land employed 150,000 men, beſides thoſe firſt mentioned. All this wealth was got on our coaſts; while our attention was taken up in a diſtant whale-fiſhery.

Of the Scots fiſhery in the Weſtern Iſles, the following account is given by Mr. Pennant. "The fiſhing is always performed in the night, unleſs by accident. The buſſes remain at anchor, and ſend out their boats a little before ſun ſet; which continue out, in winter and ſummer, till day-light; often taking up and emptying their nets, which they do 10 or 12 times in a night, in caſe of good ſucceſs. During winter it is a moſt dangerous and fatiguing employ, by reaſon of the greatneſs and frequency of the gales, in theſe ſeas, and in ſuch gales are the moſt ſucceſsful captures: but, by the Providence of heaven, the fiſhers are ſeldom loſt; and, what is wonderful, few are viſited with illneſs. They go out well prepared, with a warm great coat, boots, and ſkin aprons, and a good proviſion of beef and ſpirits. The ſame good fortune attends the buſſes, which in the tempeſtuous ſeaſon, and in the darkeſt nights, are continually ſhifting, in theſe narrow ſeas, from harbour to harbour.

"The herrings in general are exported to the Weſt Indies, to feed the negroes; or to Ireland, for the Iriſh are not allowed to fiſh in theſe ſeas. By having a draw back of 5d. a barrel, and by repacking the fiſh in new barrels of 28 gallons, they are enabled to export them to our colonies at a cheaper rate than the Scots can do. The migration of theſe fiſh from their Northern retreat is regular; their viſits to the Weſtern iſles and coaſts, certain; but their attachment to one particular lock, extremely precarious. All have their turns; that which ſwarmed with fiſh one year, is totally deſerted the following; yet the next loch to it may be crowded with the ſhoals. Theſe changes of place give often full employ to the buſſes, who are continually ſhifting their harbour in queſt of news reſpecting theſe important wanderers.

"They commonly appear here in July; the latter end of Auguſt they go into deep water, and continue there for ſome time, without any apparent cauſe: in November, they return to the ſhallows, when a new fiſhery commences, which continues till January; at that time the herrings become full of roe, and are uſeleſs as articles of commerce. Some doubt, whether theſe herrings that appear in November are not part of a new migration; for they are as fat, and make the ſame appearance, as thoſe that compoſed the firſt.

"The ſigns of the arrival of the herrings are flocks of gulls, who catch up the fiſh while they ſkim on the ſurface; and of gannets, who plunge and bring them up from conſiderable depths. Both theſe birds are cloſely attended to by the fiſhers.

"Cod fiſh, haddocks, and dog fiſh, follow the herrings in vaſt multitudes; theſe voracious fiſh keep on the outſides of the columns, and may be a concurrent reaſon of driving the ſhoals into bays and creeks. In ſummer, they come into bays generally with the warmeſt weather, and with eaſy gales. During winter, the hard gales from north-weſt are ſuppoſed to aſſiſt in forcing them into ſhelter. Eaſt winds are very unfavourable to the fiſhery.

"In a fine day, when the fiſh appear near the ſurface, they exhibit an amazing brilliancy of colours; all the various coruſcations that dart from the diamond, ſapphire, and emerald, enrich their tract; but, during night, if they break, i. e. play on the ſurface, the ſea appears on fire, luminous as the brighteſt phoſphorus."

Herrings are cured either white, or pickled, or red.

1. Of the firſt, thoſe done by the Dutch are the moſt eſteemed, being diſtinguiſhed into four ſorts, according to their ſizes; and the beſt are thoſe that are fat, fleſhy, firm, and white, ſalted the ſame day they are taken, with good ſalt, and well barrelled. The Britiſh cured herrings are little inferior, if not equal, to the Dutch; for in ſpite of all their endeavours to conceal the ſecret, their method of curing, laſting, or caſking the herrings, has been diſcovered, and is as follows: After they have hauled in their nets, which they drag in the ſtern of their veſſels backwards and forwards in traverſing the coaſt, they throw them upon the ſhip's deck, which is cleared of every thing for that purpoſe: the crew is ſeparated into ſundry diviſions, and each diviſion has a peculiar taſk; one part opens and guts the herrings, leaving the melts and roes; another cures and ſalts them, by lining or rubbing their inſide with ſalt; the next packs them, and between each row and diviſion they ſprinkle handfuls of ſalt; laſtly, the cooper puts the finiſhing hand to all, by heading the caſks very tight, and ſtowing them in the hold.

2. Red herrings muſt lie 24 hours in the brine, in as much as they are to take all their ſalt there; and when they are taken out, they are ſpitted, that is, ſtrung by the head on little wooden ſpits, and then hung in a chimney made for that purpoſe. After which, a fire of bruſh-wood, which yields a deal of ſmoke but no flame, being made under them, they remain there till ſufficiently ſmoked and dried, and are afterwards barrelled up for keeping.

Mackerel FISHERY. The Mackarel is a ſummer fiſh of paſſage, found in large ſhoals, in divers parts of the ocean; but eſpecially on the French and Engliſh coaſts. The fiſhing is uſually in the months of April, May, and June, and even July, according to the place. They enter the Engliſh channel in April, and proceed up to the ſtreights of Dover, as the ſummer advances; ſo that by June they are on the coaſts of Cornwall, Suſſex, Normandy, Picardy, &c. where the fiſhery is moſt conſiderable. They are an excellent food, freſh; and not to be deſpiſed when well prepared, pickled, and put up in barrels: a method of preſerving them chiefly uſed in Cornwall. Naturaliſts have obſerved, that the water wherein mackerel have been boiled, often yields a light, after ſtirring it a little. See FIRE, and luminouſneſs of the SEA.

The fiſh is taken two ways; either with a line, or nets: the latter is the more conſiderable, and is uſually performed in the night time. The rules obſerved in the fiſhing for mackerel are much the ſame as thoſe already mentioned in the fiſhery of herrings.

Pearl FISHERY. See PEARL.

Salmon FISHERY. The chief ſalmon fiſheries in Europe are in England, Scotland and Ireland, in the rivers, and ſea coaſts adjoining to the river mouths. The moſt diſtinguiſhed for ſalmon in Scotland are, the river Tweed, the Clyde, the Tay, the Dee, the Don, the Spey, the Neſs, the Bewly, &c. in moſt of which it is very common, about the height of ſummer, eſpecially if the weather happens to be very hot, to catch four or five ſcore ſalmon at a draught. The chief rivers in England for ſalmon are, the Tyne, the Trent, the Severn, and the Thames. The fiſhing is performed with nets, and ſometimes with a kind of locks or weirs made on purpoſe, which in certain places have iron or wooden grates ſo diſpoſed, in an angle, that being impelled by any force in a contrary direction to the courſe of the river, they may give way and open a little at the point of contact, and immediately ſhut again, cloſing the angle. The ſalmon, therefore, coming up into the rivers, are admitted into theſe grates, which open, and ſuffer them to paſs through, but ſhut again, and prevent their return. The ſalmon is alſo caught with a ſpear, which they dart into him when they ſee him ſwimming near the ſurface of the water. It is cuſtomary likewiſe to catch them with a candle and lanthorn, or whiſp of ſtraw ſet on fire; for the fiſh naturally following the light, are ſtruck with the ſpear, or taken in a net ſpread for that purpoſe, and lifted with a ſudden jerk from the bottom.

"The capture of ſalmon in the Tweed, about the month of July, (ſays Mr. Pennant) is prodigious. In a good fiſhery, often a boat load, and ſometimes near two, are taken in a tide: ſome few years ago there were above 700 fiſh taken at one hawl, but from 50 to 100 is very frequent. The coopers in Berwick then begin to ſalt both ſalmon and gilſes in pipes and other large veſſels, and afterwards barrel them to ſend abroad, having then far more than the London markets can take off their hands.

"Moſt of the ſalmon taken before April, or to the ſetting in of the warm weather, is ſent freſh to London in baſkets: unleſs now and then the veſſel is diſappointed, by contrary winds, of ſailing immediately; in which caſe the fiſh is brought aſhore again to the coopers offices, and boiled, pickled, and kitted, and ſent to the London markets by the ſame ſhip, and freſh ſalmon put in the baſkets in lieu of the ſtale ones. At the beginning of the ſeaſon, when a ſhip is on the point of ſailing, a freſh clean ſalmon will ſell from ſix pence to a ſhilling a pound; and moſt of the time that this part of the trade is carried on, the prices are from five to ſeven ſhillings per ſtone; the value riſing and falling according to the plenty of fiſh, or the proſpect of a fair or foul wind. Some fiſh are ſent in this manner to London the latter end of September, when the weather grows cool; but then the fiſh are full of large roes, grow very thin-bellied, and are not eſteemed either palatable or wholeſome.

"The ſeaſon for fiſhing in the Tweed begins November 30th, but the fiſhermen work very little till after Chriſtmas: it ends on Michaelmas day; yet the corporation of Berwick (who are conſervators of the river) indulge the fiſhermen with a fortnight paſt that time, on account of the change of the ſtyle. There are on the river 41 conſiderable fiſheries, extending upwards, about 14 miles from the mouth, (the others above being of no great value), which are rented for near 5400l. per annum: the expence attending the ſervants wages, nets, boats, &c. amount to 5000l. more; which together make up the ſum 10,400l. Now, in conſequence, the produce muſt defray all and no leſs than 20 times that ſum of fiſh will effect it; ſo that 208,000 ſalmon muſt be caught there one year with another.

“Scotland poſſeſſes great numbers of fine fiſheries on both ſides of that kingdom. The ſalmon are cured in the ſame manner as at Berwick, and a great quantity is ſent to London in the ſpring; but after that time, the adventurers begin to barrel and export them to foreign countries: but we believe that commerce is far leſs lucrative than it was in former times, partly owing to the great increaſe of the Newfoundland fiſhery, and partly to the general relaxation of the diſcipline of abſtinence in the Romiſh church. Ireland (particularly the north) abounds with this fiſh: the moſt conſiderable fiſhery is at Cranna, on the river Ban, about a mile and an half from Coleraine.

“Mr. Pennant obſerves, that when he made the tour of that kingdom, in 1754, it was rented by a neighbouring gentleman for 620l. a year, who aſſured him, that the tenant, his predeceſſor, gave 1600l. *per annum*, and was a much greater gainer by the bargain for the reaſons before mentioned, and on account of the number of poachers who deſtroy the fiſh in the fence mouths.

“The mouth of this river faces the north; and is finely ſituated to receive the fiſh that roam along the coaſt, in ſearch of an inlet into ſome freſh water, as they do all along that end of the kingdom which oppoſes itſelf to the northern ocean. We have ſeen near Ballicaſtle, nets placed in the ſea at the foot of the promontories that jut into it, which the ſalmon ſtrike into as they are wandering cloſe to ſhore; and numbers are taken by that method. In the Ban they fiſh with nets 18 ſcore yards long, and are continually drawing night and day the whole ſeaſon, which we think laſts about four months, two ſets of 16 men each alternately relieving one another. The beſt drawing is when the tide is coming in: we were told, that at a ſingle draught there were once 840 fiſh taken. A few miles higher up the river is a wear, where a conſiderable number of fiſh that eſcape the nets are taken. We were lately informed, that, in the year 1780, about 320 tons were taken in the Cranna fiſhery.”

Curing Salmon. When the ſalmon are taken, they open them along the back, take out the guts and gills, and cut out the greateſt part of the bones, endeavouring to make the inſide as ſmooth as poſſible: they then ſalt the fiſh in large tubs for the purpoſe, where they lie a conſiderable time ſoaking in brine; and about October, they are packed cloſe up in barrels, and ſent to London, or exported up the Mediterranean. They have alſo in Scotland, a great deal of ſalmon ſalted in the common way, which after ſoaking in brine a competent time, is well preſſed, and then dried in ſmoke: this is called kipper, and is chiefly made for home conſumption; and, if properly cured and prepared, is reckoned very delicious.

Sturgeon FISHERY. The greateſt ſturgeon fiſhery is in the mouth of the Volga, on the Caſpian ſea; where the Muſcovites employ a great number of hands, and catch them in a kind of incloſure formed by huge ſtakes repreſenting the letter Z repeated ſeveral times. Theſe fiſheries are open on the ſide next the ſea, and cloſe on the other; by which means the fiſh aſcending in its ſeaſon up the river, is embarraſſed in theſe narrow angular retreats, and ſo is eaſily killed with a harping iron. Sturgeons, when freſh, eat deliciouſly; and in order to make them keep, they are ſalted or pickled in large pieces, and put up in cags from 30 to 50 pounds. But the great object of this fiſhery is the roe, of which the Muſcovites are extremely fond, and of which is made the cavear, or kavia, ſo much eſteemed by the Italians. See CAVEAR.

Whale FISHERY. Whales are chiefly caught in the north ſeas: the largeſt ſort are found about Greenland, or Spitzbergen. At the firſt diſcovery of this country, and at the firſt beginning of this fiſhery, they took nothing but the pure oil and the whalebone, and all the buſineſs was executed in the country; by which means a ſhip could bring home the product of many more whales than ſhe can according to the preſent method of conducting this trade. The fiſhery alſo was then ſo plentiful, that they were obliged ſometimes to ſend other ſhips to fetch off the oil they had made, the quantity being more than the fiſhing ſhips could bring away. But time and change of circumſtances have ſhifted the ſituation of this trade; the ſhips coming in ſuch numbers from Holland, Denmark, Hamburgh, and other northern countries, all intruders upon the Engliſh, who were the firſt diſcoverers of Greenland.

The whale fiſhery begins in May, and continues all June and July; but whether the ſhips have good or bad ſucceſs, they muſt come away, and get clear of the ice, by the end of Auguſt; ſo that in the month of September at fartheſt, they may be expected home; but a ſhip that meets with a fortunate and early fiſhery in May, may return in June or July.

The manner of taking whales at preſent is as follows: Every ſhip is provided with ſix boats, to each of which belong ſix men for rowing the boat, and an harpooneer, whoſe buſineſs is to ſtrike the whale with his harpoon. Two of theſe boats are kept conſtantly on the watch at ſome diſtance from the ſhip, faſtened to pieces of ice, and are relieved by others every four hours. As ſoon as a whale is perceived, both the boats ſet out in purſuit of it, and if either of them can come up before the whale finally deſcends, which is known by his throwing up his tail, the harpooneer diſcharges his harpoon at him. There is no difficulty in chooſing the place where the whale is to be ſtruck, as ſome have aſſerted; for theſe creatures only come up to the ſurface in order to ſpout up the water, or blow, as the fiſhermen term it, and therefore always keep the ſoft and vulnerable part of their bodies above water. A late improvement was made in the method of diſcharging the harpoon; namely, by ſhooting it out of a kind of ſwivel or muſquetoon: but it doth not appear that, ſince this improvement was made, the whale-fiſhing ſhips have had better ſucceſs than before. As ſoon as the whale is ſtruck, the men ſet up one of their oars in the middle of the boat as a ſignal to thoſe in the ſhip. On perceiving this, the watchmen alarms all the reſt with the cry of *fall! fall!* upon which all the other boats are immediately ſent out to the aſſiſtance of the firſt.

The whale finding himſelf wounded, runs off with prodigious violence. Sometimes he deſcends perpendicularly; at others goes off horizontally, at a ſmall depth below the ſurface. The rope which is faſtened to the harpoon is about 200 fathoms long, and properly coiled up, that it may freely be given out as there is a demand for it. At firſt, the velocity with which this line runs over the ſide of the boat is ſo great, that it is wetted to prevent its taking fire; but in a ſhort time the ſtrength of the whale begins to fail, and the fiſhermen, inſtead of letting out more rope, ſtrive as much as poſſible to pull back what is given out already, though they always find themſelves neceſſitated to yield at laſt to the efforts of the animal, to prevent his ſinking their boat. If he runs out the 200 fathoms of line contained in one boat, that belonging to another is immediately faſtened to the end of the firſt, and ſo on; and there have been inſtances, where all the rope belonging to the ſix boats has been neceſſary, though half that quantity is ſeldom required.

The whale cannot ſtay long below water, but again comes up to blow; and being now much fatigued and wounded, ſtays longer above water than uſual. This gives another boat time to come up with him, and he is again ſtruck with an harpoon. He again deſcends, but with leſs force than before; and when he comes up again, is generally incapable of deſcending, but ſuffers himſelf to be wounded and killed with long lances which the men are provided with for the purpoſe. He is known to be near death when he ſpouts up the water deeply tinged with blood. A conſiderable trade is alſo carried on to the South-Seas, as the whales in that quarter, though inferior in ſize to thoſe of the northern climes, are much more valuable, in producing the ſpermaceti, a very profitable branch of commerce.

Beſides theſe fiſheries, there are ſeveral others both on the coaſts of Great Britain and in the North Seas, which, although not much the ſubject of merchandize, nevertheleſs employ great numbers of ſhips and men; as, 1. The oyſter-fiſhing at Colcheſter, Feverſham, Milton, the iſle of Wight, in the Swales of the Medway, and in all the creeks between Southampton and Chicheſter, from whence they are carried to be fed in pits about Wevenhoe and other places. (See OSTREA.) 2. The lobſter-fiſhing all along the Britiſh Channel, the Frith of Edinburgh, on the coaſt of Northumberland, and on the coaſt of Norway, from whence great quantities are brought to London. 3. And laſtly, The fiſhing of the pot-fiſh, fin-fiſh, ſea-unicorn, ſea-horſe, and the ſeal, or dog-fiſh; all which are found in the ſame ſeas with the whales, and yield blubber in a certain degree; beſides, the horn of the unicorn is as eſtimable as ivory, and the ſkins of the ſeals are particularly uſeful to trunk-makers.

FISHING, in general, the art of catching fiſh, whether by means of nets, of ſpears, or of the line and hook.

FISHING in the great, performed by the net, ſpear, or harpoon, has been explained in the preceding article. That performed by the rod, line and hook, is uſually termed angling: and for the particular manner of angling for the different kinds of fiſh, ſee their reſpective names.

Right of FISHING, and property of fiſh. It has been held, that where the lord of the manor hath the ſoil on both ſides of the river, it is a good evidence that he hath a right of fiſhing; and it puts the proof upon him who claims *liberam piſcariam:* but where a river ebbs and flows, and is an arm of the ſea, there it is common to all, and he who claims a privilege to himſelf muſt prove it; for if the treſpaſs is brought for fiſhing there, the defendant may juſtify, that the place where is *brachium maris, in quo unuſquiſque ſubditus domini regis habet et habere debet liberam piſcariam.* In the Severn the ſoil belongs to the owners of the land on each ſide; and the ſoil of the river Thames is in the king, but the fiſhing is common to all. He who is owner of the ſoil of a private river, hath *ſeparalis piſcaria*; and he that hath *libera piſcaria*, hath a property in the fiſh, and may bring a poſſeſſory action for them; but *communis piſcaria* is like the caſe of all other commons. One that has a cloſe pond in which there are fiſh, may call them *piſces ſuos*, in an indictment, &c. but he cannot call them *bona & catalla*, if they be not in trunks. There needs no privilege to make a fiſh-pond, as there doth in the caſe of a warren. See FRANCHISE. Jacob's Law Dictionary.

FISSURES, in the hiſtory of the earth, certain interruptions that horizontally or parallely divide the ſeveral ſtrata of which the body of our terreſtrial globe is compoſed.

FISTULA, in ſurgery, a deep, narrow, and callous ulcer, generally ariſing from abſceſſes. It differs from a ſinus, in its being callous, the latter not. See **Surgery**.

Fistula, in farriery. See Syſtem of **Farriery**. Sect XII.

FISTULARIA, or **Tobacco-pipe Fish**; a genus of fiſhes, belonging to the order of abdominales. Of this genus Linnæus enumerates only two ſpecies.

FIT, in medicine, an acceſs or paroxyſm. See **Paroxysm**.

FITCHEE, or **Fichee**, in heraldry, is when the lower part of any croſs is ſharpened into a point fit to fix into the ground. Thus, he bears azure, a croſs potent fitchee.

FITZ, a French term, literally denoting ſon, ſometimes given by way of addition to the natural ſons of the kings of England; as James Fitz-Roy, duke of Grafton, &c.

FIXATION, in chymiſtry, the rendering any volatile ſubſtance fixed, ſo as not to fly off upon being expoſed to a great heat; hence,

FIXED *Bodies*, are thoſe which bear a conſiderable degree of heat without evaporating, or loſing any of their weight. Among the moſt fixed bodies are diamonds, gold, &c. See **Diamond**, **Gold**, &c.

Fixed *Bodies*, in the general, are thoſe which neither the fire nor any corroſive has ſuch effect on, as to reduce or reſolve into their component elements; i. e. abſolutely to deſtroy them.

Fixed *Stars* are ſuch as conſtantly retain the ſame poſition and diſtance with reſpect to each other. By which they are contradiſtinguiſhed from erratic or wandering ſtars, which are continually ſhifting their ſituation and diſtance. The fixed ſtars are what we properly and abſolutely call ſtars; the reſt have their peculiar denomination of planet and comet.

FIXITY, or **Fixedness**, in philoſophy, the quality of a body which denominates and renders it fixed; or a property which enables it to endure the fire and other violent agents.

Fixity, or **Fixedness**, in chymiſtry, is, in a peculiar manner, uſed for the affection oppoſite to volatility; i. e. the property whereby bodies bear the action of the fire, without being diſſipated in fumes.

FLACCIDITY, in medicine, &c. a diſorder of the fibres or ſolid parts of the body, oppoſed to rigidity. The too great flaccidity of the parts is cured by cardiacs, exerciſe, friction, a dry warm air, proper food, &c.

FLAG, a general name, including colours, ſtandards, ancients, banners, enſigns, &c. which authors frequently confound with each other.

Flag is more particularly uſed in ſea language, for the colours, ancients, ſtandards, &c. borne on the top of the maſts of veſſels, to notify the quality of the perſon who commands the ſhip, of what nation it is, and whether it be equipped for war or trade. For a particular deſcription of the flags of this, and other nations, ſee **Naval Affairs**.

Flags, in the military art, are ſmall banners of diſtinction ſtuck in the baggage-waggons of the army, to diſtinguiſh the baggage of one brigade from another, and of battalion from another, that they may be marſhalled by the waggon-maſter-general according to the rank of their brigades, to avoid the confuſion that otherwiſe might ariſe.

Flag *Officers*, thoſe who command the ſeveral ſquadrons of a fleet; as admirals, vice-admirals, and rear-admirals. The flag-officers in our ſea-pay, are the admiral, vice-admiral, and rear-admiral, of the white, red, and blue.

Flag *Ship*, a ſhip commanded by a general or flag-officer, who has a right to carry a flag, in contradiſtinction to the ſecondary veſſels under the command thereof.

Flag *Staves*, are the ſtaves ſet on the heads of the top-gallant maſts, ſerving to let fly and unfurl the flag.

FLAGELLANTES, a ſect of wild fanatics who chaſtiſed and diſciplined themſelves with whips in public. The ſect of the flagellantes had its riſe in Italy in the year 1260; its author was one Rainier, a hermit; and it was propagated from hence through almoſt all the countries of Europe. It was in all probability no more than the effect of an indiſcreet zeal. A great number of perſons of all ages and ſexes made proceſſions, walking two by two with their ſhoulders bare, which they whipped till the blood ran down, in order to obtain mercy from God, and appeaſe his indignation again the wickedneſs of the age. They were then called the devout; and having eſtabliſhed a ſuperior, he was called the general of the devotion. Though the primitive flagellantes were exemplary in point of morals, yet they were joined by a turbulent rabble, who were infected with the moſt ridiculous and impious opinions; ſo that the emperors and pontiffs thought proper to put an end to this religious phrenzy, by declaring all devout whipping interest. contrary to the Divine Law, and prejudicial to man's eternal

FLAGELLATION, whipping, a voluntary diſcipline, or penance, frequently practiſed by the ancient penitents. The parliament of Paris prohibited all public flagellations by an arret of 1601.

Flagellation is a term more peculiarly appropriated to the ſufferings of Jeſus Chriſt, when whipped and ſcourged by the Jews; from the Latin, *flagellum*, *a ſcourge* or *whip*.

FLAGEOLET, or **Flajolet**, a kind of a little flute; or a muſical inſtrument of the flute kind, uſed chiefly by ſhepherds and country people. It is uſually made of box, or ſome other hard wood, ſometimes of ivory. It has ſix holes or ſtops beſides that at bottom, the mouth-piece, and that behind the neck. The ambit of the flageolet, according to the ſcale exhibited by Merſennus, is two octaves from *a ſol re ut* upwards.

FLAIL, an inſtrument for threſhing corn. It conſiſts of the following parts. 1. The hand-ſtaff, or piece held in the threſher's hand. 2. The ſwiple, or that part which ſtrikes out the corn. 3. The caplins, or ſtrong double leathers, made faſt to the tops of the hand-ſtaff and ſwiple. 4. The middle-band, being the leather thong, or fiſh-ſkin, that ties the caplins together.

FLAKE *White*, in painting, is lead corroded by means of the preſſing of grapes, or a ceruſe prepared by the acid of grapes. It is brought here from Italy, and far ſurpaſſes, both with regard to the purity of its whiteneſs and the certainty of its ſtanding, all the ceruſe or white lead made with us in common. It is uſed in oil and varniſh painting for all purpoſes, where a very clean white is required. The white flake ſhould be procured in lumps as it is brought over, and levigated by thoſe who uſe it, becauſe that which the colourmen ſell in a prepared ſtate is levigated and mixed up with ſtarch, and often with white lead, and worſe ſophiſtications.

FLAME, is a general name for every kind of luminous vapour, provided the light it emits hath any conſiderable degree of intenſity. The name flame, however, is moſt generally applied to ſuch as are of a conical figure, like thoſe ariſing from our common fires; without this, they are commonly called luminous vapours, or ſimply lights. According to Sir Iſaac Newton, flame is only red-hot ſmoke, or the vapour of any ſubſtance raiſed from it by fire and heated to ſuch a degree as to emit light copiouſly.

But Dr. Prieſtley has properly obſerved, that the ſmoke of common fuel conſiſts of two very different things: that which riſes firſt is mere water, loaded with ſome of the groſſer parts of the fuel, and is hardly more capable of becoming red-hot than water itſelf; but the other kind of ſmoke, which alone is capable of ignition, is properly inflammable air, which is alſo loaded with other heterogeneous matter, ſo as to appear like a very denſe ſmoke. A lighted candle ſoon ſhews them to be eſſentially different; for one of them inſtantly takes fire, whereas the other extinguiſhes a candle. Prieſtley on Air, vol. i. p. 207.

It is certain, that bodies are capable of emitting flame only in proportion to the quantity of vapour that riſes from them. Thus wood, coals, &c. which emit a great quantity of vapour, flame violently; while lead, tin, &c. which emit but a ſmall fume, can ſcarce be perceived to flame at all. Some vapours ſeem to be in their own nature uninflammable, and capable of extinguiſhing flame, as thoſe of water, the mineral acids, ſal-ammoniac, arſenic, &c. while others take fire on the ſlighteſt approach of a flaming ſubſtance, ſuch as ether, ſpirit of wine, &c. Theſe laſt mentioned ſubſtances alſo exhibit a remarkable phenomenon; namely, that they cannot be made to flame without the approach of ſome ſubſtance actually in flames beforehand. Thus, ſpirit of wine, poured on a red-hot iron, though inſtantly diſſipated in vapour, will not flame; but if a burning candle touches its ſurface, the whole is ſet in a flame at once. The caſe is otherwiſe with oils, eſpecially thoſe of the groſſer kind; for their vapours will readily be changed into flame by the mere increaſe of heat, without the approach of any flaming ſubſtance.

There is however, no kind of vapour, perhaps, that is incapable of being converted into flame, provided it is expoſed to a ſufficient degree of heat. Thus the vapour of water, made to paſs through burning coals, produces an exceedingly ſtrong and bright flame. It is remarkable, that this kind of vapour ſeems to be more powerful than almoſt any other in abſorbing heat, and detaining it in a latent ſtate. Dr. Black hath ſhewn, that when any quantity of aqueous vapour is condenſed, more heat will be ſeparated from it than would have been ſufficient to heat an equal bulk of iron red-hot. It is moſt probably to this property which all vapours have of abſorbing heat, and detaining it in a latent ſtate, that we are to attribute the phenomena of flame, and alſo the exceeding great elaſticity of ſteam. It is certain, that vapours, of water at leaſt, have a much greater power of abſorbing and retaining heat, than the water from which they are raiſed. In open veſſels, water cannot be heated more than 212 degrees of Fahrenheit's thermometer; but in Papin's digeſter, where the vapour is forcibly confined, it has been heated to 400 of the ſame degrees; and, no doubt, might have been heated a great deal more, had the veſſels been ſtrong enough to bear the expanſile force of the ſteam. On opening the veſſels, however, the exceſs of heat was found to have reſided entirely in the vapour; for the water in the veſſel very ſoon ſunk down to 212°, while the ſteam iſſued forth with great violence. From theſe experiments it appears, that the ſteam of water, after it has abſorbed as much heat in a latent ſtate as it can contain, continues to abſorb, or detain among its particles, an unlimited quantity of ſenſible heat; and if the ſteam could be confined till this quantity became great enough to be viſible by its emiſſion of light, there cannot be the leaſt doubt that the vapour would then be converted into flame.

We find that when gun-powder takes fire, it goes off in a flaming ſmoke. The manner we conceive to be this: the charcoal and ſulphur eaſily take fire, and ſet fire to the nitre; by which the ſpirit of the nitre being rarefied into vapour, ruſhes out like the vapour of water out of an æolipile. Then the acid ſpirit of the ſulphur entering violently into the fixed body of the nitre ſets looſe the ſpirit of the nitre, and excites a greater fermentation, whereby the heat is increaſed, and the fixed body of the nitre rarefied into fume, and thus is a vehement exploſion effected. The flame of gun-powder ariſes from a violent action, whereby the mixt being quickly and vehemently heated, is rarefied and converted into fume and vapour: which vapour, by the violence of the action becoming ſo hot as to ſhine, appears in the form of flame. Newt. Optics, p. 318. See Air, Fire, Heat, and Phologiston. Flames are of different colours, according to the ſubſtances from which they are produced. Thus, the flame of ſulphur and ſpirit of wine is blue; the flame of nitre and zinc, of a bright white; that of copper, of a greeniſh blue, &c. Theſe varieties afford an opportunity of making a number of agreeable repreſentations in fire work, which could not be done if the flame produced from every different ſubſtance was of the ſame colour. See Pyrotechnics. We have ſeveral inſtances of actual flame being produced by the mixture of two cold liquors. Dr. Slare gives us a liſt of the oils which burſt into flame upon mixing them with compound ſpirit of nitre; ſuch are thoſe of caraways, cloves, ſaſſafras, guaiacum, box, camphire, pepper, hartſhorn, blood, &c. Philoſoph. Tranſact. N° 213.

FLAMEN, among the ancient Romans, was a prieſt or miniſter of ſacrifice. There were as many kinds of flamens at Rome as there were gods who had prieſts and ſacrifices offered them.

FLANCONADE, in fencing, is the action of dropping the point of your ſword under your adverſary's hilt, in ſeizing with force the feeble of his blade; which, binding without quitting it, form the parade in octave, and then throw in your thruſt. See Syſtem of Fencing, deſcription of Fig. IV. Plate I.

FLANEL, or Flannel, a kind of ſlight, looſe, woollen ſtuff, not quilted, but very warm, compoſed of a woof and warp, and wove on a loom with two treddles, after the manner of bays.

FLANK, or Flanc, is applied to the ſides of a horſe's buttocks, &c. In a ſtrict ſenſe, the flanks of a horſe are the extremes of the belly, where the ribs are wanting, and are below the loins.

Flank, in fortification, is a line drawn from the extremity of the face towards the inſide of the work. Or, flank is that part of a baſtion which reaches from the curtain to the face, and defends the oppoſite face, the flank and the curtain.

FLANKING, in general, is the act of diſcovering and firing upon the ſide of a place, body, battalion, &c. To flank a place, is to diſpoſe a place or other work in ſuch a manner as that there ſhall be no part of the place but what may be played on, both in front and rear. Any fortification that has no defence but juſt right forwards is faulty; and to render it complete, one part ought to be made to flank the other. Hence the curtain is always the ſtrongeſt part of any place, becauſe it is flanked at each end. Battalions alſo are ſaid to be flanked by the wings of the cavalry. A houſe is ſometimes ſaid to be flanked with two pavilions, or two galleries, meaning it has a gallery, &c. on each ſide.

FLAT *Bottomed Boats* are ſuch as are made to ſwim in ſhallow water, and to carry a great number of troops, artillery, ammunition, &c.

Flats, in muſic, a kind of additional or half-notes contrived together with ſharps, to remedy the defects of muſical inſtruments.

FLATULENCY, a word uſed by medical writers to expreſs a diſtempered ſtate of the body in which there is an uncommon and unnatural generation of flatuſes or halituous and elaſtic matter of the nature of air, ariſing from the humidity of the abdomen, and attended with ſeveral very bad ſymptoms.

FLATULENT, ſomething that has a relation to flatuſes, or blaſts of wind. Peas, and moſt kind of pulſe, onions, &c. are flatulent foods.

FLAX, the Engliſh name of the genus Linum, for a deſcription of which and its ſpecies, ſee Linum. For the cultivation of flax, ſee Syſtem of Agriculture, Sect. XVIII. For the dreſſing of flax, ſee the following.

Flax *Dreſſing*. For many ages it was the practice to ſeparate the boon or core from the flax, which is the bark of the plant, by the following ſimple hand methods. Firſt, for breaking the boon, the ſtalks in ſmall parcels were beat with a mallet. This method of breaking and ſcutching the flax being ſlow and very laborious, a water mill is ſometimes uſed; which, with ſome late improvements, makes great diſpatch, and in ſkilful and careful hands gives ſatisfaction.

The ſcutching is next carried on by the mill in the following manner: Four arms, ſomething like the hand-ſcutchers before deſcribed, project from a perpendicular axle; a box around the axle incloſes theſe projecting ſcutchers; and this box is divided among the workmen, each having ſufficient room to ſtand and handle his flax, which, through ſlits in the upper part and ſides of the box, they hold in to the ſtroke of the ſcutchers: which moving round horizontally, ſtrike the flax a-croſs or at right angles, and ſo threſh out or clear it of the boon.

The breaking of the flax by rollers is ſcarcely ſubject to any objection, but that it is dangerous to workmen not ſufficiently on their guard, who ſometimes allow the rollers to take hold of their fingers, and thereby their whole arm is inſtantly drawn in; thus many have loſt their arms. To avoid this danger, a break upon the general principles of the hand-break before deſcribed, has been lately adapted to water-machinery, and uſed in place of rollers. The horizontal ſtroke of the ſcutchers was long thought too ſevere, and waſteful of the flax; but very careful experiments have diſcovered that the waſte complained of muſt be charged to the unſkilfulneſs or negligence of the workmen, as in good hands the mill carries away nothing but what, if not ſo ſcutched off, muſt be taken off in the heckling with more loſs both of time and flax. But to obviate this objection of the violence of the horizontal ſcutchers, an imitation of hand-ſcutching has lately been applied to water. The ſcutchers then project from an horizontal axle, and move like the arms of a check-reel, ſtriking the flax neither acroſs nor perpendicularly down, but ſloping in upon the parcel exactly as the flax is ſtruck by the hand-ſcutcher. This ſloping ſtroke is got by raiſing the ſcutching-ſtock ſome inches higher than the centre of the axle; and by raiſing or lowering the ſtock, over which the flax is held, or ſcrewing it nearer to or farther from the ſcutchers, the workmen can temper or humour the ſtroke almoſt as he pleaſes.

A lint mill with horizontal ſcutchers upon a perpendicular axle requires a houſe of two ſtories, the rollers or break being placed in the ground ſtory, and the ſcutchers in the loft above; but a mill with vertical ſcutchers on an horizontal axle, requires but one ground ſtory for all the machinery. Another method of breaking and ſcutching flax, more expeditious than the old hand methods and more gentle than water-mills has alſo been lately invented. It is much like the break and ſcutcher giving the ſloping ſtroke laſt deſcribed, moved by the foot. The treddle is remarkably long, and the ſcutchers are fixed upon the rim of a fly-wheel. The foot-break is alſo aſſiſted in its motion by a fly. Theſe foot machines are very uſeful where there are no water-mills, but they are far inferior to the mills in point of expedition.

The next operation that flax undergoes after ſcutching is heckling. The heckle is firmly fixed to a bench before the workman, who ſtrikes the flax upon the teeth of the heckle, and draws it through the teeth. To perſons unacquainted with that kind of work this may ſeem a very ſimple operation; but, in fact, it requires as much practiſe to acquire the ſlight of heckling well, and without waſting the flax, as any other operation in the whole manufacture of linen. They uſe coarſer and wider teethed heckles, or finer, according to the quality of the flax, generally putting the flax through two heckles, a coarſer one firſt, and next a fine one.

Flax for cambric and fine lawn, thread, and lace, is dreſſed in a manner ſomewhat different. It is not ſkutched ſo thoroughly as common flax; which from the ſkutch proceeds to the heckle, and from that to the ſpinner: whereas, this fine flax, after a rough ſkutching, is ſcraped and cleanſed with a blunt knife upon the workman's knee covered with his leather apron; from the knife it proceeds to the ſpinner, who, with a bruſh made for the purpoſe, ſtraights and dreſſes each parcel juſt before ſhe begins to ſpin it.

Flax *made to reſemble Cotton*. In the Swediſh tranſactions for the year 1747, a method is given of preparing flax in ſuch a manner as to reſemble cotton in whiteneſs and ſoftneſs, as well as in coherence. For this purpoſe, a little ſea-water is to be put into an iron pot or an untinned copper-kettle, and a mixture of equal parts of birch-aſhes and quicklime ſtrewed upon it: a ſmall bundle of flax is to be opened and ſpread upon the ſurface, and covered with more of the mixture, and the ſtratification continued till the veſſel is ſufficiently filled. The whole is then to be boiled with ſea-water for ten hours, freſh quantities of water being occaſionally ſupplied in proportion to the evaporation, that the matter may never become dry. The boiled flax is to be immediately waſhed in the ſea by a little at a time, in a baſket, with a ſmooth ſtick: When grown cold enough to be borne by the hands, it muſt be well rubbed, waſhed with ſoap, laid to bleach, and turned and watered every day. Repetitions of the waſhing with ſoap expedite the bleaching; after which the flax is to be beat in again well waſhed; when dry, it is to be worked and carded in the ſame manner as common cotton, and preſſed betwixt two boards for 48 hours. It is now fully prepared and fit for uſe. It loſes in this proceſs near one half its weight, which is abundantly compenſated by the improvement made in its quality.

Flax *Plant*, is a name which we may give to a plant that ſerves the inhabitants of New Zealand inſtead of hemp and flax. Of this plant there are two ſorts; the leaves of both reſemble thoſe of flags, but the flowers are ſmaller, and their cluſters more numerous; in one kind they are yellow, and in the other a deep red. Of the leaves of theſe plants, with very little preparation, they make all their common apparel, and alſo their ſtrings, lines, and cordage, for every purpoſe, which are ſo much ſtronger than any thing we can make with hemp, that they will not bear a compariſon. From the ſame plant, by another preparation, they draw long ſlender fibres, which ſhine like ſilk, and are as white as ſnow: of theſe which are very ſtrong, they make their fineſt cloaths; and of the leaves, without any other preparation than ſplitting them into proper breadths, and tying the ſtrips together, they make their fiſhing nets, ſome of which are of an enormous ſize. Hawkeſworth's Voyag. vol. iii. p. 39.

The ſeeds of this valuable plant have been brought over into England; but, upon trial, appeared to have loſt their vegetating power. The filamentous parts of different vegetables have been employed in different countries for the ſame mechanic uſes as hemp and flax among us. Putrefaction, and in ſome degree alcaline lixivia, deſtroy the pulpy or fleſhy matter, and leave the tough filaments entire. By curiouſly putrefying the leaf of a plant in water, we obtain the fine flexible fibres.

Earth FLAX. See AMIANTHUS.

FLEA, in entomology, the Engliſh name of the genus pulex belonging to the order of aptera; for a particular deſcription of which, ſee PULEX.

FLEAM, in ſurgery and farriery, an inſtrument for letting blood of a man or horſe. A caſe of fleams, as it is called by farriers, comprehends ſix ſorts of inſtruments; two hooked ones, called drawers, and uſed for cleaning wounds; a pen knife; a ſharp pointed lancet, for making inciſions; and two fleams, one ſharp and the other broad pointed. Theſe laſt are ſomewhat like the point of a lancet, fixed in a flat handle, and no longer than is juſt neceſſary to open the vein.

FLEECE, the covering of wool ſhorn off the bodies of ſheep.

The Golden FLEECE, is famous among the ancient writers. It was this that the Argonauts, under the command of Jaſon, went in purſuit of to Colchis, a province of Aſia, now called Mingrelia. The miſtery of the golden fleece is variouſly explained; either of the profit of the wool trade to Colchis; or of the gold that they commonly gather there, with fleeces, in the rivers. Arbuth. Diſſ. p. 224. See ARGONAUTS.

FLEET, a number of veſſels, going in company, whether on a deſign of war, or commerce. In times of peace, merchants ſhips go in fleets, for their mutual aid and aſſiſtance: in times of war, beſides this ſecurity, they likewiſe procure convoys of men of war; either to eſcort them to the places whither they are bound, or only a part of the way, to a certain point or latitude, beyond which they are judged out of danger of privateers, &c.

FLEET is alſo a priſon in London, thus called from the river Fleet, on the border whereof it once ſtood. To this priſon perſons are uſually committed for contempt of the king and his laws; or upon abſolute command of the king, or ſome of his courts, particularly that of chancery; and laſtly, for debt.

FLEMISH, or the Flemiſh tongue, is that which we otherwiſe call low Dutch, to diſtinguiſh it from the German, whereof it is a corruption, and a kind of dialect. The Flemiſh is the language uſed throughout the provinces of the Netherlands. It differs conſiderably from the Walloon, which is a corrupt French.

FLESH, *Caro*, in anatomy, a fibrous part of an animal body, ſoft and bloody; being that whereof moſt of the other parts are compoſed, and whereby they are connected together. Fleſh is properly underſtood of ſuch parts of the body where the blood-veſſels are ſo ſmall, as only to retain blood enough to preſerve their colour red. The ancients accounted five different kinds of fleſh; the firſt muſcular, fibrous, or fiſtular; as the ſubſtance of the heart, and other muſcles; the ſecond parenchymous, as that of the lungs, liver, and ſpleen; the third viſcerous, as the fleſh of the ſtomach and inteſtines; the fourth glandulous, as that of the breaſts, pancreas, tonſils, &c. and the fifth ſpurious, as that of the gums, glans of the penis, the lips, &c. The moderns admit only of one kind of fleſh: viz. the muſcular, conſiſting of little tubes and veſſels, with blood therein; ſo that fleſhy and muſcular parts of the body with them are the ſame thing. Sometimes, however, they apply the terms to the glands, which they call, by way of diſtinction, glandulous fleſh. As to the parenchymas, they are now found to be quite other things than the ancients imagined. The lungs are only an aſſemblage of membranous veſicles, inflated with air; the liver a collection of glands, wherein the bile is ſeparated; the ſpleen, a heap of veſicles, full of blood; and the kidneys, like the liver, a maſs of glands for ſeparating of the urine.

FLESH is alſo uſed, in theology, in ſpeaking of the myſteries of the incarnation and euchariſt. The word was made fleſh, *Verbum caro factum eſt*. The Romaniſts hold, that the bread in the ſacrament of the ſupper is turned into the real fleſh of Jeſus Chriſt. See TRANSUBSTANTIATION.

FLESH is ſometimes alſo uſed by botaniſts for the ſoft pulpy ſubſtance of any fruit, incloſed between the outer rind or ſkin, and the ſeeds, or ſtone; or for that part of a root, fruit, &c. fit to be eaten.

FLEUR-DE-LIS, FLEURETTE, FLEURONNE, and FLEURY, in heraldry. See FLORY.

FLEXIBLE, in phyſics, is applied to bodies, that are capable of being bent, or changed from their natural form and direction. A body is not capable of being inflected or bent, unleſs the whole thereof be at reſt. In bending a body, it conſtitutes, as it were, two levers; and the point it is to be bent in, is a fulcrum: hence, as a moving power, the farther it is from the fulcrum, it acquires a greater force; the longer the flexible body is, the eaſier it is bent.

FLEXION, in anatomy, &c. is applied to the motion of an arm, or other member, whereby it is bent. The arm has a motion of flexion, and another of extenſion. The motion of flexion is, when the radius and humerus approach each other, and form an angle at the elbows.

FLEXOR, in anatomy, a name given to ſeveral muſcles in reſpect of their action, viz. the bending of the members, or joints, in oppoſition to the extenſors, which open and ſtretch them. See Syſtem of ANATOMY, Part III. Sect. XIII and XIV.

FLEXURE, or FLEXION, in geometry, is uſed to ſignify; that a curve is both concave and convex, with reſpect to a given right line, or a fixed point. And the point which limits the concavity and convexity, is called the point of contrary flexure.

FLIE, or FLY, that part of the mariner's compaſs on which the thirty two winds are drawn, and over which the needle is placed, and faſtened underneath.

FLIGHT, the act of a bird in flying; or the manner, duration, &c. thereof. The feathers of birds are admirably contrived and fitted for the eaſe and convenience of flight. Almoſt every kind of bird has its particular flight: the eagle's flight is the higheſt: the flight of the ſparrow hawk and vulture are noble, and are fit for high enterprize and combat. The flight of ſome birds is low, weak, tranſient, and, as they call it, *terra à terra*; the flight of the partridge and pheaſant is but of ſhort continuance; that of the dove is laboured; that of the ſparrow undulatory, &c.

FLINT, in natural hiſtory, a kind of ſemi-tranſparent, or quite opaque ſtones; generally of a roundiſh form, and covered with white cruſt; of a ſmooth, uniform ſhining texture; ſo hard, that they will ſtrike fire with ſteel.

FLINTS are of the claſs of earths called vitrifiable, becauſe theſe earths are generally employed, together with fixed alkali, as materials in the making of glaſs. See GLASS.

Breaking of FLINTS. The art of cutting, or rather breaking, flint-ſtones into uniform figures, is by ſome ſuppoſed to be one of the arts now loſt. That it was known formerly, appears from the ancient Bridewell at Norwich, from the gate of the Auguſtin friars at Canterbury, and that of St. John's Abbey, Colcheſter. But that the art is not loſt, and that the French know it, appears from the platform on the top of the royal obſervatory at Paris; which, inſtead of being leaded, is paved with flint cut or broke into regular figures.

FLIP, a ſort of ſailors drink, made of malt liquor, ſpirits, and ſugar mixed.

FLOAT, denotes a certain quantity of pieces of timber joined together with rafters athwart, thrown into a river, to be conveyed down the ſtream; and even ſometimes to carry burthens down a river with the ſtream. The invention of floats is of great uſe; it is ſaid to have been firſt put in execution at Paris, in the year 1618.

FLOAT *Boards*, thoſe boards fixed to water wheels of underſhot mills, ſerving to receive the impulſe of the ſtream, whereby the wheel is carried round.

It is a diſadvantage to have too great a number of float-boards; becauſe when they are all ſtruck by the water, in the beſt manner it can be brought to act againſt them, the ſum of all theſe impulſes will only be equal to the impulſe made againſt one float-board at right angles, by all the water coming out of the pen-ſtock, through the opening, ſo as to take place on the float-board. The beſt rule in this caſe is, to have juſt ſo many, that each of them may come out of the water as ſoon as poſſible, after it has received and acted with its full impulſe; or, which comes to the ſame thing, when the ſucceeding one is in a perpendicular direction to the ſurface of the water. As to the length of theſe float-boards, it may be regulated according to the breadth of the ſtream. See Deſaguliers, vol. ii. p. 425.

FLOATING *Bridge*, a bridge conſiſting of ſeveral boats covered with planks; which ought to be ſo ſolidly framed as to bear both horſes and cannon.

FLOATING, in huſbandry, is the drowning or watering of meadows.

FLOOD, a deluge or inundation of waters. See DELUGE.

FLOOD is alſo uſed in ſpeaking of the tide. When the water is at loweſt, it is called flood; when riſing, young, or old flood; when at higheſt, high flood; when beginning to fall, ebb water.

FLOOD *Mark*, the mark which the ſea makes on the ſhore, at flowing water, and the higheſt tide: it is alſo called high water mark.

FLOOR, in building, the underſide of a room, or that part we walk on. Floors are of divers ſorts; ſome of earth, ſome of brick, others of ſtone, others of boards, &c. Carpenters, by the word floor, underſtand as well the frame work of timber, as the boarding over it.

FLOOR *of a Ship*, ſtrictly taken, is only ſo much of her bottom which ſhe reſts on, when a-ground. Such ſhips as have long, and withal broad floors, lie on the ground with moſt ſecurity, and are not apt to ſeel, or tilt on one ſide; whereas others, which are narrow in the floor, or, in the ſea phraſe, cranked by the ground, cannot be grounded without danger of being overturned.

FLORA, the goddeſs of flowers, was, according to the poets, the wife of Zephyrus, and was firſt honoured among the Sabines; but, according to Lactantius, ſhe was a lady of pleaſure, who having gained large ſums of money by proſtituting herſelf, made the Roman people her heir, on condition that certain games, called floralia, might be annually celebrated on her birth day. Her image in the temple of Caſtor and Pollux was dreſſed in a cloſe habit, and ſhe held in her hands the flowers of peaſe and beans: but the modern poets and painters have been more laviſh in ſetting off her charms, conſidering that no parts of nature offered ſuch innocent and exquiſite entertainment to the ſight and ſmell, as the beautiful variety which adorns, and the odour which embalms, the floral creation.

FLORALES *Ludi*, or FLORAL *Games*, in antiquity, were games held in honour of Flora, the goddeſt of flowers. Theſe were celebrated with ſhameful debaucheries. The moſt licentious diſcourſes were not enough, but the courteſans were called together by the ſound of a trumpet, and made their appearance naked, and entertained the people with indecent ſhews and poſtures: the comedians appeared after the ſame manner on the ſtage. Val. Maximus relates, that Cato being once preſent in the theatre on this occaſion, the people were aſhamed to aſk for ſuch immodeſt repreſentations in his preſence; till Cato, appriſed of the reſervedneſs and reſpect with which he inſpired them, withdrew, that the people might not be diſappointed of their accuſtomed diverſion.

FLORID *Style*, is that enriched and heightened with figures and flowers of rhetoric. Longinus uſes the terms florid and affected ſtyle indifferently, and lays them down as quite contrary to the true ſublime.

FLORIN, as a money of account, is uſed by the Italian, Dutch, and German merchants and bankers, in keeping their books, and making up their accounts. But this florin admits of different diviſions. Fabian obſerves, the florins were not of ſo fine gold as the nobles and half-nobles of Edw. III.

FLORIST, a perſon curious or ſkilled in flowers; their kinds, names, characters, culture, &c. It is alſo applied to an author who writes what is called the flora of any particular place, that is, a catalogue of the plants and trees which are found ſpontaneouſly growing there. The Flora Laponica of Linnæus, and Flora Virginia of Gronovius, are works of this kind; and theſe authors, as the authors of thoſe works, are properly called floriſtæ.

FLOTA, or FLOTTA, *Fleet*; a name the Spaniards give particularly to the ſhips which they ſend annually from Cadiz, to the port of Vera Cruz, to fetch thence the merchandizes gathered in Mexico for Spain. It conſiſts of the captains, admiral, and patach, or pinnace, which go on the king's account; and about ſixteen ſhips, from four hundred to a thouſand tons, belonging to particular perſons. They ſet out from Cadiz about the month of Auguſt, and are eighteen or twenty months before they return. Thoſe ſent to fetch the commodities prepared in Peru, are called galleons. The name flotilla is given to a number of ſhips, which get before the reſt in their return, and give information of the departure and cargo of the flota and galleons.

FLOTAGES, all ſuch things as are floating on the top of the ſea, or great rivers, a word chiefly uſed in the commiſſions of water bailiffs.

FLOUNDER, in ichthyology, the Engliſh name of a ſpecies of the genus Pleuronectes. For the various ſpecies ſee PLEURONECTES.

FLOUR, the meal of any grain, but more particularly of wheat, ground and ſifted for the purpoſe of food. The grain itſelf is not only ſubject to be eaten by inſects in that ſtate, but when ground into flour it gives birth to another race of deſtroyers, who eat it unmercifully and increaſe ſo faſt in it, that it is not long before they wholly deſtroy the ſubſtance. The fineſt flour is moſt liable to breed them, eſpecially when ſtale or ill prepared; in this caſe, if it be examined in a good light, it will be perceived to be in a continual motion; and on a nicer inſpection, there will be found in it a great number of little animals of the colour of the flour, and very nimble. If a little of this flour be laid on the plate of the double microſcope, the inſects are very diſtinctly ſeen in great numbers, very briſk and lively, continually crawling over one another's backs, and playing a thouſand antic tricks together; whether for diverſion, or ſearch of food, it is not eaſily to be determined. Theſe animals are of an oblong ſlender form, their heads are furniſhed with a kind of trunk, or oblong hollow tube, by means of which they take in their food, and their body is compoſed of ſeveral rings. They do vaſt miſchief among the magazines of flour laid up for armies and other public uſes; when they have once taken poſſeſſion of a parcel of this valuable commodity, it is impoſſible to drive them out, and they increaſe ſo faſt, that the only method of preventing the total loſs of the parcel, is to make it up into bread as ſoon as can be. The way to prevent their breeding in the flour is to preſerve it from damp; nothing gets more injury by being put up damp than flour, and yet nothing is ſo often put up ſo. It ſhould be always carefully and thoroughly dried before it is put up, and the barrels alſo dried into which it is to be put: then if they are kept in a room tolerably warm and dry, they will preſerve it well. Too dry a place never does any hurt, though one too moiſt always ſpoils it. See MEAL.

Flour, when carefully analyzed, is found to be compoſed of three very different ſubſtances. The firſt and moſt abundant is pure ſtarch, or white fecule, inſoluble in cold but ſoluble in hot water, and of the nature of mucous ſubſtances; which, when diſſolved, form water-glues. The ſecond is the gluten, moſt of whoſe properties have been deſcribed under the article BREAD. The third is of a mild nature, perfectly ſoluble in cold water, of the nature of ſaccharine extractive mucous matters. It is ſuſceptible of the ſpirituous fermentation, and is found but in ſmall quantity in the flour of wheat. See BREAD, GLUTEN, STARCH, and SUGAR.

FLOWER, FLOS, among botaniſts, the moſt beautiful part of trees and plants, containing the organs or parts of fructification. Though no parts of plants are more generally known than their flowers, yet the definitions given by different authors of this word are very various, and neceſſary to be explained, in order to the underſtanding of their works.

Jungius defines it to be the moſt tender part of a plant, remarkable for its colour or form, or for both, and cohering with the fruit. But this author himſelf acknowledges his definition to be too limited, as there are ſeveral plants whoſe flowers are produced remote from their fruit. Mr. Ray, ſays the flowers cohere for the moſt part with the rudiments of the fruit; which is likewiſe a phraſeology too inaccurate to be admitted in definitions. Tournefort defines the flower to be a part of a plant very often remarkable for its peculiar colours, for the moſt part adhering to the young fruit, to which it ſeems to afford the firſt nouriſhment, in order to explicate its moſt tender parts: but this is ſtill a more indeterminate definition than the former. Pontedera defines a flower to be a part of a plant, unlike the reſt in form and nature. If the flower has a tube, it adheres to or is fixed very near the embryo, to the uſe of which it is ſubſervient; but if the flower has no tube, then its baſe does not adhere to the embryo. This definition is ſcarce intelligible, except to expert botaniſts. Juſſieu defines a flower to be compoſed of chives and a piſtillum, and to be of uſe in the generation of the plant: but this definition is too imperfect, as there are many plants in which the piſtillum are found at a great diſtance from the chives, many flowers which have no piſtillum, and many which have their chives. Vaillant has been happier in his definition.

He ſays, that flowers are the organs which conſtitute the ſexes of plants, which are ſometimes found naked, and without any covering; and that the petals which moſt of them have, are not eſſential to their uſe, but ſerve, and are intended, merely as covers for them: but yet, as theſe coats or coverings are the moſt conſpicuous and moſt beautiful parts of the flowers, theſe are to be called flowers, be they of whatever form or ſtructure, or colour; and whether they contain the organs of both ſexes in each individual, or only of one, or even but of ſome part of one, provided they are not of the ſame figure and colour with the leaves of the plant. The ſhorteſt and moſt expreſs definition, however, ſeems to be that of Martin; which is, that flowers are the organs of generation of both ſexes, adhering to a common placenta, together with their common covering; or of either ſex ſeparately with its proper coverings if it have any.

The parts of flowers are, 1. The piſtillum or ovary, which is the rudiment of the fruit, and is therefore properly the organ of generation. 2. The ſtyle, which is a body accompanying the ovary; either ariſing from the middle of it, or ſtanding as an axis in the middle, with the embryos of the ſeeds round it. 3. The ſummits, called alſo apices, and antheræ, which are thoſe bodies that contain the prolific powder analogous to the male ſperm of animals, and generally hung upon ſlender threads, which are called the chives. 4. The petals, commonly called the flower-leaves, which are thoſe tender fine coloured leaves that are generally the moſt conſpicuous parts of a flower. 5. The empalement or calyx, which is formed of theſe tender leaves that cover the outer parts of the flower. Flowers, according to the number of their leaves or petals, are called monopetalous, or one-leaved; dipetalous, or two-leaved, &c.

The ſtructure of different flowers is very various; but Dr. Grew has obſerved, that the far greater number of them have the empalement, foliation, chives, &c. Mr. Ray accounts that every perfect flower has the petals, ſtamina or chives, apices or ſummits, and the ſtyle or piſtil; and ſuch as want any of theſe he calls imperfect flowers. The greater number of plants have a flower cup; which is of a firmer ſtructure than their leaves, and ſerves for their ſupport.

Flowers, deſigned for medicinal uſe, ſhould be plucked when they are moderately blown, and on a clear day before noon: for conſerves, roſes muſt be taken in the bud.

Eternal FLOWER. See XERANTHEMUM.
Everlaſting FLOWER. See GNAPHALIUM.
FLOWER-*Fence*. See POINCIANA.
Sun-FLOWER. See HELIANTHUS.
Wind-FLOWER. See ANEMONE.
FLOWER-*de-Luce*. See IRIS.

FLOWERS, in heraldry. They are much uſed in coats of arms; and in general ſignify hope, or denote human frailty and momentary proſperity. See ROSE, &c.

FLOWERS, in chymiſtry. By this name are generally underſtood bodies reduced into very fine parts, either ſpontaneouſly, or by ſome operation of art; but the term is chiefly applied to volatile ſolid ſubſtances, reduced into very fine parts, or into a kind of meal by ſublimation. Some flowers are nothing elſe than the bodies themſelves, which are ſublimed entire, without ſuffering any alteration or decompoſition; and other flowers are ſome of the conſtituent parts of the body ſubjected to ſublimation.

Preſerving of **FLOWERS.** The method of preſerving flowers in their natural beauty through the whole year has been much ſought after by many people.

The flowers of plants are by much the moſt difficult parts of them to preſerve in any tolerable degree of perfection; of which we have inſtances in all the collections of dried plants, or *horti ſicci*. In theſe the leaves, ſtalks, roots, and ſeeds of the plants appear very well preſerved; the ſtrong texture of theſe parts making them always retain their natural form, and the colours in many ſpecies naturally remaining. But where theſe fade, the plant is little the worſe for uſe as to the knowing the ſpecies by it. But it is very much otherwiſe in regard to flowers; theſe are naturally by much the moſt beautiful parts of the plants to which they belong; but are ſo much injured in the common way of drying, that they not only loſe, but change their colours one into another, by which means they give a handle to many errors; and they uſually alſo whither up, ſo as to loſe their form and natural ſhape. The primroſe and cowſlip kinds are very eminent inſtances of the change of colours in the flowers of dried ſpecimens: for thoſe of this claſs of plants eaſily dry in their natural ſhape; but they loſe their yellow, and, inſtead of it, acquire a fine green colour much ſuperior to that of the leaves in their moſt perfect ſtate. The flowers of all the violet kind loſe their beautiful blue, and become of a dead white; ſo that in dried ſpecimens there is no difference between the blue flowered violet, and the white flowered kinds. Sir Robert Southwell recommends the following method to preſerve both flowers and fruit throughout the whole year. Take ſalt-petre one pound; armenian bole, two pounds; clean common ſand, three pounds. Mix all well together: then gather fruit of any kind that is not fully ripe, with the ſtalk to each; put theſe in, one by one, into a wide-mouthed glaſs, laying them in good order. Tie over the top with an oilcloth, and carry them into a dry cellar, and ſet the whole upon a bed of the prepared matter of four inches thick in a box. Fill up the remainder of the box with the ſame preparation; and let it be four inches thick all over the top of the glaſs, and all round its ſides. Flowers are to be preſerved in the ſame ſort of glaſſes, and in the ſame manner; and they may be taken up after a whole year as plump and fair as when they were buried.

FLOWER *de lis*, or *Flour de luce*, in heraldry, a bearing repreſenting the lily, called the *queen of flowers*, and the true hieroglyphic of royal majeſty; but of late it is become more common, being borne in ſome coats one, in others three, in others five, and in ſome *ſemee* or ſpread all over the eſcutcheon in great numbers. The arms of France are, three flower de lis or, in a field azure.

FLOWERING *of Bulbous Plants*. Theſe plants will grow and flower in water alone, without any earth, and make a very elegant appearance.

We daily ſee this practiſed in ſingle roots; but there is a method of doing it with ſeveral roots in the ſame veſſel. Take a common ſmall garden pot; ſtop the hole at the bottom with a cork, and lute in the cork with putty, that no water can get through; then fit a board to the top of the pot, and bore ſix or ſeven holes in it at equal diſtances, to place the bulbs in; and as many ſmaller ones near them to receive ſticks, which will ſerve to tie up the flowers. Then fill up the pot with water to the board; and place tulips, jonquils, narciſſus's, and the like plants in the root upon the holes, ſo that the bottom of the roots may touch the water: thus will they all flower early in the ſeaſon, and be much more beautiful than any pot of gathered flowers, and will laſt many weeks in their full perfection. After the ſeaſon of flowering is over, the roots will gradually ſhrink through the holes of the board, and get looſe into the water: but, inſtead of being ſpoiled there, they will ſoon increaſe in ſize; ſo that they cannot return through the holes, and will produce ſeveral off-ſets. It is natural to try from this the conſequence of keeping the roots under water during the whole time of their blowing; and in this way they have been found to ſucceed very well, and flower even ſtronger and more beautifully than when in the ground. They may thus, alſo, with proper care in the degree of heat in the room, be kept flowering from before Chriſtmas till March or April. It is not eaſy, in this laſt manner, to manage the keeping the boards under water; for which reaſon, it is better to procure ſome ſheet lead of about four pounds to the foot, and cut this to the ſize of the mouth of the pot. In this there ſhould be bored holes for the bulbs, and other holes for the ſticks: and, in order to keep the ſticks quite firm, it is proper to have another plate of lead ſhaped to the bottom of the pot, with holes in it, anſwering to thoſe of the upper plate made for the ſticks. The ſticks will by this means be always kept perfectly ſteady; and the roots, being kept under water by the upper plate of lead, will flower in the moſt vigorous and beautiful manner imaginable. Some have thought of adding to the virtues of the water by putting in nitre in ſmall quantities, and others have added earth and ſand at the bottom; but it has always been found to ſucceed better without any addition.

It may be more agreeable to ſome to uſe glaſs jars in this laſt method with the leads, inſtead of earthern pots. The bulbs ſucceed full as well in theſe; and there is this advantage that the progreſs of the roots is ſeen all the while, and they are managed better as to the ſupply of water. By repeated experiments in this way on dried bulbs, and on thoſe taken freſh out of the ground, the former have been found to ſucceed the beſt. For thoſe taken freſh out of the ground being full of moiſture, will not ſo ſoon, upon changing their element, be nouriſhed fully by a new one; and the fibres which they had ſtruck in the ground, always rot when put into the water, and new ones muſt be formed in their places; ſo that it requires more time for them to come to flowering. The bulbs themſelves will not rot in this manner; but they will never be ſo ſtrong as thoſe which were put into the water dry, which gradually fill themſelves with moiſture from it, and regularly plump up. The beſt method of managing the whole proceſs is this: Place the bulbs at firſt only on the ſurface of the water; for thus they will ſtrike out their fibres moſt ſtrongly. When they have ſtood thus ſix weeks, pour in the water ſo high as to cover them entirely, and keep them thus till they have done flowering.

Sometimes the roots will become mouldy in ſeveral parts while they ſtand above the water, and the cleaning them of it is to no purpoſe; for it will eat and ſpread the farther, and frequently eat through two or three of their coats. In this caſe they muſt be immediately covered with water; when the mould will be ſtopped, and the roots become ſound, and flower as well as thoſe which never had any ſuch diſtemper. If the roots are ſuffered to remain in water all the year, they will not decay: but will flower againſt their proper ſeaſon, and that as vigorouſly as thoſe which have been taken out and dried. The old fibres of thoſe roots never rot till they are ready to puſh forth new ones. It is found by experience, that the hyacinth, and many other plants, grow to a greater degree of perfection when thus in water, than when in the ground. There is a peculiar ſpecies of hyacinth called *Keyſer's jewel*: this never, or very rarely, produces ſeed-veſſels in the common way of flowering, in the ground; but it will often produce ſome pods when blown in water.

Mr. Miller has intimated, in the Philoſophical Tranſactions, that bulbs ſet in glaſſes grow weaker, and ſhould be renewed every other year: but it is found, that, when managed in this manner, and kept under water, at the time of taking them up, they are as large; and ſome of them larger, than when planted; and if theſe be dried at a proper ſeaſon, they will flower, year after year, as well as freſh ones.

Ranunculus and anemone roots have been found to ſhoot up their ſtalks very well in this way; but the flowers are uſually blaſted, which ſeems to ariſe from want of free air. Pinks will flower very well in this manner; auriculus alſo may, with care, be brought to flower, but not ſtrongly. Roſes, jeſſamines, and honeyſuckles, may alſo be made to flower this way, and will thrive and ſend out ſuckers; the beſt pieces to plant, are ſuckers cut off about three inches under ground, without any fibres. The ſucculent plants may alſo be raiſed this way; for inſtance, the opuntia or Indian fig. If a fragment of a leaf of this plant be cut and laid by to dry for a month till it is an abſolute ſkin, as ſoon as it is put in this manner into water, it begins to plump up, and ſoon ſends out fibrous roots, and produces new leaves as quickly as it would do in the ground.

This is the more ſingular in theſe ſorts of plants, becauſe in their natural ſtate in the ground, they cannot bear much water. This method of growing in water is not peculiar to the bulbous rooted ones, but others may even be raiſed from ſeed by it. A bean, or pea, ſet in this manner, will grow up to its proper ſtandard, and will flower and produce pods which will ripen their ſeed. The ſmaller ſeeds may be alſo raiſed in this manner, by the help of wool ſupport them.

No vegetable tranſplanted out of the earth into water will thrive kindly: but any plant, whether raiſed from the root or ſeed in water, may be tranſplanted to the earth, and will ſucceed very well. It may be poſſible, therefore, from this method of raiſing plants in water, to come at a better way than is uſually practiſed of raiſing ſome roots in the earth which are ſubject to rot there; ſuch as anemonies, ranunculuſes, and hyacinths. A bulb dropped by chance upon the ground, will ſtrike out both ſtronger and more numerous fibres than thoſe which are planted in the uſual way in the ground. On this principle, it may be proper to take out the earth of the bed where the bulbs are to ſtand at the time of planting them, to ſuch a depth as they are to be placed under it when ſet for flowering. The bulbs are then to be ſet in their places, on the ſurface of this low ground; and to ſtand there till they have ſhot out their fibres and their head: then the earth is to be added over them by degrees, till they are covered as high above the head as they are in the uſual manner of planting them: thus they would be preſerved from the danger of rotting; and their fibres would be much ſtronger, and conſequently they would draw more nouriſhment, and flower better, than in the common way. The common method of planting theſe roots renders them liable to be deſtroyed by either extreme of a wet or a dry ſeaſon. In the firſt caſe, they immediately rot, by the abundant moiſture they receive; and, in the ſecond, they become dry as a ſtick, and mouldy; ſo that they are infallibyl rotted by the firſt rain that falls afterwards.

The directions neceſſary to the ſucceſs of the bulbs planted in water are theſe. When the leaden falſe bottoms are fixed down tight within two or three inches of the bottom of the veſſel (which is only deſigned to hold the ſticks ſteady which are to ſupport the leaves and ſtalks), then lay on the lead upon which the bulbs are to reſt, placing the notched part oppoſite to that in the falſe bottom, as near as the ſticks, when placed, will ſuffer it; then place the bulbs one in each hole, and fill up with water to the upper lead. The bottom of the bulb will then touch the water; and as the water diminiſhes in quantity, keep it ſupplied with more up to the ſame height for a month or ſix weeks; in which time the bulbs will have ſhot ſtrong fibres. Then fill up the water about half an inch above the ſurface of the lead; and, by degrees, as the fibres ſtrengthen, and the plume ſhoots from the head, keep the water higher and higher, till at length the whole bulb is covered. The water is to be kept at this ſtandard till the ſeaſon for drying them returns. At the time of planting the bulbs, they muſt be carefully cleaned from any foulneſſes at the bottom, by ſcraping them with the point of a knife till the ſound part of the bulb appears; clear them likewiſe from any looſe ſkins, and even take off their brown ſkin till they appear white; otherwiſe this brown ſkin will tinge the water, and the growth will not ſucceed ſo well.

The notches in the ſide of each lead are intended to give eaſy paſſage to the water, that, if there ſhould be any foulneſs or ſediment in it, on ſhaking it a little it may all run through, and freſh water be put in its place. But this ſhifting the water need not be done more than once or twice in a winter, as there may be occaſion from the foulneſs; and when this is done, the ſides of the veſſel ſhould be cleaned with a painter's bruſh, and rinced out again, and the bulbs themſelves waſhed, by pouring water on them at a little diſtance.

At any time when the outer ſkins of the bulbs dry, they are to be pealed off, that they may not occaſion foulneſs in the water; and if any duſt or foul matter be at any time obſerved ſwimming on the ſurface, the method is to fill up the pot or veſſel to the rim, and let it run over: this will carry off that light foulneſs, and the water may afterwards be poured away to the proper ſtandard. Bulbs of equal bigneſs ſhould be planted together in the ſame pot, that they may all have the ſame benefit of the water. Narciſſuſes and hyacinths do well together; as alſo tulips and jonquils, and crocuſes and ſnow-drops.

FLOWERS, in gardening, are diſtinguiſhed into early, or ſpring flowers, which flouriſh in the months of March, April, and May. Of this claſs are the annemonies, daffodils, hyacinths, tulips, jonquils, cowſlips, primroſes, &c. Summer-flowers, which open in June, July, and Auguſt, as pinks, gilly-flowers, lilies, daiſies, campanulas, poppies, ſunflowers, &c. Autumnal, or late flowers, denote thoſe of September, and October; as the occulus chriſti, Indian pinks and roſes, pancy, flower-gentle, &c. Of theſe flowers, thoſe which ſubſiſt all the year, we mean in the ſtem, or root at leaſt, are called perennials. And thoſe which are to be planted or ſowed a-freſh every year, according to the ſeaſon, are called annuals.

FLOWERS, in the animal œconomy, denote women's monthly purgations, or menſes. Nicod derives the word in this ſenſe from *fluere*, q. d. *fluors*. Others will have the name occaſioned hence, that women do not conceive till they have had their flowers: ſo that theſe are a ſort of forerunners of their fruit.

FLOWERS, in rhetoric, are figures or ornaments of diſcourſe by the Latins called *floſculi*.

FLUID, an appellation given to all bodies whoſe particles eaſily yield to the leaſt partial preſſure, or force impreſſed. For the laws and properties of fluids, ſee HYDROSTATICS. There are various kinds of animalcules to be diſcerned in different fluids by the microſcope. Of many remarkable kinds of theſe, a deſcription is given under the article ANIMALCULE. All of theſe little creatures are eaſily deſtroyed by ſeparating them from their natural element.

Naturaliſts have even fallen upon ſhorter methods. A needle point, dipped in ſpirit of vitriol, and then immerſed into a drop of pepper water, readily kills all the animalcules; which, though before friſking about with great livelineſs and activity, no ſooner come within the influence of the acid particles, than they ſpread themſelves, and tumble down to all appearance dead. The like may be done by a ſolution of ſalt; only with this difference, that, by the latter application, they ſeem to grow vertiginous turning round and round, till they fall down. Tincture of ſalt of tartar, uſed in the ſame manner, kills them ſtill more readily; yet not ſo, but there will be apparent marks of their being firſt ſick and convulſed.

Inks deſtroy them as faſt as ſpirit of vitriol, and human blood produces the ſame effect. Urine, ſack, and ſugar, all deſtroy them, though not ſo faſt; beſides, that there is ſome diverſity in their figures and appearances, as they receive their deaths from this poiſon or that. The point of a pin dipped in ſpittle, preſently killed all the kinds of animalcules in puddle-water, as Mr. Harris ſuppoſes it will other animalcules of this kind.

All who are acquainted with microſcopic obſervations, know very well, that in water, in which the beſt glaſſes can diſcover no particle of animated matter, after a few grains of pepper or a fragment of a plant of almoſt any kind, has been ſome time in it, animals full of life and motion are produced; and thoſe in ſuch numbers, as to equal the fluid itſelf in quantity. When we ſee a numerous brood of young fiſhes in a pond, we make no doubt of their having owed their origin to the ſpawn, that is, to the eggs of the parents of the ſame ſpecies. What are we then to think of theſe? If we conſider the progreſs of nature in the inſect-tribes in general, and eſpecially in ſuch of them as are moſt analogous to theſe, we ſhall find it leſs difficult to give an account of their origin than might have been imagined.

A ſmall quantity of water taken from any ditch in the ſummer-months, is found to be full of little worms, ſeeming in nothing ſo much as in ſize to differ from the microſcopic animalcules. Nay, water, without theſe, expoſed in open veſſels to the heat of the weather, will be always found to abound with multitudes of them, viſible to the naked eye, and full of life and motion. Theſe we know, by their future changes, are the fly worms, of the different ſpecies of gnats, and multitudes of other fly ſpecies; and we can eaſily determine, that they have owed their origin only to the eggs of the parent fly there depoſited. Nay, a cloſer obſervation will at any time give ocular proof of this, as the flies may be ſeen laying their eggs there, and the eggs may be followed through all their changes, to the fly again. Why then are we to doubt but that the air abounds with other flies and animalcules as minute as the worms in thoſe fluids; and that theſe laſt are only the fly worms of the former, which, after a proper time ſpent in that ſtate, will ſuffer changes like thoſe of the larger kinds, and become flies like thoſe to whoſe eggs they owed their origin? Vid. Reaumur. Hiſt. Inſect. vol. iv. p. 431.

The differently medicated liquors made by infuſions of different plants, afford a proper matter for the worms of different ſpecies of theſe ſmall flies: and there is no reaſon to doubt, but that among theſe ſome are viviparous, others oviparous; and to this may be, in a great meaſure, owing the different time taken up for the production of theſe inſects in different fluids. Thoſe which are a proper matter for the worms of the viviparous fly, may be ſooneſt found full of them; as, probably, the liquor is no ſooner in a ſtate to afford them proper nouriſhment, than their parents place them there: whereas thoſe produced from the eggs of the little oviparous flies, muſt, after the liquor is in a proper ſtate, and they are depoſited in it in the form of eggs, have a proper time to be hatched, before they can appear alive. It is eaſy to prove, that the animals we find in theſe vegetable infuſions were brought thither from elſewhere. It is not leſs eaſy to prove, that they could not be in the matter infuſed any more than in the water in which it is infuſed. Notwithſtanding the fabulous accounts of ſalamanders, it is now well known, that no animal, large or ſmall, can bear the force of fire for any conſiderable time; and, by parity of reaſon, we are not to believe, that any inſect, or embryo inſect, in any ſtate, can bear the heat of boiling water for many minutes. To proceed to inquiries on this foundation; if ſeveral tubes filled with water, with a ſmall quantity of vegetable matter, ſuch as pepper, oak-bark, truffles, &c. in which, after a time, inſects will be diſcovered by the microſcope; and other like tubes be filled with ſimple water boiled, with water and pepper boiled together, and with water with the two other ingredients, all ſeparately boiled in it; when all theſe liquors come to proper time for the obſervation of the microſcope, all, as well thoſe which have been boiled, as thoſe which have not, will be found equally to abound with inſects; and thoſe of the ſame kind, in infuſions of the ſame kind, whether boiled or not boiled. Thoſe in the infuſions which had ſuſtained a heat capable of deſtroying animal-life, muſt therefore not have ſubſiſted either in the water, or in the matters put into it, but muſt have been brought thither after the boiling; and it ſeems by no way ſo probably, as by means of ſome little winged inhabitants of the air depoſiting their eggs or worms in theſe fluids.

On this it is natural to aſk, how it comes to paſs, that while we ſee myriads of the progeny of theſe winged inſects in water, we never ſee themſelves? The anſwer is equally eaſy, viz. becauſe we can always place a drop of this water immediately before the focus of the microſcope, and keep it there while we are at leiſure to examine its contents; but that is not the caſe with regard to the air inhabited by the parent-flies of theſe worms, which is an immenſe extent in proportion to the water proper for nouriſhing theſe worms; and conſequently, while the latter are cluſtered together in heaps, the former may be diſperſed and ſcattered. Nor do we want inſtances of this, even in inſects of a larger kind. In many of our gardens, we conſequently find veſſels of water filled with worms of the gnat kind, as plentifully, in proportion to their ſize, as thoſe of other fluids are with animalcules. Every cubic inch of water in theſe veſſels contains many hundreds of animals; yet we ſee many cubic inches of air in the garden not affording one of the parent flies.

But neither are we poſitively to declare that the parent flies of theſe animalcules are in all ſtates wholly inviſible to us; if not ſingly to be ſeen, there are ſome ſtrong reaſons to imagine that they may in great cluſters. Every one has ſeen in a clear day, when looking ſtedfaſtly at the ſky, that the air is in many places diſturbed by motions and convolutions in certain ſpots. Theſe cannot be the effects of imagination, or of faults in our eyes, becauſe they appear the ſame to all; and if we conſider what would be the caſe to an eye formed in ſuch a manner as to ſee nothing ſmaller than an ox, on viewing the air on a marſh fully peopled with gnats, we muſt be ſenſible, that the clouds of theſe inſects, though to us diſtinctly enough viſible, would appear to ſuch an eye merely as the moving parcels of air in the former inſtance do to us; and ſurely it is thence no raſh concluſion to infer, that the caſe may be the ſame, and that myriads of flying inſects, too ſmall to be ſingly the objects of our view, yet are to us what the clouds of gnats would be in the former caſe.

Nervous FLUID. See NERVOUS *Fluid.*

Elaſtic FLUIDS. See AIR, GAS, VAPOUR, &c.

FLUIDITY, is by Sir Iſaac Newton defined to be, that property of bodies by which they yield to any force impreſſed, and which have their parts very eaſily moved among one another. To this definition ſome have added, that the parts of a fluid are in a continual motion. This opinion is ſupported by the ſolution of ſalts, and the formation of tinctures. If a ſmall bit of ſaffron is thrown into a vial full of water, a yellow tincture will ſoon be communicated to the water to a conſiderable height, though the vial is allowed to remain at reſt; which indicates a motion in thoſe parts of the fluid which touch the ſaffron, by which its colouring matter is carried up.

With regard to water, this can ſcarce be denied; the conſtant exhalations from its ſurface ſhew, that there muſt be a perpetual motion in its parts from the aſcent of the ſteam through it. In mercury, where inſenſible evaporation does not take place, it might be doubted; and accordingly the Newtonian philoſophers in general have been of opinion, that there are ſome ſubſtances eſſentially fluid, from the ſpherical figure of their conſtituent particles. The congelation of mercury, however, by an extreme degree of cold, demonſtrates that fluidity is not eſſentially inherent in mercury more than in other bodies. That fluids have vacuities in their ſubſtance is evident, becauſe they may be made to diſſolve certain bodies without ſenſibly increaſing their bulk. For example, water will diſſolve a certain quantity of ſalt; after which it will receive a little ſugar, and after that a little alum, without increaſing its firſt dimenſions. Here we can ſcarce ſuppoſe any thing elſe than that the ſaline particles were interpoſed between thoſe of the fluid; and as, by the mixture of ſalt and water, a conſiderable degree of cold is produced, we may thence eaſily ſee why the fluid receives theſe ſubſtances without any increaſe of bulk. All ſubſtances are expanded by heat, and reduced into leſs dimenſions by cold: therefore, if any ſubſtance is added to a fluid, which tends to make it cold, the expanſion by the bulk of the ſubſtance added, will not be ſo much perceived as if this effect had not happened; and if the quantity added be ſmall, the fluid will contract as much, perhaps more, from the cold produced by the mixture, than it will be expanded from the bulk of the ſalt. This alſo may let us know with what theſe interſtices between the particles of the fluid were filled up; namely, the element of fire, or heat. The ſaline particles, upon their ſolution in the fluid, have occupied theſe ſpaces; and now the liquor, being deprived of a quantity of this element equal in bulk to the ſalt added, feels ſenſibly colder. As, therefore, there is ſcarce any body to be found, but what may become ſolid by a ſufficient degree of cold; and none but what a certain degree of heat will render fluid; the opinion naturally ariſes, that fire is the cauſe of fluidity in all bodies, and that this element is the only eſſentially fluid ſubſtance in nature. Hence we may conclude, that thoſe ſubſtances which we call fluids are not eſſentially ſo, but only aſſume that appearance in conſequence of an intimate union with the element of fire; juſt as gums aſſume a fluid appearance on being diſſolved in ſpirit of wine, or ſalts in water.

Upon theſe principles Dr. Black mentions fluidity as an effect of heat. The different degrees of heat which are required to bring different bodies into a ſtate of fluidity, he ſuppoſes to depend on ſome particulars in the mixture and compoſition of the bodies themſelves; which becomes extremely probable, from conſidering that we change the natural ſtate of bodies in this reſpect, by certain mixtures; thus, if two metals are compounded, the mixture is uſually more fuſible than either of them ſeparately.

It is certain, however, that water becomes warmer by being converted into ice; which may ſeem contradictory to this opinion. To this, however, the Doctor replies, that fluidity does not conſiſt in the degree of ſenſible heat contained in bodies, which will affect the hand or a thermometor; but in a certain quantity which remain in a latent ſtate. This opinion he ſupports from the great length of time required to melt ice; and to aſcertain the degree of heat requiſite to keep water in a fluid ſtate, he put 5 ounces of water into a Florence flaſk, and converted it into ice by means of a freezing mixture put round the flaſk. Into another flaſk of the ſame kind he put an equal quantity of water cooled down nearly to the freezing point, by mixing it with ſnow, and then pouring it off. In this he placed a very delicate thermometer; and found, that it acquired heat from the air of the room in which it was placed: ſeven degrees of heat were gained the firſt half-hour. The ice being expoſed to the ſame degree of heat, namely, the air of a large room without fire, it cannot be doubted that it received heat from the air as faſt as the water which was not frozen: but, to prevent all poſſibility of deception, he put his hand under the flaſk containing the ice, and found a ſtream of cold air very ſenſibly deſcending from it, even at a conſiderable diſtance from the flaſk; which undeniably proved, that the ice was all that time abſorbing heat from the air. Nevertheleſs, it was not till 11 hours, that the ice was half-melted, though in that time it had abſorbed ſo much heat as ought to have raiſed the thermometer to 140°; and even after it was melted, the temperature of the water was found ſcarce above the freezing point: ſo that, as the heat which entered could not be found in the melted ice, he concluded that it remained concealed in the water, as an eſſential ingredient of its compoſition.

FLUMMERY, a wholeſome ſort of jelly made of oat-meal. The manner of preparing it is as follows. Put three large handfuls of finely ground oat-meal to ſteep, for 24 hours, in two quarts of fair water: then pour off the clear water, and put two quarts of freſh water to it: ſtrain it through a fine hair-ſieve, putting in two ſpoonfuls of orange-flower water, and a ſpoonful of ſugar: boil it till it is as thick as haſty-pudding, ſtirring it continually while it is boiling, that it may be very ſmooth.

FLUENT, or flowing quantity, in the doctrine of fluxions, that quantity (whether line, ſurface, ſolid, &c.) which is continually increaſing, or decreaſing. Thoſe fluents, which are generated in the ſame time, or in equal times, or which begin together and end together, are called contemporary fluents, and their fluxions are called contemporary fluxions; and if two or more of theſe contemporary fluents are always equal, or in any invariable ratio to each other, their contemporary fluxions will likewiſe be equal, or in the ſame proportion, and vice verſa. See Syſtem of FLUXIONS.

FLUOR, in phyſics, a fluid; or, more properly, the ſtate of a body that was before hard or ſolid, but is now reduced by fuſion, or fire, into a ſtate of fluidity.

FLUOR, in mineralogy, a certain kind of ſtone which facilitates fuſion. They are of different colours, purple, green, yellow, &c. more or leſs tranſparent, which are commonly found in veins of ores, and ſerve as the matrix to the minerals which they envelope. Moſt of them affect a cubical form, but others are found in lumps which have no determinate ſhape.

FLUOR *Albus*, or *Uterinus*, a kind of flux, incident to women, called the whites. It conſiſts in an irregular, diſorderly diſcharge of ſome corrupt humour from the uterus, near the os internum and the vagina, ſometimes white and pale, like whey; ſometimes yellow, green, or blackiſh. At firſt, it is uſually mild, and harmleſs; but in time, it grows hot, ſharp and corroſive, and excoriates all the parts it touches. It is attended with a pain in the ſpina dorſi, a ſwelling of the feet and eyes, wearineſs, lumbago, a loſs of appetite, loathings, and unaccountable longings, change of complexion, &c. It generally proceeds from a relaxed habit, ariſing from indolence, extreme grief, or the immoderate uſe of coffee, tea, or other weak and watery diet; and ſometimes from exceſſive menſtrual diſcharges, abortions, &c.

FLUTE, an inſtrument of muſic, the ſimpleſt of all thoſe of the wind-kind. It is played on by blowing it with the mouth; and the tones or notes are changed by ſtopping and opening the holes diſpoſed for that purpoſe along its ſide. German Flute is an inſtrument entirely different from the common flute. Its ſound is exceeding ſweet and agreeable; and ſerves as treble in a concert.

FLUX, FLUXUS, in medicine, an extraordinary iſſue, or evacuation of ſome humour. Fluxes are various, and variouſly denominated, according to their ſeats, or the humours thus voided; as a flux of the belly, uterine flux, hepatic flux, ſaliva flux, &c. The flux of the belly is of four kinds which have each their reſpective denominations, viz. the *lientery*, or *fluxus lientericus*; the *coeliac*, or *fluxus chyloſus*; the *diarrhoea*; and the *dyſentery*, or *bloody flux*. A wound, or ſcarification acroſs the crown of the head, is uſed in Scotland, to cure fluxes and dyſenteries. Philoſoph. Tranſact. N° 312. See Syſtem of MEDICINE.

FLUX, in metallurgy, is ſometimes uſed ſynonimouſly with fuſion. For inſtance, an ore, or other matter, is ſaid to be in liquid flux, when it is completely fuſed. But the word flux is generally uſed to ſignify certain ſaline matters, which facilitates the fuſion of ores, and other matters which are difficultly fuſible in eſſays and reductions of ores. Fixed alkalis, nitre, borax, tartar, and common ſalt, are the ſaline matters of which fluxes are generally compoſed. But the word flux is more particularly applied to mixtures of different proportions of only nitre and tartar; and theſe fluxes are called by particular names, according to the proportions of theſe ingredients as white flux, crude flux, and black flux.

FLUXION, in medicine, a ſudden collection of morbid matter. The velocity by which a flowing quantity is increaſed by its generating motion. In arithmetic, the method of finding an infinitely ſmall quantity, which, being taken an infinite number of times, becomes equal to a given quantity. See Syſtem of FLUXIONS.

SYSTEM OF FLUXIONS.

INTRODUCTION.

THE method of Fluxions, by ſome termed the *differential calculus*, and by others the *modern Geometry*, is one of the greateſt, moſt ſubtle, and ſublime diſcoveries of this, or perhaps of any age: it opens a new world to us, and extends our views, as it were, to infinity; it carries our conceptions beyond the bounds that ſeemed to have been preſcribed to the human mind, at leaſt infinitely beyond thoſe to which the ancient geometry was confined. Sir I. Newton and M. Leibnitz, both claimed the invention thereof; and nothing can be more glorious for the method itſelf, than the zeal wherewith the partiſans of either ſide have aſſerted their title. The firſt time the method made its appearance in public, was in 1684, when M. Leibnitz gave the rules thereof in the Leipſic Acts of that year; but the demonſtrations he kept to himſelf. The two brothers, the Bernouillis, were preſently ſtruck with it, and found out the demonſtrations, though very difficult; and practiſed the calculus with ſurpriſing ſucceſs. However, M. Leibnitz began to propoſe his differential method in a letter, dated 21 Jan. 1677, in which he exactly purſues Dr. Barrow's method of tangents, publiſhed in 1670; and Sir I. Newton communicated his method of drawing tangents to Mr. Collins, in a letter dated 10 Dec. 1672; which letter, together with another dated 13 June 1676, were ſent to M. Leibnitz by Mr. Oldenburgh, in 1676. So that there is a ſtrong preſumption that he might avail himſelf of the information contained in theſe letters, and other papers tranſmitted with them, and alſo in 1675, before the publication of his own letter, containing the firſt hint of his differential method. And it ſufficiently appears, that ſir I. Newton had invented his method before the year 1669, and that he actually made uſe of it in his Compendium of Analyſis and Quadrature of Curves before that time. His attention ſeems to have been directed this way, even before the plague which happened in London in 1665 and 1666, when he was about 23 years of age: and therefore there is no foundation for the hint ſuggeſted by the authors of the French Encyclopedic Art. *Differentielle*, that ſir Iſaac borrowed the differential method from Dr. Barrow.

In the year 1711, M. Leibnitz complained to the Royal Society, that Dr. Keill had accuſed him of publiſhing the method of Fluxions invented by ſir I. Newton, under other names and characters. He inſiſted, that nobody knew better than ſir Iſaac himſelf, that he had ſtolen nothing from him; and required that Dr. Keill ſhould publicly diſavow the ill conſtruction which might be put on his words. The ſociety therefore appointed a committee to examine all the old letters, papers, &c. that had paſſed among the ſeveral mathematicians, relating to the point; and after a ſtrict examen of all the evidences that could be procured, gave in their report, "That M. Leibnitz was in London in 1673, and kept a correſpondence with Mr. Collins by means of Mr. Oldenburgh, till Sept. 1676, when he returned from Paris to Hanover, by way of London and Amſterdam: that it did not appear that M. Leibnitz knew any thing of the differential calculus before his letter of the 21ſt June, 1677, which was a year after a copy of a letter, wrote by ſir I. Newton, in the year 1672, had been ſent to Paris to be communicated to him, and above four years after Mr. Collins began to communicate that letter to his correſpondents; wherein the method of fluxions was ſufficiently explained, to let a man of his ſagacity into the whole matter: and that ſir I. Newton had even invented his method before the year 1669, and, of conſequence, fifteen years before M. Leibnitz had given any thing on the ſubject in the Leipſic Acts." And thence they concluded, that Dr. Keill had not at all injured M. Leibnitz in what he had ſaid. The ſociety printed this cenſure of theirs, together with all the pieces and materials relating thereto, under the title of Commercium Epiſtolicum de Analyſi Promota, Lond. 1712. This book was carefully diſtributed through Europe, to vindicate the title of the Engliſh nation to the diſcovery.

SECT. I.

NATURE OF FLUXIONS.

In the Doctrine of Fluxions, Quantities and Magnitudes are conſidered, not as compoſed of an infinite number of conſtituent parts, but as deſcribed by continued local motion. Thus a line is conceived as deſcribed by the motion of a point; a rectangle, as produced by the motion of a line, and in ſhort all Quantities of what kind ſoever may (by analogy) be conceived to be generated after the like manner. Hence the following

DEFINITIONS.

1ſt. Quantities that are conſidered as generated by continual increaſe, are named *fluents* or *flowing*, *variable* or *indeterminate* quantities; while thoſe quantities that are aſſumed as already perfect, and retaining the ſame value, are named *conſtant*, *ſtanding*, or *invariable* quantities. Thus in a circle, the diameter is a *conſtant* quantity; but the ſine, verſed ſine, coſine, &c. are variable quantities; ſo alſo in a Parabola the Latus Rectum is a conſtant quantity; but the Abſciſſa and Correſpondent Ordinate are variable quantities.

2d. The *velocity*, *celerity*, or *rate of increaſe*, of any generating quantity, (or the degree of quickneſs, or ſlowneſs, wherewith the new parts thereof do continually ariſe) is named its Fluxion. Thus when a line is deſcribed by the motion of a point, the generated line itſelf is the *fluent*, and the *velocity* or *celerity* of the moving point is its Fluxion; but though this holds with reſpect to the generating of a line (becauſe in this caſe the rate of increaſe is as the velocity of the moving point) yet the idea of a fluxion ought to be carefully diſtinguiſhed from that of the mere abſtracted velocity of a moving body; for in many caſes the *celerity* or *rate of increaſe* of a flowing quantity (which is the ſtrict idea of a fluxion) is far from being proportional to the ſimple velocity of the generating point or line, &c. Thus, if a triangle be ſuppoſed to be generated by the parallel motion of a line, from an angular point, formed by two other lines, the ſpaces or areas deſcribed with the ſame velocity in equal times, will not be equal, but will be augmented at each, in proportion as the triangle increaſes in altitude; and therefore the fluxions in different parts thereof, though generated with the ſame velocity of motion, will not be equal to each other, but will be every where as the reſpective altitudes. Further, more variable quantities are not always conſidered as growing or increaſing, after this manner; but ſometimes as perpetually diminiſhing, till they vaniſh, and then the *celerities*, or *rates of decreaſe*, are the fluxions, and the *quantities* thus *diminiſhing* are the *fluents*.

3d. The indefinitely ſmall portions of the fluent, which are generated in any indefinitely ſmall particles of time, are called *moments* or *increments*; or, if the fluent decreaſes, the portions continually deſtroyed are named *decrements*.

4th. The celerity, variation, or quickneſs of increaſe or decreaſe of any fluxion, is called the ſecond fluxion; and the like variation, &c. of a ſecond fluxion is named the third fluxion, &c.

5th. Contemporary fluents are thoſe which are ſuppoſed to be generated together, or in equal times.

6th. In any fluxionary equation, a quantity of the firſt order is that which has only one firſt fluxion in it; a quantity of the ſecond order has either one ſecond fluxion, or two firſt fluxions; a quantity of the third order contains either a third fluxion, the product of three firſt fluxions, or the product of a firſt and ſecond fluxion, &c.

THE ALGORITHM OF FLUXIONS.

It muſt be obſerved, that in this art, it is not ſtrictly the fluxions themſelves that are brought into operation, but the *relation* of the fluxions among one another; for we do not determine what are the poſitive celerities of increaſe or decreaſe of variable quantities, but what is their ratio or proportion to each other; it being all that is requiſite to come at the ſolution of our enquiries. But in fluxional operations, for the ſake of brevity, we frequently ſpeak of the relations of fluxions and fluents, as though the algebraic expreſſions, exhibiting ſuch relations, were abſolutely the proper fluxional and fluential quantities themſelves. Hence we frequently ſay that ſuch and ſuch expreſſions are the fluxions of ſuch and ſuch variable quantities, when we only mean that thoſe expreſſions exhibit the true proportion or relation of the fluxions compared with one another. Therefore, when ever we ſpeak of a *fluxion* or a *fluent*, in any operation, the ſame muſt be underſtood in the like relative ſenſe. Hence if any terms are put to denote the relation of the fluxions of certain flowing quantities, ſuch fluxional relation will be alſo truly repreſented by any other terms which have the ſame proportion to each other.

To determine the relation of fluxional quantities, the immortal inventor of this art advances the following Axiom.

AXIOM I.

"Fluxions are very nearly as the augments of their fluents, generated in equal, but very ſmall, particles of time; and to ſpeak correctly, they are in the firſt ratio of their naſcent augments, or the laſt ratio of the evaneſcent parts; but they may be expounded by any lines that are proportional to them."

Hence they are proportional to the generating increment at the very inſtant: not the increment to be generated in the ſucceeding interval, however ſmall; neither the increment already generated in the preceding interval, but that which comes into exiſtance at that moment of duration when the fluent is complete. Nevertheleſs, in caſes where the fluxion or celerity of increaſe is uniform, the fluxions may be expounded by the contemporary increments taken either before or after, becauſe the celerity by which the fluent increaſes is every where alike. Thus, if a line be deſcribed by the uniform motion of a point, the fluxion in every part thereof is the ſame; and the like holds with reſpect to the generating of a parallelogram by the uniform motion of a line, &c. Hence alſo this other General Axiom.

AXIOM II.

The increments by which any contemporary flowing quantities *would be* uniformly increaſed in a given portion of time, with the generating celerity at any propoſed poſition or inſtant (were they from thence to continue invariable or uniform) would be to each other in the ſame proportion as are the fluxions of thoſe quantities at that poſition or inſtant; conſequently by means of thoſe increments the relation of the fluxions are had.

The following Axiom alſo will be found uſeful in many uſes.

AXIOM III.

Quantities, which in any finite time converge to an equality, and before the end of that time approach nearer to each other than by any aſſignable difference, do at the laſt become perfectly equal. Should any deny this, and ſay they may not be equal; then let D be the ultimate difference, and ſo it will follow that they cannot approach nearer to equality than by this aſſigned difference D; but according to the conditions of the Axiom, they may before the end of the time approach nearer to equality than by any aſſignable difference, and conſequently nearer than by D. Hence, to deny the Axiom is abſurd, even though D be ſuppoſed ever ſo ſmall, for ſtill it will always involve a contradiction, except when D is poſitively nothing; and when D, the ſuppoſed difference, is nothing, the quantities muſt be perfectly equal.

Hence, in caſes where the fluxions are not uniform, their true ratio may be found by means of the increments generated in the equal preceding and ſucceeding ſmall particles of time; for they converge to an equality, the one after a direct motion, and the other by a retrograde motion; ſo that before they come to the point in queſtion, the generating increment and decrement become nearer to an equality than by any given difference; and conſequently by the above Axiom, they do at the laſt, or in the point where they coincide, become perfectly equal.

In the method of fluxions, the firſt letters of the alphabet, *a*, *b*, *c*, &c. are generally put to denote invariable or ſtanding quantities; and the laſt letters, *x*, *y*, *z*, &c. to repreſent the relation of fluents or variable or flowing quantities. Alſo, when *x* and *y*, &c. are made the repreſentatives of variable quantities, then thoſe letters with points over them ($\dot{x}$ and $\dot{y}$) denote the fluxions of *x* and *y*; or more properly *x* and *y* are put to expreſs the relation of the fluents, and $\dot{x}$ and $\dot{y}$ the relation of the fluxions: likewiſe the ſame letters twice pointed ($\ddot{x}$ and $\ddot{y}$) denote the relation of the ſecond fluxions of *x* and *y*; and $\dddot{x}$ and $\dddot{y}$ are, in like manner, put for the third fluxions of *x* and *y*, &c.

Furthermore x' denotes the moment, increment, or decrement, of *x*; and y', the moment, increment, &c. of *y*. Alſo x'' and y'' are the moments of the moments, or ſecond moments of *x* and *y*. Invariable quantities have no fluxion, or their fluxion is 0.

SECT. II.

DIRECT METHOD OF FLUXIONS.

By means of the foregoing Axioms, writers on Fluxions have demonſtrated the following Rules for performing fluxional operations.

Prob. I. *To find the Fluxion of any Power of a flowing Quantity.*

Rule. Multiply the fluxion of the root by the exponent of the power, and the product by a power of the ſame root, leſs by unity than the given exponent. Thus, the fluxion of x^3 is $3x^2\dot{x}$, of x^n $nx{-}^{n1}\dot{x}$; for the root of x^n is x, whoſe fluxion is $\dot{x}$; which, multiplied by the exponent n, and by a power of x leſs by unity than n, gives the above fluxion.

Prob. II. *To find the Fluxion of the Product of ſeveral variable Quantities multiplied together.*

Rule. Multiply the fluxion of each by the product of the reſt of the quantities, and the ſum of the products thus ariſing will be the fluxion ſought. Thus, the fluxion of xy, is $\dot{x}y+\dot{y}x$; that of xyz, is $xy\dot{z}+xz\dot{y}+yz\dot{x}$; and that of $xyzu$, is $xyz\dot{u}+xyu\dot{z}+xzu\dot{y}+yzu\dot{x}$.

Prob. III. *To find the Fluxion of a Fraction.*

Rule. From the fluxion of the numerator multiplied by the denominator, ſubtract the fluxion of the denominator multiplied by the numerator, and divide the remainder by the ſquare of the denominator. Thus, the fluxion of $\frac{x}{y}$ is $\frac{\dot{y}x-\dot{x}y}{y^2}$; that of $\frac{x}{x+y}$, is $\frac{\dot{x}\times\overline{x+y}-\overline{\dot{x}+\dot{y}}\times x}{\overline{x+y}|^2}=\frac{y\dot{x}-x\dot{y}}{\overline{x+y}|^2}$.

In complex caſes, let the particulars be collected from the ſimple rules, and combined together.

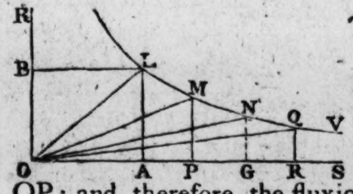
The fluxion of $\frac{x^2y^2}{z}$ is $\frac{\overline{2x^2y\dot{y}+2y^2x\dot{x}}\times z-x^2y^2\dot{z}}{x^2}$; for the fluxion of x^2 is $2x\dot{x}$, and of y^2 is $2y\dot{y}$, by Prob. I. and therefore the fluxion of x^2y^2 (by Prob. II.) $2x^2y\dot{y}+2y^2x\dot{x}$; from which, multiplied by z, (by Prob. III.) and ſubtracting from it the fluxion of the denominator z, multiplied by the numerator, and dividing the whole by the ſquare of the denominator, gives the above fluxion.

Prob. IV. *To find the* Fluxions *of Surd Quantities.* Suppoſe it required to find the fluxions of $\sqrt{2rx-xx}$, or $\overline{2rx-xx}|^{\frac{1}{2}}$. Suppoſe $\overline{2rx-xx}|^{\frac{1}{2}}=z$; then is $2rx-xx=zz$; and conſequently $r\dot{x}-x\dot{x}=z\dot{z}$; and, by diviſion, $\frac{r\dot{x}-x\dot{x}}{z}=\dot{z}=$ (by ſubſtitution) $\frac{r\dot{x}-x\dot{x}}{\sqrt{2rx-xx}}=$ to the fluxion of $\sqrt{2rx-xx}$.

Or, by the preceding rule, the fluxion of $\overline{2rx-xx}|^{\frac{1}{2}}$ will be $\frac{1}{2}\times\overline{2rx-2x\dot{x}}\times\overline{2rx-xx}|^{\frac{1}{2}-1}=\overline{r\dot{x}-x\dot{x}}+\overline{2rx-xx}|^{-\frac{1}{2}}=\frac{r\dot{x}-x\dot{x}}{\overline{2rx-xx}|^{\frac{1}{2}}}$.

If it be required to find the fluxion of $\overline{ay-xx}|^{\frac{1}{3}}$; for $\overline{ay-xx}|^{\frac{1}{3}}$ put z; then $ay-xx=z^{\frac{1}{3}}$, and $a\dot{y}-2x\dot{x}=\frac{1}{3}\dot{z}z^{-\frac{2}{3}}$; and multiplying by 3, $3a\dot{y}-6x\dot{x}=\dot{z}z^{-\frac{2}{3}}$; and, conſequently, $3az^{\frac{2}{3}}\dot{y}-6z^{\frac{2}{3}}x\dot{x}=\dot{z}$; equal (ſubſtituting $\overline{ay-xx}|^2=z^{\frac{2}{3}}$) $3a^3y^2\dot{y}-6a^2x^2y\dot{y}+3ax^4\dot{y}-6a^2y^2x\dot{x}+12ayx^3\dot{x}-6x^5\dot{x}=$ to the fluxion of $\overline{ay-xx}|^{\frac{1}{3}}$.

Prob. V. *To find the* Fluxion *of a Logarithm.* The fluxion of the hyperbolic logarithm of any quantity is equal to the fluxion of that quantity divided by the quantity itſelf; e. gr. the fluxion of the hyperbolic logarithm of x is $=\frac{\dot{x}}{x}$: for let L Q, *Figure* I. be an hyperbola, whoſe aſymptotes are OR and OS, and whoſe parameter is $AL=AO=1$: draw an ordinate PM parallel to AL, and the ſpace APML will be the hyperbolic logarithm of the line OP; and, therefore, the fluxion of the ſpace APML will be equal to the fluxion of the hyperbolic logarithm of the line OP. But the fluxion of this ſpace, OP being $=x$, and $PM=y$, is $=y\dot{x}$, and OP : AO :: LA : MP by the nature of the curve; i. e. $x:1::1:y=\frac{1}{x}$; therefore, $y\dot{x}=\frac{\dot{x}}{x}$. Then, from the nature of logarithms, the hyperbolic logarithm of 10, (viz. 2.30258, &c.) is to the common logarithm of 10, (viz. 1) as the hyperbolic logarithm of any number x, to the common logarithm of the ſame number x; i. e. L being made $=2.30258$, &c. L : 1 :: the hyperbolic logarithm of x : common logarithm of x: and therefore L : 1 :: the fluxion of the hyperbolic logarithm of x : the fluxion of the common logarithm of x : i. e. L : 1 :: $\frac{\dot{x}}{x}:\frac{\dot{x}}{Lx}$, which is the fluxion of the common logarithm of x; or becauſe $\frac{1}{L}=0.43429$, &c. the modulus of the Brigean or common form of logarithms, if $\frac{1}{L}$ be $=M$, the fluxion of the common logarithm of x (viz. $\frac{\dot{x}}{Lx}$) will be $=\frac{\dot{x}}{x}\times M$; or, the fluxion of the hyperbolic logarithm of any number multiplied by M or 0.43429, &c. is = the fluxion of the common logarithm of the ſaid number.



Prob. VI. *To find the* Fluxion *of an exponential or percurrent Quantity*, i. e. of a quantity having a variable exponent, as y^x. Suppoſe $y^x=u$; then, by the properties of logarithms, $x\times\log. y=\log. u$. And finding the fluxions of theſe terms, $\dot{x}\times\log. y+\frac{M\dot{y}}{y}\times x=\frac{M\dot{u}}{u}$, M being as in the preceding article: conſequently, the fluxion of y^x or $u=\frac{u\dot{x}}{M}\times\log. y+\frac{\dot{y}xu}{y}=\frac{\dot{x}}{M}\times y^x\times\log. y+xy^{x-1}\dot{y}$.

Second Fluxions are derived from the firſt, in the ſame manner as the firſt are from the flowing quantity. In the ſame way are third fluxions derived from ſecond fluxions, and fluxions of the fourth order from thoſe of the third, &c. Thus the fluxion of x^3, $3x^2\dot{x}$; its ſecond, $6x\dot{x}^2+3x^2\ddot{x}$ (by Prob. II.); and ſo on: but if $\dot{x}$ be invariable, $\ddot{x}=0$, and the ſecond fluxion of $x^3=6x\dot{x}^2$.

SECT. III.

THE APPLICATION OF THE DIRECT METHOD.

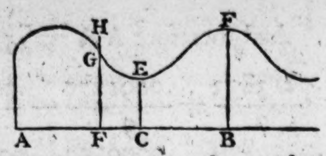
Prob. I. *To determine the Maxima and Minima.*

When a quantity increaſes, its fluxion is poſitive; when it decreaſes, it is negative; therefore, when it is juſt betwixt increaſing, its fluxion is $=0$.

Rule. Find the fluxion of the Equation, and put it $=0$, and the reſult will give an anſwer to the queſtion.

Examp. I. To determine the dimenſions of a cylindric meaſure, open at the top, which ſhall contain a given quantity of liquor, grain, &c. under the leaſt internal ſuperficies poſſible. Let the diameter $=x$, and the altitude $=y$; moreover, let p (3,14159, &c.) denote the periphery of the circle, whoſe diameter is unity, and let c be the given content of the cylinder. Then it will be $1:p::x:(px)$ the circumference of the baſe; which, multiplied by the altitude y, gives pxy for the concave ſuperficies of the cylinder. In like manner, the area of the baſe, by multiplying the ſame expreſſion into $\frac{1}{4}$ of the diameter x, will be found $=\frac{px^2}{4}$; which drawn into the altitude y, gives $\frac{px^2y}{4}$ for the ſolid content of the cylinder; which being made $=c$, the concave ſurface pxy will be found $=\frac{4c}{x}$, and conſequently the whole ſurface $=\frac{4c}{x}+\frac{px^2}{4}$: Whereof the fluxion, which is $-\frac{4c\dot{x}}{x^2}+\frac{px\dot{x}}{2}$ being put $=0$, we ſhall get $-8c\times px^3=0$; and therefore $x=2\sqrt[3]{\frac{c}{p}}$: Further, becauſe $px^3=8c$, and $px^2y=4c$, it follows, that $x=2y$; whence y is alſo known, and from which it appears, that the diameter of the baſe muſt be juſt the double of the altitude.

Examp.



Examp. II. To find the longeſt and ſhorteſt ordinates of any curve, GEF, *Figure* II. whoſe equation or relation which the ordinates bear to the abſciſſas is known.

Make AC the abſciſſa x, and CE the ordinate $=y$; take a value y in terms of x, and find its fluxion; which making $=0$, an equation will reſult whoſe roots give the value of x when y is a maximum or a minimum. To determine when it is a maximum and when a minimum, take the value of y, when x is a little more than the root of the equation ſo found, and it may be perceived whether it increaſes or decreaſes. If the equation has an even number of equal roots, y will be neither a maximum nor minimum when its fluxion is $=0$.

Art. II. *To draw a Tangent to any Curve.*

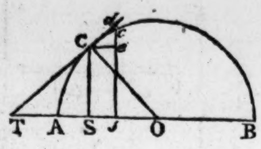


Figure III. When the abſciſſa C S of a curve moves uniformly from A to B, the motion of the curve will be retarded if it be concave, and accelerated if convex, towards A B; for a ſtraight line T C is deſcribed by an uniform motion, and the fluxion of the curve at any point is the ſame as the fluxion of the tangent, becauſe it would deſcribe the tangent if it continued to move equally from that point. Now if S*s* or C*e* be the fluxion of the baſe, C*d* will be the fluxion of the tangent, and *de* of the ordinate. And becauſe the triangles TSC, C*ed*, are equiangular, $de : ce :: \mathrm{CS} : \mathrm{ST}$, wherefore

Rule. Find a fourth proportional to the fluxion of the ordinate valued in terms of the abſciſſa, the fluxion of the abſciſſa, and the ordinate, and it determines the line ST, which is called the ſemi-tangent, and TC joined is a tangent to the curve.

Examp. To draw a right line C T, (ſee *fig.* 3.) to touch a given circle BCA in a given point C.

Let CS be perpendicular to the diameter AB, and put $\mathrm{AB}=a$, $\mathrm{AS}=x$, and $\mathrm{SC}=y$; then, by the property of the circle, y^2 (CS^2) $=\mathrm{BS}\times\mathrm{AS}$ ($=x\times\overline{a-x}$) $=ax-x^2$; whereof the fluxion being taken, in order to determine the ratio of $\dot{x}$, and $\dot{y}$, we get $2y\dot{y}=a\dot{x}-2x\dot{x}$; conſequently $\frac{\dot{x}}{\dot{y}}=\frac{2y}{a-2x}=\frac{y}{\frac{1}{2}a-x}$; which multiplied by y, gives $\frac{y\dot{x}}{\dot{y}}=\frac{y^2}{\frac{1}{2}a-x}=$ the ſubtangent ST. Whence (O being ſuppoſed the centre) we have OS ($\frac{1}{2}a-x$) : CS (y) :: CS (y) : ST; which we alſo know from other principles.

Art. III. *To determine Points of contrary Flexure in Curves.*
See *Fig.* II.

Suppoſing C to move uniformly from A to B, the curve GEF will be convex towards AB when the celerity of E increaſes, and concave when it decreaſes; therefore at the point where it ceaſes to be convex and begins to be concave, or the oppoſite way, the celerity of E will be uniform, that is, C E will have no ſecond fluxion. Therefore,

Rule. Find the ſecond fluxion of the ordinate in terms of the abſciſſa, and make it $=0$; and from the equation that ariſes you get a value of the abſciſſa, which determines the point of contrary flexure.

Examp. Let the nature of the cuve AGF be defined by $ay=a^{\frac{3}{2}}x^{\frac{1}{1}}+xx$, (the abſciſſa AF and the ordinate FG being, as uſual, repreſented by x and y reſpectively). Then $\dot{y}$, expreſſing the celerity of the point r, in the line FH, will be equal to $\frac{\frac{1}{2}a^{\frac{3}{2}}x^{-\frac{1}{2}}\dot{x}+2x\dot{x}}{a}$

Whoſe fluxion, or that of $\frac{1}{2}a^{\frac{3}{2}}x^{-\frac{1}{2}}+2x$ (becauſe a and $\dot{x}$ are conſtant) muſt be equal to nothing; that is, $-\frac{1}{4}a^{\frac{3}{2}}x^{-\frac{3}{2}}\dot{x}+2x=0$: Whence $a^{\frac{3}{2}}x^{-\frac{3}{2}}=8$, $a^{\frac{3}{2}}=8x^{\frac{3}{1}}64x^3=a^3$, and $x=\frac{1}{4}a=\mathrm{AF}$; therefore F G ($=\frac{a^{\frac{3}{2}}x^{\frac{1}{2}}+xx}{a}$) $=\frac{9}{16}a$: From which the poſition of the point G is given.

Art. IV. *To find the Radii of Curvature.*

The curvature of a circle is uniform in every point, that of every other curve continually varying: and it is meaſured at any point by that of a circle whoſe radius is of ſuch a length as to coincide with it in curvature in that point. All curves that have the ſame tangent have the ſame firſt fluxion, becauſe the fluxion of a curve and its tangent are the ſame. If it moved uniformly on from the point of contact, it would deſcribe the tangent. And the deflection from the tangent is owing to the acceleration or retardation of its motion, which is meaſured by its ſecond fluxion; and conſequently two curves which have not only the ſame tangent, but the ſame curvature at the point of contact, will have both their firſt and ſecond fluxions equal. It is eaſily proved from thence, that if y, x, and z, repreſent the abſciſſa, ordinate, and curve reſpectively, the radius curvature is $=\frac{\dot{z}^3}{-\dot{x}\ddot{y}}$.

Examp. Let the given curve be the common parabola, whoſe equation is $y=a^{\frac{1}{2}}x^{\frac{1}{2}}$: Then will $\dot{y}=\frac{1}{2}a^{\frac{1}{2}}\dot{x}x^{-\frac{1}{2}}=\frac{a^{\frac{1}{2}}\dot{x}}{2x^{\frac{1}{2}}}$, and (making $\dot{x}$ conſtant) $\ddot{y}=-\frac{1}{2}\times\frac{1}{2}a^{\frac{1}{2}}\dot{x}^2x^{-\frac{3}{2}}=\frac{-a^{\frac{1}{2}}\dot{x}^2}{4x^{\frac{3}{2}}}$: Whence $\dot{z}$ $\left(\sqrt{\dot{x}^2+\dot{y}^2}\right)=\frac{\dot{x}}{2}\sqrt{\frac{4x+a}{x}}$, and the radius of curvature $\left(\frac{\dot{z}^3}{-\dot{x}\ddot{y}}\right)=\frac{\overline{a+4}|^{\frac{3}{2}}}{2\sqrt{a}}$: Which at the vertex, where $x=0$, will be $=\frac{1}{2}a$.

SECT. III. INVERSE METHOD.

Prob. *From a given Fluxion to find a Fluent.*

This is done by tracing back the ſteps of the direct method. The fluxion of x is $\dot{x}$; and therefore the fluent of $\dot{x}$ is x: but as there is no direct method of finding fluents, this branch of the art is imperfect. We can aſſign the fluxion of every fluent; but we cannot aſſign the fluent of a fluxion, unleſs it be ſuch a one as may be produced by ſome rule in the direct method from a known fluent.

General Rule. Divide by the fluxion of the root, add unity to the exponent of the power, and divide by the exponent ſo increaſed.

For, dividing the fluxion $nx{-}^{n1}\,\dot{x}$ by $\dot{x}$ the fluxion of the root x) it becomes nx^{n-1}; and, adding 1 to the exponent ($n-1$) we have nx^n; which, divided by n, given x^n, the true fluent of $nx^{n-1}\dot{x}$.

Hence (by the ſame rule) the fluent of $3x^2\dot{x}$ will be $=x^3$; that of $8x^2\dot{x}=\frac{8x^3}{3}$; that of $2x^5\dot{x}=\frac{x^6}{3}$; that of $y^{\frac{1}{2}}\dot{y}=\frac{2}{3}y^{\frac{3}{2}}$.

Sometimes the fluent ſo found requires to be corrected. The fluxion of x is $\dot{x}$, and the fluxion of $a+x$ is alſo $\dot{x}$, becauſe a is invariable and has therefore no fluxion. Now when the fluent of $\dot{x}$ is required, it muſt be determined, from the nature of the problem, whether any invariable part, as a, muſt be added to the variable part x. When fluents cannot be exactly found, they can be approximated, by infinite ſeries.

Examp. Let it be required to approximate the fluent of $\frac{\overline{a^2-x^2}|^{\frac{1}{2}}\times x^n}{\overline{c^4-x^2}|^{\frac{1}{2}}}$ in an infinite ſeries.

The value of $\frac{\overline{a^2-x^2}|^{\frac{1}{1}}}{\overline{c^2-x^2}|^{\frac{1}{2}}}$, expreſſed in a ſeries, is $\frac{a}{c}+\overline{\frac{a}{2c^3}-\frac{1}{2ac}}\times x^2+\overline{\frac{3a}{8c^5}-\frac{1}{4ac^3}-\frac{1}{8a^3c}}\times x^4+\overline{\frac{5a}{16c^7}-\frac{3}{16ac^5}-\frac{1}{16a^3c^3}-\frac{1}{16a^5c}}\times x^6+$ &c. Which value being therefore multiplied by $x^n x$, and the fluent taken (by the common method) we get $\frac{ax^{n+1}}{\overline{n+1}\times c}+\overline{\frac{a}{2c^3}-\frac{1}{2ac}}\times\frac{x^{n+3}}{n+3}+\overline{\frac{3a}{8c^5}-\frac{1}{4ac^3}-\frac{1}{8a^3c}}\times\frac{x^{n+5}}{n+5}+\overline{\frac{5a}{16c^7}-\frac{3}{16ac^5}-\frac{1}{16a^3c^3}-\frac{1}{16a^5c}}\times\frac{x^{n+7}}{n+7}+$ &c.

SECT. IV. APPLICATION OF THE INVERSE METHOD.

Art. I. *To find the Area of any Curve.*

Rule. Multiply the ordinate by the fluxion of the abſciſſa, and the product gives the fluxion of the figure, whoſe fluent is the area of the figure.

Examp. 1. Let the curve, whoſe area you will find, be the common parabola. Put u to repreſent the area, and $\dot{u}$ its fluxion. In which caſe the relation of the abſciſſa (x) and ordinate (y) being expreſſed $y^2=ax$ where a is the parameter) we thence get $y=a^{\frac{1}{2}}x^{\frac{1}{2}}$; and therefore $\dot{u}$ ($=y\dot{x}$) $=a^{\frac{1}{2}}x^{\frac{1}{2}}\dot{x}$: whence $u=\frac{2}{3}\times a^{\frac{1}{2}}x^{\frac{2}{3}}=\frac{2}{3}a^{\frac{1}{2}}x^{\frac{1}{2}}\times x=\frac{2}{3}yx$ (becauſe $a^{\frac{1}{2}}x^{\frac{1}{2}}=y$) $=\frac{2}{3}\times x\times y$. Hence a parabola is $\frac{2}{3}$ of a rectangle of the ſame baſe and altitude.

Examp. 2. Let the propoſed curve LMNQ (*fig.* 1.) be of ſuch a nature, that (ſuppoſing OA unity) the ſum of the areas LMPA and LNGO anſwering to any two propoſed abciſſas OP and OG, ſhall be equal to the area LQRA whoſe correſponding abſciſſa OR is equal to OP×OG, the product of the meaſures of the two former abſciſſas. Firſt, in order to determine the equation of the curve, (which muſt be known before the area is found), let the ordinates NG and OR, move parallel to themſelves, towards SV; and having put $\mathrm{GN}=y$, $\mathrm{QR}=z$, $\mathrm{OP}=a$, $\mathrm{OG}=s$, and $\mathrm{OR}=u$, the fluxion of the area LNGA will be repreſented by $y\dot{s}$, and that of the area LQRA by $z\dot{u}$; which two expreſſions muſt, by the nature of the problem, be equal to each other; becauſe the latter area exceeds the former by the area LMPA, which is here conſidered as a conſtant quantity: and it is evident, that two expreſſions, that differ only by a conſtant quantity, muſt always have equal fluxions. Since, therefore, $y\dot{s}$ is $= z\dot{u}$, and $u = as$, by hypotheſis, it follows, that $\dot{u} = a\dot{s}$, and that the firſt equation (by ſubſtituting $a\dot{s}$ for $\dot{u}$) will become $y\dot{s} = az\dot{s}$, or $y = az$; or, laſtly, $ys = zas$, that is, GN × OG : = QR + OR : therefore, GN : QR : : OR : OG; whence it appears, that every ordinate of the curve is reciproſally as its correſponding abcciſſa. Now to find the area of the curve ſo determined, put $OA = 1$, $AL = b$, and $AG = x$; then, ſince OG $(1+x)$: OA (1) : : AL (b) : GN (y) we have $y = \frac{b}{1+x}$, consequently $\dot{u}\ (= y\dot{x}) = \frac{b\dot{x}}{1+x}$ $= b \times \overline{\dot{x} - x\dot{x} + \dot{x}^2 z - n^3\dot{x} + \dot{x}x^4} -$ &c. Whence AGNL, the area itſelf will be $= b \times x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5}$, &c which was to be found.

Hence it appears, that as theſe areas have the ſame properties as logarithms, this ſeries gives an eaſy method of computing logarithms; and the fluent may be found by means of a table of logarithms, without the trouble of an infinite ſeries; and every fluxion whoſe fluent agrees with any known logarithmic expreſſion, may be found the ſame way. Hence the fluents of fluxions of the following forms are deduced.

The fluent of $\frac{\dot{x}}{\sqrt{x^2 \pm a^2}} =$ hyp. log. of $x + \sqrt{x^2 \pm a^2}$;

of $\frac{\dot{x}}{\sqrt{2ax+xx}} =$ hyp. log. $a \times x + \sqrt{2ax + x^2}$;

of $\frac{2a\dot{x}}{a^2 - x^2} =$ hyp. log. of $\frac{a+x}{a-x}$;

and of $\frac{2a\dot{x}}{x\sqrt{a^2 \pm x^2}} =$ hyp. log. $\frac{a - \sqrt{a^2 \pm x^2}}{a + \sqrt{a^2 \pm x^2}}$

ART. II. *To determine the Length of Curves.*

Fig. 3. Becauſe C de is a right-angled triangle, $Cd^2 = Ce^2 + de^2$; wherefore the fluxions of the abſciſſa and ordinate being taken in the ſame terms and ſquared, their ſum gives the ſquare of the fluxion of the curve; whoſe root being extracted, and the fluent taken, gives the length of the curve.

EXAMP. To find the length of a circle from its tangent. Make the radius AO (*fig.* 3.) $= a$, the tangent of AC $= t$, and its ſecant $= s$, the curve $= z$, and its fluxion $= \dot{z}$; becauſe the triangles OTC, OCS, are ſimilar, OT : OC : : OC : : OS; whence OS $= \frac{a^2}{s}$, and SA $= a - \frac{a^2}{s} = a - \frac{a^2}{\sqrt{a^2+t^2}}$; whoſe fluxion is $\frac{a^2 t\dot{t}}{\overline{a^2+t^2}|^{\frac{2}{3}}}$; and becauſe the triangles OTC, dCe are ſimilar, TC $(= t)$: TO $(= \sqrt{a^2+t^2})$: : Ce $= \left(\frac{a^2 t\dot{t}}{\overline{a^2+t^2}|^{\frac{2}{3}}}\right)$: C$d = \frac{a^2\dot{t}}{a^2+t^2} =$ fluxion of the curve. Now by converting this into an infinite ſeries, we have the fluxion of the curve $= \dot{t} - \frac{t^2\dot{t}}{a^2} + \frac{t^4\dot{t}}{a^4} - \frac{t^6\dot{t}}{a^6}$, &c. and conſequently $z = - \frac{t^3}{3a^2} + \frac{t^5}{5a^4} - \frac{t^7}{7a^6} + \frac{t^9}{9a^8}$ &c. $=$ AR. Where, if (for example ſake) AR be ſuppoſed an arch of 30 degrees, and AO (to render the operation more eaſy) be put $=$ unity, we ſhall have $t = \sqrt{\tfrac{1}{3}} = .5773502$ (becauſe Ob $\sqrt{\tfrac{3}{4}}$: bR $(\tfrac{1}{2})$: : O A (1) : AT $(t) = \sqrt{\tfrac{8}{2}}$) Whence,

$t^3 \quad (= t \times t^2 = t \times \tfrac{1}{3}) = .1924500$

$t^5 \quad (= t^3 \times t^2 = \frac{t^3}{3}) = .0641500$

$t^7 \quad (= t^5 \times {}^5t = \frac{t^2}{3}) = .0213833$

$t^9 \quad (= t^7 \times t^2 = \frac{t^7}{3}) = .0071277$

$t^{11} \quad (= t^9 \times t^2 = \frac{t^9}{3}) = .0023759$

$t^{13} \quad (= t^{11} \times t^2 = \frac{t^{11}}{3}) = .0007919$

$t^{15} \quad (= t^{13} \times t^2 = \frac{t^{13}}{3}) = .0002639$

&c.

And therefore $AR = .5773502 - \frac{.1934500}{3} + \frac{.0641500}{5} - \frac{.0213833}{7} + \frac{.0091277}{9} - \frac{.0023759}{11} + \frac{.0007919}{13} - \frac{.0002639}{15} + \frac{.0000879}{17} - \frac{.0000293}{19} + \frac{0000097}{21} - \frac{.0000032}{23} = .5235987$; for the length of an arch of 30 degrees, which multiplied by 6 gives 3.141592 + for the length of the ſemi periphery of the circle whoſe radius is unity.

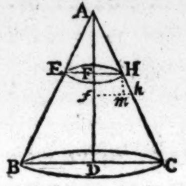
Other ſeries may be deduced from the verſed ſine, ſine, and ſecant; and theſe are of uſe for finding fluents which cannot be expreſſed in finite terms. Thus,

the fluent of	is equal to the arch whose	is $\frac{w}{a}$, and Radius Unity.
$\frac{\dot{w}}{\sqrt{2aw - w^2}}$	Verſed ſine	
$\frac{\dot{w}}{\sqrt{a^2 - w^2}}$	Right ſine	
$\frac{a\dot{w}}{{}^2 + w^2}$	Tangent	
$\frac{a\dot{w}}{w\sqrt{w^2 - a^2}}$	Secant	

ART. III. *To find the Contents of a Solid.*

Let the ſurface of the generating plane be multiplied by the ſpace it paſſes through in any time, the product will give a ſolid which is the fluxion of the ſolid required; the ſurface muſt therefore be computed in terms of x, which repreſents the line or axis on which it moves, and by its motion on which the fluxion is to be meaſured, and the fluent found will give the contents of the ſolid.

EXAMP. Let it be propoſed to find the content of a cone, ABC, *Fig.* IV.



Put the given altitude (AD) of the cone $= a$, and the ſemi-diameter (BD) of its baſe $= b$, the ſolid $= s$, its fluxion $= \dot{s}$ and the area of a circle, whoſe radius is unity, $= p$; then the diſtance (AF) of the circle EH, from the vertex A, being denoted by x, we have, by ſimilar triangles, as $a : b : : x :$ EF, $(y) = \frac{bx}{a}$. Whence in this caſe, $\dot{s}\ (= py^2\dot{x}) = \frac{pb^2x^2\dot{x}}{a^2}$; and conſequently $s = \frac{pb^2x^3}{3a^2}$; which, when $x = a$ (= AD) gives $\frac{pb^2a}{3}$ $(= p \times BD^2 \times \tfrac{1}{3}$ AD) for the content of the whole cone ABC; which appears from hence to be juſt $\tfrac{1}{3}$ of a cylinder of the ſame baſe and altitude.

ART. IV. *To compute the Surface of any Solid Body.*

The fluxion of the ſurface of the ſolid is equal to the periphery of the ſurface, by whoſe motion the ſolid is generated, multiplied by its velocity on the edge of the ſolid, and the computation is made as in the foregoing.

EXAMP. Let it be propoſed to determine the convex ſuperficies of a cone ABC, ſee *Fig.* 4.

Then, the ſemi-diameter of the baſe (BD, or CD) being put $= b$, the ſlanting line or hypothenuſe AC $= c$, and FH (parallel to DC) $= y$, AG $= z$, the ſurface $= w$, its fluxion $= \dot{w}$, and $p =$ the periphery of a circle whoſe diameter is unity, we ſhall, from the ſimilarity of the triangles A D C and H m h, have $b : c : : \dot{y}\ (mh) : x$ (H h) $= \frac{c\dot{y}}{b}$: whence $\dot{w}\ (2py\dot{z}) = \frac{2pcy\dot{y}}{b}$; and conſequently $w = \frac{pcy^2}{b}$. This, when $y = b$, becomes $= pcb = p \times DC \times AC =$ the convex ſuperficies of the whole cone ABC: which therefore is equal to a rectangle under half the circumference of the baſe and the ſlanting line.

The method of fluxions is alſo applied to find the centres of gravities, and oſcillation of different bodies; to determine the paths deſcribed by projectiles and bodies acted on by central forces, with the laws of centripetal force in different curves, the retardates given to motions performed in reſiſting medii, the attractions of bodies under different forms, the direction of wind which has the greateſt effect on an engine, and to ſolve many other curious and uſeful problems.

In this brief Syſtem of Fluxions, I have taken the ſtricteſt care to avoid Perplexity, and to make the Definitions and Axioms conſiſtent with Science, and pure Geometry. I have introduced the moſt uſeful Articles to which it is applicable, and extracted the moſt eſſential parts, from the valuable works of Sir Iſaac Newton, Maclaurin, Simpſon, Emerſon, and others, diſtinguiſhed for their Knowledge in the Science.

WILLIAM SQUIRE,
Late Maſter of the Academy in St. John's Lane.

FLY, in entomology, a large order of inſects, the diſtinguiſhing characteriſtic of which is, that their wings are tranſparent. By this they are diſtinguiſhed from beetles, butterflies, graſhoppers, &c. See SCARABÆUS, GRYLLUS, &c. Flies are ſubdivided into thoſe which have four, and thoſe which have two wings. Of thoſe with four wings there are ſeveral, genera or kinds; as the ant, abis, ichneumon, &c. See APIS, FORMICA, &c. Of thoſe with two wings, there are ſeveral kinds, as the gad-fly, gnat, &c. See GAD-*Fly*, &c. Thoſe who deſire a particular account of the anatomy, generation, ſtructure, and manifold ſubdiviſions of flies, may conſult the Syſtem of ENTOMOLOGY.

FLY, in mechanics, a croſs with leaden weights at its ends; or rather a heavy wheel at right angles to the axis of a windlaſs, jack, or the like; by means of which, the force of the power, whatever it is, is not only preſerved, but equally diſtributed in all parts of the revolution of the machine. See MECHANICS.

Vegetable FLY, a very curious and natural production chiefly found in the Weſt Indies. "Excepting that it has no wings, it reſembles the drone in ſize and colour more than any other Britiſh inſect. The credulous part of the natives believe that in the month of May it buries itſelf in the earth, and vegetates." Such was the account originally given of this extraordinary production. But ſeveral boxes of theſe flies having been ſent to Dr. Hill for examination, his report was this. "There is in Martinique a fungus of the clavaria kind, different in ſpecies from thoſe hitherto known. It produces ſoboles from its ſides, I call it therefore *clavaria ſobolifera*. It grows on putrid animal bodies, as our *fungus ex pede equino* from the dead horſe's hoof. The cicada is common in Martinque, and in its nympha ſtate, in which the old authors call it *tettigometra*; it buries itſelf under dead leaves to wait its change; and, when the ſeaſon is unfavourable, many periſh. The ſeeds of the clavaria find a proper bed on this dead inſect, and grow. The tettigometra is among the cicadæ in the Britiſh muſeum; the clavaria is juſt now known. This is the fact, and all the fact; though the untaught inhabitants ſuppoſe a fly to vegetate, and though there is a Spaniſh drawing of the plant's growing into a trifoliate tree, and it has been figured with the creature flying with this tree on its back." The ingenious Mr. Edwards has taken notice of this extraordinary production in his gleanings of Natural Hiſtory.

FLY-*Boat*, or *Flight*, a large flat-bottomed Dutch veſſel, whoſe burden is generally from 400 to 600 tons. It is diſtinguiſhed by a ſtern remarkably high, reſembling a Gothic turret, and by very broad buttocks below.

FLY-*Catcher*, the Engliſh name of the genus Muſicapa, according to Linnæus, the 73d genus of birds, and belonging to the 6th order called Paſſerds. Latham in his improved arrangement makes it the 38th genus, and the 3d order. For the deſcription, ſee MUSCICAPA. For the claſſification, ſee Syſtem of ORNITHOLOGY, for the repreſentation, ſee Plate III.

FLY-*Tree*, in natural hiſtory, a name given by the common people in America to a tree, whoſe leaves, they ſay, at a certain time of the year, produce flies. On examining theſe leaves about the middle of ſummer, the time at which the flies uſe to be produced, there are found on them a ſort of bags of tough matter, of about the ſize of a filbert, and of a duſky greeniſh colour; on opening one of theſe bags with a knife, there is uſually found a ſingle full-grown fly of the gnat kind, and a number of ſmall worms, which, in a day or two more, have wings, and fly away in the form of their parent. The tree is of the mulberry-kind, and its leaves are uſually very largely ſtocked with theſe inſect bags, and the generality of them are found to contain the inſects in the worm ſtate; when they become winged, they ſoon make their way out. The bags begin to appear when the leaves are young, and afterwards grow with them; but they never rumple the leaf, or injure its ſhape. They are of the kind of leaf galls, and partake in all reſpects, except ſize, of a ſpecies we have frequent on the large maple, or, as it is called the ſycamore. Philoſ. Tranſ. N° 431.

FLYING, the progreſſive motion of a bird, or other winged animal, in the liquid air. Flying is either natural, or artificial.

Natural FLYING is that performed by an apparatus, or ſtructure of parts, concerted for that end by nature herſelf. Such is that of moſt birds and inſects, and of ſome fiſhes. In Virginia and New-England they have monſtrouſly large flying beetles. Philoſoph. Tranſact. N° 127. And in Languedoc, graſhoppers about an inch long, wherewith the ground, in ſeveral parts, in the year 1685, was covered one third of a foot deep. Ibid. N° 182. The parts of birds, &c. chiefly concerned in flying, are the wings and tails: by the firſt the bird ſuſtains and wafts himſelf along; and by the ſecond, he is aſſiſted in aſcending and deſcending, to keep his body poiſed and upright, and to obviate the vacillations thereof. It is by the largeneſs and ſtrength of the pectoral muſcles, that birds are ſo well diſpoſed for quick, ſtrong, and continued flying. Theſe muſcles, which in men are ſcarce a ſeventieth part of the muſcles of the body, in birds exceed and outweigh all the other muſcles taken together. See COMPARATIVE ANATOMY, Sect. II.

The flying of birds is thus effected: The bird firſt bends his legs, and ſprings with a violent leap from the ground; then opens, or expands the jointures of his wings, ſo as to make a right line, perpendicular to the ſides of his body; thus, as the wings, with the feathers therein, conſtitute one continued lamina, being now raiſed a little, and vibrating the wings, with great force and velocity, perpendicularly againſt the air; the air, though a fluid, reſiſts thoſe ſucculſions, both from its natural inactivity and from its elaſticity, which makes it reſtore itſelf after it has been compreſſed; and re-act as much as it has been acted on: by ſuch means is the whole body of the bird protruded. The ſagacity of nature is very remarkable in the opening and recovering of the wing for freſh ſtroke. To do it directly, and perpendicularly, it muſt needs have a great reſiſtance to overcome; to avoid which the bony part, or bend, of the wing, into which the feathers are inſerted, moves ſideways, with its ſharp end foremoſt, the feathers following it like a flag. The reſiſtance the air makes to the withdrawing of the wings, and, conſequently, the progreſs of the bird will be ſo much the greater, as the waft, or ſtroke, of the fan of the wing is the longer; but as the force of the wing is continually diminiſhed by this reſiſtance, when the two forces come to be in equilibrio, the bird will remain ſuſpended in the ſame place; for the bird only aſcends ſo long as the arch of air, the wing deſcribes, makes a reſiſtance equal to the exceſs of the ſpecific gravity of the bird above the air: if the air, therefore, be ſo rare as to give way with the ſame velocity as it is ſtruck withal, there will be no reſiſtance, and, conſequently, the bird can never mount.

Artificial FLYING, is that attempted by men by the aſſiſtance of mechanics. The art of flying is one of the great deſiderata of mechanics: it has been attempted in divers ages; the diſcovery of it might prove of great ſervice, and alſo of great diſſervice to mankind. No body ſeems to bid ſo fair for that invention, as our famous friar Bacon, who lived upwards of five hundred years ago. He not only affirms the art feaſible, but aſſures us he himſelf knew how to make an engine, in which a man ſitting might be able to carry himſelf through the air like a bird; and affirms that there was another perſon who had actually tried it with ſucceſs. The ſecret conſiſted in a couple of large thin hollow copper globes, exhauſted of air, being much lighter than air, would ſuſtain a chair, whereon a perſon might ſit. The famous biſhop Wilkins was ſo confident of ſucceſs in this art, that he ſeems to intimate, that in future ages it will be as uſual to hear a man call for his wings when he is going a journey, as it is now to call for his boots.

FLYING *of Colours*, is uſed by painters to denote their want of durableneſs, which they expreſs by their ſtanding.

FLYING *Fiſh*, a name given by the Engliſh writers to ſeveral ſpecies of fiſh, which by means of their long fins have a method of keeping themſelves out of water for ſome time. The flying fiſh, moſt properly ſo called, is the exocœtus, a genus belonging to the order of aſdominales. For deſcription, ſee EXOCOETUS; for claſſification, ſee Syſtem of ICHTHYOLOGY.

FOAL, or COLT, the young of the horſe kind. The word colt, ſimply ſpoken, is, among the dealers, underſtood to mean the male kind; the female, or mare colt, being called a filly.

FOCUS, in geometry, and the conic ſections, is applied to certain points of the parabola, ellipſis, and hyperbola; wherein the rays reflected from all parts of theſe curves do concur or meet. See Syſtem of GEOMETRY.

FOCUS, in optics, is a point wherein ſeveral rays concur, and are collected; either after having undergone refraction, or reflection. It is thus called, becauſe the rays being here brought together, and united, their force and effect are increaſed; ſo that they become able to burn; accordingly it is in this point, that bodies are placed to ſuſtain the force of burning glaſſes, or mirrors. See Syſtem of OPTICS.

FODDER, any kind of meat for horſes, or other cattle: in ſome places hay and ſtraw mingled together are more peculiarly denominated fodder.

FŒTOR, in medicine, ſtinking or fetid effluvia, proceeding from the body or the parts thereof. Fœtors ariſe from ſtagnant, extravaſated, corrupted, or poiſoned humours: as alſo from any thing capable of attenuating and volatilizing the oils and ſalts, as abſtinence, heat, too much motion, acrimony of food, &c.

FOETOR *Oris*, a term uſed by medical writers to expreſs that ill ſmell in the mouth, actually, though often, improperly, called by us a ſtinking breath. This is a malady ariſing in different cauſes; as from the ſcurvy, and particularly that ſpecies, of it which affects the mouth, and is therefore called *ſtomacace*, from the French pox; from an ulceration, whether ſimple or fiſtulous, in the lungs, which is the caſe in conſumptions; from ulcers in the mouth; from caries or rottenneſs of the teeth, or from any other impurity of them; from crudities in the ſtomach ariſing from a bad digeſtion, and in particular, from a weakneſs about the left orifice of the ſtomach from which part the fœtid vapours will often ariſe in very great abundance.

Method of Cure. According to the different cauſes of this diſorder, it requires a very different method of cure. In caſes where it depends on the ſcurvy, pox, or other diſeaſes, thoſe diſeaſes are to be attacked by the proper medicines in order to its cure; when it ariſes from a carious tooth, there is no cure for it but drawing the tooth; when the impurities of the teeth occaſion it cleaning them proves a cure.

FOETUS, the young of all viviparous animals whilſt in the womb, and of oviparous animals before being hatched: the name is transferrable by botaniſts to the embryos of vegetables. In the human fetus are ſeveral peculiarities not to be found in the adult; ſome of them are as follows. 1. The arteries of the navel ſtring, which are continuations of the hypograſtics, are, after the birth, ſhrivelled up, and form the ligamenta umbilic. infer. 2. The veins of the navel ſtring are formed by the union of all the venaous-branches in the placenta, and paſſing into the abdomen become the falciform ligament of the liver. 3. The lungs, before being inflated with air, are compact and heavy; but after one inſpiration they become light, and as it were ſpongy: and it may be noted here, that the notion of the lungs ſinking in water before the child breathes, and of their ſwimming after the reception of air, are no certain proofs that the child had or had not breathed, much leſs than it was murdered: for the uninflated lungs become ſpecifically lighter than water as ſoon as any degree of putrefaction takes place in them; and this ſoon happens after the death of the child: beſides, where the utmoſt care hath been taken to preſerve the child, it hath breathed once or twice, and then died. 6. The thymus gland is very large in the fetus, but dwindles away in proportion as years advance. 7. The foramina ovale in the heart of a fetus, is generally cloſed in an adult. See Syſtem of MIDWIFRY; and for an account of the different opinions concerning the formation and growth of the fetus, ſee GENERATION.

FOG, or MIST, a meteor, conſiſting of groſs vapours, floating near the ſurface of the earth. Miſts, according to lord Bacon, are imperfect condenſations of the air, conſiſting of a large proportion of the air, and a ſmall one of the aqueous vapour: and theſe happen in the winter, about the change of the weather from froſt to thaw, or from thaw to froſt; but in the ſummer, and in the ſpring, from the expanſion of the dew. If the vapours, which are raiſed plentifully from the earth and waters, either by the ſolar or ſubterraneous heat, do at their firſt entrance into the atmoſphere, meet with cold enough to condenſe them to a conſiderable degree, their ſpecific gravity is by that means increaſed; and ſo they will be ſtopped from aſcending, and either return back, in form of dew or of drizzling rain; or remain ſuſpended ſome time in the form of a fog. Vapours may be ſeen on the high grounds as well as the low, but more eſpecially about marſhy places: they are eaſily diſſipated by the wind, as alſo by the heat of the ſun: they continue longeſt in the loweſt grounds, becauſe theſe places contain moſt moiſture, and are leaſt expoſed to the action of the wind. Hence we may eaſily conceive, that fogs are only low clouds, or clouds in the loweſt region of the air; as clouds are no other than fogs raiſed on high. See CLOUD. When fogs ſtink, then the vapours are mixed with ſulphureous exhalations, which ſmell ſo. Objects viewed through fogs, appear larger and more remote than through the common air. Mr. Boyle obſerves, that upon the coaſt of Coromandel, and moſt maritime parts of the Eaſt Indies, there are, notwithſtanding the heat of the climate, annual fogs ſo thick, as to occaſion people of other nations who reſide there, and even the more tender ſort of the natives, to keep their houſes cloſe ſhut up.

FOIBLE, a French term, frequently uſed alſo in our language. It literally ſignifies weak; and in that ſenſe is applied to the body of animals, and the parts thereof; as *foible* reins, *foible* ſight, &c. being derived from the Italian *fievole*, of the Latin *flebilis*, *to be lamented*, *pitied*. But it is chiefly uſed with us ſubſtantively to denote a defect, or flaw in a perſon, or thing. Thus we ſay, every perſon has his foible; and the great ſecret conſiſts in hiding it artfully: princes are gained by flattery, that is their foible: the foible of young people is pleaſure; the foible of old men is avarice; the foible of the great and learned is vanity; the foible of women and girls, coquetry, and an affectation of having gallants. It is a term alſo uſed in fencing, to denote the weakeſt part of a blade; in oppoſition to the fort, which is the ſtrongeſt.

FOIL, in fencing, denotes a blunt ſword, or one that has a button at the end covered with leather uſed in learning the art of fencing.

FOIL, among jewellers, a thin leaf of metal, placed under a precious ſtone, in order to make it tranſparent, to improve the colour, or to give it an agreeable different colour, either deep or pale. Thus the effect of giving luſtre is produced by the poliſh of the ſurface of the foil, which is colourleſs; but if a ſtone is wanted to be of a pale colour, a foil of that colour muſt be put under it: if deep, a dark one muſt be laid under it. Theſe foils are made either of copper, tin, gold, or gold and ſilver together: the copper foils are generally known by the name of Nuremberg or German foils.

FOILING, among hunters, the footing and treading of deer, which remains on the graſs, but ſcarce viſible.

FOLD *Net*, among ſportſmen, a ſort of net with which ſmall birds are taken in the night: there are two ſizes of it; the leaſt may be managed by one man, but the largeſt muſt be carried by two, and uſed thus: let the net be fixed on both ſides to two ſtrong poles about twelve feet long, each man holding one of them; let a third carry lights behind them, at the diſtance of two yards: the net ſhould be carried between the wind and birds, which rooſt on their perches with their breaſts againſt the wind: another perſon, who beats the buſhes on the other ſide of the hedge, will drive out the birds towards the light.

FOLIAGE, a cluſter or aſſemblage of flowers, branches, leaves, &c.

FOLIAGE is generally uſed for repreſentations of ſuch flowers, leaves, branches, rinds, &c. whether natural or artiſiical; uſed as enrichments on capitals, freezes, pediments, &c. See Syſtem of CHITECTURE, on the principles of the Art.

FOLIATING *of Looking Glaſſes*, is the ſpreading compoſition of ſomething which will firmly adhere to the back of the glaſs, and there reflect the image. This compoſition is called the foil, and is uſually made with quickſilver, mixed with tin, and ſome other ingredients. For the method of foliating looking glaſſes, ſee LOOKING-GLASS.

FOLIATION, in botany, &c. is uſed by Dr. Crew, to expreſs the aſſemblage of the folia, or petala, of a flower. The foliation is the moſt conſpicuous part of flowers, being that collection of fugaceous, coloured leaves, which conſtitutes the compaſs, or body of the flower.

FOLIO, in books of account, &c. ſignifies page. See Syſtem of BOOK-KEEPING, Sect. IV.

FOLIO, among bookſellers, a book in folio, or ſimply a folio, is that where the ſheet is only folded in two, each leaf making half a ſheet. Beneath the folio are the quarto, octavo, duodecimo, ſixteens, twenty-fours, &c.

FOLLY, according to Mr. Locke, conſiſts in the drawing of falſe concluſions from juſt principles; by which it is diſtinguiſhed from madneſs, which draws juſt concluſions from falſe principles. But this ſeems too confined a definition; folly, in its moſt general acceptation, denoting a weakneſs of intellect or apprehenſion, or ſome partial abſurdity in ſentiment or conduct.

FOMENTATION, a liquid medicine applied to any diſeaſed part, to reſolve, diſcuſs, ſoften, aſſwage, fortify, or conſtringe the ſame. Fomentations are either ſimple or compound.

Compound FOMENTATIONS, are decoctions of roots, leaves, flowers, and ſeeds, made in common water, or other proper liquor, to which are ſometimes added ſalts, exungiæ, oils, &c. To uſe, or apply them, they dip a hot linen cloth, or flannel, in the liquor, and ſpread it on the part affected.

Simple FOMENTATIONS, are thoſe made with luke-warm water, milk, oil, oxycrate, or the like liquors. Fomentations are alſo called local baths, or partial bathings; becauſe, being applied on a diſeaſed part, they have much the ſame effect as a bath, or half-bath, has on the whole body.

FONT, or *Baptiſmal* FONT, a ſtone or marble veſſel in churches ſerving to hold water to be uſed in adminiſtering the ſacrament of baptiſm.

FONT, or FOUNT, among printers, &c. a ſet, or quantity of characters, or letters, of each kind, caſt by a letter founder, and ſorted. We ſay, a founder has caſt a fount of pica, of engliſh, of pearl, &c. meaning that he has caſt a ſet of characters of theſe kinds. A complete fount does not only include the running letter, but alſo majuſcules, or large and ſmall capitals, ſingle letters, double letters, points, commas, lines, borders, head pieces, tail-pieces, and numeral characters. Founts are large or ſmall, according to the demand of the printer, who orders them by the hundred weight, or by ſheets. When the printer orders a fount of five hundred, he means that the fount ſhall weigh five hundred pounds. When he demands a fount of ten ſheets, it is underſtood, that with that fount he ſhall be able to compoſe ten ſheets, or twenty forms, without being obliged to diſtribute. The founder takes his meaſures accordingly; he reckons a hundred and twenty pounds for a ſheet, including the quadrates, &c. or ſixty pounds for a form, which is half a ſheet: not that the ſheet always weighs a hundred and twenty pounds, or the form ſixty pounds; on the contrary, it varies according to the ſize of the form; beſides, it is always ſuppoſed that there are letters left in the caſes. The letter founders have a kind of liſt, or tariff, whereby they regulate their founts: the occaſion thereof is, that ſome letters being in much more uſe, and oftener repeated, than others, their cells, or caſes, ſhould be better filled and ſtored, than thoſe of the letters which do not return ſo frequently. Thus the *o*, and *i*, for inſtance, are always in greater quantity than *k*, or *z*. This difference will be beſt perceived from a proportional compariſon of thoſe letters with themſelves, or ſome others. Suppoſe a *fount* of a hundred thouſand characters, which is a common *fount*; here the *a* ſhould have five thouſand; the *c*, three thouſand; the *e*, eleven thouſand; the *i*, ſix thouſand; the *m*, three thouſand; the *k*, only ſixty; and the *x*, *y*, and *z*, not many more. But this is only to be underſtood of the letters of the lower caſe; thoſe of the upper caſe having other proportions, which it would be, here, too long to inſiſt on.

FOOD, in the moſt extenſive ſignification of the word, implies whatever aliments are taken into the body, whether ſolid or fluid; but, in common language, it is generally uſed to ſignify only the ſolid part of our aliment.

Diſſertation on the Nature and Properties of Food.

The remarkable diſtinction of foods is into thoſe which are already aſſimilated into the animal nature, and ſuch as are not. Of the firſt kind are animal ſubſtances in general; which if not entirely ſimilar, are nearly ſo, to our nature. The ſecond comprehends vegetables, which are much more difficultly aſſimilated.

The moſt remarkable properties of different vegetable ſubſtances as food, are taken notice of under their different names: here we ſhall only compare vegetable foods in general with thoſe of the animal kind.

I. *In the Stomach.*

They differ remarkably, in that the vegetables always have a tendency to acidity, while animal-food of all kinds tend rather to alkaleſcency and putrefaction. Some animal-foods, indeed, turn manifeſtly acid before they putrify; and it has been aſſerted, that ſome degree of aceſcency takes place in every king of animal food before digeſtion. This aceſcency of animal food, however, never comes to any morbid degree, but the diſeaſe is always on the ſide of putreſcency. The aceſcency of vegetables is more frequent, and ought to be more attended to, than the alkaleſcency of animal food; which laſt, even in weak ſtomachs, is ſeldom felt; while aceſcency greatly affects both the ſtomach and ſyſtem.

With regard to their difference of ſolution: Heavineſs, as it is called, is ſeldom felt from vegetables, except from tough farinaceous paſte, or the moſt viſcid ſubſtances; while the heavineſs of animal food is more frequently noticed, eſpecially when in any great quantity. Difficulty of ſolution does not depend ſo much on firmneſs of texture, but on viſcidity; and hence it is more frequent in animal food, eſpecially in the younger animals. With regard to mixture:—There is no inſtance of difficult mixture in vegetables, except in vegetable oils; while animal foods, from both viſcidity and oilineſs, eſpecially the fatter meats, are refractory in this reſpect. Perhaps the difference of animal and vegetable foods might be referred to this head of mixture. For vegetable food continues long in the ſtomach, giving little ſtimulus: now the ſyſtem is affected in proportion to the extent of this ſtimulus, which is incomparably greater from the animal viſcid oily food, than from the vegetable, firmer, and more aqueous. However, there are certain applications to the ſtomach, which have a tendency to bring on the cold fit of fever, independent of ſtimulus, merely by their refrigeration: and this oftener ariſes from vegetables; as we ſee, in thoſe hot countries where intermittents prevail, they are oftener induced from a ſurfeit of vegetable than of animal food. A proof of this is, that when one is recovering of an intermittent, there is nothing more apt to cauſe a relapſe than cold food, eſpecially if taken on thoſe days when the fit ſhould return, and particularly aceſcent, fermentable vegetables, as ſallad, melons, cucumbers, &c. acido-dulces, &c. are the moſt frequent cauſes of epidemics; therefore, when an intermittent is to be avoided, we ſhun vegetable diet, and give animal foods, although their ſtimulus be greater.

II. *In the Inteſtines.*

When the putreſcency of animal food has gone too far, it produces an active ſtimulus, cauſing diarrhœa, dyſentery, &c. But theſe effects are but rare: whereas from vegetable food and its acid, which, united with the bile, proves a pretty ſtrong ſtimulus, they more frequently occur; but luckily, are of leſs conſequence, if refrigeration is not very great. In the autumnal ſeaſon, when there is a tendency to dyſentery, if it is obſerved that eating of fruits brings it on, it is rather to be aſcribed to their cooling than ſtimulating the inteſtines.

As to *ſtool*—Wherever neither putrefaction, nor acidity, has gone a great length, animal food keeps the belly more regular. Vegetable food gives a greater proportion of feculent matter, and, when exſiccated by the ſtomach and inteſtines, is more apt to ſtagnate, and produce ſlow belly and coſtiveneſs, than animal ſtimulating food; which, before it comes to the great guts, where ſtoppage is made, has attained a putrefactive tendency, and gives a proper ſtimulus: and thus thoſe who are coſtive from the uſe of vegetables, when they have recourſe to animal-food are in this reſpect better.

III. *In the Blood Veſſels.*

They both give a blood of the ſame kind, but of a different quality. Animal-food gives it in greater quantity, being in great part, as the expreſſion is, convertible in *ſuccum et ſanguinem*, and of eaſy digeſtion; whereas vegetable is more watery, and contains a portion of unconquerable ſaline matter, which cauſes it to be thrown out of the body by ſome excretion. Animal-food affords a more denſe ſtimulating elaſtic blood than vegetable: ſtretching and cauſing a greater reſiſtance in the ſolids, and again exciting their ſtronger action. It has been ſuppoſed, that aceſcency of vegetable food is carried into the blood-veſſels, and there exerts its effects; but the tendency of animal-fluids is ſo ſtrong to alkaleſcency, that the exiſtence of an acid acrimony in animal-blood ſeems very improbable. Animal-food alone will ſoon produce an alkaleſcent acrimony; and if a perſon who lives entirely on vegetables were to take no food for a few days, his acrimony would be alkaleſcent.

IV. *Quantity of Nutriment.*

We are next to take notice of the quantity of nutriment theſe different foods afford. Nutriment is of two kinds: the firſt repairs the waſte of the ſolid fibres; the other ſupplies certain fluids, the chief of which is oil. Now, as animal-food is eaſier converted, and alſo longer retained in the ſyſtem, and as it contains a greater proportion of oil, it will afford both kinds of nutriment more copiouſly than vegetables.

V. Laſtly, *The Different degrees of Perſpirability of theſe Foods.*

This is not yet properly determined. Sanctorius conſtantly ſpeaks of mutton as the moſt perſpirable of all food, and of vegetables as checking perſpiration. This is a conſequence of the different ſtimulus thoſe foods give to the ſtomach, ſo that perſons who live on vegetables have not their perſpiration ſo ſuddenly excited. In time of digeſtion, perſpiration is ſtopped from whatever food, much more ſo from cooling vegetables. Another reaſon why vegetables are leſs perſpirable is, becauſe their aqueo-ſaline juices determine them to go off by urine, while the more perfectly mixed animal food is more equally diffuſed over the ſyſtem, and ſo goes off by perſpiration. Hence Sanctorius's accounts may be underſtood; for vegetable aliment is not longer retained in the body, but moſtly takes the courſe of the kidneys. Both are equally perſpirable in this reſpect, viz. that a perſon living on either, returns once a day to his uſual weight; and if we conſider the little nouriſhment of vegetables, and the great tendency of animal food to corpulency, we muſt allow that vegetable is more quickly perſpired than animal food. As to the queſtion, whether man was originally deſigned for animal or vegetable food, ſee the article CARNIVOROUS.

With regard to the effects of theſe foods on men, it muſt be obſerved, that there are no perſons who live entirely on vegetables. The Pythagoreans themſelves eat milk; and thoſe who do ſo moſtly, as theſe Pythagoreans, are weakly, ſickly, and meagre, labouring under a conſtant diarrhœa and ſeveral other diſeaſes. None of the hardy, robuſt, live on theſe; but chiefly ſuch as gain a livelihood by the exertion of their mental faculties, as (in the Eaſt Indies) factors and brokers; and this method of life is now confined to the hot climates, where vegetable diet, without inconvenience, may be carried to great exceſs. Though it be granted, therefore, that man is intended to live on theſe different foods promiſcuouſly, yet the vegetable ſhould be in very great proportion. Thus the Laplanders are ſaid to live entirely on animal food: but this is contradicted by the beſt accounts; for Linnæus ſays, that beſides milk, which they take ſour, to obviate the bad effects of animal food, they uſe alſo calla, menianthes, and many other plants copiouſly. So there is no inſtance of any nation living entirely either on vegetable or animal food, though there are indeed ſome who live particularly on one or other in the greateſt proportion. In the cold countries, e. g. the inhabitants live chiefly on animal food, on account of the rigour of the ſeaſon, their ſmaller perſpiration, and little tendency to putrefaction. Of more importance, however, is the following than the former queſtion, viz.

In what Proportion Animal and Vegetable Food ought to be mixed?

Animal food certainly gives moſt ſtrength to the ſyſtem. It is a known aphoriſm of Sanctorius, that *pondus addit robur*; which may be explained from the impletion of the blood veſſels, and giving a proper degree of tenſion for the performance of ſtrong oſcillations. Now animal food not only goes a greater way in ſupplying fluid, but alſo gives the fluid more denſe and elaſtic. The art of giving the utmoſt ſtrength to the ſyſtem is beſt underſtood by thoſe who breed fighting cocks. Theſe people raiſe the cocks to a certain weight, which muſt bear a certain proportion to the other parts of the ſyſtem, and which at the ſame time is ſo nicely proportioned, as that, on loſing a few ounces of it, their ſtrength is very conſiderably impaired. Dr. Robinſon of Dublin has obſerved, that the force and weight of the ſyſtem ought to be determined by the largeneſs of the heart, and its proportion to the ſyſtem: for a large heart will give large blood-veſſels, while at the ſame time the viſcera are leſs, particularly the liver; which laſt being increaſed in ſize, a greater quantity of fluid is determined into the cellular texture, and leſs into the ſanguineous ſyſtem. Hence we ſee how animal food gives ſtrength, by filling the ſanguiferous veſſels. What pains we now beſtow on cocks, the ancients did on the Athletæ, by proper nouriſhment bringing them to a great degree of ſtrength and agility. It is ſaid that men were at firſt fed on figs, a proof of which we have from their nutritious quality; however, in this reſpect they were ſoon found to fall far ſhort of animal food; and thus we ſee, that men, in ſome meaſure, will work in proportion to the quality of their food. The Engliſh labour more than the Scots; and wherever men are expoſed to hard labour, their food ſhould be animal. Animal food, although it gives ſtrength, yet loads the body; and Hippocrates long ago obſerved, that the athletic habit, by a ſmall increaſe, was expoſed to the greateſt hazards. Hence it is only proper for bodily labours, and entirely improper for mental exerciſes; for whoever would keep his mind acute and penetrating, will exceed rather on the ſide of vegetable food. Even the body is oppreſſed with animal food; a full meal always produces dulneſs, lazineſs and yawning; and hence the feeding of gameſters, whoſe mind muſt be ready to take advantage, is always performed by avoiding a large quantity of animal food. Farther, with regard to the ſtrength of the body, animal-food in the firſt ſtage of life is hardly neceſſary to give ſtrength: in manhood, when we are expoſed to active ſcenes, it is more allowable; and even in the decline of life, ſome proportion of it is neceſſary to keep the body in vigour. There are ſome diſeaſes which come on in the decay of life, at leaſt are aggravated by it; among theſe the moſt remarkable is the gout. This, when it is in the ſyſtem, and does not appear with inflammation in the extremities, has pernicious effects there, attacking the lungs, ſtomach, head, &c. Now to determine this to the extremities, a large proportion of animal food is neceſſary, eſpecially as the perſon is commonly incapable of much exerciſe.

Animal Food.

Although it gives ſtrength, is yet of many hazards to the ſtyſtem, as it produces plethora and all its conſequences. As a ſtimulus to the ſtomach and to the whole ſyſtem, it excites fever, urges the circulation, and promotes the perſpiration. The ſyſtem, however, by the repetition of theſe ſtimuli, is ſoon worn out; and a man who has early uſed the athletic diet, is either early carried off by inflammatory diſeaſes, or, if he takes exerciſe ſufficient to render that diet ſalutary, ſuch an accumulation is made of putreſcent fluids, as in his after-life lays a foundation for the moſt inveterate chronic diſtempers. Therefore it is to be queſtioned, whether we ſhould deſire this high degree of bodily ſtrength, with all the inconveniences and dangers attending it. Thoſe who are chiefly employed in mental reſearches, and not expoſed to too much bodily labour ſhould always avoid an exceſs of animal-food. There is a diſeaſe which ſeems to require animal-food, viz. the hyſteric or hypochondriac; and which appears to be very much a-kin to the gout, affecting the alimentary canal. All people affected with this diſeaſe are much diſpoſed to aceſcency; which ſometimes goes ſo far, that no other vegetable but bread can be taken in, without occaſioning the worſt conſequences. Here then we are obliged to preſcribe an animal-diet, even to thoſe of very weak organs; for it generally obviates the ſymptoms. However, ſeveral inſtances of ſcurvy in exceſs have been produced by a long continued uſe of this diet, which it is always unlucky to be obliged to preſcribe; and when it is abſolutely neceſſary to preſcribe, it ſhould be joined with as much of the vegetable as poſſible, and when a cure is performed we ſhould gradually recur to that again. Next let us conſider the

Vegetable Diet.

The chief inconveniency of this is difficulty of aſſimilation; which, however, in the vigorous and exerciſed, will not be liable to occur. In warm climates, the aſſimilation of vegetable aliment is more eaſy, ſo that there it may be more uſed, and when joined to exerciſe gives a pretty tolerable degree of ſtrength and vigour; and though the general rule be in favour of animal diet, for giving ſtrength, yet there are many inſtances of their being remarkably produced from vegetable. Vegetable diet has this advantage, that it whets the appetite, and that we can hardly ſuffer from a full meal of it. Beſides the diſorders it is liable to produce in the *primæ viæ*, and its falling ſhort to give ſtrength, there ſeem to be no bad conſequences it can produce in the blood-veſſels; for there is no inſtance where its peculiar acrimony was ever carried there, and it is certainly leſs putrifiable than animal food; nor, without the utmoſt indolence, and a ſharp appetite, does it give plethora, or any of its conſequences: ſo that we cannot here but conclude, that a large proportion of vegetable food is uſeful for the generality of mankind. There is no error in this country more dangerous, or more common, than the neglect of bread: for it is the ſafeſt of vegetable aliment, and the beſt corrector of animal food; and, by a large proportion of this alone, its bad conſequences, when uſed in a hypochondriac ſtate, have been obviated. The French apparently have as much animal-food on their tables as the Britons; and yet, by a greater uſe of bread and the dried acid fruits, its bad effects are prevented; and therefore bread ſhould be particularly uſed by the Engliſh, as they are ſo voracious of animal food. Vegetable food is not only neceſſary to ſecure health, but long life: and, as we have ſaid, in infancy and youth we ſhould be confined to it moſtly; in manhood, and decay of life, uſe animal food, and near the end vegetable again. There is another queſtion much agitated, viz.

What are the Effects of Variety in Food?

Is it neceſſary and allowable, or univerſally hurtful; variety of a certain kind ſeems neceſſary; as vegetable and animal foods have their mutual advantages, tending to correct each other. Another variety, which is very proper, is that of liquid and ſolid food, which ſhould be ſo managed as to temper each other; and liquid food, eſpecially of the vegetable kind, is too ready to paſs off before it is properly aſſimilated, while ſolid food makes a long ſtay. But this does not properly belong to the queſtion, whether variety of the ſame kind is neceſſary or proper, as in animal-foods, beef, fiſh, fowl, &c. It doth not appear that there is any inconvenience ariſing from this mixture, or difficulty of aſſimulation, provided a moderate quantity be taken. When any inconvenience does ariſe, it probably proceeds from this, that one of the particular ſubſtances in the mixture, when taken by itſelf, would produce the ſame effect; and, indeed, it would appear, that this effect is not heightened by the mixture, but probably obviated by it. There are few exceptions to this, if any, e. g. taking a large proportion of aceſcent ſubſtances with milk. The coldneſs, &c. acidity, flatulency, &c. may appear; and it is poſſible that the coagulum, from the aceſcency of the vegetables, being ſomewhat ſtronger induced, may give occaſion to too long retention in the ſtomach, and to acidity in too great degree. Again, the mixture of fiſh and milk often occaſions inconveniences. The theory of this is difficult, though, from univerſal conſent, it muſt certainly be juſt. Can we ſuppoſe that fiſh gives occaſion to ſuch a coagulum as runnet? If it does ſo, it may produce bad effects. Beſides, fiſhes approach ſomewhat to vegetables, in giving little ſtimulus; and are accuſed of the ſame bad effects as theſe, viz. bringing on the cold fit of fever.

Thus much may be ſaid for variety. But it alſo has its diſadvantages, provoking to gluttony; this, and the art of cookery, making men take in more than they properly can digeſt: and hence, perhaps, very juſtly, phyſicians have univerſally almoſt preferred ſimplicity of diet; for, in ſpite of rules, man's eating will only be meaſured by his appetite, and ſatiety is ſooner produced by one than by many ſubſtances. But this is ſo far from being an argument againſt variety, that it is one for it, as the only way of avoiding a full meal of animal food, and its bad effects, is by preſenting a quantity of vegetables. Another mean of preventing the bad effects of animal food, is to take a large proportion of liquid; and hence the bad effects of animal food are leſs felt in Scotland, on account of their drinking much with it, and uſing broths, which are at once excellent correctors of animal food and preventives of gluttony.

With regard to the differences between animal foods, properly ſo called, the firſt regards their ſolubility, depending on a lax or firm texture of their different kinds.

I. *Solubility of Animal Food,*

Seems to deſerve leſs attention than is commonly imagined; for there are many inſtances of perſons of a weak ſtomach incapable of breaking down the texture of vegetables, or even of diſſolving a light pudding, to whom hung beef, or a piece of ham, was very grateful and eaſily digeſted. None of the theories given for the ſolution of animal-food in the human ſtomach ſeem to have explained that proceſs ſufficiently. Long ago has been diſcarded the ſuppoſition of an active corroſive menſtruum there; and alſo the doctrine of trituration, for which, indeed, there ſeems no mechaniſm in the human body; and, till lately, phyſicians commonly agreed with Boerhaave in ſuppoſing nothing more to be neceſſary than a watery menſtruum, immoderate heat, and frequent agitation. This will account for ſolution in ſome caſes, but not entirely. Let us try to imitate it out of the body with the ſame circumſtances, and in ten times the time in which the food is diſſolved in the ſtomach we ſhall not be able to bring about the ſame changes. Take the coagulated white of an egg, which almoſt every body can digeſt, and yet no artifice ſhall be able to diſſolve it. Hence, then, we are led to ſeek another cauſe for ſolution, viz. fermentation; a notion indeed, formerly embraced, but, on the introduction of mechanical philoſophy, induſtriouſly baniſhed, with every other ſuppoſition of that proceſs taking place at all in the animal œconomy. Many of the ancients imagined this fermentation to be putrefactive. But this we deny, as an acid is produced; though hence the fermentation might be reckoned the vinous, which, however, ſeems always to be morbid. Neither, indeed is the fermentation purely acetous, but modified by putreſcence; for Pringle has obſerved, that animal-matters raiſe and even expedite the acetous proceſs. The fermentation, then, in the ſtomach is of a mixed nature, between the acetous and the putrefactive, mutually modifying each other; though, indeed, in the inteſtines, ſomewhat of the putrefactive ſeems to take place, as may be obſerved from the ſtate of the fæces broke down, and from the little diſpoſition of ſuch ſubſtances to be ſo, which are not liable to the putrefactive proceſs, as the firmer parts of vegetables, &c. Upon this view ſolution ſeems to be extremely eaſy, and thoſe ſubſtances to be moſt eaſily broke down which are moſt ſubject to putrefaction. But ſolution alſo depends on other circumſtances, and hence requires a more particular regard.

1. There is a difference of ſolubility with reſpect to the manducation of animal-food, for which bread is extremely neceſſary, in order to keep the more ſlippery parts in the mouth till they be properly comminuted. See the Article Bread. From want of proper manducation perſons are ſubject to eructations; and this more frequently from the firm vegetable foods, as apples, almonds, &c. than from the animal, though, indeed, even from animal food, very tendinous, or ſwallowed in unbroken maſſes, ſuch ſometimes occur. Manducation is ſo much connected with ſolution, that ſome, from imperfectly performing that, are obliged to belch up their food, remanducate it, and ſwallow it again before the ſtomach can diſſolve it, or proper nouriſhment be extracted. Another proof of our regard to ſolubility, is our rejecting the firmer parts of animal food, as bull-beef, and generally carnivorous animals.

2. Its effects with regard to ſolubility, ſeem alſo to be the foundation of our choice between fat and lean, young and old meats. In the lean, although, perhaps, a ſingle fibre might be ſufficiently tender, yet theſe, when collected in faſciculi, are very firm and compact, and of difficult ſolution; whereas in the fat there is a greater number of veſſels, a greater quantity of juice, more interpoſition of cellular ſubſtance, and conſequently more ſolubility. Again, in young animals, there is probably the ſame

number of fibres as in the older, but theſe more connected: whereas, in the older, the growth depending on the ſeparation of theſe, and the increaſe of veſſels and cellular ſubſtance, the texture is leſs firm and more ſoluble; which qualities, with regard to the ſtomach, are at that time too increaſed, by the increaſed alkaleſcency of the animal. To this alſo may be referred our choice of caſtrated animals, viz. on account of their diſpoſition to fatten after the operation.

3. It is with a view to the ſolubility, that we make a choice between meats recently killed, and thoſe which have been kept for ſome time. As ſoon as meat is killed, the putrefactive proceſs begins; which commonly we allow to proceed for a little, as that proceſs is the moſt effectual breaker down of animal matters, and a great aſſiſtance to ſolution. The length of time during which meat ought to be kept, is proportioned to the meat's tendency to undergo the putrid fermentation, and the degree of thoſe circumſtances which favour it: thus in the Torrid Zone, where meat cannot be kept above four or five hours, it is uſed much more recent than in theſe northern climates.

4. Boiled or roaſted meats create a difference of ſolution. By boiling we extract the juices interpoſed between the fibres, approximate them more to each other, and render them of more difficult ſolubility; which is increaſed too by the extraction of the juices, which are much more alkaleſcent than the fibres: but when we want to avoid the ſtimulus of alkaleſcent food, and the quick ſolution, as in ſome caſes of diſeaſe, the roaſted is not to be choſen. Of roaſted meats it may be aſked, which are more proper, thoſe which are moſt or leaſt roaſted? That which is leaſt done is certainly the moſt ſoluble: even raw meats are more ſoluble than dreſſed, as Dr. Cullen was informed by a perſon who from neceſſity was obliged, for ſome time, to eat ſuch. But at the ſame time that meats little done are very ſoluble, they are very alkaleſcent; ſo that, wherever we want to avoid alkaleſcency in the primæ viæ, the moſt roaſted meats ſhould be choſen. Thoſe who throw away the broths of boiled meat do very improperly; for, beſides their ſupplying a fluid, from their greater alkaleſcency, they increaſe the ſolubility of the meat. Here we ſhall obſerve, that pure blood has been thought inſoluble. Undoubtedly it is very nutritious; and though out of the body, like the white of eggs, it ſeems very inſoluble, yet, like that too, in the body it is commonly eaſily digeſted. Moſes very properly forbad it the Iſraelites, as, in warm countries, it is highly alkaleſcent; and even here, when it was uſed in great quantity, the ſcurvy was more frequent: but to a moderate uſe of it, in theſe climates, no ſuch objection takes place. 5. Solubility is varied from another ſource, viz. viſcidity of the juice of aliment. Young animals, then, appear more ſoluble than old, not only on account of the compaction and firmneſs of texture in the latter, but alſo their greater viſcidity of juice. And nothing is more common, than to be longer oppreſſed from a full meal of veal, than from the ſame quantity of beef, &c. Upon account, too, of their greater viſcidity of juice, are the tendinous and ligamentous parts of animals longer retained than the purely muſcular, as well as on account of their firmneſs of texture. Even fiſhes, whoſe muſcular parts are exceedingly tender, are, on account of their gluey viſcocity, longer of ſolution in the ſtomach. And eggs, too, which are exceedingly nouriſhing, have the ſame effect, and cannot be taken in great quantity: for the ſtomach is peculiarly ſenſible to gelatinous ſubſtances; and by this means has nature perhaps taught us, as it were by a ſort of inſtinct, to limit ourſelves in the quantity of ſuch nutritive ſubſtances.

6. With regard to ſolution, we muſt take in the oils of animal-food; which, when tolerably pure, are the leaſt putreſcent part of it, and, by diminiſhing the coheſion of the fibres, render them more ſoluble. On this laſt account is the lean of fat meat more eaſily diſſolved than other lean. But when the meat is expoſed to much heat, this oil is ſeparated, leaving the ſolid parts leſs eaſily ſoluble, and becoming itſelf empy-reumatic, ranceſcent, and of difficult mixture in the ſtomach. Fried meats, from the reaſons now given, and baked meats, for the ſame, as well as for the tenacity of the paſte, are preparations which diminiſh the ſolubility of the food. From what has been ſaid, the preparation of food by fattening it, and keeping it for ſome time after killed, although it may adminiſter to gluttony, will yet, it muſt be confeſſed, increaſe the ſolution of the food.

II. *The Second Difference of Animal Food is with regard to Alkaleſcency.*

1. From their too great alkaleſcency we commonly avoid the carnivorous animals, and the feræ; and chooſe rather the granivorous. Some birds, indeed, which live on inſects, are admitted into our food; but no man, without nauſea, can live upon theſe alone for any length of time. Fiſhes, too, are an exception to this rule, living almoſt univerſally on each other. But in theſe the alkaleſcency does not proceed ſo far; whether from the viſcidity of their juice, their want of heat, or ſome peculiarity in their economy, is not eaſy to determine.

2. Alkaleſcency is determined by difference of age. The older animals are always more alkaleſcent than the young, from their continual progreſs to putrefaction. Homberg always found, in his endeavours to extract an acid from human blood, that more was obtained from the young than from the old animals.

3. A third circumſtance which varies the alkaleſcency of the food, is the wildneſs or tameneſs of the animal; and this again ſeems to depend on its exerciſe. We knew a gentleman who was fond of cats for food: but he always uſed to feed them on vegetable food, and kept them from exerciſe; and in the ſame manner did the Romans rear up their rats, when intended for food. In the ſame way the fleſh of the partridge and the hen ſeems to be much the ſame; only, from its being more on the wing, the one is more alkaleſcent than the other. Again, tame animals are commonly uſed without their blood; whereas the wild are commonly killed in their blood, and upon that account, as well as their greater exerciſe, are more alkaleſcent.

4. The alkaleſcency of food may be determined from the quantity of volatile ſalt it affords. The older the meat is, it is found to give the greater proportion of volatile ſalt.

5. The alkaleſcency of aliment may alſo, in ſome meaſure, be determined from its colour, the younger animals being whiter and leſs alkaleſcent. We alſo take a mark from the colour of the gravy poured out, according to the redneſs of the juices, judging of the animals alkaleſcency.

6. The reliſh of food is found to depend much on its alkaleſcency, as does alſo the ſtimulus it gives, and the fever it produces in the ſyſtem. Theſe effects are alſo complicated with the viſcidity of the food, by which means it is longer detained in the ſtomach and the want of alkaleſcency ſupplied. Having mentioned animal food as differing in ſolubility and alkaleſcency, which often go together in the ſame ſubject, we come to the third difference viz.

III. *Quantity of Nutriment.*

Which is either abſolute or relative: abſolute with reſpect to the quantity it really contains, ſufficient powers being given to extract it; relative, with reſpect to the aſſimilatory powers of thoſe who uſe it. The abſolute nutriment is of ſome conſequence; but the relative, in the robuſt and healthy, and except in caſes of extraordinary weakneſs, may, without much inconvenience, be diſregarded. In another caſe is the quantity of nouriſhment relative, viz. with regard to its perſpirability; for if the food is ſoon carried off by the excretions, it is the ſame thing as if it contained a leſs proportion of nouriſhment. For giving more fluid, that which is longer retained affords moſt; and, for the repair of the ſolids, that attention alſo is of advantage. Now gelatinous ſubſtances are long retained; and are, beſides, animal ſubſtances themſelves, diſſolved: ſo that, both abſolutely and relatively, ſuch ſubſtances are nutritious. Of this kind are eggs, ſhell-fiſh, &c. In adults, though it is diſputed whether their ſolids need any repair, yet, at any rate, at this period, fluid is more required; for this purpoſe the alkaleſcent foods are moſt proper, being moſt eaſily diſſolved. They are at the ſame time, the moſt perſpirable; on one hand that alkaleſcency leading to diſeaſe, while on the other their perſpirability obviates it. Adults, therefore, as writers juſtly obſerve, are better nouriſhed on the alkaleſcent; the young and growing, on gelatinous foods. All this leads to a compariſon of young and old meats; the firſt being more gelatinous, and the laſt more alkaleſcent. This, however, by experience, is not yet properly aſcertained. Mr. Geoffroy is the only perſon who has been taken up with the analyſis of foods. See *Memoirs de l' Academie*, l' an 1731 & 1732. His attempt was certainly laudable, and in ſome reſpects uſefully performed; but, in general, his experiments were not ſufficiently repeated, nor are, indeed, ſufficiently accurate. He has not been on his guard againſt the various circumſtances which affect meats; the cow kind liking a moiſt ſucculent herbage, which is not to be got in warm climates; while the ſheep are fond of a dry food, and thrive beſt there. Again, ſome of his experiments ſeem contradictory. He ſays, that veal gives more ſolution than beef, while lamb gives leſs than mutton, which is much to be doubted. If both he and Sanctorius had examined the Engliſh beef, the reſult, probably, would have been very different as to its perſpirability, &c. Beſides, Mr. Geoffroy has only analyſed beef and veal when raw; has made no proper circumſtantial compariſons between quadrupeds and birds; and has examined theſe laſt along with their bones, and not their muſcles, &c. by themſelves, as he ought to have done, &c. If a ſet of experiments of this kind were properly and accurately performed, they might be of great uſe; but, at preſent, for the purpoſe of determining our preſent ſubject, we muſt have recourſe to our alkaleſcency ſolubility, &c.

IV. *The Fourth Difference of Animal Food, is the Nature of the Fluids they afford.*

The whole of this will be underſtood, from what has been ſaid on alkaleſcency; the fluid produced being more or leſs denſe and ſtimulating, in proportion as that prevails.

V. *The Fifth Difference of Animal Foods is with Reſpect to their Perſpirability.*

The ſum of what can be ſaid on this matter is this, that ſuch foods as promote an acumulation of fluid in our veſſels, and diſpoſe to plethora, are the leaſt perſpirable, and commonly give moſt ſtrength; that the more alkaleſcent foods are the moſt perſpirable, though the viſcid and leſs alkaleſcent may attain the ſame property by long retention in the ſyſtem. The authors thers on perſpirability have determined the perſpiration of foods as imperfectly as Mr. Geoffroy has done the ſolubility, and in a few caſes only. We muſt not lay hold on what Sanctorius has ſaid on the perſpirability of mutton, becauſe he has not examined, in the ſame way, other meats in their perfect ſtate; far leſs on what Keil ſays of oyſters, as he himſelf was a valetudinarian, and conſequently an unfit ſubject for ſuch experiments, and probably of a peculiar temperament. As to the effects of Food on the Mind, we have already hinted at them above. It is plain, that delicacy of feeling, livelineſs of imagination, quickneſs of apprehenſion, and acuteneſs of judgment, more frequently accompany a weak ſtate of the body. True it is, indeed, that the ſame ſtate is liable to timidity, fluctuation, and doubt; while the ſtrong have that ſteadineſs of judgment, and firmneſs of purpoſe, which are proper for the higher and more active ſcenes of life. The moſt valuable ſtate of the mind, however, appears to reſide in ſomewhat leſs firmneſs and vigour of body. Vegetable aliment, as never overdiſtending the veſſels or loading the ſyſtem, never interrupts the ſtronger motions of the mind; while the heat, fulneſs, and weight, of animal food, are an enemy to its vigorous efforts. Temperance, then, does not ſo much conſiſt in the quantity, for that always will be regulated by our appetite, as in the quality, viz. a large proportion of vegetable aliment.

Food *of Plants*. See Syſtem of AGRICULTURE.

FOP, is uſed to denote a perſon who cultivates a regard to adventitious ornament and beauty to exceſs.

FORAMEN, in anatomy, a name given to ſeveral apertures or perforations in divers parts of the body; as, the external and internal foramina of the cranium or ſkull. The foramina in the upper and lower jaw. Foramen lachrymale. Foramen membranæ tympani.

Foramen *Ovale*, an oval aperture or paſſage through the heart of a fœtus, which cloſes up after birth. It ariſes above the coronal vein, near the right auricle, and paſſes directly into the left auricle of the heart, ſerving for the circulation of the blood in the fœtus, till ſuch time as the infant breathes, and the lungs are open; it being generally reckoned one of the temporary parts of the fœtus, wherein it differs from an adult; although almoſt all anatomiſts, Mr. Cheſelden excepted, aſſure us, that the foramen ovale has ſometimes been found open in adults. See FOETUS.

FORCE, in mechanics, denotes the cauſe of the change in the ſtate of a body when, being at reſt, it begins to move, or has a motion, which is either not uniform or not direct. See Syſtem of MECHANICS.

Force, in law, ſignifies any unlawful violence offered to things or perſons, and is divided into ſimple and compound. *Simple force*, is what is ſo committed, that it has no other crime attending it; as where a perſon by force enters on another's poſſeſſion, without committing any other unlawful act. *Compound force*, is where ſome other violence is committed with ſuch an act which of itſelf alone is criminal: as if one enters by force into another's houſe, and there kills a perſon or raviſhes a woman. There is likewiſe a force implied in law, as in every treſpaſs, reſcue, or diſſeiſin, and an actual force with weapons, number of perſons, &c. Any perſon may lawfully enter a tavern, inn, or victualling-houſe; ſo may a landlord his tenant's houſe to view repairs, &c. But if, in theſe caſes, the perſon that enters commits any violence or force, the law will intend that he entered for that purpoſe.

Force is alſo divided into *true force*, or *force after a ſort*. There are other branches; as forcible entries, forcible detaining, or holding unlawful aſſemblies, routes, riots, rebellions, &c.

Force, in grammar, and ſome other arts, is applied to a thing which ſtands in lieu of, or has the ſame effect, as another. In our language, the ſ between two vowels has the force or power of a *z*, and is ſometimes put for a *z*; as in horiſon, baptiſing, &c. In Hebrew, the *dageſh*; and in Arabic, the *teſdid*; have the force of a letter ſuppreſſed. An unit before a cypher, has the force of ten.

FORCEPS, a ſurgeon's inſtrument, wherewith dead and corrupt parts are ſeized, cut, or pulled off, &c. As alſo foreign bodies extracted out of wounds, &c. The word literally denotes a pair of tongs. They are of divers forms: long, crooked, with teeth, with beaks, half-mooned, &c. The forceps is alſo uſed for extracting the fœtus in caſes of preternatural delivery. The inſtrument uſed for this purpoſe is either ſtrait or curved. The ſtrait forceps is uſed for bringing the head of the child forward, when on account of its ſize, or the want of pains, it cannot otherwiſe be protruded; but the uſe of them requires great care; and it is obſerved, that inſtruments of this kind are never neceſſary, whilſt the head is above the brim of the pelvis, and rarely when it hath deſcended lower. Dr. Hunter abſolutely forbids the uſe of them, if they can poſſibly be avoided. Thoſe improved by Smellie are the beſt, who has reduced their length, in order to prevent their being uſed before the head is low enough. The long curved forceps was invented by Smellie, with a view of ſaving the life of the child, when the body being delivered, the head could not be brought away in the uſual manner. Theſe are longer than the ſtrait ones, becauſe they are applied, when the head of the child is above the brim of the pelvis. The ſtrait and curved forceps, as well as the blunt hook, are uſed to expedite and facilitate delivery; whereas the crotchet, which has a hook at its point that is forced into the part to which it is applied, wounds, and generally kills the child. See Syſtem of MIDWIFERY.

FORCER, in mechanics, is properly a piſton, without a valve. There are ſeveral ways of making forcers; the moſt common of all conſiſts of a braſs cylinder, a very little leſs in diameter, at its bottom and top, than the bore of the barrel of the pump, and turned ſtill leſs at the middle, in order to let in a leathern ring or collar (made of a thick leather put round the braſs cylinder,) which makes it juſt equal to the bore of the barrel, ſo as to fit it quite when it is put into it.

FORCIBLE *Entry*, a violent, actual entry into houſes, or lands, &c. with menaces or weapons, whether violence or hurt be offered to any perſon therein, or not.

Forcible *Holding*, or *detaining*, a with-holding by violence, and with a ſtrong hand, of the poſſeſſion of land, &c. whereby he who has a lawful right of entry is barred or hindered. This was formerly allowable to every perſon diſſeiſed, or turned out of poſſeſſion, unleſs his entry was taken away or barred by his own neglect, or other circumſtances. But being found very prejudicial to the public peace, it was thought neceſſary, by ſeveral ſtatutes, to reſtrain all perſons from the uſe of ſuch violent methods even of doing themſelves juſtice: ſo that the entry now allowed by law is a peaceable one.

Forcible *Abduction*, and *Marriage*, vulgarly called ſtealing an heireſs. By ſtat. 3 Hen. VII. cap. 2. it is enacted, that if any perſon ſhall, for lucre, take any woman, maid, widow, or wife, having ſubſtance either in goods or lands, or being heir apparent to her anceſtors, contrary to her will, and afterwards ſhe be married to ſuch miſdoer, or by his conſent to others, or defiled; ſuch perſon, and all his acceſſaries, ſhall be deemed principal felons: and by ſtat. 39 Eliz. cap. 9. the benefit of clergy is taken away from all ſuch felons, except acceſſaries after the offence. See MARRIAGE.

FORCING, in the wine trade, a term uſed by the wine coopers for the fining down wines, and rendering them fit for immediate draught.

Forcing, among gardeners, is uſed for producing ripe fruits from trees before their natural ſeaſon. The method of doing it is this: a wall ſhould be erected ten foot high; a border muſt be marked out on the ſouth ſide of it, of about four foot wide, and ſome ſtakes muſt be faſtened into the ground all along the edge of the border; theſe ſhould be four inches thick. They are intended to reſt the glaſs-lights upon, which are to ſlope backwards to the wall, to ſhelter the fruit as there ſhall be occaſion; and there muſt be at each end a door to open either way, according as the wind blows. The frame ſhould be made moveable along the wall, that when a tree has been forced one year, the frame may be removed to another, and ſo on, that the trees may be each of them forced only once in three years, at which rate they will laſt a long time. They muſt be always well-grown trees that are choſen for forcing, for young ones are ſoon deſtroyed, and the fruit that is produced from them is never ſo well taſted. The fruits moſt proper for this management are the avant, or ſmall white nutmeg, the albermarle, the early Newington, and the brown nutmeg peaches; Mr. Fairchild's early, and the elrugo and Newington nectarins; the maſculine apricot, and the May-duke and May-cherry. For grapes, the white and black ſweet-water are the moſt proper; and of gooſeberries, the Dutch white, the Dutch early green, and the walnut gooſeberry; the large Dutch white, and large Dutch red currants. The dung, before it is put to the wall, ſhould be laid together on a heap for five or ſix days, that it may heat uniformly through; and when thus prepared, it muſt be laid four foot thick at the baſe of the wall, and go ſloping up, till it is two foot thick at the top. It muſt be laid at leaſt within three or four inches of the top of the wall, and when it ſinks, as it will ſink two or three feet, freſh dung muſt be laid; for the firſt heat will do little more than juſt ſwell the bloſſom-buds. The covering of the trees with glaſſes is of great ſervice, but they ſhould be taken off to admit the benefit of gentle ſhowers to the trees.

FORE, applied to a ſhip, denotes all that part of a ſhip's frame and machinery which lies near the ſtem.

Fore and *Aft* is uſed for the whole ſhip's length, or from end to end.

Fore *Caſtle of a Ship*, is a ſhort deck placed in the fore part of the ſhip, above the upper deck.

FORECLOSED, in our ancient law books, ſignifies barred, ſhut out, or excluded for ever: as, when the equity of redemption on MORTGAGES is barred.

FOREIGN, ſomething extraneous, or that comes from abroad.

Foreign in the Engliſh law, is uſed in various ſignifications. Thus, Foreign attachment, is an attachment of the goods of foreigners found within a city or liberty, for the ſatisfaction of ſome citizen to whom the foreigner is indebted; or it ſignifies an attachment of a foreigner's money in the hands of another perſon. Foreign kingdom, a kingdom under the dominion of a foreign prince. At the inſtance of an ambaſſador or conſul, an offender againſt the laws here may be ſent for hither from a foreign kingdom to which he hath fled. And, where a ſtranger of Holland, or any foreign country, buys goods at London, for inſtance, and then goes away privately into Holland; in that caſe, the ſeller may have a certificate from the lord mayor, on the proof of the ſale and delivery of ſuch goods, whereupon a proceſs will be executed on the party in Holland. Foreign ſeamen, ſerving two years on board Britiſh ſhips, whether of war, trade, or privateers, during the time of war, ſhall be deemed natural born ſubjects.

FOREIGNER, the natural born ſubject to ſome foreign prince. Foreigners, though made denizens, or naturalized, are diſabled to bear any office in government, to be of the privy council, or members of parliament, &c. This is by the acts of the ſettlement of the crown. Such perſons as are not freemen of a city or corporation, are alſo called foreigners, to diſtinguiſh them from the members of the ſame.

FOREIGNERS reſiding ſeven years in the Britiſh plantations, without any longer abſence than two months at one time, and taking the oaths, are to be deemed natural born ſubjects. But, excepting quakers and Jews, all other perſons muſt receive the ſacrament in ſome proteſtant or reformed congregation in Great Britain, or the colonies; a certificate whereof muſt be produced at the time of taking the oaths. 13 Geo. II. cap. 7 ſect. 2. See NATURALIZATION.

FOREJUDGER, in law, ſignifies a judgment whereby one is deprived, or put by a thing in queſtion. To be forejudged the court, is where an officer or attorney of any court is expelled the ſame for mal-practice, or for not appearing to an action on a bill filed againſt him, &c. And where an attorney of the common-pleas is ſued, the plaintiff's attorney delivers the bill to one of the criers of the court, who calls the attorney defendant, and ſolemnly proclaims aloud, that, if he does not appear thereto, he will be forejudged: likewiſe a rule is given by the ſecondary for his appearance: and if the attorney appears not in four days, then the clerk of the warrants ſtrikes ſuch an attorney off the roll of attorneys; after which he becomes liable to be arreſted like any other perſon: but where an attorney is forejudged, he may be reſtored on clearing himſelf from his contumacy, and making ſatisfaction to the plaintiff, &c.

FOREJUDGED *the Court*, is when an officer of any court is baniſhed, or expelled the ſame, for ſome offence; or for not appearing to an action by bill filed againſt him; in which latter caſe, he is not to be admitted to officiate, till he appear to the bill. Anno 2 Hen. IV. cap. 8.

FOREST, in geography, a large wood or great extent of ground covered with trees. The Caledonian and Hercynian foreſts are famous in hiſtory. The firſt was a celebrated retreat of the ancient Picts and Scots: the latter anciently poſſeſſed the greateſt part of Europe; particularly Germany, Poland, Hungary, &c. In Cæſar's time it extended from the borders of Alſatia and Switzerland to Tranſylvania, and was computed ſixty days journey long, and nine broad: ſome parts or cantons thereof are ſtill remaining. The foreſt of Dean in Glouceſterſhire, is famous for the iron works therein. The ancients adored foreſts, and imagined a great part of their gods to reſide therein: temples were frequently built in the thickeſt foreſts, the gloom and ſilence whereof naturally inſpired ſentiments of devotion, and turned men's thoughts within themſelves. For the like reaſon, the ancient Druids made foreſts the place of their reſidence, and performed their ſacrifices, inſtructed their youth, and gave laws therein. See DRUIDS.

FOREST, in a law ſenſe, is defined a certain territory of woody grounds and fruitful paſtures, privileged for wild beaſts and fowls of foreſt, chace, and warren, to reſt and abide in, under protection of the king, for his recreation and delight; bounded with unremoveable marks and meres, either known by matter of record or preſcription. The properties and characters of a foreſt are, firſt, that it cannot be in the hands of any but the king; becauſe none elſe had power to conſtitute ſuch commiſſions as are neceſſary to the being of a foreſt, beſide the king; as, particularly, that of juſtice in eyre of the foreſt. And yet the abbot of Whitby had a foreſt by grant of king Henry II. and king John, with all officers incident thereto. The ſecond character, is the courts belonging thereto, which are, the juſtice-ſeat, and the regard, held every third year; the ſwanimote, held thrice every year; and the attachment, once every forty days.

The third characteriſtic is the officers belonging thereto, for preſervation of the game as the juſtices of the foreſt, the warder or keeper, ranger, verderers, foreſters, agiſtors, regarders, bailiffs, beadles, &c. See each under its proper article, JUSTICE *of the foreſt*, KEEPER, &c.

New foreſt in Hampſhire, hiſtory tells us, was made by the deſtruction of twenty-two pariſh churches, and all the villages, manors, chapels, &c. for the ſpace of thirty miles together. Beſide New Foreſt, there are now ſubſiſting ſixty-eight foreſts in England, &c. thirteen chaces, the four principal foreſts are New-foreſt on the ſea, Shirewood-foreſt on the Trent, Dean-foreſt on the Severn, and Windſor-foreſt on the Thames.

A foreſt in the hands of a ſubject is properly the ſame thing with a chaſe; being ſubject to the common law, and not to the foreſt laws. But a chaſe differs from a foreſt, in that it is not incloſed; and likewiſe, that a man may have a chaſe in another man's ground as well as his own; being indeed the liberty of keeping beaſts of chaſe, or royal game therein, protected even from the owner of the land, with a power of hunting them thereon. See PARK.

Our ancient Norman kings were the firſt who incloſed foreſts; and ſettled the juriſdiction thereof. In the courſe of a few reigns from the Conqueſt, no leſs than ſixty-eight foreſts were incloſed; the ſtricteſt laws were made to ſecure them, and the ſevereſt penalties inflicted on all treſpaſſers thereon. William the Conqueror decreed the eyes of any perſon to be pulled out, who took either a buck or boar: William Rufus, made the ſtealing of a doe a hanging matter; the taking of a hare was fined 20s. and a coney at 10s. Eadmer adds, that fifty perſons of fortune, being apprehended by that laſt prince for killing his bucks, were forced to purge themſelves by the fire of ordeal, &c. Henry I. made no diſtinction between him who killed a man, and him who killed a buck; and puniſhed thoſe who deſtroyed the game, though not in the foreſt, either by forfeiture of their goods, or loſs of limbs; though Henry II. remitted it for a temporary impriſonment. Richard I. revived the old diſcipline of gelding and pulling out the eyes of thoſe convicted of hunting in the foreſt: but he afterwards relaxed a little, and was contented to make ſuch convicts abjure the realm, or be committed, or pay a fine.

FOREST *Law*. The foreſt laws are peculiar laws, different from the common law of England. Before the making of Charta de Foreſta, in the time of king John and his ſon Henry III. confirmed in parliament by 9 Henry III. offences committed therein were puniſhed at the pleaſure of the king, in the ſevereſt manner. By this charter, many foreſts were diſafforeſted and ſtripped of their oppreſſive privileges, and regulations were made for the government of thoſe that remained; particularly, killing the king's deer was made no longer a capital offence, but only puniſhed by fine, impriſonment, or abjuration of the realm: yet even in the charter there were ſome grievous articles, which the clemency of later princes have ſince by ſtatute thought fit to alter *per aſſiſas* foreſtæ.

FOREST *Trees*. Many are wholly averſe to pruning foreſt trees; but though it is to be done with care, and under proper regulations (ſee LOPPING), yet it is by no means to be wholly omitted. It may be obſerved in foreſts and large woods, that for one tree which thrives well, there are twenty that grow faulty, and all this is owing to the want of pruning or lopping in a proper manner, for this, when wiſely executed, is a renewal of their age, and of their growth too; the want of it being what occaſions trees to run out into ſuckers, and to load themſelves with uſeleſs boughs, which draw away the ſap from the upper part, and make it grow knotty and diſtempered, and uſually covered with moſs.

FORE *Staff*, an inſtrument uſed at ſea, for taking the altitude of heavenly bodies. The fore ſtaff, called alſo croſs ſtaff, takes its denomination hence, that the obſerver, in uſing it, turns his face towards the object, in contradiſtinction to the back ſtaffs where he turns his back to the object.

FORESTALLING, the buying or bargaining for corn, cattle, or other merchandize, by the way, before it reaches the market or fair, to be ſold; or by the way, as it comes beyond the ſeas, or otherwiſe, toward any city, port, haven, or creek, of this realm, with deſign to take advantage thereof, and ſell it again at a more advanced and dear rate. By the 5th and 6th Edw. VI. cap. 14. any buying or contracting for merchandize, victuals, or other things whatſoever, in the way, coming by land or water to any fair or market, or to any port, &c. to be ſold, or cauſing the ſame to be bought; or diſſuading people by word, letter, or meſſage, or otherwiſe, from bringing ſuch things to market; or perſuading them to enhance the price after they are brought thither; is foreſtalling: and the party guilty of any offence of foreſtalling, &c. upon conviction at the quarter-ſeſſions by two witneſſes, on bill, information, preſentment, &c. ſhall, for the firſt offence, loſe the goods ſo bought, or the value of them, and ſuffer two months impriſonment; for the ſecond offence, he ſhall forfeit double the value, and be impriſoned ſix months; and for the third offence, he ſhall loſe all his goods, be ſet up in the pillory, and be impriſoned at the king's pleaſure.

FORFEITURE, originally ſignifies a tranſgreſſion or offence againſt ſome penal law. But the word is now frequently uſed for the effect of ſuch tranſgreſſion, or the loſing ſome right, privilege, eſtate, honour, office, or effects, in conſequence thereof than for the tranſgreſſion itſelf; as forfeiture of eſcheats, forfeiture of goods, &c. A fee becomes vacant by the forfeiture or rebellion of the vaſſal.

Goods forfeited, and goods confiſcated, differ: thoſe which have a known owner, who has committed ſome offence, whereby he loſes his goods, are ſaid to be forfeited: thoſe which an offender diſavows, as not his own, and which are not claimed by any other, are ſaid to be confiſcated, ſtat. 25 Edw. III. Add, that forfeiture, or forfeit, is more general; and confiſcation more particular, being principally uſed for ſuch as forfeit only to the king's exchequer.

The true reaſon of any forfeiture for crimes, ſays judge Blackſtone, is this; that all property is derived from ſociety, being one of thoſe civil rights which are conferred upon individuals, in exchange for that degree of natural freedom, which every man muſt ſacrifice when he enters into ſocial communities; if, therefore, a member of any national community violates the fundamenta contract of his aſſociation, by tranſgreſſing the municipal law, he forfeits his right to ſuch privileges as he claims by that contract; and the ſtate may very juſtly reſume that portion of property, or any part of it, which the laws have before aſſigned him. Hence, in every offence of an atrocious kind, the laws of England have exacted a total confiſcation of the moveables or perſonal eſtate; and in many caſes a perpetual, in others only a temporary loſs of the offender's immoveables or landed property; and have veſted them both in the king, who is the perſon ſuppoſed to be offended, being the one viſible magiſtrate in whom the majeſty of the public reſides. Blackſt. Com. vol. i. p. 299.

FORFICULA, the ear-wig, in entomology, a genus of inſects belonging to the order of coleoptera. The antennæ are briſtly; the elytra are dimidiated; the wings are covered; and the tail is forked. There are two ſpecies, viz. the auriculata, or common ear-wig, with the tops of the elytra white; and the minor, with teſtaceous and unſpotted elytra. It is a very troubleſome creature, frequently introducing itſelf into the ears, and cauſing a great deal of pain by its biting: it likewiſe burrows in other parts of the body; which it bites in the ſame manner. For the claſſification, ſee ſyſtem of ENTOMOLOGY.

Ear-wigs are very miſchievous vermin in gardens, eſpecially where carnations are preſerved; for they are ſo fond of theſe flowers, that, if care is not taken to prevent them, they will entirely deſtroy them, by eating off the ſweet part at the bottom of the petals or leaves. To prevent this, moſt people have ſtands erected, which have a baſon of earth or lead round each ſupporter, which is conſtantly kept filled with water. Others hang the hollow claws of crabs and lobſters upon ſticks in divers parts of the garden, into which thoſe vermin get; and by often ſearching them, you will deſtroy them without much trouble, which will be of great ſervice to your wall fruit, for theſe are great deſtroyers alſo of all ſoft fruits.

FORGE properly ſignifies a littlefurnace, wherein ſmiths, and other artificers in iron or ſteel, &c. heat their metals red hot, in order to ſoften and render them more malleable and manageable on the anvil, &c. We ſay, a farrier's forge, ſilverſmith's forge, cutler's forge, lockſmith's forge, &c. The forge uſed by the ſeveral operators in iron is very ſimple; we ſhall inſtance in that of the blackſmith, to which all the reſt are reducible.

The hearth or fire place, is a maſs of brick, about two feet ſix inches high: the back of the forge is built upright to the cieling, and is incloſed over the fire place with a hovel, which leads into a chimney, to carry away the ſmoke. In the back of the forge, againſt the fire place, is a thick iron plate, with a taper pipe fixed therein, about five inches long, called the tewel, into which the noſe or pipe of the bellows is received: the uſe of this plate and tewel is, to preſerve the pipe of the bellows, and the back of the hearth, from being burnt. Right before the back, at about two feet diſtance, is the trough, filled with water, to wet the coals with, and thereby increaſe their force, as alſo to quench the iron in. Behind the back of the forge is placed the bellows, one of whoſe boards is fixed ſo, that it moves not, either upward or downward; and to the other is fitted [illegible]e, chain, or even a rod, which riſing perpendicularly, is fixed to a croſs piece, called the rocker, which moving on a kind of fulcrum near the middle, ſerves as a handle. By drawing down this handle, the moveable board of the bellows riſes, and, by a conſiderable weight at the top of its upper ſide, it ſinks down again, and, by this alternate agitation, performs the neceſſary motions of a pair of bellows. See BELLOWS.

Braziers and copperſmiths forge differs but little from that already deſcribed; only that it is much leſs, and that nothing is burnt in it but charcoal, the metals uſed by theſe operators not working well with pit-coal. Forge is alſo uſed for a large furnace, wherein iron ore, taken out of the mine, is melted down. But this is not ſo properly called a forge as a furnace.

FORGE is more properly uſed for another kind of furnace wherein the iron ore, melted down and ſeparated in a former furnace, and there caſt into ſows and pigs, is heated; and fuſed over again, and beaten afterwards with large hammers, and thus rendered more ſoft, pure, ductile, and fit for uſe. Of theſe forges there are two kinds, which the iron ſucceſſively paſſes through, before it comes to the ſmith. The firſt is called the finery, where the pigs are worked into groſs iron, and prepared for the ſecond, which is called the chafery, where it is farther wrought into bars fit for uſe.

FORGE, *Travelling*, in the train of artillery, is a kind of portable ſmith's ſhop, by means of which any neceſſary work may be performed on a march, as well as in camp. This kind of forge has been formerly fixed in a carriage with two wheels, and wooden ſupporters, to prop the forge when uſed: but they are now commonly made with four wheels, ſo that they ſtand more firmly, and are more eaſily removed.

FORGE *for Red-hot Balls*, is a place where the balls are made red hot before they are fired off: it is conſtructed about five or ſix feet below the ſurface of the ground, of ſtrong brick-work, and an iron grate upon which the balls are laid with a large fire under them.

FORGERY, in law, is where a perſon fraudulently make and publiſhes falſe writings, to the prejudice of another man's right: and forgery is either at common law, or by ſtatute, puniſhable by indictment, information, &c. But there can be no forgery where no one can be prejudiced by it, but the perſon doing it. 1 Salk. 375. Forgery, by common law, extends to a falſe and fraudulent making or altering of a deed or writing, whether it be matter of record, or any other writing, deed, or will. 3 Inſt 169. 1 Roll. abr. 65. Not only where a falſe deed is made, but where a fraudulent alteration is made of a true deed in a material part of it, it is forgery. By a late act, an offender forging or counterfeiting any deed, will, bond, bill of exchange, note, or acquittance for money, or any indorſement or aſſigment of a bill, &c. with intent to defraud any perſon, or publiſhing ſuch falſe deed, &c. to be true, knowingly, ſhall be guilty of felony, and ſuffer death as a felon; but not to work any corruption of blood, &c. Stat. 2 Geo. II. cap. 25. 7 Geo. II. cap. 22.

By an act paſſed in 1778, explaining the former laws on the ſubject of forgeries, it is enacted, that making or forging, &c. or cauſing to be made or forged, &c. or aſſiſting in making or forgeing, &c. any acceptance of any bill of exchange, or the number or principal ſum of any accountable receipt for any note or bill, or any warrant or order for payment of money or delivery of goods, with intention to defraud any corporation, or publiſhing as true any ſuch forged acceptance, &c. incur the guilt of felony, and the puniſhment of death, without benefit of clergy, 18 Geo. III.

FORGING, in the mechanic arts, the act of beating or hammering iron on an anvil, after having firſt made it red-hot in the forge in order to extend it into various forms, and faſhion it into works. Iron is hammered and forged two ways; either by the force of the hand, in which there are uſually ſeveral perſons employed, one of them turning the iron, and hammering likewiſe, and the reſt only hammering. Or, it is done by the force of a water mill, which raiſes and works ſeveral huge hammers, beyond the force of man, under the ſtrokes whereof the workmen preſent large lumps or peices of iron, which are ſuſtained, at one end, by the anvils, and, at the other, by iron chains faſtened to the ceiling of the forge. This laſt way of forging is only uſed in the largeſt works, as anchors for ſhips, &c. which uſually weigh ſeveral thouſand pounds. For the lighter works, a ſingle man ſuffices to hold, heat, and turn, with one hand, while he ſtrikes with the other. Each purpoſe for which the work is deſigned, requires its proper heat. If it be too cold it will not feel the weight of the hammer, as the ſmiths call it, i. e. it will not ſtretch or give way; and, if it be too hot, it will red-ſear, i. e. it will break or crackle under the hammer. The ſeveral heats the ſmiths give to their irons are. 1. A blood-red heat. 2. A white-flame heat. 3. A ſparkling or welding heat.

FORM, in phyſics, the eſſential or diſtinguiſhing modification of the matter whereof a natural body is compoſed, ſo as thereby to give it ſuch a particular manner of exiſtence; being that which conſtitutes it ſuch a particular body, and diſtinguiſhes it from every other body.

FORM is alſo uſed, in a moral ſenſe, for the manner of being or doing a thing according to rules: thus we ſay, a form of government, a form of argument, &c.

FORM, in law, the rules eſtabliſhed and requiſite to be obſerved in legal proceedings. The formal part of the law, or method of proceeding, cannot be altered but by parliament; for if once theſe outworks were demoliſhed, there would be an inlet to all manner of innovation in the body of the law itſelf.

FORM, in carpentry, is uſed to denote the long ſeats or benches in the choirs of churches or in ſchools, for the prieſts, prebends, religious, or ſcholars, to ſit on. At ſchools, the word form is frequently applied to what is otherwiſe termed a claſs. See CLASS.

FORM alſo denotes the external appearance or ſurface of a body, or the diſpoſition of its parts, as to the length, breadth, and thickneſs.

FORM is alſo uſed, among mechanics, for a ſort of mould whereon any thing is faſhioned or wrought.

Printer's FORM, an aſſemblage of letters, words, and lines, ranged in order, and ſo diſpoſed into pages by the compoſitor; from which by means of ink and a preſs, the printed ſheets are drawn. Every form is incloſed, in an iron chaſe, wherein it is firmly locked by a number of pieces of wood: ſome long and narrow, and others of the form of wedges. There are two forms required for every ſheet, one for each ſide; and each form conſiſts of more or fewer pages, according to the ſize of the book.

Hatter's FORM, is a large block or piece of wood, of a cylindrical figure; the top thereof rounded, and the bottom quite flat. Its uſe is, to mould or faſhion the crown of the hat, after the matter thereof has been beaten and fulled.

Paper-maker's FORM, is the frame or mould wherein the ſheets are faſhioned. See PAPER.

FORMA *Pauperis*, or *in* FORMA *Pauperis*, is when a perſon has a cauſe or ſuit, but is ſo poor that he cannot defray the uſual charges of ſuing at law, or in equity. In this caſe, upon his making oath that he is not worth 5l. his debts being paid, and bringing his certificate from ſome lawyer, that he has juſt cauſe of ſuit, the judge admits him to ſue *in forma pauperis*; that is without paying fees to the councellor, attorney, or clerk. This cuſtom has its beginning from ſtat. 11 Hen. VII. cap. 12.

FORMAL, ſomething that regards the form; or that gives the manner, or form.

The formal cauſe joining itſelf to the material, produces the body or compound. The ſchoolmen alſo apply the word to any thing which has a kind of form, either eſſential or accidental, at leaſt, in our conception. Thus we frequently hear the philoſophers talk of the formal object of knowledge; and of the formal reaſon of any thing; formal unity, &c. Formal cauſe is defined, by certain philoſophers, to be ſomething implanted in one parcel of matter, whereby it is diſtinguiſhed from all other matter. For matter is ſuppoſed common to all bodies: conſequently, that they are diſtinguiſhable from one another, does not ariſe from their matter, but from the form which is peculiar to each: hence, what is produced by ſuch cauſe, is ſaid to be formal. Hence it follows, that the cauſalty of matter and form is not the ſame: or that the component power and the actual compoſition, are different; contrary to the opinion of the generality of ſchoolmen, who, maintaining form to be a ſubſtance co-extended with matter, make it a real component part, as much as matter itſelf.

FORMAL is alſo uſed in a moral ſenſe, importing poſitive, expreſs, and preciſe. Thus we ſay, a formal agreement, a formal text, formal anſwer, &c. Formal evidence.

FORMALITIES, in matters of law, are frequently uſed for the formulas themſelves, or the rules preſcribed for judiciary proceedings. In contracts of ſtrict law, all the formalities muſt be ſtrictly obſerved: an omiſſion of the leaſt formality may ruin the whole convention. The term is alſo uſed for a certain order, or decorum, to be obſerved.

FORMATION, in philoſophy, &c. the act of forming, faſhioning, or producing a thing.

FORME', or FORMY, in heraldry. A croſs formé, or formy, is a croſs narrow in the centry, and broad at the extremes.

FORMICA, or the ANT, in entomology, a genus of inſects belonging to the order of hymenoptera, the characters of which are theſe: There is a ſmall ſcale betwixt the breaſt and belly, and the joint is ſo deep, that the animal appears as if it were almoſt cut through the body. The females, and the neuters or working ants which have no ſexual characteriſtics, are furniſhed with a hidden ſting; and both the males and females have wings, but the neuters have none. There are 18 ſpecies, moſt of them diſtinguiſhed by their colours. Theſe inſects keep together in companies like bees, and maintain a ſort of republic. Their neſt is exactly ſquare, but longer one way than the other; and in it there are a ſort of paths, which lead to different magazines. Some of the ants are employed in making the ground firm, by mixing it with a ſort of glue, for fear it ſhould crumble and fall down upon their heads. They may be ſometimes ſeen to gather ſeveral twigs, which ſerve them for rafters, which they place over the paths, to ſupport the covering; they lay others acroſs them, and upon them ruſhes, weeds, and dried graſs, which they heap up into a double declivity, which ſerves to turn off the water from their magazines. Some of theſe ſerve to lay up their proviſions in, and in others they lay their eggs.

As for the proviſions, they lay up every thing that is fit for them to eat; and you may often ſee one loaded with pippin or grain of fruit, another with a dead fly, and ſeveral together with the carcaſe of a May-bug or other inſect. If they meet with any thing they cannot bring away, they eat it upon the ſpot, or at leaſt ſo much of it as may reduce it to a bulk ſmall enough for them to carry. They do not run about where they pleaſe, at all adventures: for ſome of them are ſent abroad to make diſcoveries; and if they bring back news that they have met with a pear, or a ſugar-loaf, or a pot of ſweet-meats, they will run from the bottom of the garden, as high as the third ſtory of a houſe, to come at it. They all follow each other in the ſame path, without wandering to the right or the left; but in the fields they are more at their liberty, and are allowed to run about in ſearch of game. There is a ſort of green fly, that does a great deal of miſchief among the flowers, and which curls up the leaves of peach and pear trees; and theſe are ſurrounded with a ſort of glue, or honey, which the ants hunt after very greedily; for they touch neither the plant nor the flies themſelves. Next to this, their greateſt paſſion is to lay up hoards of wheat, and other corn; and for fear the corn ſhould ſprout by the moiſture of the ſubterraneous cells, they gnaw off the end which would produce the blade. The ants are often ſeen puſhing along grains of wheat, or barley, much larger than themſelves.

In Africa, and particularly in Guinea, the ants are exceedingly troubleſome, and do a great deal of miſchief. They make their neſts of earth in the fields, twice as high as a man; beſides which they build large neſts in high trees, from which places they advance in ſuch prodigious ſwarms to their houſes, that they frequently oblige the inhabitants to quit their beds in the night-time. If you place a worm or a beetle where only one or two ants are, they will immediately depart, and bring with them above an hundred; after which they ſeize their prey, and march off with it in good order. Theſe ants are of various ſorts; ſome great, others ſmall; ſome black, and others red: the ſting of this laſt is very painful, and cauſes an inflammation. the white are as tranſparent as cryſtal, and have ſuch ſtrong teeth, that in a night's time they will eat their way through a thick wooden cheſt, and make it as full of holes as if it had been penetrated by hail-ſhot.

The ant lays eggs in the manner of the common flies, and from theſe eggs are hatched a ſort of ſmall maggots, or worms without legs: theſe are ſharp at one end, and blunt at the other; and are white, but ſo tranſparent, that the inteſtines are ſeen through the ſkin. Theſe, after a ſhort time, change into large white aureliæ, which are what are uſually called ants eggs. That end which is to be the tail is the largeſt, and that which is the head is ſomewhat tranſparent. The ants move theſe about at pleaſure with their forceps. It is well known, that when a neſt of theſe creatures is diſturbed, and the auraliæ ſcattered about, the ants are at infinite pains to get together all that are unhurt, and make a neſt for them again: nay, any ants will do this, and thoſe of one reſt will often take care of the aureliæ of another.

The affection of the ant for its offspring is amazing. They carry the young worms about in their mouths, that nothing may injure them; and when the earth of the neſt is dry, they carry them down to a greater depth, but when wet they bring them to the ſurface, that they may not be injured by the damps. The common ant builds only with ſmall pieces of dry earth, and there is always found a vaſt quantity either of eggs, worms, or aureliæ, at the bottom of the neſt. The aureliæ are covered only with a thin ſkin; and when carefully opened, they ſhew the worm perfect, and in its ſeveral ſtages of perfection.

The forecaſt of ants in providing againſt the winter is a miſtake. They are ſuppoſed not to eat in the winter, but to ſpend that ſeaſon, like dormice and many other ſorts of animals, in a ſtate of ſleep. What confirms this is, that they have been obſerved, as the cold draws on in the autumn, to move very heavily, and in the vintage-time they can hardly ſtir at all: ſo that the proviſion they make ſeems intended not for themſelves, but for their young. The care theſe creatures take of their offspring is remarkable. Whenever a hill is diſturbed, all the ants are buſied in conſulting the ſafety, not of themſelves, but of the eggs or theſe larger bodies incloſing the maggot or young ant; they carry theſe down any way ſo as to get them out of ſight, and will do this over and over as often as they are diſturbed. They carry away the eggs and vermicles together in their confuſion; but, as ſoon as the danger is over, they carefully ſeparate them, and place each ſort in parcels by themſelves under ſhelter of different kinds, and at various depths, according to the different degrees of warmth and coverture the different ſtates require. In the warm ſeaſon of the year, they every morning bring up the eggs, as they are uſually called, to the ſurface, or nearly ſo; and from ten in the forenoon to five in the afternoon or thereabouts, all theſe will be found juſt under the ſurface; and if the hills be examined toward eight in the evening, they will be found to have carried them all down; and if rainy weather be coming on, it will be neceſſary to dig a foot deep or more, in order to find them. Theſe little creatures are very troubleſome in gardens, and in paſture-lands; as well by feeding on the fruit, as by making up hills for their habitation. In the hotter countries, as Italy, Spain, and the Weſt Indies, ants are the greateſt peſt of [illegible]. Trees may be preſerved from them by encompaſſing the [illegible], for four fingers breadth, with a roll of wool, newly pulled from the ſheep's belly; or by laying ſaw-duſt all round the ſtump of it. Some anoint the tree with tar, which has the ſame effect. For the claſſification of this inſect. See Syſtem of ENTOMOLOGY, Genus LXI.

FORMICA *Leo*, the Ant lion, in entomology, an inſect ſo called from its devouring great numbers of ants. It is the caterpillar or worm of a fly much reſembling the libellæ or dragon-flies; and feeds chiefly upon ants, from which property it derives its name. It is ſomewhat of the nature of the ſpider in its way of taking its prey, its manner of ſpinning, and the figure and ſoftneſs of its body. It has, in its general figure, ſomewhat of the appearance of the millepes or wood-louſe, ſo that ſome have miſtaken it at firſt ſight for that animal. It is of a dirty greyiſh colour, marked with ſome black ſpots; and theſe are alſo compoſed of many points when viewed with a microſcope, which make it reſemble a hedgehog or porcupine. Its body is compoſed of ſeveral rings, and has thence a wrinkled look. It has ſix legs, four are joined to the breaſt, and the other two to a longer part, which may be taken for its neck. Its head is ſmall and flat, and it has two remarkable horns: theſe are about a ſixth part of an inch long, and as thick as a hair: they are hard, hollow, and hooked at the end like the claws of a cat. At the origin of each of theſe horns, it has a clear and bright black eye, which ſees very diſtinctly, and gives the creature notice to eſcape on ſight of the ſmalleſt object. This creature [illegible] not able to hunt after its prey, nor to deſtroy large inſects; [illegible] can only draw into its ſnares ſuch as come near its habitation, and of theſe very few are ſuch as he can manage: all the winged kind are able to eſcape by flight; and the beetle kinds, and others that have hard ſhells upon their bodies, are of no uſe to him, as his horns cannot pierce them. The ſmallneſs of the ant, and its want of wings, make it the deſtined prey of this devourer. The manner in which he catches his prey is as follows.

He uſually encamps under an old wall, that he may be ſheltered from the injuries of the weather; and he always chooſes a place where the ſoil is compoſed of a fine dry ſand. In this he makes a pit of the ſhape of a funnel, or an inverted hollow cone. If he intends the pit to be but ſmall, he thruſts down his hinder part into the ſand, and by degrees plunges himſelf backward into it; and when he has got to a certain depth, he toſſes out the looſe ſand which has run down with his head, artfully throwing it off beyond the edges of his pit. Thus he lies at the bottom of a ſmall hollow, which is wideſt at the top, and comes ſloping down to his body.

But if he is to make a larger pit, more pains are required to bring it to perfection. He firſt traces, in the ſurface of the ſand, a large circle, which is the erected baſe or mouth of the pit he is to make in form of an inverted cone. He then buries himſelf in the ſand near the edge of this circle, and carefully throws up the ſand above him, with his head toſſing it out beyond the circumference of the circle. Thus he continues his work, running down backwards in a ſpiral line all the way, and carefully throwing off the ſand from above him, till he is come to the place of his reſt, which is the point or reverted apex of the hollow cone he has formed by his paſſage. The length of his neck, and the flatneſs of his head, give him a power of uſing the whole as a ſpade, and throwing off the ſand with great eaſe; and his ſtrength in this part is ſo great, that he is able to throw off a quantity of it to ſix inches diſtance. This is a power he exerts oftener, however, in throwing away the remains of the animals he has fed upon, that his den may not become frightful to others of the ſame ſpecies, by ſeeing their fellow carcaſes about it.

When he has finiſhed his pit, he buries himſelf at the bottom of it among the ſand, leaving no part above ground but the tips of his two horns, which he expands to the two ſides of the pit. In this condition he lies and waits for his prey, and never comes up afterwards. When an ant, or any other ſuch creature, chances to walk over the edges of his pit, its ſteps throw down a little of the ſand, which naturally running down to the bottom of the pit, gives the enemy notice of his prey; he then toſſes up the ſand which covers his head, to bury the ant, and bring him down with its returning force to the bottom; and as one ſuch attempt cannot be ſufficient to prevent the ant's eſcape, he throws more and more ſand upon him, till he by degrees brings him down. All the endeavours of the ant to eſcape, when once it is within the verge of the pit, are in vain; for, as it attempts to climb, the ſand runs away from under its feet, and it ſinks the lower for every attempt.

This motion of the ſand alſo informs the enemy where it is, and directs him to throw up more ſand in the right place; which it does, till the poor ant falls to the bottom between its horns. It then plunges their points deep into the ant's body; and having ſucked out all the juice out of the prey, it throws out the empty ſkin as far from the hole as it can. This done, it mounts up the edges of its pit, and if it has ſuffered any injury, repairs it with great care, and immediately buries itſelf again in the centre, to wait for another meal. The horns of this creature are its only organs for receiving nouriſhment; it never brings any animal which it has ſeized near to its [illegible] but always holds it at the tip of the horns. They therefore only ſerve as ſyringes, to draw into its ſtomach the juices of the bodies of the inſects it feeds upon: neither is there any mouth or trunk, or any other organ to be diſcovered about its head, which could ſerve to the purpoſe of eating; the head ſeeming only intended for throwing away the ſand in forming the pit. The horns of this animal being ſo neceſſary to its life, nature has provided for the reſtoring them in caſe of accidents; and if cut off, they are found to grow again.

The food this creature procures by its pit can be but little; and as it has no power of catching its prey any other way, its motion being only backwards, and that ſlowly, and by ſmall ſpaces at a time, ſome people have believed its catching now and then an ant by this means was rather for diverſion than hunger. But though the formica leo will live a long time without food, and even paſs through all its changes, when ſhut up in a box, yet it always ready to eat when food is offered it; always appears ſtarved and ſmall when kept thus; and if a fly is given it in this hungry ſtate, it will ſo ſuck out all its juices, that the ſhell remaining may be rubbed to powder between the fingers, while the body of the creature that has ſucked it appears remarkably ſwelled and diſtended; ſo that it is plain that the juices of the prey are conveyed into the body of the creature; though it is not eaſy to ſee by what means, the horns not appearing to have any perforation.

When the formica leo has lived a proper time in this ſtate, it leaves its pit, and is only ſeen drawing lines and traces [illegible] the ſurface of the ſand. After this it buries itſelf under [illegible]; and there incloſes itſelf in a fine web, in which it is to [illegible] tranſformation into the winged ſtate.

When the creature has lain ſome time in this caſe, it [illegible] off its outer ſkin, with the eyes, the horns, and every other part neceſſary to its life before, and becomes an oblong nymph, which a careful eye may trace the form of the fly into which it is to be transformed. There may be ſeen, through its tranſparent covering, new eyes, new horns, wings, and all other parts of the animal in its perfect ſtate. This nymph makes its way about half out of the ſhell, and remains in this condition, but without farther life and motion, till the perfect fly makes its way out at a ſlit in the back. In this laſt ſtate it much reſembles the libellæ or dragon flies common about our waters. The male couples with the female in this ſtate only; and M. Poupart, to whom the world is obliged for this curious deſcription, is of opinion that the females lay only one egg; but this is very different from the courſe of nature in the other animals of the ſame claſs.

The common formica-leo moves only backward; but Mr Rouet has obſerved a ſpecies which moves forward in the common way of other animals, and makes no pit of this kind to entrap its prey, but ſeizes other inſects by force.

FORMING is uſed for the act of giving being or birth to any thing. The word is alſo ſimply uſed for giving the figure to any thing. The potter forms his veſſels as he pleaſes. Geometry teaches how to form all kinds of figures. It is alſo uſed for the producing of a thing: thus, the lineaments of the face began to be formed.

Forming *of a Siege*, is the making lines of circumvallation, to fortify the camp, and diſpoſing things for the attack of a place in form. They alſo ſay, to form a ſquadron or battalion; meaning to range the ſoldiers in form of a ſquadron, &c. The term is alſo uſed in ſpeaking of a body of forces, which being out of any order of ſquadrons, battalions, &c. do halt, range themſelves in order, and put themſelves in a condition for the attack. Forming the line, is drawing up infantry, cavalry, and artillery, into line of battle. See Line.

Forming is alſo uſed in grammar, in ſpeaking of certain tenſes of verbs, which are made from others, by a change of certain letters. The preſent tenſe is formed from the infinitive. Compound and derivative words alſo, and even all that have any etymology, are ſaid to be formed.

FORMULA, a rule, or model, or certain terms preſcribed and decreed by authority, for the form and manner of an act, inſtrument, proceeding, or the like.

FORMULARY, a writing, containing the form or formula of an oath, declaration, atteſtation, or abjuration, &c. to be made on certain occaſions. There are alſo formularies of devotion, of prayers, &c. Liturgies are formularies of the public ſervice in moſt churches.

FORNICATION, *Fornicatio*, from the *fornices* in Rome, where the lewd women proſtituted themſelves for money, is whoredom, or the act of incontinency, between ſingle perſons; for if either of the parties is married it is adultery. Formerly court-leets had power to enquire of and puniſh fornication and adultery; in which courts the king had a fine aſſeſſed on the offenders, as appears by the book of domeſday.

In the year 1650, when the ruling powers found it for their intereſt to put on the ſemblance of a very extraordinary ſtrictneſs and purity of morals, not only inceſt and wilful adultery were made capital crimes, but alſo the repeated act of keeping a brothel, or committing fornication, were, upon a ſecond conviction, made felony without benefit of clergy. But, at the reſtoration, when men, from an abhorrence of the hypocriſy of the late times, fell into a contrary extreme of licentiouſneſs, it was not thought proper to renew a law of ſuch unfaſhionable rigour. And theſe offences have been ever ſince left to the feeble-coercion of the ſpiritual court, according to the rules of the canon law; a law which has treated the offence of incontinence, nay, even adultery itſelf, with a great degree of tenderneſs and lenity; owing perhaps to the conſtrained celibacy of its firſt compilers. The temporal courts therefore take no cogniſance even of the crime of adultery otherwiſe than as a private injury.

FORRAGE, or Forage, proviſion for cattle, of hay, oats, and ſtraw; particularly in war. In marching, encamping, &c. care muſt be taken, that the cavalry may find forrage. A ratio of forrage is the portion of hay, ſtraw, and oats, allowed each horſeman, for the ſubſiſtence of his horſe one day; which is twenty pounds of hay, five of ſtraw, and ten pounds of oats.

Forrage *Guard*, in military affairs, a detachment ſent out to ſecure the forragers. The forrage guard is poſted at all places, where the enemies parties may come to diſturb the forragers. This guard is likewiſe called the covering party, and marches generally the night before the forraging, that they may be poſted in the morning before the forragers come. The guard conſiſts both of horſe and foot, and muſt ſtay at their poſt till the forragers be all come off the ground.

FORT, a little caſtle, or fortreſs; or a place of ſmall extent, fortified by art, or nature, or both. A fort is a work encompaſſed round with a moat, rampart, and parapet, to ſecure ſome high ground, or paſſage of a river; to make good an advantageous poſt; to fortify the lines and quarters of a ſiege.

FORTIFICATION, called alſo military architecture, is the art of fortifying or ſtrengthening a place, by making works around the ſame, ſuch as to render it capable of being defended by a ſmall force, againſt the attacks of a more numerous enemy.

SYSTEM OF FORTIFICATION.

WHEN villages and towns were firſt formed, it was found neceſſary, for the common ſafety, to encompaſs them with walls and ditches, in order to prevent all violence and ſudden ſurprizes from approaching enemies. When offenſive weapons were firſt invented, walls were made with loop-holes at proper diſtances in order to ſcreen the defenders againſt the arrows of the aſſailants; but finding, that as ſoon as the enemy got cloſe to the walls, they could from no part be diſcovered or repulſed, they added ſquare towers at proper diſtances from each other, ſo that every part of the wall might be defended by the adjacent ſides of the towers. But this manner of incloſing towns was found to be imperfect, becauſe there remained ſtill one of the faces of the towers which fronted the field, that could not be ſeen from any other part, and therefore could not be defended. To remedy this, they made the towers round inſtead of ſquare, imagining this figure to be the ſtrongeſt for reſiſting the battering engines, and likewiſe to be better defended from the other parts of the wall. Nevertheleſs part of theſe towers remained unſeen, and incapable of being defended, which made them change them again into ſquares as before; but, inſtead of preſenting a face to the field as formerly, they preſented an angle; and thus they obtained ſuch a diſpoſition of their works that no part could be attacked without being ſeen or defended by ſome other part.

The period, in which the modern practice of military architecture may be ſuppoſed to have taken its riſe, was that in which the old circular towers were firſt converted into baſtions, about the year 1500.

The firſt authors who have written of fortification, conſidered as a particular formed art, are La Treille, Alghiſi, Marchi, Paſino, Ramelli, Cataneo, and Speckle, who, as Mr. Robins ſays, was one of the greateſt geniuſes that has applied to this art. He was architect of the city of Straſburg, and died in the year 1589. He publiſhed a treatiſe of fortification in German, which was reprinted at Leipſic in 1736. Robins's Math. Tracts, vol. i. preface, p. 9. After them Errard, engineer to Henry the Great of France; Stevinus, engineer to the prince of Orange; Marolois, the chevalier de Ville, Lorini, Coehorn, the count de Pagan, and the marſhal de Vauban; which laſt two noble authors have contributed greatly to the perfection of the art. To whom we may add Scheiter, Mallet, Belidor, Blondel, Muller, &c.

From the idea and office of fortification may be drawn the following

Fundamental Axioms.

1. That the manner of fortifying ſhould be accommodated to that of attacking; ſo that no one manner can be aſſured always to hold, unleſs it be aſſured the manner of beſieging be incapable of being altered; and that to judge of the perfection of a fortification, the method of beſieging at the time when it was built muſt be conſidered. 2. All the parts of a fortification ſhould be able to reſiſt the moſt forcible machines uſed in beſieging, and they ſhould be equally ſtrong on all ſides. 3. A fortification ſhould be ſo contrived, as that it may be defended with as few men as poſſible; which conſideration, when well attended to, ſaves a vaſt deal of expence. 4. That the defendants may be in the better condition, they muſt not be expoſed to the enemy's guns and mortars; but the aggreſſors muſt be expoſed to theirs. 5. All the parts of a fortification ſhould be ſo diſpoſed as that they may defend each other: in order to which, every part muſt be flanked, ſo that there be no place where an enemy can lodge himſelf, either unſeen, or under ſhelter. 6. All the campaign around muſt lie open to the defendants; ſo that no hills or eminence muſt be allowed, behind which the enemy might ſhelter himſelf from the guns of the fortification; or from which he might annoy them with his own; wherefore the fortreſs, is to command all the place round about; conſequently the out-works muſt all be lower than the body of the place. 7. No line of defence is to be above point-blank muſket ſhot, which is from one hundred and twenty to one hundred and fifty fathom. 8. The acuter the angle at the centre, the ſtronger is the place; as conſiſting of the more ſides, and conſequently more defenſible. 9. All the defences ſhould be as nearly direct as poſſible. Such are the general laws and views of fortification.

Notwithſtanding all the improvements which have been made in the art of fortifying ſince the invention of gun-powder, that of attacking is ſtill ſuperior to it: engineers have tried in vain to render the advantages of a fortification equal to thoſe of the attack; the ſuperiority of the beſiegers fire, together with the greater number of men, obliges generally, ſooner or later, the beſieged to ſubmit. Fortification is either regular or irregular. Regular fortification, is that built in a regular polygon, the ſides and angles of which are all equal, being commonly about a muſket-ſhot from each other. Irregular fortification, on the contrary, is that where the ſides and angles are not uniform, equidiſtant, or equal; which is owing to the irregularity of the ground, valleys, rivers, hills, and the like.

SECT. I. OF REGULAR FORTIFICATION.

Although authors agree to the general form in the preſent manner of fortifying, yet they moſtly differ in particular conſtructions of the parts. As it would be both needleſs and ſuperfluous to treat of all the different methods hitherto propoſed, we ſhall content ourſelves with explaining thoſe only, which are moſt eſteemed by the beſt judges, and have been moſtly put in practice.

Conſtruction of M. Vauban's Method.

This method is divided into little, mean, and great, the little is chiefly uſed in the conſtruction of citadels, the mean in that of all ſorts of towns, and the great in particular caſes only. We ſhall give the conſtruction of the mean, as being moſt uſeful; and refer the reader to the table hereafter, for thoſe dimenſions which are different in theſe ſeveral fortifications. Inſcribe in a circle a polygon of as many ſides as the fortification is deſigned to have fronts; ſee *fig.* 1, plate II. let AB be one of the ſides of half an hexagon, which biſect by the perpendicular CD; divide half AC of it into nine equal parts, and one of theſe into ten others; then theſe diviſions will ſerve as a ſcale to conſtruct all the parts of the fortification, and each of them is ſuppoſed to be a toiſe or fathom, that is ſix French feet; and therefore the whole ſide AB is ſuppoſed to be 180 toiſes.

As the dividing a line into ſo many equal parts, is troubleſome and tedious; it is more convenient to have a ſcale of equal parts by which the works may be conſtructed. If therefore, in this caſe, the radius is taken equal to 180 toiſes, and the circle deſcribed with that radius being divided into ſix equal parts, or the radius being carried ſix times round, you will have an hexagon inſcribed; AB being biſected by the perpendicular CD as before, ſet off 30 toiſes from C to D, and draw the indefinite lines ADG, BDF; in which take the parts AE, BH, each equal to 50 toiſes; from the centre E deſcribe an arc through the point H, meeting AD in G, and from the centre H deſcribe an arc through the point E, meeting BD in F; or which is the ſame, make each of the lines EG, HF, equal to the diſtance EH; then the lines joining the points A, E, F, G, H, B, will be the principal or outline of the front. If the ſame conſtruction be performed on the other ſides of the polygon, you will have the principal or outline of the whole fortification. If, with a radius of 20 toiſes, there be deſcribed circular arcs, from the angular points B, A, M, T, and lines are drawn from the oppoſite angles E, H, &c. ſo as to touch theſe arcs their parts *ab*, *bc*, &c. together with theſe arcs, will repreſent the outline of the ditch.

Definitions.

1. The part FEALN, is called the baſtion. 2. AE, AL, the faces of the baſtion. 3. EF, LN, the flanks. 4. FG, the curtain. 5. FN, the gorge of the baſtion. 6. AG, BF, the lines of defence. 7. AB, the exterior ſide of the polygon. 8. CD, the perpendicular. 9. Any line which divides a work into two equal parts, is called the capital of that work. 10. *abc*, the counterſcarp of the ditch. 11. A, M, the flanked angles. 12. H, E, L, the angles of the ſhoulder, or ſhoulder only. 13. G, F, N, the angles of the flank. 14. Any angle whoſe point turns from the place is called a ſaliant angle, ſuch as A, M; and any angle whoſe point turns towards the place, re-entering angle, ſuch as *b*, F, N. 15. If there be drawn two lines parallel to the principal or outline, the one at 3 toiſes diſtance, and the other at 8 from it; then the ſpace *y*X, included between the principal one and that fartheſt diſtant, is called the rampart. And the ſpace *x x*, contained by the principal line, and that near to it, and which is generally ſtained black, is called the parapet. 16. There is a fine line drawn within four feet of the parapet, which expreſſes a ſtep called banquette.

N. B. All works have a parapet of three toiſes thick, and a rampart of 8 or 10, beſides their ſlopes. The rampart is elevated more or leſs above the level of the place, from 10 to 20 feet, according to the nature of the ground and the particular conſtructions of engineers. The parapet is a part of the rampart elevated from 6 to 7 ½ feet above the reſt, in order to cover the troops which are drawn up there from the fire of the enemy in a ſiege; and the banquette is two or three feet higher than the rampart, or about four feet lower than the parapet; ſo that when the troops ſtand upon it, they may juſt be able to fire over the parapet. 17. The body of the place, is all that which is contained within this firſt rampart: for which reaſon, it is often ſaid to conſtruct the body of the place; which means properly, the conſtruction of the baſtions and curtains. 18. All the works which are conſtructed beyond the ditch before the body of the place are called outworks.

TABLE.

	Forts.						Little Fortif.				Mean.		Great.	
Side of Polyg.	80	90	100	110	120	130	140	150	160	170	180	190	200	260
Perpendicul.	10	11	12½	14	15	16	20	21	23	25	30	31	25	22
Faces baſt.	22	25	28	30	33	35	40	42	45	47	50	53	55	60
Cap. of ravel.	25	28	30	35	38	40	45	50	50	52	55	55	60	50

In the firſt vertical column are the numbers expreſſing the lengths of the exterior ſides from 80 to 260. In the ſecond, the perpendiculars anſwering to theſe ſides. In the third, the lengths of the faces of baſtions; and in the fourth, the lengths of the capitals of the ravelins. The ſorts are moſtly, if not always, ſquares: for which reaſon, the perpendiculars are made one eighth of the exterior ſides; becauſe if they were more, the gorges of the baſtions would become too narrow. The little fortification is chiefly deſigned for citadels, and are commonly pentagons; the perpendiculars are made one ſeventh of the exterior ſide: the mean is uſed in all kinds of fortifications from an hexagon upwards to any number of ſides: and the great is ſeldom uſed but in an irregular fortification, where there are ſome ſides that cannot be made leſs without much expence; or in a town which lies near a great river, where the ſide next the river is made from 200 to 260 toiſes; and as that ſide is leſs expoſed to be attacked than any other, the perpendicular is made ſhorter, which ſaves much expence. The faces of the baſtions are all $\frac{2}{7}$ths of the exterior ſides, or nearly ſo, becauſe the fractions are neglected. It may be obſerved in general, that in all ſquares the perpendicular is $\frac{1}{8}$th of the exterior ſide, and all pentagons $\frac{1}{7}$th, and in all the reſt upwards $\frac{1}{6}$th.

1. *Conſtruction of Orillons and retired Flanks.*

Deſcribe the front MPQRST as before, and divide the flank into three equal parts, of which ſuppoſe S *r* to be one: from the oppoſite flanked angle M draw a line M *r*, in which take the part *m r* of 5 toiſes; take likewiſe R *n* in the line of defence M R, produced, equal to 5 toiſes, and join *n m*, upon which as a baſe deſcribe the equilateral triangle *n* P *m*, and from the angle P, oppoſite to the baſe as centre, is deſcribed the circular flank *n m*. And if S *r* be biſected by the perpendicular 1, 2, and another be erected upon the face S T, at S; the interſection 2 of theſe two perpendiculars, will be the centre of the arc which forms the oriſlon. The orillons are very uſeful, in covering the retired flanks, which cannot be ſeen but directly in the front; and as theſe orillons are round, they cannot be ſo eaſily deſtroyed as they would be if they were of any other figure.

2. *Conſtruction of Ravelins or Half-moons.*

Fig. 1. Plate I. Set off 55 toiſes, from the re-entering angle O of the counterſcarp, on the capital OL, or on the perpendicular produced, and from the point L draw lines to the ſhoulders A B; whoſe parts L M, L N, terminated by the counterſcarp, will be the faces, and MO, ON, the ſemi-gorges of the ravelin required. This is Mr. Vauban's method of conſtructing ravelins, according to ſome authors: and others will have the faces of the ravelin to terminate on thoſe of the baſtions within 3 toiſes of the ſhoulders; which ſeems to be the beſt way, for theſe ravelins cover the flanks much better than the others. The ditch before the ravelin is 12 toiſes, its counterſcarp parallel to the faces of the ravelins; and is made in a circular arc, before the ſaliant angle; as likewiſe all ditches are in general. When the ravelins are made with flanks, as in *fig.* 2, Plate I, the faces ſhould terminate on thoſe of the baſtions, at leaſt 5 toiſes from the ſhoulders. The flanks are made by ſetting off 10 toiſes from the extremities of the faces, from *f* to *h*, and from *m* to *l*; and from the points *h*, *l*, the flanks *h k*, *l p*, are drawn parallel to the capital L O of the ravelin. There are ſometimes redoubts made in the ravelin, ſuch as in *fig.* 1, Plate I. which is done by ſetting off 16 toiſes from the extremities of the faces on the ſemi-gorges from N to *b*, and from M to *a*; and from the points *b*, *a*, the faces are drawn parallel to thoſe of the ravelin: the ditch before the redoubt is 6 toiſes, and its counterſcarp parallel to the faces.

3. *Conſtruction of Tenailles.*

A tenaille is a work made in the ditch before the curtains, the parapet of which is only 2 or 3 feet higher than the level ground of the ravelin. There are three different ſorts: the firſt are thoſe as in *fig.* 3. Plate I. which are made in the direction of the lines of defence, leaving a paſſage of 3 toiſes between their extremities and the flanks of the baſtions, as likewiſe another of 2 in the middle for a bridge of communication to the ravelin.

The ſecond ſort are thoſe as in *fig.* 4. Plate I. Their faces are in the lines of defence, and 16 toiſes long, beſides the paſſage of 3 toiſes between them and the flanks of the baſtions; their flanks are found by deſcribing arcs from one ſhoulder of the tenaille as centre through the other, on which are ſet off 10 toiſes for the flanks deſired. The faces of the third ſort are 16 toiſes, as in the ſecond ſort, and the flanks are parallel to thoſe of the baſtions. The uſe in general of tenailles, is to defend the bottom of the ditch by a grazing fire, as likewiſe the level ground of the ravelin, and eſpecially the ditch before the redoubt within the ravelin, which can be defended from no where elſe ſo well as from them. The firſt ſort do not defend the ditch ſo well as the others, as being too oblique a defence; but as they are not ſubject to be enfiladed, M. Vauban has generally preferred them in the fortifying of places, as may be ſeen in the citadel of Lille, at Laudau, New Briſac, and in a great many other places. The ſecond ſort defend the ditch much better than the firſt, and add a low flank to thoſe of the baſtions; but as theſe flanks are liable to be enfiladed, they have not been much put in practice. This defect might however be remedied, by making them ſo as to be covered by the extremities of the parapets of the oppoſite ravelins, or by ſome other work. As to the third ſort, they have the ſame advantage as the ſecond, and are likewiſe liable to the ſame objections: for which reaſon, they may be uſed with the ſame precautions which have been mentioned in the ſecond. Tenailles are eſteemed ſo neceſſary, that there is hardly any place fortified without them: and it is not without reaſon. For when the ditch is dry, the part behind the tenailles ſerves as a place of arms, from which the troops may ſally, deſtroy the works of the enemy in the ditch, oppoſe their deſcent, and retire with ſafety; and the communication from the body of the place to the ravelin becomes eaſy and ſecure: which is a great advantage; for by that means the ravelin may make a much better defence, as it can be ſupplied with troops and neceſſaries at any time. And if the ditch is wet, they ſerve as harbours for boats, which may carry out armed men to oppoſe the paſſage over the ditch whenever they pleaſe; and the communication from the tenailles to the ravelin, becomes likewiſe much eaſier than it would be without them.

4. *Conſtruction of Lunettes.*

Fig. 5. Plate I. Lunettes are placed on both ſides of the ravelin, ſuch as B, to increaſe the ſtrength of a place: they are conſtructed, by biſecting the faces of the ravelin with the perpendicular LN; on which is ſet off 30 toiſes from the counterſcarp of the ditch, for one of its faces; the other face, PN, is found by making the ſemi-gorge TP of 25 toiſes: the ditch before the lunettes is 12 toiſes, the parapet 3, and the rampart 8, as in the ravelin. There is ſometimes another work made to cover the ſaliant angle of the ravelin, ſuch as A, called *bonnet*, whoſe faces are parallel to thoſe of the ravelin, and when produced biſect thoſe of the lunettes; the ditch before it is 10 toiſes. There are likewiſe lunettes, whoſe faces are drawn perpendicular to thoſe of the ravelin, within a third part from the ſaliant angle; and their ſemi-gorges are only 20 toiſes. Theſe kind of works may make a good defence, and coſt no very great expence: for as they are ſo near the ravelin, the communication with it is very eaſy, and one cannot well be maintained till they are all three taken.

5. *Conſtruction of Tenaillons.*

Fig. 6. Plate I. Produce the faces of the ravelin beyond the counterſcarp of the ditch, at a diſtance MN of 30 toiſes, and take on the counterſcarp of the great ditch 15 toiſes from the re-entering angle *p* to *q*, and draw N *q*; then *q* NM *p* will be the tenailles required; its ditch is 12 toiſes, that is, the ſame as that of the ravelin. Sometimes there is made a retired battery in the front of the tenaillons, as in B; this battery is 10 toiſes from the front to which it is parallel, and 15 toiſes long. There are commonly retrenchments made in the tenaillons, ſuch as O; their parapets are parallel to the fronts MN, and biſect the ſide PN; the ditch before this retrenchment is 3 toiſes: and there is a banquette before the parapet next to the ditch of about 8 feet, called *berm*; which ſerves to prevent the earth of the parapet (which ſeldom has any revetment) from falling into the ditch. It is to be obſerved, that the ravelin, before which tenaillons are conſtructed, muſt have its ſaliant angle much greater than the former conſtruction makes them; otherwiſe the ſaliant angle of the tenaillons become too acute: for which reaſon we made the capital of this ravelin 45 toiſes, and the faces terminate within 3 toiſes of the ſhoulders.

6. *Conſtruction of Counterguards.*

Fig. 2, 3. Plate II. When the counterguard is placed before the ravelin, ſet off 40 toiſes on the capital of the ravelin from the ſaliant angle A, to the ſaliant angle B, of the counterguard; and 10 from C to D, on the counterſcarp of the ditch.

When the counterguard is before the baſtion, its ſaliant angle F, *fig.* 3. is 50 toiſes from the ſaliant angle E of the baſtion, and the breadth near the ditch of the ravelin 10 toiſes as before. The ditch before the counterguards is 12 toiſes, and its counterſcarp parallel to the faces. Counterguards are made before the ravelin on ſome particular occaſions only; but are frequently conſtructed before the baſtions, as covering the flanks wonderfully well.

7. *Conſtructions of Hornworks.*

Fig. 4. Plate II. Produce the capital of the ravelin beyond the ſaliant angle A, at a diſtance AB of about 80 toiſes; draw DBI at right angles to AB; in which take BD, BI, each equal to 55 toiſes; and on the exterior ſide DI, trace a front of a polygon in the ſame manner as that of the body of the place, making the perpendicular BF 10 toiſes, and the faces 30.

The branches D *a*, I *d*, of the hornwork, when produced terminate, on the faces of the baſtions, within 5 toiſes of the ſhoulders, the ditch of the hornwork is 12 toiſes, and its counterſcarp parallel to the branches; and in the front terminates at the ſhoulders, in the ſame manner as the great ditch before the baſtions. The capital of the ravelin before the front of the hornwork is 35 toiſes, and the faces terminate on the ſhoulders, or rather 2 or 3 toiſes beyond them: and the ditch before the ravelin is 8 toiſes. There are ſometimes retrenchments made within the hornwork, ſuch as S, S; which are conſtructed by erecting perpendiculars to the faces of the ravelins, within 25 toiſes of their extremities. This retrenchment, like all others, has a parapet

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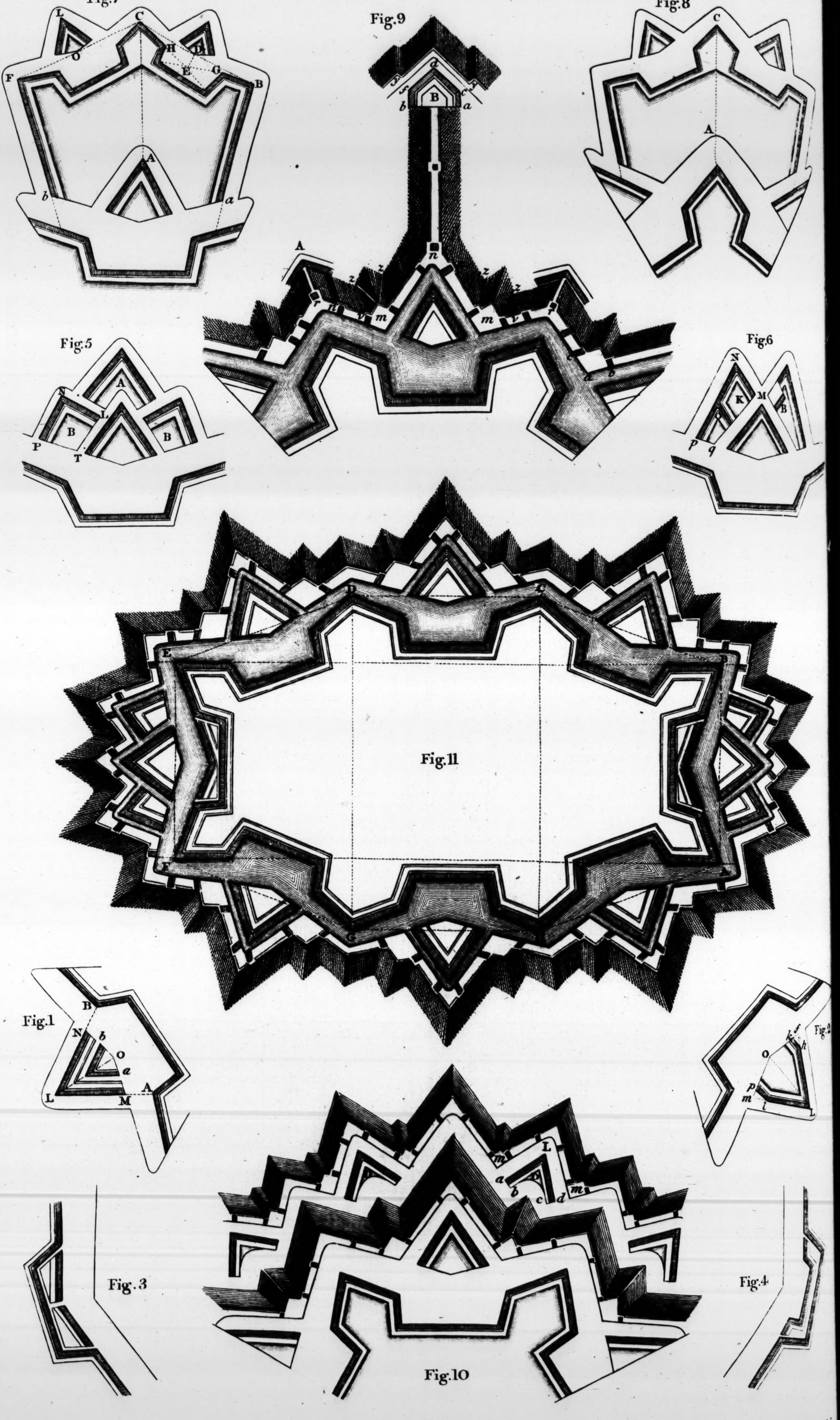

Fig. 7

L
C
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H
D
F
E
G
B
A
b
a

Fig. 9

d
f
e
B
c
b
a
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m
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z
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Fig. 8

C
A

Fig. 5

A
N
L
B
B
P
T

Fig. 6

N
K
M
O
B
p
q

Fig. 11

D
C
E
B
F
G

Fig. 1

B
N
b
O
a
L
M
A

Fig. 2

f
k
h
O
p
m
i
L

Fig. 3

Fig. 4

m
L
a
b
c
d
m

Fig. 10

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turfed only with a berm of 8 feet before it; as likewiſe a ditch from 3 to 5 toiſes broad. *Fig*. 5. Plate II. When a hornwork is made before the baſtion, the diſtance DL of the front from the ſaliant angle of the baſtion is 100 toiſes, and the branches terminate on the faces of the adjacent ravelins within 5 toiſes from their extremities; all the reſt is the ſame as before.

8. *Conſtruction of Crown-works.*

Fig. 7. Plate I. From the ſaliant angle, A, of the ravelin, as a centre, deſcribe an arc of a circle with a radius of about 120 toiſes, cutting the capital of the ravelin produced at C; from the point C, ſet off the cords CB, CF, each of them equal to 110 toiſes: and on each of which, as an exterior ſide, conſtruct a front of a polygon of the ſame dimenſions as in the hornwork; that is, the perpendicular ſhould be 18 toiſes, the faces 30, and the branches terminate on the faces of the baſtions within 25 toiſes of the ſhoulders. The ditch is 12 toiſes, the capital of the ravelin 35, and its ditch 8; that is, the ſame as in the hornwork. Sometimes the crownwork is made before the baſtion, as in *fig*. 8. Plate I. The arc is deſcribed from the ſaliant angle A of the baſtion, with a radius of 120 toiſes, as before; and the branches terminate on the faces of the adjacent ravelins within 25 toiſes of their extremities: the reſt of the dimenſions and conſtructions are the ſame as before.

9. *Conſtruction of Covert-ways and Glacis.*

Although we have not hitherto mentioned the covert-way, nevertheleſs all fortifications whatſoever have one; for they are eſteemed to be one of the moſt eſſential parts of a modern fortification; and it is certain, the taking the covert-way when it is in a good condition and well defended, is generally the moſt bloody action of the ſiege. After having conſtructed the body of the place, and all the outworks which are thought neceſſary, lines are drawn parallel to the outmoſt counterſcarp of the ditches, at 6 toiſes diſtant from it; and the ſpace *m n*, *m n*, included between that line and the counterſcarp, will be the covert-way required, as in *Fig*. 9. Plate I. There is in every re-entering angle of the counterſcarp a place of arms, *m*; which is found by ſetting off 20 toiſes from the re-entering angle *a*, on both ſides, from *a* to *b*, and from *a* to *c*; and from the points *b*, *c*, as centres, arcs are deſcribed with a radius of 25 toiſes, ſo as to interſect each other in *d*; then the lines drawn from this interſection to the points *b*, *c*, will be the faces of the places of arms. If lines are drawn, parallel to the lines which terminate the covert way, and the places of arms, at 20 toiſes diſtant from them, the ſpace *x*, *x*, *x*, between theſe lines and thoſe which terminate the covert-way, will be the glacis. At the extremities of the place of arms, are traverſes made, ſuch as *v*, *v*, which ſerve to incloſe them; theſe traverſes are 3 toiſes thick, and as long as the covert-way is broad; and a paſſage is cut in the glacis round them, of about 6 or 8 feet, in order to have a free communication with the reſt of the covert-way. There are alſo traverſes of the ſame dimenſions before every ſaliant angle of the baſtion and outworks, and are in the ſame direction as the faces of thoſe works produced: and the thickneſs lies at the ſame ſide as the parapets. The paſſages round theſe laſt traverſes are likewiſe from 6 to 8 feet wide. In each place of arms are two ſally ports *z z*, which are 10 or 12 feet wide, for the troops to ſally out; in time of a ſiege they are ſhut up, with barriers or gates.

10. *Conſtruction of Arrows and Detached Redoubts.*

An arrow is a work made before the ſaliant angles of the glacis, ſuch as A, *fig*. 9. plate I. It is compoſed of a parapet of 3 toiſes thick, and 40 long; and the ditch before it 5 toiſes, terminating in a ſlope at both ends. The communication from the covert way into theſe arrows is 4 or 5 toiſes wide; and there is a traverſe, *r*, at the entrance, of 3 toiſes thick, with a paſſage of 6 or 8 feet round it. A detached redoubt is a kind of work much like a ravelin, with flanks placed beyond the glacis, ſuch as B; they are made in order to occupy ſome ſpot of ground which might be advantageous to the beſiegers; likewiſe to oblige the enemy to open their trenches farther off than they would do otherwiſe. Their diſtance from the covert-way ought not to exceed 120 toiſes, that it may be defended by muſket ſhot from thence. The gorge *a b* is 40 toiſes: the flanks *a c*, *b f*, which are perpendicular to the gorge, 10; and the faces *c d*, *f d*, 30; the ditch before it is 6 toiſes, ending in ſlopes at both ends: the covert-way are 4; the branches of the covert-way are 42 toiſes long, or thereabouts; the faces of the places of arms *y*, *y*, which are perpendicular to the branches, 10; and the other, which is parallel to them, 14. The communication from the covert-way into the redoubt, is 5 or 6 toiſes wide; and there is a traverſe made juſt at the entrance, and another in the middle when it is pretty long. The parapets of this communication terminate in a ſlope or glacis. If theſe redoubts are above 50 toiſes diſtant from the covert-way, the beſiegers carry their trenches round, and enter through the gorge; by which the troops that are in them are made priſoners of war, if they do not retire betimes; to prevent which, ſome other outworks ſhould be made to ſupport them.

11. *Conſtruction of Second Ditches and Covert-ways.*

Fig. 10. Plate I. When the ground is low, and water to be found, there is often a ditch about 10 or 12 toiſes made round the glacis; and oppoſite to the places of arms are conſtructed lunettes, beyond the ditch; ſuch as D, whoſe breadth on the counterſcarp of the ditch is 10 toiſes, from *b* to *a*, and from *c* to *d*; and the faces *a* L, *d* L, are parallel to thoſe of the places of arms; the ditch before them is from 8 to 10 toiſes wide. The ſecond covert-way is 4 toiſes, the ſemi-gorges of the places of arms, *m*, about 15, and the faces perpendicular to the counterſcarp; the ſecond glacis is from 15 to 18 toiſes broad. This ſecond covert-way has traverſes every where, in the ſame manner as the firſt.

Hitherto we have chiefly adopted the Methods of M. Vauban, as being the moſt generally followed; though in our Judgment thoſe of the ingenious John Muller, Eſq; late Profeſſor of Artillery and Fortification at the Royal Academy at Woolwich, contain many juſt Improvements in this Art: we ſhall therefore, in addition to the former, give them a place in this work; as we are anxious that nothing which appears truly valuable in any Branch of Science may eſcape our notice.

12. *Irregular* FORTIFICATION, Is that wherein the baſtions are uenqual, and unlike; or the ſides and angles not all equal, and equidiſtant. In an irregular fortification, the defence and ſtrength being unequal, there is a neceſſity for reducing the irregular figure, as near as may be, to a regular one; i. e. inſtead of inſcribing it in a circle, it ſhould be inſcribed in an oval, ſo that one half may be ſimilar and equal to the other half. *Fig*. 11. Plate I. repreſents a fortification inſcribed in an oval. In this caſe the ſides CD, CH, on the flat parts are ſtronger than the ſides AB, EF, on the narrow parts, ſuppoſing all the exterior ſides equal, and the place equally fortified. When the angles BCD, CDE, of the polygon are very great, and the beſieger comes within a ſmall diſtance of the works, he cannot approach nearer, without being ſeen in front, except by a direct ſap, with traverſes; and as this way of approaching preſents but a ſmall front, the beſieged, who have a much larger, may oppoſe with peculiar advantage: whereas if the angles HAB, ABC, of the polygon, are very ſmall, the beſiegers may carry their approaches to the counterſcarp itſelf, and have always a larger front than the beſieged; and, as the beſiegers muſt extend their approaches to three fronts, whether they are ſmall or large, the work of the approaches before the front, BCDE will be to the work before the front HABC, as the line BE is to the line HC, nearly, and therefore the front CD, on the flat ſide, is ſtronger than the front AB, on the narrow ſide; conſequently, the longer C D is, ſo that the lines of defence are within the reach of muſket-ſhot, and the angles BCD, CDE, are the ſame, the ſtronger will the front be. The greater the angles of the polygon BCD, CDE, are, the exterior ſides being the ſame, the ſtronger will be the front CD. But, as it is found difficult to inſcribe a polygon in an ellipſe or oval, the following eaſy method will anſwer the purpoſe. Reduce the ſpot of ground to be fortified to the figure ACEG, and draw BE, AF, parallel to each other; draw CH, DG, perpendicular to theſe lines, and at equal diſtance from the points B and E, and let their interval be equal to that of the lines BE and AF; then, draw DC, GH, parallel to AF and BE, and equally diſtant from them; and from their interſections C, D, G, H, with DG, CH, as centres, deſcribe arcs, with a radius equal to CD or GH, ſo as to interſect the lines AF, BE, in A, B, E, F; join the points A, B, E, F, and ABCDEFGH, will be an oblong octagon, having one half ſimilar and equal to the other half. If a hexagon be to be deſcribed, inſtead of drawing the two lines CH, DG, one will be ſufficient; in a decagon there muſt be three, and four in a dodecagon. If the ſides cannot eaſily be made equal, then the ſides AB, EF, on the narroweſt part of the polygon, ſhould be the longeſt, becauſe it is the weakeſt. Muller's Elements of Fort. p. 146. &c.

13. FORTIFICATION, *according to Muller's firſt Method.*

Let AB, *Fig*. 6. Plate II. be the exterior ſide of a polygon of any length, e. gr. a hundred and eighty toiſes; make the perpendicular CD of any length, as the ſixth, fifth or fourth part of the exterior ſide, according to the expence or importance of the place: here it is the ſixth part or thirty toiſes: ſet off fifty toiſes or more for the faces BH, AE, or rather $\frac{2}{7}$ of the exterior ſide; from the ſaliant angle A deſcribe an arc with the radius AI of twenty toiſes, that is two or three toiſes more than the breadth of the ditch; draw from the oppoſite ſhoulder H a tangent HI to that arc, and from the angle A the indefinite line A *b* parallel to that tangent; then, if from the angle A as centre, an arc *a b* be deſcribed with any radius, the flank GH is drawn parallel to the chord *a b*; one of the flanks being thus found, the others will be found by taking the diſtance DG, between the perpendicular and the angle of the flank, and carrying it from the extremities of all the perpendiculars on the lines of defence, as from D to F; this being done, the counterſcarp of the ditch is drawn parallel to the line HI or to A *b*; and having the points or re-entering angle O, its diſtance from the extremity of the perpendicular being carried all round, will give the re-entering angles before the other fronts. The tenailles *h k*, which M. Belidor has invented, and called them rams-horns, are deſcribed, by ſetting off three toiſes from the ſhoulder Q of the baſtion to the point *h*, and drawing *h f* perpendicular to the line of defence; then its interſection *f*, with the other line of defence produced, will be the centre of the arc *h k*. In order to conſtruct the ravelin, ſet off twelve or fifteen toiſes from the ſhoulder E to the point *r*, in the face of the baſtion, and from the angle G of the flank as centre, deſcribe an arc through the point *r*, meeting the perpendicular CD produced at L; from this point L draw the faces, ſo as when produced to fall on the faces of the baſtions within three toiſes of the ſhoulders; the ditch of the ravelin is twelve toiſes. For the retired flanks, find the flank QR as before, on which ſet off five or ſix toiſes for the ſhoulder or orillons; and from a point *g* in the oppoſite face of the baſtion at five toiſes from the ſaliant angle B, draw the broken part of the flank; then draw the retired flank parallel to the line QR, at five toiſes diſtant from it: the orillon may be made round in the manner of M. Vauban's, if it be thought proper.

14. *Muller's ſecond Method of fortifying with detached Baſtions.*

Let the interior ſide AB, *fig.* 8. plate II. of an octagon be a hundred and thirty toiſes; take A *b*, B *n*, equal to twelve toiſes for the ſemi-gorges of the ſmall baſtions, and as much for their capitals A *c*, B *r*; from the points *c*, *r*, draw the lines *c n*, *r b*, to the extremity of the gorges, and make the flanks *b d*, *n m*, perpendicular to the lines of defence; the ditch is ſix toiſes at the ſaliant angles *c*, *r*, and its counterſcarp drawn to the extremities of the flanks of the detached baſtions. The capitals *c* C, *r* D, of the detached baſtions are fifty-five toiſes, and the lines of defence are drawn to the extremities *b* and *n* of the interior flanks; the faces are ſixty; the radius of the arc, which ſerves to determine the poſition of the flanks, eighteen; and the ditch ſixteen at the ſaliant angle. The ravelin is conſtructed by deſcribing an arc from the extremity of the flank, as centre, through a point in the oppoſite face of the baſtion, within twenty toiſes of the ſhoulder, which arc interſects the capital of the ravelin at the ſaliant angle; the faces terminate within five toiſes of the ſhoulders, the ſemi-gorge of the redoubt R is fifteen, its faces parallel to thoſe of the ravelin, and its parapet two toiſes: the ditch of the ravelin twelve, and that of the redoubt ſix. The ſemi-gorges of the places of arms are twenty toiſes, thoſe of the ſtone redoubts *P* within them twelve; the faces of the places of arms are twenty-five; and thoſe of the redoubts parallel to them, with a dry ditch of three toiſes before them; the covert way is ſix, and the glacis twenty. The faces of tenailles are ſixteen toiſes, the paſſage between them and the flanks of the baſtions three; their flanks are parallel to the others, the curtain is drawn through the points where they meet the lines of defence, and the inſide of the tenailles is terminated by lines drawn through the extremities of the flanks of the detached baſtions.

15. *Muller's third Method of fortifying with detached OrillonBaſtions.*

Let the exterior ſide AB, *fig.* 7, plate II. of an octagon be two hundred toiſes, the perpendicular CD forty, that is, a fifth part of the exterior ſide, the faces AE, BF, fifty-five; the radius of the arc which ſerves to determine the poſition of the flanks twenty-two; the ditch ſixteen at the ſaliant angles; the orillon five: the flank is retired five toiſes; and the line *k d*, which terminates the flanks, is drawn from a point *d*, in the face at five toiſes from the ſaliant angle; the ſhoulders of the tenailles are twenty toiſes from thoſe of the baſtions; the flanks parallel to the others, and the curtain is drawn through the points of interſection of the flanks and lines of defence. Take on the lines E *l*, F *h*, drawn from the extremities of the faces parallel to the flanks, and which terminate the inſide of the tenailles, the parts *l n*, *h m*, each of ſix toiſes, for the breadth of the ditch; and upon the exterior ſide *r n*, conſtruct a front of a polygon, by making the perpendicular twelve, and faces twenty toiſes. The redoubts V are made of a wall three feet thick only with loop-holes; their ſaliant angle is determined by the counterſcarps of the inner ditch produced: and the faces terminate within three toiſes of the ſhoulders; the ditch about theſe redoubts is four toiſes. The ravelins and covert-way are conſtructed in the ſame manner as thoſe in the former method. Mr. Muller has made remarks on theſe ſeveral conſtructions, deſigned to ſhew in what reſpects they are ſuperior to the methods of M. Vauban. See Muller's Elem. of Fortification, p. 100, 104, 108, &c.

16. *Conſtruction of Profiles.*

A profile is the repreſentation of a vertical ſection of a work; it ſerves to ſhew thoſe dimenſions which cannot be repreſented in plans, and is neceſſary in the building of a fortification. Profiles are generally conſtructed upon a ſcale of 30 feet to an inch. It would be endleſs to deſcribe all their particular dimenſions; we ſhall therefore lay down the principal rules only, given by M. Vauban, on this ſubject. 1. Every work ought to be at leaſt 6 feet higher than that before it, ſo that it may command thoſe before it; that is, that the garriſon may fire from all the works at the ſame time, with great and ſmall arms, at the beſiegers in their approaches. Notwithſtanding this ſpecious pretence, there are ſeveral authors who object againſt it. For, ſay they, if you can diſcover the enemy from all the works, they can diſcover, by the ſame reaſon, all the works from their batteries; ſo that they may deſtroy them without being obliged to change their ſituation, and thereby diſmount all the guns of the place before they come near it. But if all the works were of the ſame height, thoſe within cannot be deſtroyed, till ſuch time as thoſe before them are taken: guns might be placed in the covert-way and outworks to obſtruct the enemy's approach; and when they come near the place, they might be tranſported into the inner-works; and as the body of the place would be much lower, the expence would be conſiderably diminiſhed. But when works are low, they are eaſily enfiladed by the ricochet batteries, which is a kind of firing with a ſmall quantity of powder, by giving the gun an elevation of 10 or 12 degrees; this might however be partly prevented, by making the parapets near the ſaliant angles, for the ſpace of 8 toiſes on each ſide, 5 or 6 feet higher than the reſt of the works. 2. The covert-way ſhould be lower than the level-ground, otherwiſe the body of the place muſt be raiſed very high, eſpecially where there are ſeveral outworks; this is to be underſtood only when the works exceed each other in height, otherwiſe it need not be below the level. 3. The baſes of all inward ſlopes of earth ſhould be at leaſt equal to the height, if not more. 4. The baſes of all outward ſlopes of earth, two thirds of their heights. 5. The ſlopes of all walls or revetments ſhould be one fifth of their height: or one ſixth might perhaps be ſufficient: the height of a wall is eſtimated from the bottom of the ditch, and not from the beginning of its foundation. 6. The ſlopes of all parapets and traverſes are one ſixth of the breadth: that is, 3 feet towards the field; or the inſide, where the banquettes ſhould be, 3 feet higher than the outſide. 7. When the revetment of a rampart goes quite up to the top, 4 feet of their upper-part is a vertical wall of 3 feet thick, with a ſquare ſtone at the top of it, projecting 6 inches; and a circular one below, or where the ſlope begins, of 8 or 10 inches diameter: they go quite round the rampart, and the circular projection is called the cordon. Where the ſtraight part of the wall ends and the ſlope begins, the wall is always made 5 feet thick; and the counterforts or buttreſſes reach no higher than that place. 8. When the rampart is partly walled, and partly turfed, then one fifth of the height which is turfed muſt be added to 5 feet, to get the thickneſs of the wall above. And having the thickneſs of any wall above, by adding one fifth of its height from the bottom of the ditch, the ſum will be the thickneſs of the wall at the bottom; but if a ſixth part is only taken for the ſlope, then a ſixth part muſt be added. For inſtance, ſuppoſe a rampart of 30 feet high from the bottom of the ditch, and that 10 of which are to be turfed: then the fifth part of 10, which is 2, added to 5, gives 7 for the wall above; and as this wall is 20 feet high, the fifth of which is 4, and 4 added to the thickneſs 7 above, gives 11 for the thickneſs near the foundation.

17. *Marine* FORTIFICATION, Is ſometimes uſed by way of diſtinction from land fortification, and denotes the art of raiſing works fit for the defence of a harbour againſt the attacks of any kind of ſhipping; but the works proper for this purpoſe depend in a great meaſure on the principles employed in the fortification of towns. However, attention ſhould be given to the ſituation of roads or harbours in contriving works for their defence: e. gr. when a town lies open to the ſea, on a curved, or ſtraight bold ſhore, and has before it a ſufficient depth of water and good anchorage; the ſhips, in this ſituation, may be well defended by forts built near the water's edge on each ſide of the anchoring place, ſo contrived as to have two or three batteries, one higher than the other, and furniſhed with a ſufficient number of cannon, carrying ſhot from twenty four to forty eight pounds. A town, in this ſituation, may be defended by a rampart, or wall, well flanked, built along the ſhore, beſides the fortifications on the land ſide. The works along the ſhore ſhould be carried ſo near to the water's edge, that troops, attempting to land under the cannon of a fleet, might not find ground on which to intrench themſelves. Farther, when a harbour, being a bay, has a ſhoal or ſmall iſland lying before its entrance, a ſtrong fort ſhould be built upon the iſland, in a place where it can command the entrance on both ſides, if the iſland be not too large; otherwiſe two or more forts ſhould be erected in ſuch places as may command the avenues to the bay; other forts ſhould alſo be raiſed on the moſt convenient points of lands, forming the mouth of the bay. Again, when the harbour is in a bay, whoſe points, forming the entrance, ſtretch into the ſea, and approach one another within cannon ſhot; ſuch a harbour may be fortified by building on both ſides of its entrance one or more forts; and, if poſſible, a fort ſhould alſo be built within the harbour's mouth in ſuch a manner, that its cannon can rake the ſhipping fore and aft as they come in.

When a harbour is formed by a cluſter of iſlands, it is eaſily fortified, if the channel between the iſlands is not too wide for the command of cannon from one or both ſhores; but if it be too wide, the ſhipping that rides there muſt be defended from the batteries on the ſhore. When the harbour lies in an inlet, or river ſome miles above its mouth, a fort built at each point of the entrance, when the paſſage lies ſtrait, and can be commanded from ſide to ſide, and two others between them and the harbour, but not directly oppoſite, unleſs the breadth of the channel requires it, will be a proper ſecurity for the ſhipping in ſuch a harbour; and if the channel or river is winding, the forts ſhould be built where they can command a reach at leaſt, or be ſo placed at the bends, as to command two adjacent reaches. See Robertſon's Treat. of Marine Fort. part ii. § 2.

In this Syſtem I have taken the utmoſt care to make ſuch ſelections as are of moſt approved worth and eſtimation. For the greater part I have conſulted the valuable Treatiſes of Vauban and Mr. Muller, rejecting thoſe of Cohoern and other Authors, whoſe Methods, from their evident deficiency, are become exploded; and I truſt that this Compendium will afford ample inſtruction to thoſe who deſire to attain a knowledge of Military Architecture.

THOMAS MARQUOIS,
Teacher of Fortification, Artillery, Gunnery, &c.

PARLIAMENT STREET,
WESTMINSTER.

Various Principles of Fortification. See the System.

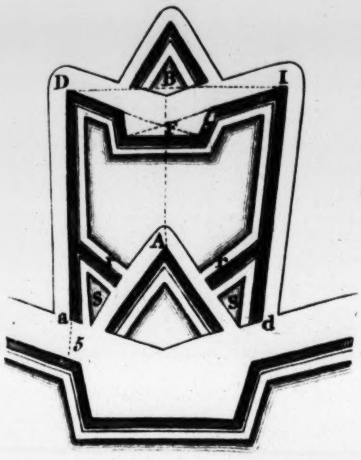
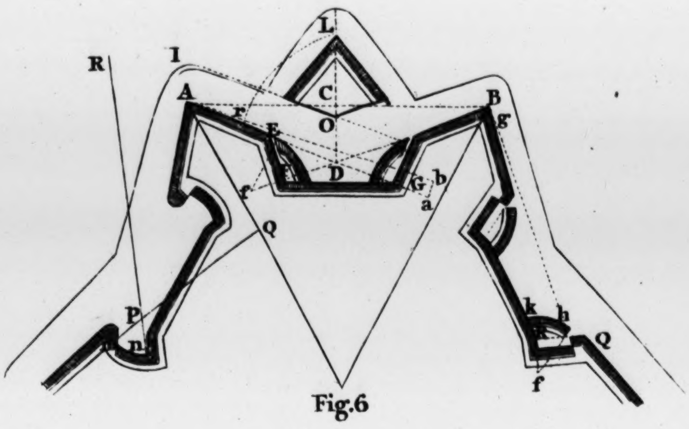


Fig.4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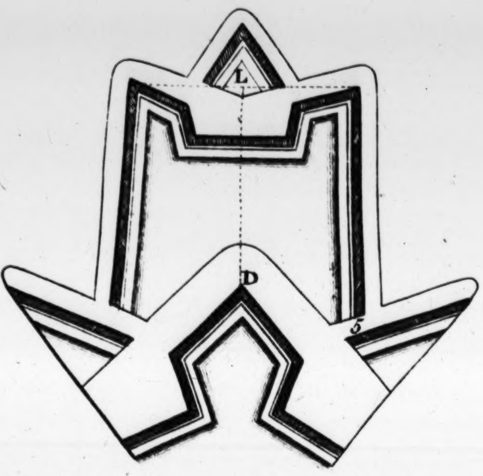
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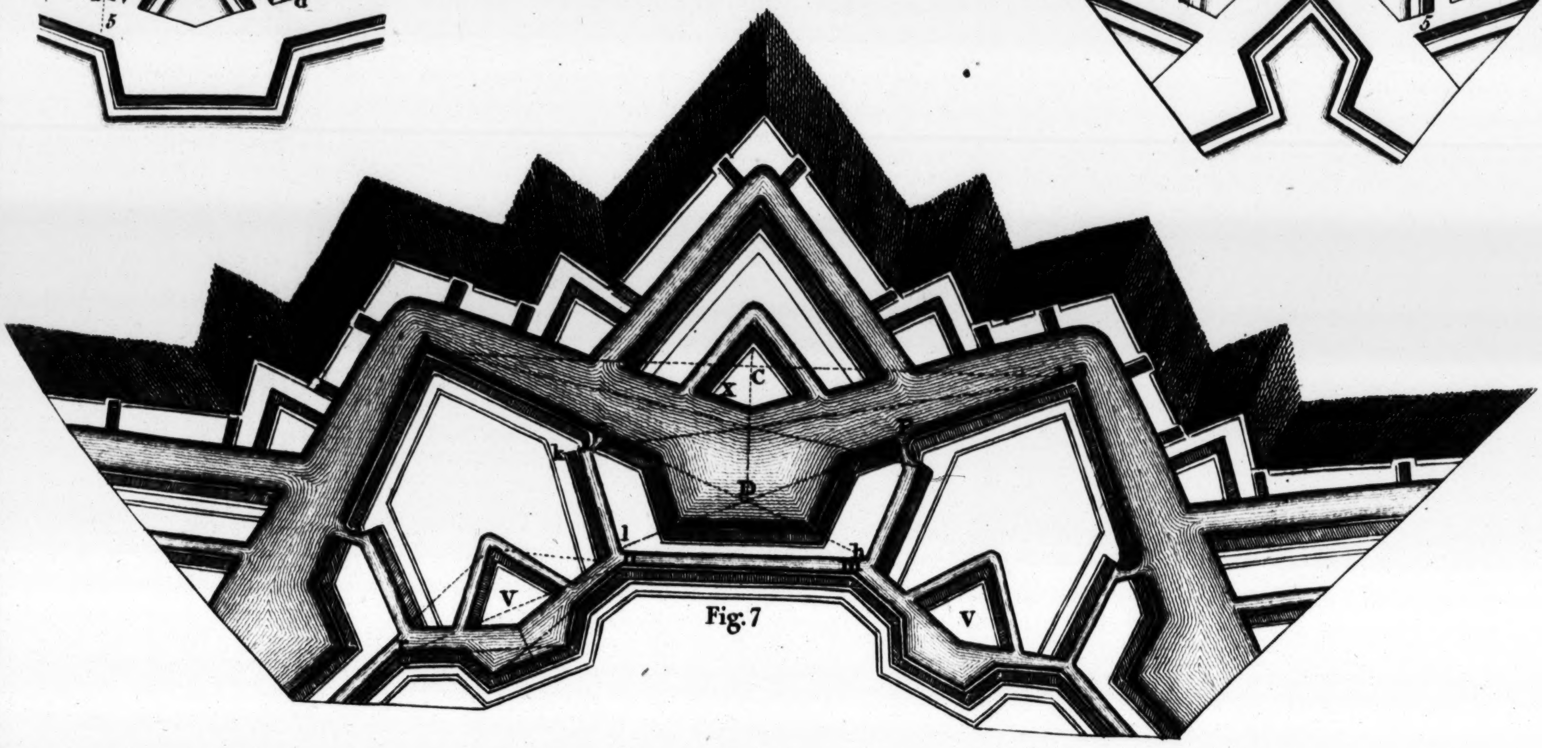
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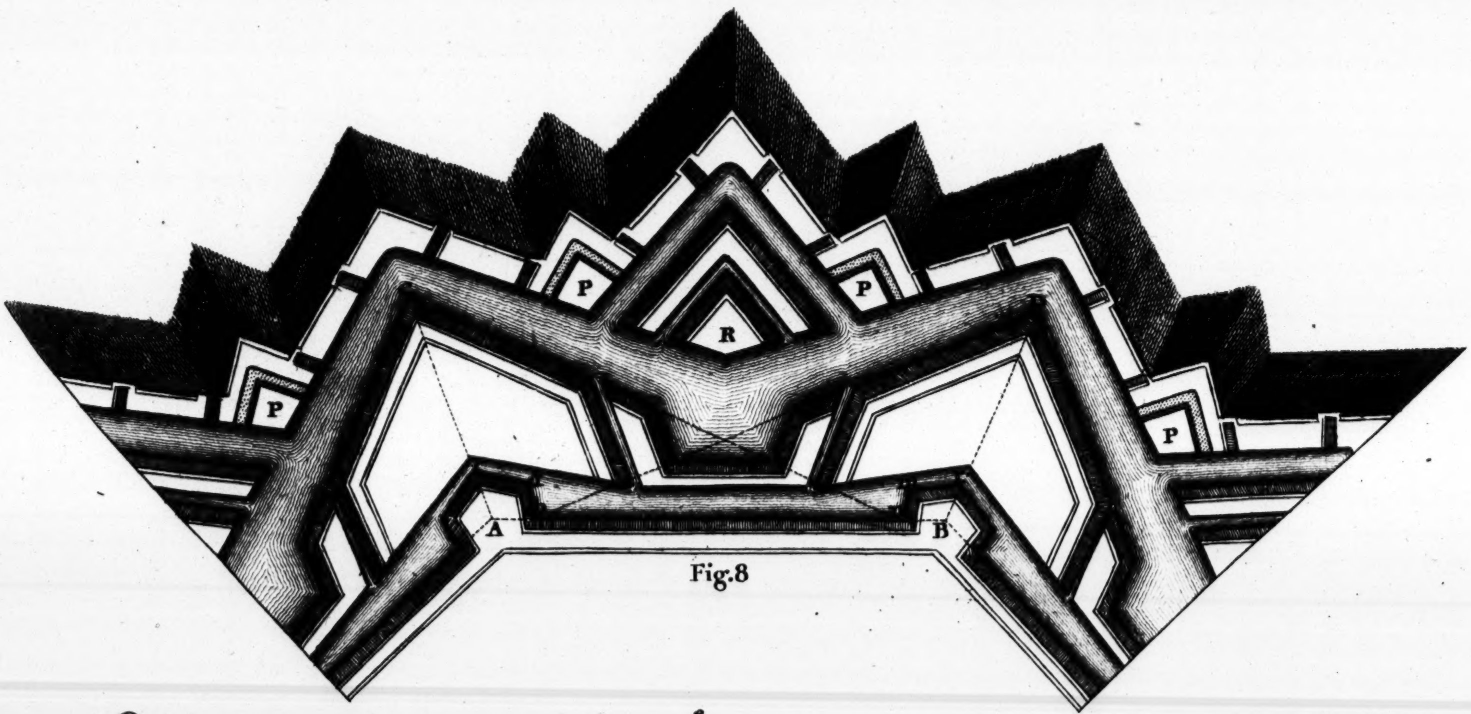
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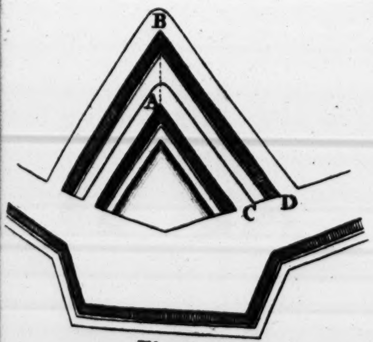
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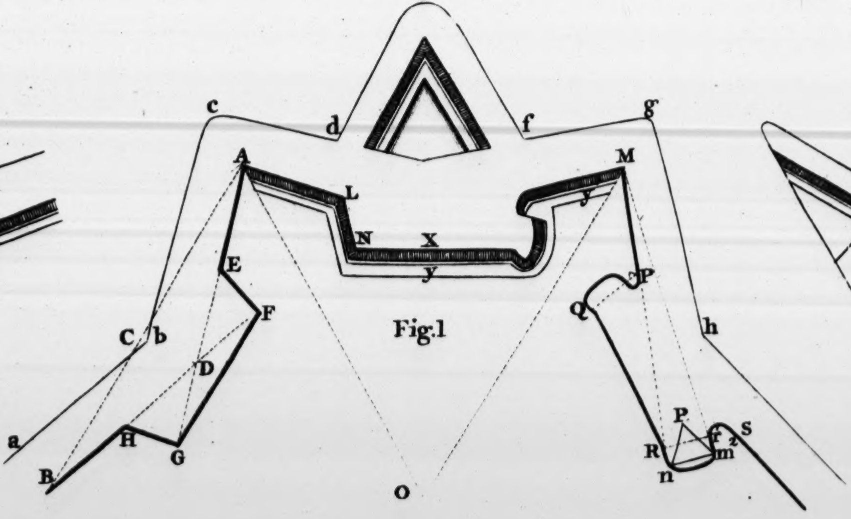
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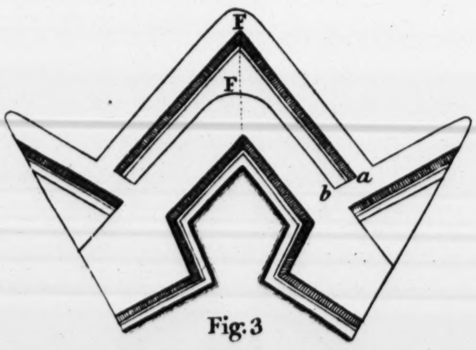
Fig.3

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MUSEUM

FORTISSIMO, in the Italian muſic, is uſed to ſignify *very ſtrong*. It is ſometimes denoted by F F F or *fff*, and intimates that the performers are to play or ſing very loud or ſtrong, to expreſs ſome paſſion, &c.

FORTUNE, a goddeſs worſhipped with great devotion by the ancient Greeks and Romans, who believed her to preſide over human affairs, and to diſtribute wealth and honour at her pleaſure. Plutarch, in an expreſs treatiſe of the Fortune of the Romans, accounts for the practice of the ancient poets, who ſeem to make Jupiter the author of the evils of life. Mankind he obſerves, before the name of Fortune had got into the world, perceiving a certain arbitrary cauſe, diſpoſing of things in an irreſiſtable manner, called it God: but the ſame cauſe being often obſerved to act at random, and without any rule or order at all, the Supreme Being came to be diveſted of the attribute: and Fortune, or Deſtiny, acknowledged in his ſtead. It is not eaſy to unravel what the ancients meant by the name Fortune. The Romans underſtood by it a principle of fortuity, whereby things came to paſs, without being neceſſitated thereto; but what and whence that principle is, they do not ſeem to have ever preciſely thought; whence their philoſophers are often intimating, that men only framed the phantom Fortune, to hide their ignorance; and that they call Fortune whatever befals a man without his knowing for what purpoſe.

Fortune was not conſidered as a deity by the old Romans, but was made ſo by the devotion and folly of the vulgar; Mr. Spencer ſays, that he has ſeen an ancient gem, in which Cybele the mother of the gods, is repreſented as turning away her head from Fortune, in an attitude of diſowning and rejecting her. Polymetis, p. 150, 154, &c. According to the opinion of the heathens, therefore, fortune, in reality, was only the arrival of things in a ſudden and unexpected manner without any apparent cauſe, or reaſon; ſo that the philoſophical cauſe of the word coincides with what is vulgarly called chance. But in religion it had a farther force; altars and temples in great numbers were conſecrated to this fortune, as a deity. This intimates that the heathens had perſonified, and even deified, their chance; and conceived her as a ſort of goddeſs, who diſpoſed of the fate of men at her pleaſure. Hence that invocation of Horace, *O diva, gratum quæ regis Antium*; in the thirty-fifth ode of the firſt book, where he recommends Auguſtus, then preparing for a viſit to Britain, to her protection. From theſe different ſentiments it may be inferred, that the ancients at one time took fortune for a peremptory cauſe, bent upon doing good to ſome and perſecuting others; and ſometimes for a blind, inconſtant cauſe, without any view or determination at all. If then the word fortune has no certain idea in the mouth of thoſe who erected altars to her; much leſs can it be aſcertained what it denotes in the mind of thoſe who now uſe the word in their writings. They who would ſubſtitute the name providence, in lieu of that of fortune, cannot give any tolerable ſenſe to half the phraſes wherein the word occurs.

The painters repreſent her in a woman's habit, with a bandage before her eyes, to ſhew that ſhe acts without diſcernment; and ſtanding on a wheel, to expreſs her inſtability. The Romans, ſays Lactantius, repreſented her with a cornucopia, and the helm of a ſhip, to ſhew that ſhe diſtributes riches, and directs the affairs of the world. In effect, it is with ſuch characters, that we ſee her repreſented on ſo many medals, with the inſcriptions, FORTVNA AVG. FORTVNA REDVX. FORTVNAE AVG. or REDVCIS, &c. Sometimes ſhe is ſeen pointing at a globe before her feet, with a ſceptre in one hand, and holding the cornucopiæ in the other. The Romans had a virile as well as a muliebrian Fortune for the objects of their adoration; the *fortuna virilis* was honoured by the men, and the *fortuna muliebris* by the women. They honoured Fortune alſo under a variety of other appellations. The Romans derived the worſhip of Fortune from the Greeks, under the reign of Servius Tullius, who dedicated the firſt temple to her in the public market. Nero alſo built a temple to Fortune. The Fortune worſhipped at Antium was probably of the moſt exalted character of any among the Romans; if we may judge by the account which Horace gives us of the great ſolemn proceſſions that were made to her. Hor. lib. i. od. xxxv. ver. 22. But the moſt celebrated temple of Fortune was at Præneſte.

Fortune *Tellers*. Pretenders to tell fortunes, and to any crafty ſcience for the diſcovery of ſtolen goods, are puniſhable by impriſonment, pillory, and binding to their good behaviour, and ſhall be deemed vagabonds. Stat. 9 Geo. II. cap. 5. ſect. 4. Stat. 17 Geo. II. cap. 5. ſect. 2. See Conjuration.

FORUM, in Roman antiquity, is uſed in divers acceptations: ſometimes for a place of traffic, anſwering to our market place; in which ſenſe it has uſually ſome adjective added to it, as *forum boarium*, the *beaſt market*; *forum piſcarium*, the *fiſh market*; *olitorium forum*, the *herb market*. Forum is uſed for any place where the governor of a province convenes his people to give judgment, according to courſe of law. Forum was alſo a public ſtanding place in the city of Rome, where cauſes were judicially tried, and orations delivered to the people.

FOSS, or Fosse, in fortification, &c. a ditch, or moat. The word is French, formed of the Latin participle *foſſum*, of the verb *fodio*, *I dig*.

Foss, Fossa, in anatomy, a kind of cavity in a bone, with a large aperture, but no exit, or perforation. When the aperture is very narrow, it is called a ſinus. In the cranium there are ſix internal, and fourteen external foſſes. The cavity of the orbit, which contains the eye is a foſs.

FOSSA *Magna*, or *Navicularis*, is an oblong cavity, forming the inſide of the *pudendum muliebre*, and which preſents itſelf upon opening the labia; and in the middle whereof are the *carunculæ myrtiformes*. See Syſtem of Anatomy, Part V. Sect. XI.

FOSSIL, in natural hiſtory is uſed in a general ſenſe, for any thing dug up, or found under ground. Such are all minerals, metals, rock ſalts, &c. Foſſils are uſed in a more confined ſenſe by Linnæus, to denote the third claſs of ſtones: and includes petrified, concrete, and terrene ſubſtances. The chymiſts divide all bodies into three claſſes, or kingdoms; viz. *foſſil* or *mineral*, *vegetable*, and *animal*. Foſſils may be diſtinguiſhed into, 1. Such as are *natives* of the earth; and, 2. Such as are *adventitious*, and repoſited therein by any extraordinary means; as earthquakes, deluges, &c.

Fossils, *Native*, or Fossils *properly ſo called*, are ſenſible bodies generated and growing in the earth, and found either buried in it, or lying on its ſurface; whoſe conſtituent parts are ſo ſimple and homogeneous, that there is no apparent diſtinction of veſſels and juices; nor any difference between the part, and the whole. The firſt perſon who attempted to reduce the ſubject of foſſils into a regular ſcience, was Dr. Woodward, who publiſhed a method of arrangement, founded on the growth, ſtructure, and texture of foſſils. But this ſyſtem being found inſufficient for diſtinguiſhing the bodies of the foſſil kingdom with accuracy, was ſucceeded by the method of dividing theſe bodies, according to the various changes produced on them by fire, into *calcarii*, *apyri*, *vitreſcentes*, &c. eſtabliſhed by the Swediſh and German authors; and this method now univerſally prevails. The mineralogy of Wallerius is on this plan; however, other writers, as Dr. Hill, Mendes da Coſta, &c. have endeavoured to form a new ſyſtem from the combined principles of Woodward and Wallerius; and arranged foſſils, not only according to their growth, texture, and ſtructure, but alſo their principles and qualities, as diſcovered by the aid of fire and acid menſtrua. Native foſſils are either *ſimple*, or *compound*.

Fossils, *Simple*, are thoſe, whoſe parts, however divided, are all of the ſame nature, i. e. of the ſame gravity, magnitude, figure, hardneſs, and mobility. Such is quickſilver, which, however divided, is always found the ſame. Of foſſils naturally and eſſentially ſimple, ſome according to Dr. Hill, in his Hiſtory of Foſſils, are neither inflammable nor ſoluble in water, of which he reckons three ſeries; as thoſe of no regular ſtructure or determinate figure, comprehending the ſimple *earths*, of which there are ſeveral orders and genera; thoſe of a regular ſtructure, and no determinate figure, of which ſeries there are three claſſes, viz. the *talcs*, the *fibrariæ*, and the *gypſums*, each of which is again ſubdivided into orders and genera; and thoſe of a regular ſtructure and a determinate figure, comprehending three claſſes, viz. the *ſelenitæ*, *cryſtals*, and *ſpars*, which include various orders and genera. Other ſimple Foſſils, though uninflammable, are ſoluble in water; ſuch are the ſimple ſalts: and others, on the contrary, are inflammable, but not ſoluble in water; of which there are two ſeries, viz. thoſe of a ſolid form, comprehending the *phlogidiaugia* and the *phlogiſcieria*.

Fossils, *Compound*, are thoſe which may be divided into different, or diſſimilar parts. As antimony, which may be reſolved by fire into ſulphur, and a metalline part. Of theſe compound foſſils, in the diſtribution of Dr. Hill, ſome are neither inflammable, nor ſoluble in water, of which there are four ſeries; as thoſe that are found in continued ſtrata, comprehending the two claſſes of *compound earths*, ſubdivided into *loams* and *moulds*, and their ſubordinate genera; and *ſtones*, including three orders, and under thoſe eight genera; thoſe again, that are formed in detached maſſes of a regular ſtructure and determinate figure, comprehending the two claſſes of *ſeptariæ* and *ſiderochita*; thoſe formed in detached maſſes, of no determinate figure or regular ſtructure, and compoſed of a cryſtalline or ſparry matter, debaſed by an admixture of earth in various proportions, comprehending four claſſes, viz. the *ſcrupi*, the *ſemipellucid gems*, the *pebbles* and *ſands*; and thoſe that are formed of a fine pellucid ſubſtance, of great hardneſs, and never fouled by an admixture of earthy, or any other coarſe matter, but ſuſceptible of elegant tinges from metalline particles, of which ſeries there is only one claſs, including the pellucid *gems*, of which there are two genera, viz. ſuch as retain one ſimple and permanent appearance in all lights, as the diamond, the carbuncle, the ruby, the garnet, the hyacinth, the amethyſt, the ſapphire, the beryl, the emerald, the praſius, the chryſolite, and the topaz; and ſuch as exhibit variable colours, when viewed in different lights, as the opal and aſteria. Other compound foſſils are ſoluble in water, but not inflammable, as all the *metallic ſalts*, ſome of which are found naturally in a ſolid form, as *vitriol* and *chalcanthum*; and others in a liquid ſtate, ſuch as the water from which the blue Cyprian vitriol is procured; and others are inflammable, but not ſoluble in water, of which there are three claſſes, viz. the marcaſites, the pyritæ, and phlogoniæ.

Dr. Hill adds a third general diviſion of foſſils, including the metallic foſſils, ſome of which are fuſible by fire, and not malleable in their pureſt ſtate; ſuch are antimony, biſmuth, cobalt, zinc, and quickſilver; and others are fuſible by fire, but concrete again in the cold, and become malleable, or diſtenſible, and ductile under the hammer: ſuch are tin, iron, copper, ſilver, lead, and gold. See Stones.

Fossils, *Adventitious*, or *Foreign*, include the ſubterraneous exuviæ of ſea and land animals, and even vegetables; as ſhells, bones, teeth, leaves, ſtalks, &c. which are found buried in great abundance, in divers parts of the earth. See *Foſſile* Plants, Shells, Wood, &c.

Theſe extraneous foſſils have employed the curioſity of ſeveral of our lateſt naturaliſts, who have each their ſeveral ſyſtems to account for the ſurpriſing appearances of petrified ſea fiſhes, in places far remote from the ſea, and on the tops of mountains; ſhells in the middle of quarries of ſtone; and of elephants teeth, and bones of divers animals, peculiar to the ſouthern climates, and plants only growing in the Eaſt, found foſſile in our northern and weſtern parts. Some will have theſe ſhells, &c. to be real ſtones, and ſtone plants, formed after the uſual manner of other figured ſtones; of which opinion is the learned Dr. Liſter. That author, though he allows of petrified ſhells on the ſea ſhores, will by no means agree that there are any ſuch petrifactions in the midland countries. The ſhell-like ſtones, found in our quarries, he contends, are *lapides ſui generis*; and never were any part of an animal. His reaſons are, that their matter and texture are perfectly the ſame with that of the rock or quarry, whence they are taken; as iron-ſtone ſhells are all iron-ſtone; ſpar, or cryſtaline, all ſpar, &c. Add, that the quarries of different ſtone yield different ſorts of theſe ſhells; and that there are no animals in nature, which yield any thing exactly like many of them. But to this erroneous doctrine it is to be anſwered, 1. That theſe ſhells found under ground are often perfectly conformable to thoſe in the ſea in figure, ſubſtance, magnitude, &c. 2. The ſubſtance of theſe foſſils often alſo differs eſſentially from the common ſubſtance of ſtones. It is true, we frequently find them covered, or impregnated with a mineral, or ſtony matter, which has gradually inſinuated itſelf into the pores; but it is in many caſes eaſy to diſtinguiſh that matter from the ſubſtance of the ſhell. Another opinion is, that theſe foſſil ſhells, with all other foreign bodies found within the earth, as bones, trees, plants, &c. were buried therein at the time of the univerſal deluge; and that having been penetrated either by the bituminous matter, abounding chiefly in watery places, or by the ſalts of the earth, they have been preſerved entire, and ſometimes petrified. Others think, that the waters of the ſea, and the rivers, with thoſe which fell from heaven, turned the whole ſurface of the earth upſide down; after the ſame manner as the waters of the Loire, and other rivers, which roll in a ſandy bottom, overturn all their ſands, and even the earth itſelf, in their ſwellings and inundations; and that in this general ſubverſion, the ſhells came to be interred here, fiſhes there, trees there, &c. See Journ. des Scavans, 1715. p. 19. and Mem. de. Trev. 1713.

But nobody has ſet this ſyſtem in a better light than Dr. Woodward, in his Natural Hiſtory of the Earth. That author, purſuing and improving the hypotheſis of Dr. Burnet, maintains the whole maſs of earth, with every thing belonging thereto, to have been ſo broken and diſſolved at the time of the deluge, that a new earth was then formed in the boſom of the water, conſiſting of different ſtrata, or beds of terreſtrial matter, ranged over each other uſually, according to the order of their ſpecific gravities. By this means, plants, animals, and eſpecially fiſhes, and ſhells, not yet diſſolved among the reſt, remained mixed and blended among the mineral and foſſil matters; which preſerved them, or at leaſt aſſumed and retained their figures and impreſſions, either indentedly, or in relievo.

Camerarius attacks this opinion of Dr. Woodward, and goes yet higher, and advances many new notions. He ſuppoſes, 1. That the greateſt part of the ſhells now dug from under-ground, had been placed there before the deluge, that is, at the time of the creation, when God ſeparated the earth from the waters. 2. That, without having recourſe to the diſſolution of the earth by the waters, one might ſuppoſe moſt of them to have ſlipped in at the chinks and crevices naturally happening after the waters were retired, and the earth ſufficiently drained. 3. That particular inundations might have ſwept moſt of theſe ſhells into the places where we now find them. 4. That the ſea may have wrought, or caſt up, moſt of theſe ſhells through ſubterraneous ſpiracles and canals. 5. That God has created divers ſtony and metalline bodies, perfectly like the vegetables and animals, which we ſee on earth, and in the ſea. To all theſe ſuppoſitions, Dr. Woodward anſwers, 1. It is no ways probable, God ſhould create ſuch a number of ſhell-fiſh of the ſame ſpecies at once; and that purely with a deſign to deſtroy them all again ſo ſoon after; that among the foſſil ſhells of the ſame ſpecies it is eaſy to diſtinguiſh thoſe of different ages; that ſome appear preciſely ſuch as we now find them in the ſpring, the ſeaſon when the deluge began; that they are not only ſhells we find under-ground, but alſo bones of quadrupeds, plants, and trees of extraordinary ſizes, and which are not of the number of aquatics; and, that the waters were ſeparated from the earth on the third day, and that none of theſe things were created, till afterwards. 2. That, on the ſecond ſuppoſition, theſe ſhells would be diſpoſed perpendicularly, and not horizontally, as they are always found; that we ſhould ſometimes find them in the clefts of the earth, where in fact there are none but what are broken. 3. That we have no acquaintance with any of theſe pretended inundations; that they could never have brought ſhells, ſtags, horns, and elephants teeth, from America, and the Eaſt Indies to England, and the other parts of Europe; nor the fruits, pines, and beeches, frequently found far greater than any of our growth. Add, that theſe particular inundations muſt have riſen to the tops of the higheſt mountains, and of conſequence they muſt have been general. 4. On the fourth ſuppoſition it muſt be held, that God did not only create all theſe ſeveral bodies in the entrails of the earth, but their ſeveral parts, and the ſeparate pieces and fragments of thoſe parts; a piece of ſhell, for inſtance; one ſide of a ſhell, which conſiſts of two; a ſhell void of the fiſh it ſhould contain; beards of corn, without the grain; pieces of cedar-bark, without the wood; pieces of bullocks hides without fleſh and bones; human ſkins without bodies: a bone without the reſt of the ſkeleton; a tooth without the jaw, &c. Add, that the foſſil ſhells have not only external, but eſſential reſemblance to ſea-ſhells; both, e. gr. yielding by analyſis, a quantity of ſea-ſalt; that, among the foſſil teeth of fiſhes, we meet with ſome apparently worn; and, laſtly, that the ſhell-fiſh, called *purple*, has a long ſharp tongue, by means whereof it pierces other ſhells, and picks the fiſh out of them; and that in digging under-ground we actually meet with divers of theſe ſhells thus pierced. Can ſuch minute thorough-paced reſemblances be the accidental effects of a *luſus naturæ?* See Marine *Remains*, Petrifaction, *Formed* Stones, Shells, &c.

FOUL, in the ſea-language, is uſed when a ſhip has been long untrimmed, ſo that graſs, weeds, periwinkles, barnacles, or the like, ſtick or grow to her ſides under water. In this ſtate, ſhe is ſaid to be *foul*. A ſhip is ſaid to make *foul water*, when, being under ſail, ſhe comes into ſuch ſhoal, or low water, that though her keel doth not touch the ground, yet ſhe comes ſo near it, that the motion of the water under her raiſes the mud from the bottom, and ſo fouls the water. Foul is alſo a ſea term, importing the running of one ſhip againſt another. This happens ſomtimes by the ungovernable violence of the wind, and ſometimes by the careleſſneſs of the people on board; and ſometimes happens to ſhips of the ſame convoy: ſometimes to ſuch as meet accidentally; and ſometimes to ſuch as are in port, by means of others coming in. The damages occaſioned by running foul, are of the nature of thoſe in which both parties muſt bear a part; they are uſually made half to fall upon the ſufferer, and half upon the veſſel which did the injury: but in caſes where it is evidently the fault of the maſter of the veſſel, he alone is to bear the damage.

Foul *Wind* expreſſes that which is unfavourable, or contrary to the courſe of the ſhip, in oppoſition to large or fair.

Foul *Feeding*, in farriery, denotes a voracious appetite, to which ſome horſes are ſubject, which, though not properly a diſeaſe, is the cauſe of various maladies. It is commonly the effect of ſome latent diſtemper, and frequently occaſioned by worms irritating the inteſtines. See Syſtem of Farriery, Sect. XXII.

Foulness *in Wounds*. When what the ſurgeon calls uncleanneſs or foulneſs is perceived in a wound, that is, when the fleſh in it looks fungous, black, putrid, or livid, it muſt be well cleanſed before any attempts are made to heal it. Different methods of effecting this have been in uſe at different times among the ſurgeons; the ancients uſed honey, but the moſt uſual practice now is, to apply a digeſtive ointment made of turpentine diſſolved in the yolk of an egg, and afterwards mixed with honey of roſes; but where this is not found ſtrong enough for the purpoſe, the Egyptian ointment is to be uſed, mixed either with ſpirit of wine, or with the common digeſtive. To theſe digeſtive ointments a ſmall quantity of aloes and myrrh may alſo very properly be added; and where more ſtrength is required in them, a ſmall quantity of red precipitate is to be added. The uſe of lime-water as a detergent is alſo very great, and yet more ſo, if there be added to every pint of it twenty or thirty grains of ſublimate; this makes what is called the *phagedænic* water. Applications of this kind are to be continued till the wound is clean, and then it is to be healed with the common digeſtives.

FOUNDATION, that part of a building which is under-ground; or that maſs of ſtone, &c. which ſupports a building; or upon which the walls of the ſuperſtructure are raiſed; or, it is the coffer, or bed, dug below the level of the ground, to raiſe a building upon. The foundation either takes up the whole area and extent of the building, as when there are to be vaults, cellars or the like; or it is drawn in cuts, or trenches, as when only walls are to be raiſed. The foundation is properly ſo much of the maſonry, as reaches as high as the ſurface of the ground; and this is always to be proportioned to the load or weight of the building which it is to bear. The foundations of buildings are either *natural* or *artificial*. *Natural*, is when we build on a rock, or a very ſolid earth; in which caſe we need not ſeek for any farther ſtrengthening. *Artificial*, where the ground is ſandy, or marſhy, or has lately been dug. In the former caſe, the architect muſt adjuſt the depth of the foundation by the height, weight, &c. of the building:

a ſixth part of the whole height is looked on as a medium; and as to thickneſs, double that of the width of the wall, is a good rule. Architects ought to uſe the utmoſt diligence in regard to foundations, ſince of all errors which may happen in building, an error in this point is moſt pernicious.

When the ground is very bad, you muſt get large oaken piles of ſuch a length as may reach the ſound ground, and whoſe diameter muſt be about one twelfth part of their length: theſe muſt be driven down with a machine, as cloſe to one another as poſſible, and that under the middle walls as well as the outer ones; and upon their tops large planks are to be pinned down. But if the ground be only faulty in ſome places, arches may be turned over them, by which means no part of the weight of the building will reſt upon them. As to the rules neceſſary to be obſerved in conſtructing the ground-work, they are theſe: 1. That the bottom of the trench be made exactly level. 2. That the loweſt ledge or row be all of ſtone, laid cloſe together. 3. That the breadth of the ground-work be at leaſt double that of the wall that is to be raiſed on it. However, art ought always to give way to diſcretion, for the breadth may be regulated according to the goodneſs of the ground, and the weight of the intended edifice. 4. That the foundation be made to diminiſh as it riſes, only care muſt be taken that it do ſo equally on both ſides. 5. That you ought never to build upon the ruins of an old foundation, unleſs well aſſured of its depth and goodneſs. For further particulars ſee Syſtem of ARCHITECTURE.

FOUNDATION is alſo uſed figuratively for the eſtabliſhment of a city, empire, or the like. The Romans reckoned their years from the foundation of Rome, *ab urbe condita*; which we ſometimes expreſs by *ab U. C.* Chronologers make 745 years from the Iſraelites paſſing out of Egypt, to the foundation of Rome.

FOUNDATION alſo denotes a donation, or legacy, either in money, or lands, for the maintenance and ſupport of ſome community, hoſpital, ſchool, lecture, or other work of piety.

FOUNDER, he who lays a foundation, or who founds and endows a church, ſchool, religious houſe, or other work of charity and piety. Founder is alſo an artiſt that melts or caſts metals into various forms, for divers uſes; as guns, bells, ſtatues, bombs, types or printing characters; and other ſmall works, as candleſticks, buckles, &c.

FOUNDER, in the ſea language; a ſhip is ſaid to *founder* at ſea, when by an extraordinary leak, or a great ſea breaking in upon her, ſhe is ſo filled with water, that ſhe cannot be freed of it, nor is able to ſwim under it, but ſinks with the weight thereof.

FOUNDERY, or FOUNDRY, the art of melting and caſting all ſorts of metals; particularly braſs, iron, bell-metal, &c. The word is alſo uſed for a place, or work-houſe, furniſhed with furnaces or forges for this purpoſe.

FOUNDERY *of Statues, Great Guns, and Bells.* The art of caſting ſtatues in braſs is very ancient; inſomuch that its origin was too remote and obſcure even for the reſearch of Pliny; an author admirably ſkilled at diſcovering the inventors of other arts. All we can learn for certain is, that it was practiſed, in all its perfection, firſt among the Greeks, and afterwards among the Romans; and that the number of their ſtatues conſecrated to their gods and heroes, ſurpaſſed all belief. See STATUE.

The ſingle cities of Athens, Delphos, Rhodes, &c. had each three thouſand ſtatues; and Marcus Scaurus alone, though only ædile, adorned the circus with no leſs than three thouſand ſtatues of braſs, for the time of the Circenſian games. This taſte for ſtatues was finally carried to ſuch a pitch, that it became a proverb, that in Rome the people of braſs were not leſs numerous than the Roman people. Among us, the caſting of ſtatues was but little known or practiſed before the ſeventeenth century. As to the *caſting of guns*, it is quite modern; and it were, perhaps, to be wiſhed, we were as ignorant of it as the ancients. All authors agree, that the firſt cannon were caſt in the fourteenth century; though ſome affix the event to the year 1338, and others to 1380. See CANNON and GUNNERY.

The *caſting of bells* is of a middle ſtanding, between the other two. The uſe of bells is certainly very ancient in the weſtern church: and the ſame were likewiſe once uſed in the church of the Eaſt. But at preſent F. Vanſleb aſſures us, in his ſecond account of Egypt, he had found but one bell in all the Eaſtern church, and that in a monaſtery in the Upper Egypt.

FOUNT, or FONT, among printers. See FONT.

FOUNTAIN, in philoſophy, a ſpring or ſource of water riſing out of the earth. Among the ancients, fountains were held ſacred, and even worſhipped as a kind of divinities. For the phenomena, theory, and origin of fountains or ſprings, ſee SPRING.

Artificial FOUNTAIN, called alſo a *jet-d'eau*, is a contrivance by which water is violently ſpouted upwards. See HYDRAULICS.

FOURCHEE, or FOURCHY, in heraldry. A croſs *fourchee* is that forked at the ends.

FOURTH, in muſic, one of the harmonic intervals, or concords. The fourth is the fourth in order of the concords. It conſiſts in the mixture of two ſounds, which are in the ratio of 4 to 3; i. e. of ſounds produced by chords, whoſe length are to each other as 4 to 3. It is called *fourth*, becauſe containing four terms, or ſounds, between its extremes, and three degrees; or, as being the fourth, in the order of the natural ſcale, from the fundamental.

FOWL, among zoologiſts, denotes the larger ſorts of birds, whether domeſtic or wild: ſuch as geeſe, pheaſants, partridges, turkeys, ducks, &c. Fowls are again diſtinguiſhed into two kinds, viz. *land* and *water* fowl, theſe laſt being ſo called from their living much in and about water: alſo into thoſe which are accounted *game*, and thoſe which are not. See the article GAME.

Our common poultry came originally from Perſia and India. Ariſtophanes calls the cock, the Perſian bird, and that it was known in that country before Darius and Megabyzus; and theſe birds are now found wild in the iſle of Tinian, and other iſlands in the Indian ocean: in this ſtate their plumage is black and yellow, and their combs and wattles purple and yellow. They have been naturalized in this country before the arrival of the Romans, for Cæſar inform us, that they were one of the forbidden foods of the old Britons. They were probably imported by the Phœnicians, who traded to Britain about five hundred years before Chriſt. For all other domeſtic fowls, turkies, geeſe, and ducks excepted, we ſeem to be indebted to our conquerors, the Romans. The wild fowl were our own from the earlieſt period. It will appear remarkable enough, if we conſider how much the tame poultry which we have imported from diſtant climates has increaſed, and how much thoſe wild birds of the poultry kind that have never yet been taken into keeping have been diminiſhed and deſtroyed. They are all thinned; and many of the ſpecies, eſpecially in the more cultivated and populous parts of the kingdom, are utterly unſeen.

Under birds of the poultry kind may be ranked all thoſe that have white fleſh, and, comparatively to their head and limbs, have bulky bodies. They are furniſhed with ſhort ſtrong bills for picking up grain, which is their chief and often their only ſuſtenance. Their wings are ſhort and concave; for which reaſon they are not able to fly far. They lay a great many eggs; and as they lead their young abroad, the very day they are hatched, in queſt of food, which they are ſhown by the mother, and which they pick up for themſelves, they generally make their neſts on the ground. The toes of all theſe are united by a membrane as far as the firſt articulation, and then are divided as in thoſe of the former claſs. Under this claſs we may therefore render the common cock, the peacock, the turkey, the pintada or Guinea hen, the pheaſant, the buſtard, the grous, the partridge, and the quail. They all bear a ſtrong ſimilitude to each other, being equally granivorous, fleſhy, and delicate to the palate. They are among birds what beaſts of paſture are among quadrupeds, peaceable tenants of the field, and ſhunning the thicker parts of the foreſt, that abounds with numerous animals, who carry on unceaſing hoſtilities againſt them. As nature has formed the rapacious claſs for war, ſo ſhe ſeems equally to have fitted theſe for peace, reſt, and ſociety. Their wings are but ſhort, ſo that they are ill formed for wandering from one region to another; their bills are alſo ſhort, and incapable of annoying their oppoſers: their legs are ſtrong indeed; but their toes are made for ſcratching up their food and not for holding or tearing it. Theſe are ſufficient indications of their harmleſs nature; while their bodies, which are fat and fleſhy, render them unweildy travellers, and incapable of ſtraying far from each other.

Accordingly, we find them chiefly in ſociety: they live together; and though they may have their diſputes, like all other animals, upon ſome occaſions; yet, when kept in the ſame diſtrict, or fed in the ſame yard, they learn the arts of ſubordination; and in proportion as each knows his ſtrength, he ſeldom tries a ſecond time the combat where he has once been worſted. In this manner, all of this kind ſeem to lead an indolent voluptuous life. As they are furniſhed internally with a ſtrong ſtomach, commonly called a gizzard, ſo their voraciouſneſs ſcarce knows any bounds. If kept in cloſe captivity, and ſeparated from all their former companions, they have ſtill the pleaſure of eating left; and they ſoon grow fat and unweildy in their priſon. To ſay this more ſimply, many of the wilder ſpecies of birds, when cooped or caged, pine away, grow gloomy, and ſome refuſe all ſuſtenance whatever; none except thoſe of the poultry kind grow fat, who ſeem to loſe all remembrance of their former liberty, ſatisfied with their indolence and plenty. The ſea fowls which come on ſhore in immenſe numbers to rooſt, in the north iſlands of Scotland, ſet their watches and centinels at diſtant poſts, to give them notice of any danger; on the leaſt alarm from theſe, the whole body riſes, but without ſuch notice they are not to be alarmed, by almoſt any thing. The people of the country know this; and when they go out take them they employ all their art to take the centinels without noiſe; this they ſometimes ſucceed in, and when they do, they often afterwards catch three hundred of the others, or more, in one night. Phil. Tranſ. N° 233.

The laying of theſe ſea birds is leſs certain as to time than might be imagined. They can occaſionally defer it; and as they uſually lay in a rainy ſeaſon, if the rain does not come on at the uſual time, they will defer it ſome weeks; and if the April moon goes far in May, that alſo has been obſerved to hinder them from laying ten or twelve days longer than ordinary.

Tame FOWL are a neceſſary part of the ſtock of a country farm; and yield conſiderable ſervice and profit, by their eggs, brood, feathers, dung, &c. They may be kept at a very eaſy expence near any highway-ſide: as being able to ſhift for themſelves, during the greateſt part of the year, by their feeding on inſects, worms, ſnails, and almoſt any thing eatable. The oldeſt hens are always the beſt for ſitting, and the youngeſt for laying; but no ſort will be good for either, if kept too fat.

The beſt age to ſet a hen for chickens, is, from two years old to five; and the moſt proper month to ſet them in, is February; though it may be done, to good purpoſe, at any time between that and Michaelmas. One cock will ſerve ten hens. A hen ſits but twenty days; whereas geeſe, ducks, and turkeys, ſit thirty. Buck-wheat, or French wheat, or hemp-ſeed, it is ſaid, makes them lay faſter than any other food; and the ſame buck-wheat, either whole, or ground, and made into a paſte, fats them apace; though the common food for that purpoſe, is barley-meal; or pollard mixed up with hot water or milk. A gooſe will ſcarce ſit on any but her own eggs; a hen will ſit indifferently on all. The lighteſt coloured geeſe are the beſt, and thoſe that begin to lay the ſooneſt; as they have a chance of hatching twice in one year. They begin to lay in the ſpring, and lay twelve or ſixteen eggs. Green geeſe are begun to be fattened at a month old, and will be fat in a month more. Old geeſe are chiefly fattened at ſix months old, in or after the harveſt. A wild gooſe, if red-footed and hairy, is old; but if white-footed, and not hairy, ſhe is young. When the eggs are ſet under a hen, or other fowl, it is adviſeable to mark the upper ſides thereof; and when ſhe goes to feed, to note whether ſhe minds to turn them upſide down, or not; if ſhe neglect that office, it may be done for her.

FOWLING, the act, or art, of catching birds with nets, birdlime, decoys, and other devices; as alſo of breeding up the ſame. For particulars, ſee the article Decoy.

FOX, an animal of the dog kind; much reſembling the common dog in form, and of the ſize of the ſpaniel. It is chiefly diſtinguiſhed by its long ſtraight tail, with a white tip to it. It differs, however, from the common dog in the length, denſe diſpoſition, and ſoftneſs of the hairs, eſpecially thoſe about its tail, which is buſhy, much admired by the animal itſelf; and in cold weather wrapped round its noſe; and in its ſmell, which is peculiarly rank and diſagreeable. The ſmell of its urine is remarkably fœtid; inſomuch that the animal covers it in the earth. It is ſaid that the fox makes uſe of its urine as an expedient to force the cleanly badger from its habitation; however, it makes uſe of the badger's hole. Its uſual colour is a reddiſh tawny, though it is ſometimes found white, and ſometimes black. Its manner of digging itſelf a hole in the earth, is alſo a cuſtom wholly different from all the dog-kind; and it is far from the tameneſs of that animal, being with difficulty made to loſe its fierceneſs. Of all animals the fox has the moſt ſignificant eye, by which it expreſſes every paſſion of love, fear, hatred, &c. The fox is a crafty, lively, libidinous animal; it breeds only once a year, unleſs ſome accident befalls its firſt litter, and brings four or five young, which, like puppies, are born blind. The fox is a native of moſt northern countries, and there are three varieties of it, differing a little in form, but not in colour. They are diſtinguiſhed in Wales by different names. The *greyhound fox* is the largeſt, talleſt, and boldeſt, and will attack a grown ſheep or wether; the *maſtiff fox* is leſs, but more ſtrongly built: the *cur fox* is the leaſt, lurks about hedges, out-houſes, &c. and is the moſt pernicious to the feathered tribe. The firſt of theſe has a white tip to the tail: the laſt a black. The ſkin of this animal is furniſhed with a ſoft and warm fur, which in many parts of Europe is uſed to make muffs and fine cloths. A fox in the firſt year is called a cub; in the ſecond, a fox, and afterward an old fox. It is a beaſt of chaſe, uſually very prejudicial to the huſbandman, by taking away and deſtroying his lambs, geeſe, and poultry. It will feed on fleſh of any kind; and when urged by hunger eat carrots and inſects; and, near the ſea-coaſts, for want of other food, eat crabs, ſhrimps, or ſhell-fiſh. In France and Italy it does incredible damage to the vineyards, by eating the grapes, of which it is very fond. The fox is a great deſtroyer of rats, and field animals. It ſecures its booty by digging holes in ſeveral places; and if a whole ſtock of poultry ſhould happen to be its prey, will bring them one by one, thruſt them in with its noſe, and conceal them by ramming the looſe earth upon them, till the calls of hunger induce him to devour them. The common way to catch him is by gins, which being baited, and a train made by drawing raw fleſh acroſs his uſual paths or haunts to the gin, it proves an inducement to lure him to the place of deſtruction. They are alſo taken with greyhounds, hounds, terriers, and nets; it is a commendable exerciſe to hunt theſe miſchievous beaſts, the nature of which in many reſpects is like that of wolves. See Hunting.

FRACTION, in arithmetic and algebra, a part or diviſion of an unit, or integer; or, a number which ſtands to an unit in the relation of a part to its whole. The word literally imports a broken number. Fractions are uſually divided into *decimal*, and *vulgar*. For a full explanation, with the ſeveral rules, ſee the Syſtem of Arithmetic, Articles XI. and XII. and Syſtem of Algebra, Sect. III.

FRACTURE, in medicine and ſurgery, a breach, or rupture of a bone; or a ſolution of continuity in a bone, when it is cruſhed, or broken, by ſome external cauſe. See Syſtem of Surgery.

FRÆNUM, or Frenum, bridle, in anatomy, a name given to divers ligaments, from their office in retaining and curbing the motions of the parts they are fitted to. *Frænum linguæ*, or bridle of the tongue, is a membranous ligament, which ties the tongue to the os hyoides, larynx, fauces, and lower part of the mouth. In ſome ſubjects the *frænum* runs the whole length of the tongue, to the very tip; in which caſes, if it were not cut, it would take away all poſſibility of ſpeech. *Frænum* of the *penis*, is a ſlender ligament, whereby the prepuce is tied to the lower part of the glans of the penis. See Syſtem of Anatomy, Part III. Sect. IV.

Nature varies in the make of this part; it being ſo ſhort in ſome, that, unleſs divided, it would not admit of perfect erection. There is alſo a kind of little *frænum*, faſtened to the lower part of the *clitoris*.

FRAIGHT, or Freight, in navigation and commerce, the hire of a ſhip, or of a part of it, for the conveyance and carriage of goods from one part or place to another; or the ſum agreed on between the owner and the merchant, for the hire and uſe of a veſſel. The fraight of a veſſel is uſually agreed on either at the rate of ſo much for the voyage, or by the month, or per ton. Fraighting, or letting out veſſels on fraight, or hire, is one of the principal articles in the trade of the Hollanders: they are the carriers of all the nations of Europe, and their purveyors; notwithſtanding that their country produces little or nothing, and that they are forced to have every thing neceſſary for the building of a veſſel from other countries. If merchandizes in caſks, as wines, oils, &c. have ſo run out in carriage, that the veſſels are left empty, or almoſt empty, the merchant may relinquiſh them, and the maſter be obliged to take them for their fraight; though this does not hold of any other goods damaged, or diminiſhed of themſelves, or through accidents.

Fraight is alſo uſed for the burthen, or lading of a ſhip, or the cargo of goods, &c. which ſhe has on board.

FRAISE, in fortification, a kind of defence conſiſting of pointed ſtakes, driven parallel to the horizon, into the retrenchments of a camp, a half-moon, or the like, to ward off and prevent any approach or ſcalade.

FRAME, in joinery, &c. a kind of caſe, wherein a thing is ſet or incloſed, or even ſupported; as a window frame, a frame of a picture, of a table, &c.

Frame is alſo a machine uſed in divers arts, and more particularly for a ſort of loom, whereon artizans ſtretch their linens, ſilks, ſtuffs, &c. to be embroidered, quilted, or the like.

FRAMING *of a Houſe*, all the timber work therein, viz. the carcaſe, flooring, partitioning, roofing, cieling, beams, aſhlering, &c.

FRANCHISE, a privilege or exemption from ordinary juriſdiction. Franchiſe is alſo uſed for an immunity from the ordinary tributes and taxes. This is either real or perſonal; that is, either belonging immediately to the perſon; or accruing on account of this or that place, or office of immunity. Theſe franchiſes, being royal privileges, or branches of the king's prerogative, ſubſiſting in the hands of a ſubject, are derived from the crown by grant or charter, and, in ſome caſes, are held by preſcription and uſage. They may be veſted either in natural perſons, or bodies politic; in one man, or in many; but the ſame identical franchiſe that has before been granted to one, cannot be beſtowed on another, for that would prejudice the former grant, The principal kinds of franchiſes are the following: to be a county palatine is a franchiſe veſted in a number of perſons. It is likewiſe a franchiſe for a number of perſons to be incorporated, and ſubſiſt as a body politic, with a power to maintain perpetual ſucceſſion, and do other corporate acts; and each individual member of ſuch corporation is alſo ſaid to have a franchiſe or freedom. Other franchiſes are to hold a court leet; to have a manor or lordſhip; or, at leaſt, to have a lordſhip paramount, to have waifs, wrecks, eſtrays, treaſure-trove, royal-fiſh, forfeitures, and deodands; to have a court of one's own, or liberty of holding pleas or trying cauſes; to have the cognizance of pleas, which is a ſtill greater liberty, being an excluſive right, ſo that no other court ſhall try cauſes ariſing within that juriſdiction; to have a bailiwick, or liberty exempt from the ſheriff of the county, wherein the grantee only and his officers are to execute all proceſs; to have a fair or market, with the right of taking toll, either there, or at any other public places, as bridges, wharfs, and the like; which tolls muſt have a reaſonable cauſe of commencement, elſe the franchiſe is illegal and void; or, laſtly, to have a foreſt, chaſe, park, warren, or fiſhery, endowed with privileges of royalty.

FRANCISCAN *Monks*, *Friars Minor*, or *Grey-Friars*; religious of the order of St. Francis, founded by him in the year 1209. The rule of the Franciſcans, as eſtabliſhed by St. Francis himſelf, is briefly this: they are to live in common, to obſerve chaſtity, and to pay obedience to the pope and their ſuperiors. Before they can be admitted into the order, they are obliged to ſell all they have, and give it to the poor: they are to perform a year's noviciate; and, when admitted, never to quit the order upon any account. They are to faſt from the feaſt of All-ſaints, to the Nativity: this order produced 4 popes, 42 cardinals, and an infinite number of patriarchs.

FRANK, or FRANC, a term literally ſignifying free and open, or exempt from public impoſitions and charges; as frank, confeſſion, frank fair, frank letter, &c.

FRANK *Language*, or *Lingua* FRANCA, is a kind of jargon, ſpoken on the Mediterranean, and particularly throughout the coaſts and ports of the Levant; compoſed of Italian, Spaniſh, French, vulgar Greek, and other languages. The *lingua franca* is the trading language; and is thus called from the Franks, a common appellation given in the Levant to all the European merchants and traders who come thither to traffick.

FRANK *Letters*, or *Letters free of Poſtage*. The privilege of ſuch letters was claimed by the houſe of commons in 1660, when the firſt legal ſettlement of the preſent poſt-office was made; but afterwards dropped on a private aſſurance from the crown, that this privilege ſhould be allowed the members. Accordingly a warrant was conſtantly iſſued to the poſt-maſter general, directing the allowance thereof to the extent of two ounces in weight; till at length it was expreſsly confirmed by ſtat. 4 Geo. III. cap. 24. which adds many new regulations, rendered neceſſary by the abuſes crept into the practice of franking; whereby the annual amount of *franked letters* had gradually increaſed from 23,600l. in 1715, to 170,700l. in 1763. Blackſt. Com. vol. i. p. 322.

FRANK, or *Franc*, an ancient coin, either of gold or ſilver, ſtruck and current in France. The value of the gold franc was ſomething more than that of the gold crown; the ſilver franc was a third of the gold one: this coin is long out of uſe, though the term is ſtill retained as the name of a money of account; in which ſenſe it is equivalent to the livre, or 20 ſols.

FRANKINCENSE, or ſimply INCENSE, an odoriferous aromatic gum, or reſin, anciently burnt in temples, as a perfume, and now uſed in pharmacy, as an agglutinant and ſtrengthener. The word is formed from the Latin *incenſum, burnt*; as alluding to its ancient uſe in temples. Frankincenſe diſtils from inciſions made in a tree called *arbor thurifera*, during the heats of ſummer. But notwithſtanding the great uſe of this gum, both in the ancient religion, and the modern medicine, the tree that produces it, or even the place where the tree grows, is but little known.

Frankincenſe was formerly burnt in the temples of all religions, to do honour to the divinities that were there adored. Many of the primitive Chriſtians were put to death, becauſe they would not offer incenſe to idols. In the Romiſh church they ſtill retain the uſe of incenſe in ſome of their ceremonies; always at high maſs, and at the elevation of the hoſt at veſpers; and at ſolemn funerals, beſtowing it on ſuch perſons as they would honour, as on prelates, &c. and ſometimes alſo on the people.

FRATERIA, of *frater, brother*, a fraternity, brotherhood, or ſociety of religious perſons, who were bound to pray for the good health and life, &c. of their living brethren, and the ſouls of thoſe that were dead. In the ſtatutes of the cathedral church of St. Paul, London, collected by Ralph Baldock, dean, 1295, there is one chapter *De frateria benificiorum eccleſia S. Pauli, &c.*

FRATERNITY, in a civil ſenſe, is uſed for a guild aſſociation, or ſociety of perſons, united into a body, for ſome common intereſt or advantage. For the origin, uſe, &c. of fraternities, ſee COMPANY and GILD.

FRATERNITY, in a religious ſenſe, is a ſociety of perſons meeting together to perform ſome exerciſes of devotion, or divine worſhip. In the Romiſh church, ſuch fraternities are very numerous and conſiderable, being moſt of them eſtabliſhed by royal patents; as the fraternity of the Scapulary; of St. Francis's cord. The biſhop may hinder the eſtabliſhment of any ſuch fraternity in his dioceſe. There are nine different ſorts of fraternities, or confrairies, in France, viz. 1. Of devotion. 2. Of charity, or mercy. 3. Of penitents, under divers names. 4. Of pilgrimage. 5. Of merchants to procure the divine favour on their endeavours. 6. Of officers of juſtice. 7. Of the ſufferings of Chriſt. 8. Of arts and trades of divers kinds. And, 9. Of factions.

FRATRICIDE, of *frater, brother*; and *cædo, I kill*, the crime of murdering one's brother. See PARRICIDE. Cain committed the firſt *fratride*; and the empire of Rome began with a *fratricide*.

FRAUD, FRAUS, a ſecret underhand deceit, or injury, done to any one. To export or import goods by fraud, or fraudulently, is to do it by indirect ways, in order to avoid the paying of duty, &c. if they be permitted goods; or if they be contraband goods, to avoid the penalties adjudged by the laws.

FRAXINUS, the Aſh; a genus of the diœcia order, belonging to the polygamia claſs of plants. There are ſix ſpecies; of which the moſt uſeful is the common aſh, which is ſo well known, that it needs no deſcription.

FRAY literally ſignifies to fret; as cloth or ſtuff does by rubbing, or over-much wearing. Among hunters a deer is ſaid to *fray his head*, when he rubs it againſt a tree, to cauſe the ſkins of his new horns to come off.

FREAM, among farmers, arable or ploughed land worn out of heart, and laid fallow till it recovers.

FRECKLES, *Lentigines*, ſpots of a yellowiſh colour, of the bigneſs of a lentile ſeed, ſcattered over the face, neck, and hands. Freckles are either natural, or proceeding accidentally from the jaundice, or the action of the ſun upon the part. Heat, or a ſudden change of the weather, will often cauſe the ſkin to appear of a darker colour than natural; and thereby produce what is called tan, ſunburn, and morphew, which ſeem to differ only in degree; and uſually diſappear in winter. Perſons of a fine complexion, and ſuch whoſe hair is red, are the moſt ſubject to freckles, eſpecially in thoſe parts which they expoſe to the air. To remove freckles, put juice of lemons in a glaſs vial, and, mixing it with ſugar and borax finely powdered, let it digeſt eight days, and then uſe it. Homberg propoſes bullock's gall mixed with alum, and, after the alum has precipitated, expoſed three or four months to the ſun in a cloſe vial, as one of the beſt remedies known for the removing of freckles.

FREE, a term variouſly uſed; but generally in oppoſition to conſtrained, confined, or neceſſitated. See FRANK. Thus, a man is ſaid to be free, who is out of priſon; and a bird is free, when let out of the cage: free from pain, i. e. void of pain; we ſay, a free air, a free paſſage, &c. FREE, in ſpeaking of things endowed with underſtanding, has a more peculiar relation to the will, and implies its being at full liberty. The ſtoics maintain, that their ſage or wiſe men alone are free. FREE is alſo uſed in oppoſition to ſlave. The moment a ſlave ſets foot on Engliſh ground, he becomes to ſome purpoſes free. The fineſt legacy the ancient Romans could leave their ſlaves, was their freedom.

FREE *Bench*, or *franc banc*, ſignifies that eſtate in copyhold lands, which the wife hath after the deceaſe of her huſband, for her dower, according to the cuſtom of the manor. Fitzherbert calls *free banc* a cuſtom, whereby, in certain cities, the wife ſhall have her huſband's whole lands, &c. for her dower. Thus, at Orleton, in the county of Hereford, the relict of a copyhold tenant formerly was admitted to her *free bench*, i. e. to all her huſband's copyhold land, during her life, at the next court after her huſband's death. In the manors of Eaſt and Weſt Enbourne, in Berks, if a cuſtomary tenant died, the widow had a *free bench* in all his copyhold lands, only *dum ſola & caſta fuerit*: if ſhe committed incontinency, ſhe forfeited her eſtate; but if ſhe came into court, riding backwards on a black ram, with his tail in her hand, rehearſing a certain form of words, in the nature of a confeſſion and petition, the ſteward was bound by the ancient cuſtom to reſtore to her her *free bench*. The words were theſe:

Here I am
Riding upon a black ram,
Like a whore as I am:
And for my crincum crancum
I have loſt my bincum bancum,
And for my tail's game
Have done this worldly ſhame;
Therefore, pray, Mr. Steward, let me have my land again.

The like cuſtoms were held alſo in the manor of Chadleworth, in Berks; that of Tor, in Devonſhire; and in ſome other parts of the Weſt.

FREE *Booter*, a name given to pirates, who ſcour the American ſeas; particularly ſuch as make war againſt the Spaniards.

FREE *Chapel*, is a chapel founded by the king, and by him exempted from the juriſdiction of the ordinary. A ſubject may alſo be licenſed by the king to build ſuch a chapel, and by his charter may exempt it from the viſitation of the biſhop, &c.

FREE or *Imperial Cities* in Germany, are thoſe not ſubject to any particular prince; but governed, like republics, by their own magiſtrates. FREE-*ſtate*, is a republic governed by magiſtrates, elected by the free ſuffrages of the inhabitants.

FREE *Maſon*. See MASON.

FREE *Stone*, a whitiſh ſtone, dug up in many parts of England, that works like alabaſter; but is more hard and durable, being of excellent uſe in buildings, &c. It is a kind of the gritt ſtone, but finer ſanded, and a ſmoother ſtone; and it is called *free-ſtone*, from its being of ſuch a conſtitution as to be cut freely in any direction. The qualities of the ſeveral kinds of *free-ſtone* in common uſe in the ſeveral parts of Europe, are very different. They all agree in this general property indeed, that they are ſofter while in the quarry than when they have been ſome time expoſed to the air: but even this general property differs greatly in degree. They have a ſort of grey *free-ſtone* in uſe at Paris, of which we do not ſeem yet to have met with any quarries in England, though probably enough there are ſuch, which has this property in ſo eminent a degree, that the expence of working it is in a meaſure ſaved. Our Portland ſtone, of the fineſt kind, which is white, and of a cloſe gritt, is very fit for hewing or carving, but it will neither reſiſt water nor fire, which is a very ſingular circumſtance in ſo denſe a ſtone; while the *free-ſtone* of Kent, which is leſs beautiful to the eye, and is of a greyiſh colour, and conſiderably cloſe, though of a larger grain, reſiſts the air and water very well. The *free-ſtone* of Derbyſhire, on the other hand is ſo brittle as to be unfit for any fine working, and ſo coarſe and open in its texture that it lets water through; yet it bears the fire extremely well, and is fit for ovens, hearths, &c. Phil. Tranſ. N° 93.

FREEDOM, the quality or ſtate of being free.

FREEDOM *of a City, Town, &c.* denotes a right or capacity of exerciſing a certain trade or employment in that city or town corporate, and of being elected to the dignities and offices thereof. It is procured regularly, by ſerving an apprenticeſhip; but ſometimes purchaſed with money, and ſometimes conferred as a favour or compliment. Freedom of the will, a ſtate or faculty of the mind, wherein all the motions of our will are in our power, and we are enabled to determine on this or that; to do good or evil, without any force or conſtraint from any external cauſe whatever.

Freedom *of Conſcience.* See Liberty, and Toleration.

FREEHOLD, Frank Tenement, *liberum tenementum*, is land, or tenement, which a man holds in fee-ſimple, fee-tail, or for a term of life. Freehold is of two kinds, in deed, and in law. The firſt is the real poſſeſſion of land or tenement in fee, fee-tail, or for life: the other is the right a man has to ſuch land or tenement before his entry or ſeizure. A freehold, by the common law, cannot commence *in futuro*, but it muſt take effect preſently, either in poſſeſſion, reverſion, or remainder. Whatever is part of the freehold goes to the heir; and things fixed thereto may not be taken in diſtreſs for rent, or in execution, &c. No man ſhall be diſſeiſed of his freehold, by ſtat. Magna Charta, cap. 29. but by judgment of his peers, or according to the laws of the land: nor ſhall any diſtrain freeholders to anſwer for their freehold, in any thing concerning the ſame, without the king's writ. Freehold eſtates, of certain value, are required by ſtatutes to qualify jurors, electors of the knights of the ſhire in parliament, &c. For the method of finding the value of freehold eſtates, ſee Syſtem of Annuities, Problem VI.

Freehold is likewiſe extended to ſuch offices as a man holds in fee, or for life.

FREEZE, or Frize, in architecture, that part of the entablature of columns, between the architrave and corniche. The *freeze* is properly a large, flat face, or member, ſeparating the architrave from the corniche. See Syſtem of Architecture, on the Orders of Architecture in general.

Freeze, in commerce, a kind of cloth or ſtuff. See Frize.

FREEZING, *Congelation*, in phyſiology, the fixing of a fluid, or depriving it of its natural mobility, by the action of cold; or it is the act of converting a fluid ſubſtance into a firm, coherent, rigid one, called ice. See Congelation.

Freezing *Rain*, or *Raining Ice*, a very uncommon kind of ſhower, which fell, in the Weſt of England, in December, anno 1672. See Phil. Tranſ. N° 90. This rain, as ſoon as it touched any thing above ground, as a bough, or the like, immediately ſettled into ice: and, by multiplying and enlarging the icicles, it broke all down with its weight. The rain that fell on the ſnow, immediately froze into ice, without ſinking in the ſnow at all. It made an incredible deſtruction of trees, beyond any thing in all hiſtory. "Had it concluded with ſome guſt of wind," ſays a gentleman on the ſpot, "it might have been of terrible conſe-"quence." "The ſprig of an aſh-tree, of juſt three quarters of a pound, being weighed, the ice thereon weighed ſixteen pounds. Some were frighted with the noiſe in the air; till they diſcerned it was the clatter of icy boughs daſhed againſt each other." Dr. Beale obſerves, that there was no conſiderable froſt obſerved on the ground during the whole; whence he concludes, that a froſt may be very fierce, and dangerous, on the tops of ſome hills: while, in other places, it keeps at two, three, or four feet diſtance above the ground, rivers, lakes, &c. and may wander about very furiouſly, in ſome places, and be remiſs in others, not far off. This froſt was followed by glowing heats, and a wonderful forwardneſs of vegetation.

FRENCH, in general, ſomething belonging to France: thus we ſay, the French language, French cuſtoms, polity, &c. The French language is made up of Latin, Greek, Teutonic, and the language ſpoken by the old Gauls. It is natural, and eaſily pronounced; and therefore uſed by moſt nations in Europe in converſing with foreigners. There are very few compound words in French; which is acknowledged to be its diſadvantage. It has alſo few diminutives: but as to purity, eaſineſs, and flexibility, it yields to none.

French *Graſs*, a name given by our farmers to a plant raiſed for the food of cattle, and more properly called *ſaint-foin*. It had its name French graſs, from its coming originally to us from France, and from its uſe in ſerving both freſh and dried for the food of cattle. See Syſtem of Agriculture, Sect. IX.

FRESCO, in the Arts, a kind of painting performed on freſh plaſter, or on a wall laid with mortar not yet dry: and with water-colours. This ſort of painting has a great advantage: by its incorporating with the mortar, and drying along with it, it is rendered extremely durable; and never fails or falls, but along with it. The Italians, from whom we borrow the term, call it *freſco*, becauſe it is frequently uſed for walls, alcoves, and other buildings, in the open air. Vitruvius, lib. vii. cap. 4. calls it *udo tectorio.* Painting in *freſco* is very ancient, having been practiſed in the earlieſt ages of Greece and Rome. It is chiefly performed on walls and vaults, newly plaſtered with lime and ſand; but the plaſter is only to be laid, in proportion as the painting goes on; no more being to be done at once, than the painter can diſpatch in a day, while it dries. Before he begins to paint, a cartoon or deſign is uſually made on paper, to be calked, and transferred to the wall, about half an hour after the plaſter is applied. The ancients painted on ſtucco; and we may remark in Vitruvius what infinite care they took in making the incruſtation or plaſtering of their buildings to render them beautiful and laſting; though the modern painters find a plaſter made of lime and ſand preferable to it; both as it does not dry ſo haſtily, and as being a little browniſh, it is fitter to lay colours on than a ground ſo white as ſtucco. In this kind of painting, all the compound and artificial colours, and almoſt all the minerals, are ſet aſide, and ſcarce any thing is uſed but earths; which are capable of preſerving their colour, defending it from the burning of the lime, and reſiſting its ſalt, which Vitruvius calls its bitterneſs. For the work to come out in all its beauty, the colours muſt be laid on quick, while the plaſter is yet moiſt; nor ſhould they ever be retouched, dry, with colours mixed up with the white of an egg, or ſize, or gum, as ſome workmen do; becauſe ſuch colours grow blackiſh; nor do any preſerve themſelves, but only ſuch as were laid on haſtily at firſt. The colours uſed, are white made of lime ſlacked long before, and white marble duſt; oker, both red and yellow; verditer; lapis lazuli; ſmalt; black chalk, &c. All which are only ground, and worked up with water; and moſt of them grow brighter and brighter, as the *freſco* dries. The bruſhes and pencils for this work ought to be long and ſoft, otherwiſe they will rake and raiſe the painting. The colours ſhould be full, and flowing from the bruſh; and the deſign perfect; for, in this work, you cannot alter or add upon any colour.

FRESH *Water*, is that not tinctured or impregnated with ſalt, or ſaline particles, enough to be diſcoverable by the ſenſe. Such generally is that of ſprings, rains, wells, lakes, &c. Dr. Liſter is of opinion, that the natural and original ſtate of water is to be ſalt; the freſhneſs he ſuppoſes to be accidental, and to be owing to the vapours of plants, and the breadth of animals therein; and to the exhalations raiſed by the ſun. Others will have all water originally freſh, and take its ſaltneſs to be accidental; to account for which, a great number of hypotheſes have been framed. The ſaltneſs of water is a foreign, and in moſt caſes a hurtful quality. It renders it not only nauſeous to the taſte, but greatly prejudicial to the body; and it is generally agreed, that thoſe waters, *cæteris paribus*, are beſt, not only for drinking, but alſo for œconomical uſes, as waſhing, boiling, and brewing, which are the freeſt from ſaltneſs. The dulcifying, or making of ſalt water freſh, is a ſecret, that has been long ſought with great attention. For an account of the principal attempts that have been made with this view, ſee *Sea*-Water.

Fresh *Wind*, ſignifies ſtrong, but not violent; hence when the gale increaſes, it is ſaid to freſhen.

FRET, or Frett, in architecture, a kind of knot, or ornament, conſiſting of two liſts, or fillets; variouſly interlaced, or woven, and running at parallel diſtances, equal to their breadth.

Fret, or Frette, in heraldry, is a bearing conſiſting of ſix bars, croſſed, and interlaced, *fretwiſe*.

FRETTY, or Frette, in heraldry, is where there are divers bars laid acroſs each other.

FRET-*Work*, an enrichment of frets, or a place adorned with ſomething in manner thereof. *Fret-work* is ſometimes uſed to fill up and enrich flat, empty ſpaces; but it is principally practiſed in roofs, which are fretted over with plaſter-work.

FRIABLE is applied by naturaliſts to bodies, to denote them tender and brittle, eaſily crumbled or reduced to powder between the fingers; their force of coheſion being ſuch as eaſily expoſes them to ſuch ſolution. Such as pumice, and all calcined ſtones, burnt alum, &c. *Friability* is ſuppoſed to ariſe hence, that the body conſiſts wholly of dry parts, irregularly combined, and which are readily ſeparated, as having nothing unctuous or glutinous to bind them together.

FRIAR, or Frier, by the Latins called *frater*, the Italians *fra*, and the French *frere*, that is, *brother*, is a term common to the monks of all orders; founded on this, that there is a kind of fraternity, or brotherhood, preſumed between the ſeveral religious perſons of the ſame convent or monaſtery. The kinds of friars are very numerous; Auguſtine friars; Dominican, or black, or preaching friars; Franciſcan, or grey, or begging friars; and Carmelites, or white friars. Friar, in a more peculiar ſenſe, is reſtrained to ſuch monks as are not prieſts; for thoſe in orders are uſually dignified with the appellation of *father*.

FRIBURGH, Fridburgh, or Fritheborg, among our Anglo-Saxon anceſtors, denoted the ſame as frank-pledge did after the time of the conqueſt. Every man in this kingdom was anciently aſſociated in ſome decennary, or company of ten families, who were pledged, or bound, for each other, to keep the peace, and obſerve the law. If any offence was done by one, the other nine were to anſwer it; that is, if the criminal fled from juſtice, they had thirty days allowed to apprehend him; if he was not taken in that time, he who was the *friburgh*, i. e. the principal pledge of the ten, ſhould take two of his own number, and the chief pledges of three neighbouring *friburghs*, with two others out of each of the ſaid *friburghs*, who were to purge themſelves, and their *friburgh*, of the forfeiture and flight of the criminal. If they could not do this, the principal pledge, with the other eight, were to make ſatisfaction. Great men were not combined in any ordinary decenna, or dozen, as being deemed a ſufficient aſſurance for themſelves and their menial ſervants.

FRICASSEE, a diſh, or meſs, haſtily dreſſed in a frying-pan, and ſeaſoned with butter, oil, or the like. We ſay a *fricaſſee* of pullets, of rabbets, of tench, of tripe, of frogs, of eggs, of peas, &c.

FRICTION, the act of rubbing or grating the ſurface of one body againſt that of another, called alſo *attrition*. The phenomena ariſing upon the friction of divers bodies, under different circumſtances, are very numerous and conſiderable. Mr. Hawkſbee gives us a number of experiments of this kind; particularly of the attrition, or friction of glaſs, under various circumſtances, the reſult of which was, that it yielded light, and became electrical. All bodies by friction are brought to conceive heat; many of them to emit light; particularly a cat's back, ſugar, beaten ſulphur, mercury, ſea-water, gold, copper, &c. but, above all, diamonds, which, when briſkly rubbed againſt glaſs, gold, or the like, yield a light equal to that of a live coal when blowed by the bellows. See Syſtem of ELECTRICITY. Part I. Sect. II.

FRICTION, in mechanics, denotes the reſiſtance a moving body meets with from the ſurface on which it moves. For the laws and principles, ſee Syſtem of MECHANICS.

FRICTION, in medicine and ſurgery, denotes the act of rubbing a diſeaſed part with oils, unguents, or other matters; in order to eaſe, relieve, and cure it. Frictions are much uſed of late in venereal caſes. They prefer the applying of mercury externally by way of friction, to that of giving it internally, to raiſe a ſalivation. There are alſo frictions with the fleſh-bruſh, a linen cloth, or the hand only. Frictions of any kind are a ſort of exerciſe which contribute generally to health; as they excite and ſtir up the natural warmth, divert defluctions, promote perſpiration, open the pores of the ſkin, and carry off ſtagnant humors. The fleſh-bruſh, Dr. Cheyne obſerves, is an exerciſe extremely uſeful for promoting a full and free perſpiration, and circulation. Every body knows the effect of currying horſes; that it makes them ſleek, gay, lively, and active; ſo as ever to be judged equivalent to half the feeding. This it can no otherwiſe effect, but by aſſiſting nature to throw off the recrements of the juices, which ſtop the free circulation, and, by conſtant friction, irritation and ſtimulation, to bring the blood and ſpirits to the parts moſt diſtant from the ſeat of heat and motion; and ſo plump up the ſuperficial muſcles. And the ſame effect it would have in other creatures, and man himſelf, if managed in the ſame manner, and with the ſame care and regularity. Perſons, therefore, of weak nerves, and ſedentary lives, would do well to ſupply the want of other exerciſe with ſpending half an hour, morning and night, in currying and rubbing their whole body, eſpecially their limbs, with a fleſh-bruſh. But this means of health is moſt advantageouſly uſed when the *primæ viæ* are moſt empty.

FRIDAY, the ſixth day of the week ſo called from Friga, a goddeſs worſhipped by the Saxons on this day. It is a faſt-day in the church of England, in memory of our Saviour's crucifixion, unleſs Chriſtmas-day happens to fall on Friday which is always a feſtival.

Good **FRIDAY**. See PASSION-*Week*.

FRIGATE, a ſhip uſually of two decks, light built, deſigned for ſwift ſailing. When it hath but one deck, and conſequently is of a ſmaller ſize, they call her a light frigate. Frigates mount from twenty to thirty-eight guns, and are eſteemed excellent cruizers. The name was formerly known only in the Mediterranean, and applied to a long kind of veſſel, navigated in that ſea with ſails and oars. The Engliſh were the firſt who appeared on the ocean with theſe ſhips, and equipped them for war as well as for commerce. See NAVAL *Affairs*.

FRIGATE *Built* denotes the diſpoſition of the decks of ſuch merchant ſhips as have a deſcent of four or five ſteps from the quarter deck and fore-caſtle into the waiſt, in contradiſtinction to thoſe whoſe decks are on a continued line for the whole length of the ſhip, which are called galley built.

FRIGHT. This paſſion has been known not only to cauſe, but to cure diſeaſes. Mr. Boyle mentions agues, gout, and ſciatica, cured by this means. See Works, abr. p. 82, &c. It is a commonly known cure for the hiccough, to put the patient in a ſudden fright.

FRIGID, *Cold*, is variouſly uſed. A frigid ſtyle, is a low, jejune manner of diction; wanting force, warmth of imagination, figures of ſpeech, &c.

FRIGID *Zone*, or *Frozen Zone*, in geography. See Syſtem of GEOGRAPHY.

FRIGIDITY is alſo uſed in the ſame ſenſe with impotence.

FRIGORIFIC, of *frigus*, *cold*, and *facio*, *I make*, in phyſics, ſomething that occaſions cold.

FRINGILLA, in ornithology, according to Linnæus the 72d genus and belonging to the 6th order, called Paſſeres. Latham in his improved arrangement makes it the 37th genus, and belonging to the 3d order. For the claſſification, ſee the Syſtem. For the repreſentation, ſee Plate II. The bill is conical, ſtraight, and ſharp pointed. There are no leſs than 30 ſpecies comprehended under this genus, diſtinguiſhed principally by varieties in their colour. The following are natives of Britain:

The *carduelis*, or *goldfinch*, with the quill feathers red forwards, and the outermoſt without any ſpots; the two outermoſt are white in the middle, as the reſt are at the point. The young bird, before it moults, is grey on the head; and hence it is termed by the bird catchers a *grey pate*. There is a variety of goldfinches called by the London bird catches a *cheverel*, from the manner in which it concludes its jerk. It is diſtinguiſhed from the common ſort by a white ſtreak, or by two, ſometimes three white ſpots under the throat. Their note is very ſweet; and they are much eſteemed on that account, as well as for their great docility. Towards winter, they aſſemble in flocks; and feed on ſeeds of different kinds, particularly thoſe of the thiſtle. It is fond of orchards, and frequently builds in an apple or pear tree: its neſt is very elegantly formed of fine moſs, liverworts, and bents, on the outſide; lined firſt with wool and hair, and then with the goſlin or cotton of the ſallow. It lays five white eggs, marked with deep purple ſpots on the upper end. The *cælebs*, or *chaffinch*, has its name from its delighting in chaff. This ſpecies entertains us agreeably with its ſong very early in the year, but towards the latter end of ſummer aſſumes a chirping note: both ſexes continue with us the whole year. What is very ſingular in Sweden, the females quit that country in September, migrating in flocks into Holland, leaving their mates behind; in the ſpring they return. In Hampſhire Mr. White has obſerved ſomething of this kind; vaſt flocks of females with ſcarcely any males among them. Their neſt is almoſt as elegantly conſtructed as that of the goldfinch, and of much the ſame materials, only the inſide has the addition of ſome large feathers. They lay four or five eggs of a dull white colour, tinged and ſpotted with deep purple. The *domeſtica*, or *ſparrow*, theſe birds are proverbially ſalacious: they breed early in the ſpring; make their neſts under the eaves of houſes, in holes of walls, and very often in the neſts of the martin, after expelling the owner. Linnæus tells us (a tale from Albertus Magnus), that this inſult does not paſs unrevenged: the injured martin aſſembles its companions, who aſſiſt in plaſtering up the entrance with dirt; then fly away, twittering in triumph, and leave the invader to periſh miſerably. They will often breed in plum trees and apple trees, in old rooks neſts, and in the forks of boughs beneath them. The *linaria*, or *linnet*, hath the bottom of the breaſt of a fine blood red, which heightens as the ſpring advances. Theſe birds are much eſteemed for their ſong: they feed on ſeeds of different kinds, which they peel before they eat: the ſeed of the linum or flax is their favourite food: from whence the name of the linnet tribe. They breed among furze and white thorn: the outſide of their neſt is made with moſs and bents, and lined with wool and hair. They lay five whitiſh eggs, ſpotted like thoſe of the goldfinch. The *cannabina*, or *red headed linnet*, is leſs than the former, and hath a blood-coloured ſpot on the forehead. It is a common fraud in the bird ſhops in London, when a male bird is diſtinguiſhed from the female by a red breaſt, as in the caſe of this bird, to ſtain or paint the feathers, ſo that the deceit is not eaſily diſcovered, without at leaſt cloſe inſpection. Theſe birds are frequent on our ſea coaſts; and are often taken in flight-time near London: it is a familiar bird; and is cheerful in five minutes after it is caught. The *canaria*, or *Canary bird*, hath a whitiſh body and bill, with the prime feathers of the wings and tail greeniſh. It was originally peculiar to thoſe iſles to which it owes its name. Geſner is the firſt who mentions them; and Aldrovand ſpeaks of them as rarieties; that they were very dear on account of the difficulty attending the bringing them from ſo diſtant a country, and that they were purchaſed by people of rank alone. Olina ſays, that in his time there was a degenerate ſort found on the iſle of Elba, off the coaſt of Italy, which came there originally by means of a ſhip bound from the Canaries to Leghorn, and was wrecked on that iſland. Theſe birds will produce with the goldfinch and linnet; and the offspring is called a *mule bird*, becauſe, like that animal, it proves barren. They are ſtill found on the ſame ſpot to which we were firſt indebted for the production of ſuch charming ſongſters; but they are now become ſo numerous in our country, that we are under no neceſſity of croſſing the ocean for them.

FRITH, in its moſt uſual acceptation, ſignifies an arm of the ſea; ſuch are the Frith of Forth, or of Edinburgh, the Frith of Clyde, Murray Frith, &c.

FRIT, or **FRITT**, in the glaſs manufacture, is the matter or ingredients, whereof glaſs is to be made; when they have been calcined, or baked in a furnace. A ſalt drawn from the aſhes of the plant kali, or from fern, or other plants mixed with ſand, or flint, and baked together, makes an opake maſs, called by glaſsmen *frit*.

FRITILLARIA, **FRITILLARY**; a genus of the monogynia order, belonging to the hexandria claſs of plants. See Syſtem of BOTANY, Sect. V.

There are five ſpecies, all of them bulbous-rooted flowery perennials, producing annual ſtalks from about one foot to a yard or more high, terminated by large, bell-ſhaped, liliaceous flowers, of a great variety of colours. They are all propagated by offſets, which they furniſh abundantly from the ſides of their roots, and which may be ſeparated every ſecond or third year; they are hardy plants, and will thrive in any of the common borders.

FRIZE, or **FREEZE**, in commerce, a kind of woollen cloth, or ſtuff, for winter wear, being frized, or knapt, on one ſide: whence, in all probability, it derives its name. Of frizes, ſome are croſſed, others not croſſed: the former are chiefly of Engliſh manufacture, the latter of Iriſh.

FRIZING *of Cloth*, a term in the woolen manufactory, applied to the forming of the knap of a cloth, or ſtuff, into a number of little hard burrs, or prominences, covering almoſt the whole ground thereof. Some cloths are only frized on the back-ſide, as black cloths; others on the right ſide, as coloured and mixed cloths, ratteens, bays, frizes, &c. Frizing may be performed two ways; one with the hand, i. e. by means of two workmen, who conduct a kind of plank, that ſerves as a freezing inſtrument. The other way is by a mill, worked either by water, or a horſe, or, ſometimes, by men. This latter is eſteemed the better way of frizing, becauſe the motion being uniform and regular, the little knobs of the frizing are formed more equably and regularly.

FROG, an amphibious animal. For a particular deſcription, ſee Rand.

Frog *Fiſh* of Surinam, a very ſingular animal, of which a figure is given by Mr. Edwards, Hiſt. of Birds, Vol. I. There is no ſpecimen in the Britiſh Muſeum, nor in any private collection, except that of Dr. Fothergill. It was brought from Surinam in South America. Frogs, both in Aſia and Africa, according to Merian, change gradually from fiſhes to frogs, as thoſe in Europe; but after many years revert again into fiſhes, though the manner of their change has never been inveſtigated. In Surinam theſe fiſhes are called *jakjês*. They are cartilaginous, of a ſubſtance like our muſtela, and exquiſite food: they are formed with regular vertebræ, and ſmall bones all over the body divided into equal parts; are firſt darkiſh, and then grey: their ſcales make a beautiful appearance. Whether this animal is, in its perfect ſtate, a ſpecies of frog with a tail, or a kind of water lizard, Mr. Edwards does not pretend to determine; but obſerves, that when its ſize is conſidered, if it ſhould be deemed a tadpole at firſt produced from ſpawn, and in its progreſs towards a frog, ſuch an animal, when full grown, if it bears the ſame proportion to its tadpole as thoſe in Europe do, muſt be of enormous ſize; for our full grown frogs exceed the tadpoles at leaſt 50 times.

FRONDESCENTIA, from *frons, a leaf*; the preciſe time of the year and month in which each ſpecies of plants unfolds its firſt leaves. All plants produce new leaves every year; but all do not renew them at the ſame time. Among woody plants, the elder and moſt of the honey ſuckles; among perennial herbs, crocus and tulip, are the firſt that puſh or expand their leaves. The time of ſowing the ſeeds decides with reſpect to annuals. The oak and aſh are conſtantly the lateſt in puſhing their leaves: the greateſt number unfold them in ſpring; the moſſes and firs, in winter. Theſe ſtriking differences with reſpect to ſo capital a circumſtance in plants as that of unfolding their leaves, ſeem to indicate that each ſpecies of plants has a temperature proper or peculiar to itſelf, and requires a certain degree of heat to extricate the leaves from their buds, and produce the appearance in queſtion. This temperature, however, is not ſo fixed or conſtant as it may appear to a ſuperficial obſerver. Among plants of the ſame ſpecies, there are ſome more early than others; whether that circumſtance depends, as it moſt commonly does, on the nature of the plants, or is owing to differences in heat, expoſure, and ſoil. In general, it may be affirmed, that ſmall and young trees are always earlier than larger or old ones. The puſhing of the leaves is likewiſe accelerated or retarded according to the temperature of the ſeaſon; that is, according as the ſun is ſooner or later in diſpenſing that certain degree of heat which is ſuitable to each ſpecies.

FRONT, the forehead, or that part of the face above the eyebrows. The word is formed of the Latin, *frons*: and that from the Greek Φρονειν, *to think, perceive*; of Φρην, *mens, the mind, thought*.

Front is alſo uſed where ſeveral perſons, or things, are ranged ſide by ſide, and ſhew their *front*, or foreparts. Front, in perſpective, a projection or repreſentation of the face, or fore part of an object, or of that part directly oppoſite to the eye; called alſo, and more uſually, Orthography.

FRONTIER, the border, confine, or extreme, of a kingdom, or province; which the enemies find in front when they would enter the ſame. Thus we ſay, a *frontier* town, *frontier* province, &c. *Frontiers* were anciently called *marches*.

FRONTISPIECE, in architecture, the portait or principal face of a building. See Architecture.

Frontispiece is alſo uſed to ſignify an ornament fronting the title page of a book, which ſhould expreſs the ſubject treated of, either allegorically, or literally, as in the inſtance of the *Frontiſpiece* prefixed to this Work.

FROST, in phyſiology, ſuch a ſtate of the atmoſphere as occaſions the congelation or freezing of water and other fluids. See Congelation.

Under the articles Cold, Congelation, Evaporation, Fluidity, &c. it is ſhewn, that water and other fluids are capable of containing the element of fire, or heat, in two very different ſtates. In the one, they ſeem to imbibe the fire in ſuch a manner, that it eludes all the methods by which we are accuſtomed to obſerve it, either by our ſenſation of feeling, or the thermometer; in the other, it manifeſts itſelf obviouſly to our ſenſes, either by the touch, the thermometer, or the emiſſion of light.

In the firſt of theſe ſtates, we call the body cold; and are apt to ſay that this coldneſs is occaſioned by the abſence of heat. But this manner of expreſſing ourſelves is certainly improper: for, even thoſe fluids which are coldeſt to the touch, contain a vaſt deal of heat. Thus, vapour, which is colder to the touch than the water from which it was raiſed, contains an immenſe quantity of fire, even more than ſufficient to heat it red hot. The like may be ſaid of common ſalt, and ſnow, or ice. If a quantity of each of theſe ſubſtances is ſeparately reduced to the degree of 28 or 30 of Fahrenheit's thermometer, upon mixing them together, the heat which would have raiſed the thermometer to the degree abovementioned, now enters into the ſubſtance of them in ſuch a manner that the mercury falls down to 0. Here an exceſſive degree of cold is produced, and yet we are ſure that the ſubſtances contain the very ſame quantity of heat that they formerly did: nay, they will even ſeem exceedingly cold, when they moſt certainly contain a great deal more heat than they originally did: for they abſorb it from all bodies around them: and if a ſmall veſſel full of water is put in the middle of ſuch mixture, it will in a ſhort time be full of ice. It appears, therefore, that our ſenſes, even when aſſiſted by thermometers, can only judge of the ſtate in which the element of fire is with relation to the bodies around us, without regard to the quantity contained in them. Thus, if heat flows from any part of our body into any ſubſtance actually in contact with it, the ſenſation of cold is excited, and we call that ſubſtance cold; but if it flows from any ſubſtance into our body, the ſenſation of heat is excited, and we call that ſubſtance hot, without regard to the abſolute quantity contained in either caſe. See Heat.

Of all known ſubſtances, the atmoſphere either abſorbs or throws out heat with the moſt remarkable facility; and in one or other of theſe ſtates it always is with reſpect to the ſurface of the earth, and ſuch bodies as are placed on or near it: for theſe, properly ſpeaking, have no temperature of their own, but are entirely regulated by that of the atmoſphere. When the air has been for ſome time abſorbing the heat from terreſtrial bodies, a froſt muſt be the undoubted conſequence, for the ſame reaſon that water freezes in a veſſel put into a freezing mixture; and were this abſorption to continue for a length of time, the whole earth would be converted into a frozen maſs. There are, however, certain powers in nature, by which this effect is always prevented; and the moſt violent froſt we can imagine, muſt always as it were defeat its own purpoſes, and end in a thaw. To underſtand this ſubject, we muſt obſerve, 1. In that ſtate of the atmoſphere which we denominate froſt, there is a moſt intimate union between the air and the water it contains; therefore froſty weather, except in very high latitudes, is generally clear.

2. When ſuch an union takes place, either in winter or ſummer, we obſerve the atmoſphere alſo inclined to abſorb heat, and conſequently to froſt. Thus in clear ſettled weather, even in ſummer, though the day may be exceſſively hot by reaſon of the continued ſunſhine, yet the mornings and evenings are remarkably cold, and ſometimes even diſagreeably ſo.

3. The air being, therefore, always ready in the time of froſt, or in clear weather, to abſorb heat from every ſubſtance which comes into contact with it, it follows that it muſt alſo abſorb part of that which belongs to the vapours contained in it.

4. Though vapour is capable of becoming much colder than water without being frozen, yet by a continued abſorption it muſt at laſt part with its latent heat, i. e. that which eſſentially conſtitutes it vapour; and without which it is no longer vapour, but water or ice. No ſooner, therefore, does the froſt arrive at a certain pitch, than the vapours, every where diſperſed through the air, give out their latent heat: the atmoſphere then becomes clouded; the froſt either totally goes off, or becomes milder by reaſon of the great quantity of heat diſcharged into the air; and the vapours deſcend in rain, hail, or ſnow, according to the particular diſpoſition of the atmoſphere at the time.

5. Even in the polar regions, where it may be thought that the froſt muſt increaſe beyond meaſure, there are alſo natural means for preventing its running to extremes. The principal cauſe here is, the mixture of a great quantity of vapours from the more temperate regions of the globe with the air in thoſe dreary climates. It is well known, that aqueous vapour always flies from a warm to a colder place. For this reaſon, the vapours raiſed by the ſun in the more temperate regions of the earth, muſt continually travel northward and ſouthward in great quantities. Thus they furniſh materials for thoſe immenſe quantities of ſnow and ice which are to be found in the neighbourhood of the poles, and which we cannot imagine the weak influence of the ſun in theſe parts capable of raiſing. It is impoſſible that a quantity of vapour can be mixed with froſty air, without communicating a great deal of heat to it; and thus there are often thaws of conſiderable duration in thoſe climates where, from the little influence of the ſun, we ſhould ſuppoſe the froſt would be perpetual.

6. We may now account without ſome probability for the uncertain duration of froſts. In this country they are ſeldom of a long continuance; becauſe the vapours raiſed from the ſea with which our iſland is ſurrounded, perpetually mix with the air over the iſland, and prevent a long duration of the froſt. For the ſame reaſon, froſts are never of ſuch long duration in maritime places on the continent, as in the inland ones. There is nothing, however, more uncertain than the motion of the vapours with which the air is conſtantly filled, and therefore it is impoſſible to prognoſticate the duration of a froſt with any degree of certainty. In general

we may always be certain, that if a quantity of vapour is accumulated in any place, no intenſe froſt can ſubſiſt in that place for any length of time; and by whatever cauſes the vapours are driven from place to place, by the ſame cauſes the froſts are regulated throughout the whole world. See **Thaw**, **Vapour**, &c. In the northern parts of the world, even ſolid bodies are liable to be affected by froſt. Timber is often apparently frozen, and rendered exceedingly difficult to ſaw. Marle, chalk, and other leſs ſolid terreſtrial concretions, will be ſhattered by ſtrong and durable froſts. Metals are contracted by froſt: thus, an iron tube, 12 feet long, upon being expoſed to the air in a froſty night, loſt two lines of its length. On the contrary, froſt ſwells or dilates water near one tenth of its bulk. Mr. Boyle made ſeveral experiments with metalline veſſels, exceedingly thick and ſtrong; which being filled with water, cloſe ſtopped, and expoſed to the cold, burſt by the expanſion of the frozen fluid within them. Trees are frequently deſtroyed by froſt, as if burnt up by the moſt exceſſive heat; and in very ſtong froſts, walnut trees, aſhes, and even oaks, are ſometimes ſplit and cleft, ſo as to be ſeen through, and this with a terrible noiſe, like the exploſion of fire-arms.

Water alſo, expoſed to the cold air in large veſſels, always freezes firſt at the upper ſurface, the ice gradually increaſing and thickening downwards: for which reaſon, frogs retire in froſty weather at the bottom of ditches; and it is ſaid that ſhoals of fiſh retire in winter to thoſe depths of the ſea and rivers, where they are not to be found in ſummer. Water, like the earth, ſeems not diſpoſed to receive any very intenſe degree of cold at a conſiderable depth or diſtance from the air. The vaſt maſſes of ice found in the northern ſeas being only many flakes and fragments which, ſliding under each other, are, by the congelation of the intercepted water cemented together.

In cold countries, the froſt often proves fatal to mankind; not only producing gangrenes, but even death itſelf. Thoſe who die of it have their hands and feet firſt ſeized, till they grow paſt feeling it; after which the reſt of their bodies is ſo invaded, that they are taken with a drowſineſs, which, if indulged, they awake no more, but die inſenſibly. But there is another way whereby it proves mortal, viz. by freezing the abdomen and viſcera, which on diſſection are found to be mortified and black.

As an inſtance of the dreadful effects of extreme cold on the human body, we ſhall give the following account extracted from the deſcription of the Iſland of Terra del Fuego, from 53 to 55° ſouth latitude, in **Bankes**'s Syſtem of **Geography**, vol. I. p. 537 and 538.—"When Mr. Banks, Dr. Solander, and other gentlemen, with their attendants and ſervants, ſet out from the ſhip, with a few of the men, to penetrate as far as they could into the country, and return at night, the hills, when viewed at a diſtance, ſeemed to be partly a wood, partly a plain, and above them a bare rock. Mr. Banks hoped to get through the wood, and made no doubt but that beyond it he ſhould, in a country which no botaniſt had ever yet viſited, find plants which would abundantly compenſate his labour. Mr. Banks and the other gentlemen went on, and in a ſhort time reached the ſummit. As botaniſts, they were abundantly gratified by finding a variety of plants, which, with reſpect to the Alpine plants in Europe, are exactly what thoſe plants are, with reſpect to ſuch as grow in the plain. The cold was now become more ſevere, and the ſnow blaſts more frequent; the day alſo was ſo far ſpent, that it was found impoſſible to get back to the ſhip before the next morning. To paſs the night on ſuch a mountain, in ſuch a climate, was not only comfortleſs, but dreadful: it could not, however, be avoided, and they were to provide for it as well as poſſible."

Dr. Solander, who had more than once croſſed the mountains which divide Sweden from Norway, well knew that extreme cold produces a ſleepineſs that is almoſt irreſiſtible, and therefore conjured the company to keep moving, however painful it might be. His words were, "Whoever ſits down will ſleep, and whoever ſleeps will wake no more." Though thus admoniſhed, the cold became ſuddenly ſo intenſe as to produce the effects moſt dreaded. Dr. Solander himſelf was the firſt who found the inclination, againſt which he had warned others as irreſiſtible, and inſiſted upon being ſuffered to lie down. Mr. Banks in vain remonſtrated; he lay down upon the ground, though it was covered with ſnow, and it was with great difficulty his friend could keep him from ſleeping. Richmond alſo, one of the black ſervants, began to linger, having ſuffered from the cold in the ſame manner. Mr. Banks, therefore, ſent five of the company, among whom was Mr. Buchan, forward, to prepare a fire at the firſt convenient place; while himſelf, with four others, remained with the Doctor and Richmond, whom partly by perſuaſion and entreaty, and partly by force, they brought on; but when they had got through the greateſt part of the birch and ſwamp, they both declared they could go no farther. Mr. Banks again entreated and expoſtulated, but without effect. When Richmond was told that if he did not go on he would be frozen to death in a ſhort time, he anſwered, that he deſired nothing but to lie down and die. Doctor Solander did not ſo explicitly renounce his life: he ſaid he was willing to go on, but that he muſt firſt take ſome ſleep, notwithſtanding his former declaration that whoever ſlept would wake no more.

As it was impoſſible to carry them, and there was no remedy, they were both ſuffered to ſit down on the ground, and, in a few minutes, they fell into a profound ſleep. Soon after ſome of thoſe who had been ſent forward returned with the welcome news that a fire was kindled about a quarter of a mile farther on. Mr. Banks then happily awakened Dr. Solander, who, though he had not ſlept five minutes, had almoſt loſt the uſe of his limbs; and the muſcles were ſo ſhrunk, that his ſhoes fell from his feet. He conſented to go forward with ſuch aſſiſtance as could be given him: but all attempts to relieve poor Richmond were ineffectual. Mr. Banks, therefore, left his other black ſervant, and a ſeaman, who ſeemed to have ſuffered leaſt from the cold, to look after him, promiſing that as ſoon as two others ſhould be ſufficiently warmed, they ſhould be relieved. Mr. Banks, with great difficulty, got the Doctor to the fire; and ſoon after ſent two of the people who had been refreſhed, hoping that, with the aſſiſtance of thoſe who had been left behind, they would be able to bring Richmond, though it might ſtill be impoſſible to awake him. In about half an hour they had the mortification to ſee the two men return alone. They informed them, that, after the moſt minute ſearch, they could neither find Richmond, or thoſe who had been left with him; and that though they had repeatedly ſhouted, no voice had replied. Another fall of ſnow came on, and continued inceſſantly for two hours; ſo that all hope of ſeeing them again, at leaſt alive, was given up; but in ſome time, to the general joy of the company at the fire, a ſhouting was heard at a diſtance. Mr. Banks, with four others, immediately went out, and found the ſeaman with juſt ſtrength enough to ſtagger along, and call for aſſiſtance. Mr. Banks having ſent him immediately to the fire, proceeded, by his directions, in ſearch of the other two, whom he ſoon after found. Richmond was upon his legs, but not able to put one foot before the other. His companion was lying upon the ground, as ſenſeleſs as a ſtone. The whole company was now called from the fire, and an united attempt was made to carry them to it, but without effect. The night was extremely dark, the ſnow very deep; ſo that finding it very difficult to make way through the buſhes and bogs themſelves (all getting many falls in the attempt) the only alternative was to make a fire on the ſpot: but the ſnow that had fallen, and was ſtill falling, beſides what was momentarily ſhaken in flakes from the trees, rendered it equally impracticable to kindle one there, or to bring any part of that which had been kindled in the wood thither. They were reduced to the melancholy neceſſity of leaving the unhappy wretches to their fate, having previouſly made them a bed of boughs from the trees, and ſpread a covering of the ſame kind over them to a conſiderable height. After ſuffering the region of the cold and ſnow near an hour and a half, ſome of the reſt began to loſe their feeling, and Briſcoe, another of Mr. Banks's ſervants, was ſo ill, that it was apprehended he muſt die before he could get to the fire. However, at length they reached the fire, and paſſed the night in a ſituation dreadful in itſelf, and rendered more ſo by the remembrance of paſt ſeverities, and the uncertainty of what was to come. They were twelve in number who had ſet out in health and ſpirits. Of theſe, two were ſuppoſed to be already dead; a third was ſo bad, that it was doubtful whether he would be able to proceed in the morning; and a fourth, Mr. Buchan, was in danger of the return of his fits, from freſh fatigues after ſo uncomfortable a night. They were a long day's journey diſtant from the ſhip, through pathleſs woods, in which they might be bewildered till overtaken by the enſuing night; and not having prepared for a journey of more than eight or ten hours, their whole ſtock of remaining proviſion was a vulture, which they happened to ſhoot when they were out, and which, if equally divided, would not afford each of them half a meal; and they knew not how much more they might ſuffer from the cold, as the ſnow ſtill continued to fall; a dreadful proof of the rigour of the climate, as it was now the midſt of ſummer in this part of the world; and every thing might be dreaded from a phœnomenon which in the correſponding ſeaſon, is unknown even in Norway and Lapland. The only object viſible at day-break was ſnow which ſeemed to lie as thick upon the trees as upon the ground; and the blaſts returned ſo frequently, and with ſuch violence, that they found it impoſſible for them to ſet out. The knew not how long this might laſt, and had but too much reaſon to apprehend, that it would confine them in that deſolate foreſt till they periſhed with hunger and cold. A dawn of hope ſucceeded theſe terrific apprehenſions; for, about ſix o'clock in the morning, they diſcovered the place of the ſun, through the clouds, which were become thinner, and began to break way. Their firſt care was to know whether the poor wretches they had been obliged to leave among the buſhes were yet living: for this purpoſe they diſpatched three of the company, who ſoon after returned with the melancholy news of their death. They were now, however, preſſed with the calls of hunger, to which every other conſideration muſt give way. They therefore came to an unanimous reſolution, before they ſet forward, to eat their vulture, which was accordingly ſkinned; and it being thought beſt to divide it before it was fit to be eaten, is was cut into ten portions, and every man cooked his own as he thought proper. After this ſlender meal, which furniſhed about three mouthfuls each, they prepared to ſet out; but it was ten o'clock before the ſnow was ſo far diſſolved as to render their progreſs practicable. Having proceeded about three hours, they were moſt agreeably ſurprized to find themſelves upon the beach, and much nearer the ſhip than they had reaſon to expect. Upon reviewing their track from the veſſel, they perceived that, inſtead of aſcending the hill in a line ſo as to penetrate into the country, they had made almoſt a circle round it. On their arrival on board, they congratulated each other. and were congratulated by the crew in general, with an extacy of joy that can only be conceived by ſuch as have been expoſed to equal danger; and Captain Cook, to the honour of his humanity, obſerves, that, as he ſuffered the greateſt anxiety from their not returning in the evening of the day on which they ſet out, he participitated in no ſmall degree of the general joy."

Hoar Frost, a cold moiſt vapour, that is drawn up a little way into the air, and in the night falls again on the earth, where it is congealed into icy cryſtals of various figures. Hoar froſt, therefore, is nothing but dew turned into ice by the coldneſs of the air.

Melioration of Aromatic Spirits by Frost. Mr. Baume obſerves, that aromatic ſpirituous waters have leſs ſcent when new diſtilled than after they have been kept about ſix months: and he found that the good effects of age was produced in a ſhort time by means of cold; and that, by plunging quart bottles of the liquor into a mixture of pounded ice and ſea ſalt, the ſpirit, after having ſuffered for ſix or eight hours the cold hence reſulting, proves as grateful as that which hath been kept many years. Simple waters alſo, after having been frozen, prove far more agreeable than they were before. Geoffroy takes notice of this melioration by froſt. *Hiſt. Acad.* 1713.

FROTH, a white, light ſubſtance, formed on the ſurface of fluids, by vehement agitation. Froth conſiſts wholly of little ſpherules, or globules; and, accordingly, may be defined an aſſemblage of aqueo-aerial bubbles.

Froth-*Spit* or *Cuckow-Spit*, a name given to a white froth, or ſpyme, very common in the ſpring and firſt months of ſummer, on the leaves of certain plants, particularly on thoſe of the common white field-lychnis or catch-fly, thence called by ſome *ſpatling poppy*. All writers on vegetables have taken notice of this froth, though few have underſtood the cauſe or origin of it till of late. It is formed by a little leaping animal, called by ſome the *flea graſs-hopper*, by applying its anus cloſe to the leaf, and diſcharging thereon a ſmall drop of white viſcous fluid, which, containing ſome air in it, is ſoon elevated into a ſmall bubble: before this is well formed, it depoſits ſuch another drop; and ſo on, till it is every way overwhelmed with a quantity of theſe bubbles, that form the white froth which we ſee. Within this ſpume it is ſeen to acquire four tubercles on its back, wherein the wings are incloſed: theſe burſting, from a reptile it becomes a winged animal: and thus, rendered perfect, it flies to meet its mate, and propagate its kind. It has an oblong, obtuſe body, and a large head with ſmall eyes. The external wings, for it has four, are of a duſky brown colour, marked with two white ſpots: the head is black. It is a ſpecies of *Cicada*.

FRUCTESCENTIA, (from *fructus*, fruit,) comprehends the preciſe time in which, after the fall of the flowers, the fruits arrive at maturity, and diſperſe their ſeeds. In general, plants which flower in ſpring, ripen their fruits in ſummer, as rye; thoſe which flower in ſummer, have their fruits ripe in autumn, as the vine; the fruit of autumnal flowers ripens in winter, or the following ſpring, if kept in a ſtove or otherwiſe defended from exceſſive froſts. Theſe froſts, ſays M. Adanſon, are frequently ſo pernicious and violent as to deſtroy the greateſt part of the perennial plants of Virginia and Miſſiſſippi, that are cultivated in France, even before they have exhibited their fruit. The plants which flower during our winter, ſuch as thoſe of the Cape of Good Hope, ripen their fruit in ſpring in our ſtoves.

FRUCTIFICATION *of Plants*. Fructification is defined by Linnæus to be the temporary part of a vegetable appropriated to generation, terminating the old vegetable, and beginning the new. It conſiſts of the following ſeven parts; viz. the *calyx*, *corolla*, *ſtamen*, *piſtillum*, *pericarpium*, *ſemen or ſeed*, and *receptaculum*. See Syſtem of Botany, Sect. III. Plate III.

FRUIT, in its general ſenſe, includes whatever the earth produces for the nouriſhment and ſupport of animals; as herbs, grain, pulſe, hay, corn, flax, and every thing expreſſed by the Latins under the name *fruges*.

The fruit in the Linnæan ſyſtem is one of the parts of fructification, and is diſtinguiſhed into three parts, viz. the *pericarpium*, *ſeed*, and receptacle, or *receptaculum ſeminum*. The *fruit* is defined by Jungius and former botaniſts to be an annual part of the plant, which adheres to the flower and ſucceeds it; and, after attaining maturity, ſeparates or detaches itſelf from the parent plant; and, being commodiouſly lodged in the boſom of the earth, gives birth to a new vegetable. This definition is ſufficiently accurate, and ſo perſpicuous, that it requires no illuſtration whatever. We ſhall only obſerve, that, in its vulgar acceptation, the word fruit is expreſſive, not of the ſeeds, which are doubtleſs the eſſence of every fruit; but of the caſe or veſſel in which they are contained. Thus, when we ſpeak of the fruit of an apple-tree, we always mean the luſcious pulp which enfolds the ſeeds; although that, in ſtrict propriety, is only the cover of the fruit. In cutting open an apple tranſverſly, it will be found to conſiſt of four parts; viz. 1. A ſkin, or *cortex*, which is only a production of the ſkin, or outer bark, of the tree. 2. A *parenchyma*, or pulp; which is an expanſion and intumeſcence of the inner bark of the tree. 3. Fibres, or ramifications, of the woody part of the tree, diſperſed throughout the parenchyma. 4. The core, which is the produce of the pith, or medulla, of the plant, indurated and ſtrengthened by twigs of the wood and fibres, inoſculated therewith: it ſerves to furniſh a cell, or lodge, for the kernels; filtrates the juice of the parenchyma; and conveys it, thus prepared, to the kernel.—As to the uſe of fruits, beſide the pleaſure and advantage they afford men, &c. they are of ſervice in guarding, preſerving, and feeding the ſeed incloſed; in filtrating the coarſer, more earthy, and ſtony parts of the nutritious juice of the plant, and retaining them to themſelves; and ſending none to the ſeed but the pooreſt, moſt elabòrated, and ſpirituous parts, for the ſupport and growth of the tender, delicate embryo, or plantule, contained therein. So that the *fruit* does the ſame office to the ſeed, that the leaves of the flower do to the *fruit*. The uſe of *fruits*, with us might, under proper regulations, be rendered much more extenſive than it is. Many fruits which do hurt when eaten raw, would make wines equal in flavour to many of thoſe now obtained at great prices from abroad; and lands which will not bear corn, yet will bear trees and ſhrubs producing ſuch *fruits*; and the conſequence of this method of culture would be, that much ground, at preſent lying waſte, would be occupied, and great employment found for the numerous poor of ſome of our counties, where the quantities of waſte land are proportionably ſo great, that there is not employment for the people of one half of the county. Cherries properly managed make an excellent wine, and that in very large quantities; and plums alſo make a very agreeable kind, but that it has an auſtereneſs, which muſt be taken off by mixing a little ſugar with it when in the glaſs, not before it is drawn off. A coarſe plum, ſomewhat larger than a damſon, is the beſt kind for this wine. There is a ſort of plum that grows wild in ſome of our hedges. It will ſucceed on any ground, the pooreſt that can be imagined, and it produces a great abundance of *fruit*. The wine that is made from it is of a very conſiderable ſtrength, and affords a pleaſant brandy by diſtillation in conſiderable quantities. Our common garden currants afford very agreeable wine; and our gooſeberries are not ſecond to any thing. All theſe produce *fruit* in great abundance; and the planting and taking care of them is very cheap, and the operation very eaſy. Phil. Tranſ. N° 124.

Fruits are diſtinguiſhed, by gardeners, into *ſtone-fruit*, and *kernel-fruits*; *ſummer-fruit*, and *winter-fruit*, *wall-fruit*, and *dwarf-fruit*, &c. M. Quintinie obſerves, that cold, heavy, moiſt lands, produce the faireſt and largeſt fruit, but the hotter, drier, and lighter, the more delicious and rich-taſted.

Bread Fruit. See Bread *Tree*.

Fruit-*Flies*, a name given by gardeners, and others, to a ſort of ſmall black *flies*, found in vaſt numbers among *fruit*-trees, in the ſpring-ſeaſon, and ſuppoſed to do great injury to them. Theſe are a ſpecies of ſmall black fly. Mr. Lewenhoeck preſerved ſome of them for his microſcopical obſervations. He found that they did not live longer than a day or two, but that the females in this time uſually laid a great number of longiſh eggs. The gardeners who ſuppoſe that theſe flies wound the leaves of the trees, are miſtaken; it is true that they feed on their juices, but they have no weapons with which to extract this themſelves; they feed on ſuch as is naturally extravaſated, and when there is not enough of this for their purpoſe, they haunt thoſe places where the *pucerons* reſort, and feed on the juices which theſe little creatures extravaſate by means of the holes they bore in the leaves with their trunks. Theſe pucerons are a ſmall ſort of inſect very common on our *fruit*-trees, and other plants and trees; they are of a greeniſh colour, and are commonly called tree-lice. Philoſ. Tranſ. N° 262.

Fruit-*Stones*. The miſchiefs ariſing from the bad cuſtom of people ſwallowing the ſtones of plums and other *fruit* are very great. The Philoſophical Tranſactions give us an account of a woman who ſuffered violent pains in her bowels for thirty years, returning once in a month or leſs. At length a ſtrong purge being given her, the occaſion of all theſe complaints was driven down to the anus, where it gave a ſenſation of ſtoppage and diſtenſion, and produced a continual deſire of going to ſtool, but without voiding any thing. On the aſſiſtance of a careful hand in this caſe, there was taken out with a forceps an oblong ball of an oval figure, of about ten drams weight, and meaſuring five inches in circumference; this had cauſed all the violent fits of pain ſhe had been ſo many years afflicted with, and after the taking it out ſhe became perfectly well. The ball extracted looked like a ſtone, and felt very hard, but it ſwam in water; on cutting it through with a knife, there was found in the centre of it a plum-ſtone, round which ſeveral coats of this tough and hard matter, reſembling a ſtone, had gathered. This ſufficiently ſhews the folly of that common opinion, that the ſtones of *fruits* are wholeſome. For though by nature the guts are ſo defended by their proper mucus, that people very ſeldom ſuffer by things of this kind, yet if we conſider the various circumvolutions of the guts, their valves and cells, and at the ſame time conſider the hair of the ſkins of animals we feed on, the wool or down on herbs and *fruit*, and the fibres, veſſels, and nerves of plants, which are not altered by the ſtomach, it will appear a wonder that inſtances of this ſort of miſchief are not much more frequent. Cherry-ſtones, ſwallowed in great quantities, have occaſioned the death of many people, and there have been inſtances even of the ſeeds of ſtrawberries, and kernels of nuts, collected into a lump in the guts, and cauſing violent diſorders, which could never be cured till they were carried off. Philoſ. Tranſ. N° 282. p. 1282.

Fruit-*trees* are diſtinguiſhed, like the *fruits* they bear, into wall *fruit*-trees, ſtandard *fruit* trees, &c. With regard to *fruit*-trees, Monſ. Quintinie obſerves, 1. That the cutting and trimming of young trees hinders them from quick bearing; though it contributes both to the beauty of the tree, and to the richneſs and flavour of the fruit. 2. That kernel *fruit*-trees come later to bear than ſtone *fruit*-trees; the term required by the firſt, before they arrive at a fit age for bearing, being, one with another, about four or five years; but, when they do begin, they bear in greater plenty than ſtone-*fruit*. 3. That ſtone-*fruits*, figs, and grapes, commonly bear conſiderably in three or four years; and bear full crops the fifth and ſixth years; and hold it for many years, if well ordered. 4. That *fruits*, in the ſame neighbourhood, will ripen a fortnight ſooner in ſome grounds, than in others of a different temperature. 5. That in the ſame country, hot or cold ſummers ſet conſiderably forwards, or put backwards, the ſame *fruit*. 6. That the *fruits* of wall-trees generally ripen before thoſe on ſtandards; and thoſe on ſtandards before thoſe on dwarfs. 7. That the *fruit* of wall-trees, planted in the ſouth and eaſt quarters, ripen about the ſame time; only thoſe in the ſouth earlier than thoſe in the eaſt; thoſe in the weſt are later by eight or ten days, and thoſe in the north by fifteen or twenty. For the planting, pruning, engrafting, &c. of *fruit*-trees, ſee Planting, Transplanting, Pruning, and Grafting. See alſo Orchard, Garden, and Nursery.

There is, in the Philoſophical Tranſactions, a method of making *fruits* and flowers grow in winter inſtead of ſummer, without the common way of doing it by heat. This method is to take up the trees with their roots in the ſpring-ſeaſon, juſt as they begin to ſhoot out their buds; let them be placed upright in a cellar, and ſtand there till the end of September following; then fit veſſels to them, and place the roots in them, covering them in a proper manner with earth, and bring them up into a common ſtove; water them at times with a ſolution of the bigneſs of a walnut of crude ſal armoniac in a quart of rain-water, and they will make their natural progreſs as in ſummer, and in the months of February or March following the *fruit* will be ripe, and as well taſted as if it had grown on them in the common way, and ripened at its natural ſeaſon. Philoſ. Tranſ. N° 282, p. 44. The ſuperfluous ſhoots from theſe trees muſt be pruned off at ſuch times of the year, when the trees are full of juice, and furniſhed for a farther ſupply; and by this means there will be no marks of the wounds, they will cloſe up ſo perfectly. The manner of producing pyramidal trees by ingrafting, is not only applicable to *fruit*-trees, but has been tried on oaks, limes, and roſes, with the ſame ſucceſs.

The Peterſbourg academy furniſhes us with two ſingular inſtances of *fruits* growing in an unnatural manner; one of thoſe in the fig-tree, the other in the apple-tree. In both theſe caſes, the *fruit*, inſtead of its common ſituation, was placed upon the trunk of the tree, with no branch or leaf near it, but only a ſhort pedicle for its ſupport. The inſtance of the fig-tree afforded three figs in a cluſter, the middle one of which withered, but the other two grew to their proper ſize, and were like the reſt of the figs on the ſame tree. The other inſtance of the apple-tree afforded only one ſingle *fruit*; but there was in it ſomething very ſtrange, or that appeared ſo, however, at firſt ſight; for the apples produced on the branches of the tree were of one kind, and this of another: The tree had been grafted, and all the *fruit* of the branches grew from the graft; this ſingle one, which ſtood upon the trunk of the tree below the graft, was of the ſpecies produced by the ſtock. This had doubtleſs been preceded by a flower, though unobſerved, and it could only be as it appeared, of the nature of the genuine *fruit* of the ſtock. All gardeners know, that the ſtock ſuffers no change from the graft; in both theſe caſes there was probably the rudiment of a branch where the ſingle *fruit* appeared, and every other part of it, except the bud of the *fruit* alone, had periſhed, while that arrived at its deſtined ſize and maturity. We have alſo an account in the Philoſophical Tranſactions, N° 385, of an apple-tree bearing a conſiderable quantity of *fruit* for many years together without bloſſoming.

FRUITERY, a place for the laying up and keeping of *fruit*. The *fruitery* ſhould be inacceſſible to any thing of moiſture, or even froſt.

FRUITFULNESS, the quality of bearing plenty of fruit, called alſo *fertility*, and *fecundity*.

FRUMENTACEOUS *Plants* are thoſe which produce geniculated or knotted ſtalks, with reed-like leaves; and whoſe ſeed growing in ſpikes or *jubæ*, is uſeful to make pultege, or bread. The word is formed from *frumentum*, a general name comprehending all ſorts of corn, or grain, for bread. Hence the Italians, who follow the Latins, uſe *grano* and *frumento* for the ſame. Wheat, barley, rye, millet, &c. are *frumentaceous* plants. Some authors uſe *frumentaceous* in a narrower ſenſe, reſtraining it to plants which bear a conformity to wheat, either in reſpect of their fruits, leaves, ears, or the like. But this ſeems founded on a miſtaken notion of *frumentum*, as if it denoted only *wheat*, which is rather the ſenſe of the word *triticum*.

FRUSTUM, in mathematics, a piece cut off or ſeparated from a body. Fruſtum of a pyramid or cone, is a part or piece thereof cut off, uſually by a plane parellel to the baſe.

FRUTEX, *a Shrub*. Shrubs, according to Linnæus, make a branch of the ſeventh family in the vegetable kingdom; and are diſtinguiſhed from trees, in that they come up without buds. But this diſtinction is not univerſal, though it be generally juſt with regard to thoſe of Europe. Nature hath made no abſolute diſtinction between trees and ſhrubs. *Frutex*, in its general acceptation, is a plant whoſe trunk is perennial, gemmiparous, woody, dividing and ſubdividing into a great number of branches. In ſhort, it is the epitome of a tree exemplified in the roſe-buſh.

FUCUS, in botany, a genus of ſubmarine plants, belonging to the cryptogamia claſs. The fucus conſiſts of a tough matter, formed into a kind of leaves, which are flat and variouſly divaricated; and which have ſome appearance of fructification, in punctated tubercles, covering oblong veſicles, ſuppoſed by Linnæus to be male flowers; and ſmooth roundiſh veſicles, hollow and interwoven with filaments, which appear to him to be female flowers. There are 34 ſpecies of fucus, or ſea-wrack, many of them to be found on our coaſts. See the ſixth Plate of Botany, Claſs 24, Order III.

FUEL, in philoſophy, the *pabulum* of *fire*, or whatever receives and retains fire, and is conſumed, or rendered inſenſible thereby. It is a known truth, that *fuel* cannot conſume by means of heat alone, without the admiſſion of freſh air, and this is no way more clearly proved, than by this eaſy experiment. Let a ſtrong cylinder of iron, hollow within, be fitted with a firm ſcrew at each end; in the cavity of this cylinder incloſe a long piece of charcoal, and then ſcrew up both the ends faſt, and place the whole in a ſtrong fire; let it continue there for ſeveral hours; and when it is taken out and cooled, open it, and the piece of charcoal will be found ſtill black, in its own form, and no way apparently altered or diminiſhed. It is plain from this, that the conſumption of *fuel* depends upon the rarefaction, diſlodgment, briſk agitation, and diſcharge of its inflammable vapour, by means of freſh air: and hence we have the reaſon of the known rule of extinguiſhing fires by ſmothering them.

FUGITIVE, *Refugee*, a perſon obliged to fly his country, or remove from a place where he had ſome abode or eſtabliſhment, on account of his crimes, debts, or on other occaſions.

Fugitive *Pieces*, among the learned, denote thoſe little compoſitions which are printed on looſe ſheets, or half ſheets; thus called, becauſe eaſily loſt, and ſoon forgot.

FUGUE, of *fuga, flight*, in muſic, is when the different parts of a muſical compoſition follow each other, each repeating what the firſt had performed.

Single, or *Simple* Fugue, is ſome point conſiſting of 4, 5, 6, or any other number of notes, begun by one ſingle part, and then ſeconded by a third, fourth, fifth, and ſixth part, if the compoſition conſiſts of ſo many, repeating the ſame or ſuch-like notes; ſo that the ſeveral parts follow, or come in, one after another, in the ſame manner, the leading parts ſtill flying before thoſe which follow.

Double Fugue, is when two or more different points move together in a *fugue*, and are alternately interchanged by the ſeveral parts.

FULICA, the *Coot*, in ornithology, according to Linnæus, the 51ſt genus, and belonging to the fourth order called *Grallæ*. But Latham in his improved arrangment makes it the 78th genus, and the 8th order. For the claſſification, ſee the Syſtem. For the repreſentation, ſee Plate V. It has a convex bill, with the upper mandible fornicated over the lower at the edge; the lower mandible is gibbous behind the tip. The forehead is bald; and the feet have four toes, a little lobated. There are four ſpecies.

1. The *atra*, or *common coot*, hath a bald forehead, a black body, and lobated toes. They frequent lakes and ſtill rivers; making their neſt among the ruſhes, with graſs, reeds, &c. floating on the water, ſo as to riſe and fall with it. They lay five or ſix large eggs, of a dirty whitiſh hue, ſprinkled over with minute deep ruſt-coloured ſpots; and it is ſaid, that ſometimes they will lay 14 or more eggs. The young when juſt hatched are very deformed, and the head mixed with a red coarſe down, In winter they often repair to the ſea, and the channel near Southampton is ſometimes obſerved almoſt covered with them. They are often brought to that market, where they are expoſed to ſale without their feathers, and ſcalded like pigs.

2. The *chloropus*, or *common gallinule*, hath a bald forehead, and toes without webs. It gets its food on graſſy banks, and borders near freſh waters, and in the very waters if they be weedy. It builds upon low trees and ſhrubs by the water ſide; breeding twice or thrice in a ſummer; and, when the young are grown up, drives them away to ſhift for themſelves. They lay ſeven eggs of a dirty white, thinly ſpotted with ruſt colour. This bird ſtrikes with its bill like a hen, and in the ſpring has a ſhrill call, In flying, it hangs down its legs; in running, it often flirts up its tail, and ſhews the white feathers. We may obſerve, that the bottoms of its toes are ſo very flat and broad (to enable it to ſwim)

that it ſeems to be the bird which connects the cloven footed aquatics with the next tribe, viz. the fin toed.

3. The *fulica* with a bald forehead, a violet coloured body, and toes without webs, is the purple water hen of Edwards; and it inhabits Aſia and America. 4. The *fulica* with a carunculated head, a variegated body, ſpinous ſhoulders, and toes without webs; but the nail on the hinder toe is exceeding long. It is the ſpur-winged water hen of Edwards, and is an inhabitant of South America. The nail on the hind toe is ſtrait, and longer than a man's finger. The pollex reſts upon one joint, and the wings are green.

FULIGINOUS, an epithet applied to a thick ſmoke, or vapour, replete with ſoot or other craſs matter. The word is formed from the Latin *fuligo, ſoot*; and is rarely uſed but when joined with vapour. In the firſt fuſion of lead, there exhales a great deal of fuliginous vapour, which, retained and collected, makes what we call *lithargy*. *Lamp black* is what is gathered from the *fuliginous* vapours of pines, and other reſinous woods, when burnt. Some phyſicians talk of *fuliginous* vapours emitted from the ſpleen to the brain, which they will have to be the cauſe of the hypochondriac and hyſteric diſorders; thence called the *vapours*, and by ſome the *ſpleen*.

FULL is variouſly uſed, in oppoſition to empty, narrow, confined, &c. The Carteſians hold, that the univerſe is *full*, i. e. that every part or point has matter in it. When the body is *full* of humours it ſhould be purged.

FULLER, a workman employed in the manufactories, to full, mill, or ſcour cloths, rateens, ſerges, and other woollen ſtuffs, by means of a mill, to render them thicker, and more compact and durable.

FULLERS *Earth, ſmectis*, or *cimolia purpuraſcens*, is a hard, denſe marle, moderately heavy, of a very compact and regular texture, of a rough or dry appearance, though, when cut or ſcraped, is of a very ſmooth, unctuous, and glaſſy ſurface. It ſerves to ſcour cloths, ſtuffs, &c. and imbibe the tar employed in the external diſtemperatures of ſheep, and all the greaſe and oil, and other unctuous ſubſtances, neceſſarily uſed in the preparing, dreſſing, &c. of the wool. *Fullers-earth* is dug in great plenty out of certain pits near Brick-hill, in Staffordſhire; alſo near Ryegate, in Surry; near Maidſtone, in Kent; near Nutley and Petworth, in Suſſex. But the greateſt quantity and the fineſt earth of this kind in the world, is dug in the pits at Wavendon, near Woburn, in Bedfordſhire. The ſtrata in theſe pits lie thus: from the ſurface to the depth of ſix yards, there are ſeveral layers or beds of ſand, all reddiſh, but ſome lighter coloured than others. Under theſe there is a thin ſtratum of a ſand ſtone, which they break through, and then for the depth of about ſeven or eight yards you have ſand again, and then there is the fullers earth.

It is abſolutely neceſſary to the well dreſſing of cloth: and hence foreigners, though they can procure wool to be clandeſtinely exported out of the kingdom, can never reach to the perfection of the Engliſh cloths, &c. without *fullers*-earth, which is very plentiful in England, and excels that of other countries in quality as much as in quantity and cheapneſs. For this reaſon it is made a contraband commodity; and the export made equally criminal with that of exporting wool. Abroad they make uſe of urine, in lieu of *fullers* earth. This earth abounds much in the vegetative ſalt which promotes the growth of plants, and is therefore reckoned by ſir H. Plat, and others, great improvers of land. When mixed with vinegar, it diſperſes pimples, checks inflammations, and cures burns.

FULLERY, a place where cloths, &c. are *fulled* or ſcoured. The term is principally underſtood of the fulling-mill.

FULLING, the art, or act of cleanſing, ſcouring, and preſſing cloths, ſtuffs, and ſtockings, to render them ſtronger, cloſer, and firmer: called alſo *milling*. The fulling of clothes, and other ſtuffs, is performed by a kind of water mill; thence called a *fulling*, or *ſcouring mill*. Theſe mills, excepting in what relates to the mill ſtones and hopper, are much the ſame with corn-mills. And there are even ſome which ſerve indifferently for both purpoſes; corn being ground, and cloths fulled, by the motion of the ſame wheel. Hence in ſome places, particularly France, the fullers are called *millers*; as grinding corn, and milling ſtuffs, at the ſame time. The principal parts of the *fulling mill* are, the wheel with its trundle; which gives motion to the tree or ſpindle, whoſe teeth communicate it to the peſtles, or ſtampers, which are hereby raiſed and depreſſed alternately, according as its teeth catch on, or quit, a kind of latch in the middle of each peſtle. The peſtles and troughs are of wood; each trough having at leaſt two, ſometimes three peſtles, at the diſcretion of the maſter, and according to the force of the ſtream of water. In theſe troughs are laid the cloths, ſtuffs, &c. intended to be *fulled*; then, letting the current of water fall on the wheel, the peſtles are ſucceſſively let fall thereon, and by their weight and velocity they ſtamp and preſs the ſtuffs very ſtrongly, which by this means become thickened and condenſed. In the courſe of the operation, they ſometimes make uſe of urine, ſometimes of *fullers* earth, and ſometimes of ſoap. To prepare the ſtuffs to receive the firſt impreſſions of the peſtle, they are uſually laid in urine; then in *fullers* earth and water: and laſtly in ſoap, diſſolved in hot water. Soap alone would do very well; but this is expenſive; though *fullers* earth, in the way of our dreſſing, is ſuperior to it; but then it muſt be firſt well cleared of all ſtones and grittineſs, which are apt to make holes in the ſtuff. As to urine, it is certainly prejudicial, and ought to be entirely diſcarded; not ſo much on account of its ill ſmell, as of its ſharpneſs and ſaltneſs; which is apt to render the ſtuffs dry and harſh.

FULMINATION, in the Romiſh canon law, a ſentence of a biſhop, official, or other eccleſiaſtic appointed by the pope; whereby it is decreed, that ſome bull, diſpenſation, or reſcript, ſent from the pope, ſhall be executed. *Fulmination* is alſo uſed for the denunciation, or execution, of a ſentence of *anathema*, made in public, with due ſolemnity.

FULMINATION, or FULGURATION, in chymiſtry, a vehement noiſe, or ſhock reſembling thunder, occaſioned by the ſuddon exploſion and inflammation of divers preparations; as *aurum fulminans*, &c. when ſet on fire.

FUMARIA, *fumitory*; a genus of the hexandria order, belonging to the diadelphia claſs of plants. There are a number of different ſpecies; all of them low, ſhrubby, and deciduous and evergreen plants, growing from two to ſix or ſeven feet high, adorned with ſmall ſimple leaves, and papilionaceous flowers of different colours. The moſt remarkable is the officinalis, or common fumitory; which grows naturally in ſhady cultivated grounds, and produces ſpikes of purpliſh flowers in May and June. It is very juicy, of a bitter taſte, without any remarkable ſmell. The medical effects of this herb are, to ſtrengthen the tone of the bowels, gently looſen the belly, and promote the urinary and other natural ſecretions. It is principally recommended in melancholic, ſcorbutic, and cutaneous diſorders, for opening obſtructions of the viſcera, attenuating and promoting the evacuation of viſcid juices. Frederic Hoffman had a very great opinion of it has a purifier of the blood; and aſſures us, that in this intention ſcarce any plant exceeds it. Cows and ſheep eat the plant; goats are found not fond of it; horſes and ſwine refuſe it.

FUMIGATION, in chymiſtry, a kind of calcination, when metals, or other hard bodies, are corroded, or ſoftened, by receiving certain fumes for that purpoſe. *Fumigation*, in medicine. By the ſubtile fumes that are inſpired as well as inhaled, into our bodies, much benefit or prejudice is produced, according to the nature of the matter, and the conſtitution into which it is received; as is evident from the palſies produced among workers in lead-mines, &c. and the benefits received in many caſes when the air is impregnated with ſalutary materials. Catarrhs and catarrhous coughs are relieved by fumes received with the breath; and by the ſame method, expectoration is aſſiſted in humoural aſthmas; and even ulcers in the lungs are ſaid to have been healed by this method. The advantage of mercurial fumigations in the cure of venereal ulcers is known to every practitioner.

Powder of FUMIGATION, was invented at Moſcow, in 1771, for preventing the infection of the plague. It is prepared of different degrees of ſtrength in the following manner: 1. Take leaves of juniper, juniper-berries pounded, ears of wheat, guaiacum wood pounded, or, if this cannot be had, the cones of pines or firs, of each ſix pounds; common ſalt-petre pounded, eight pounds; ſulphur pounded, ſix pounds; Smyrna tar or myrrh, or, inſtead of this, the common tar of pines and firs, two pounds; mix all theſe ingredients together, and they will produce a *pood* of the powder, of the firſt ſtrength. 2. Take ſouthernwood or mugwort, cut into ſmall pieces, five pounds; leaves of juniper, cut in the ſame manner, four pounds; juniper berries pounded, three pounds; common ſalt-petre pounded, four pounds; ſulphur pounded, two pounds and a half; Smyrna tar or myrrh, one pound and a half; mix theſe together, and they will yield half a *pood* of the powder of the ſecond ſtrength. The efficacy of the powder of *fumigation* was tried on ten malefactors under ſentence of death, who were confined three weeks in a lazarette, and expoſed in every poſſible way to the infection of the plague, and none of them were at all injured by it. Fumigation is alſo uſed for the act of making a ſuſpended body receive the fumes or ſteams of one or more other bodies, in order to calcine it, to correct it, or impart to it ſome new quality. Ceruſs is made by the *fumigation*, or vapour, of vinegar, gnawing and corroding plates of lead.

FUMIGATOR, formed of *fumus, ſmoke*, in ſurgery, an inſtrument uſed for injecting clyſters of the ſmoke of tobacco. Clyſters of this kind have been applied in the *iliac paſſion*, in the *hernia incarcerata*, and in other caſes of an obſtinate conſtipation, or obſtruction of the bowels; and as they are admirably adapted to excite the ſuſpended or extremely languid periſtaltic motion of the inteſtines, which are reckoned among the moſt irritable parts of the body, and are allowed to retain the vital influence longer than any other, they have been peculiarly ſerviceable in caſes of recovery from apparent death by drowning, &c.

FUNCTION, the act of fulfilling the duties of any employment. *Function*, being alſo applied to the actions of the body, is by phyſicians divided into vital, animal, and natural. The *vital* functions are thoſe neceſſary to life, and without which the individual cannot ſubſiſt; as the motion of the heart, lungs, &c. The *natural* functions are ſuch as it cannot ſubſiſt any conſiderable time without; as the digeſtion of the aliment, and its converſion into blood. Under *animal* functions are included the ſenſes of touching, taſting, &c. memory, judgment, and voluntary motion; without any or all of which an animal may live but not very comfortably. The animal-functions perform the motion of the body by the action of the muſcles; and this action conſiſts chiefly in the ſhortening the fleſhy fibres, which is called *contraction*, the principal agents of which are the arteries and nerves diſtributed in the fleſhy fibres. All parts of the body have their own functions, or actions, peculiar to themſelves. Life conſiſts in the *exerciſe* of theſe functions, and health in the *free* and *ready* exerciſe of them.

FUND, **Fundus**, a Latin term, uſed for the bottom of certain things; and particularly, of certain parts of the body.

Fundus *Uteri*, or *Bottom of the Womb*, is the body or principal part thereof; ſo called in contradiſtinction to the cervix, or neck; the oſculum, or mouth; and the vagina, or ſheath. See Syſtem of Anatomy, Part V. Sect. XII, and Plate X. *Fig*. 1. letter A.

Fund, in commerce, is uſed for the capital or ſtock of a merchant, company, or corporation; or the ſum of money that they put into trade. In this ſenſe we ſay abſolutely, the *funds*, the public *funds*, meaning the ſtock of the great companies, or corporations, as the Bank, South ſea, Eaſt India, &c.

Funds, in politics, are the taxes appropriated by parliament to the ſupport of civil government, and the payment of the principal and intereſt of money borrowed for public ſervices. The practice of funding was introduced by the Venetians and Genoeſe in the 16th century, and has been adopted ſince by moſt of the nations in Europe. Princes had often borrowed money, in former times, to ſupply their exigencies, and ſometimes mortgaged their territories in ſecurity: but theſe loans were generally extorted, and their payment was always precarious; for it depended on the good faith and ſucceſs of the borrower, and never became a regular burden on poſterity. The origin of funds is derived from the peculiar manners and circumſtances of modern Europe. Since the invention of gun powder, and the progreſs of commerce, the military occupation has become a diſtinct employment in the hands of mercenaries; the apparatus of war is attended with more expence; and the deciſion of national quarrels has often been determined by command of money, rather than by national bravery. Ambitious princes have therefore borrowed money, in order to carry on their projects with more vigour. Weaker ſtates have been compelled, in ſelf defence, to apply to the ſame reſource; the wealth introduced by commerce has afforded the means; the regularity of adminiſtration, eſtabliſhed in conſequence of the progreſs of civility, has increaſed the confidence of individuals in the public ſecurity; the complicated ſyſtem of modern policy has extended the ſcenes of war, and prolonged their duration; and the colonies eſtabliſhed by the mercantile nations have rendered them vulnerable in more points, and increaſed the expence of defending them.

When a greater ſum has been required for the annual expence, than could eaſily be ſupplied by annual taxes, the government have propoſed terms, to their own ſubjects, or foreigners, for obtaining an advance of money, by mortgaging the revenue of future years for their indemnification. This mortgage may either be for a limited period, or perpetual. If the ſum allotted annually for the benefit of thoſe who advance the money, be conſiderably greater than the intereſts of the ſums advanced, they may agree to accept of ſuch allowance, for a limited time, as a full equivalent. Thus, they may either agree for the caſual produce of the revenue aſſigned; or a fixed annuity for a greater or leſs number of years; or a life annuity to themſelves or nominees; or an annuity for two or more lives; or an annuity, with the benefit of ſurvivorſhip, called a *tontine*, in which ſcheme, the whole ſum to which the original annuitants were entitled continues to be diſtributed among the ſurvivors. When the ſum allotted to the creditors of the public is only equivalent to the intereſt of the money advanced, the grant muſt be perpetual, unleſs the debt be redeemed by payment of the principal. The eſtabliſhment of the funds was introduced in Britain at the revolution; and has ſince been gradually enlarged, and carried to an amazing extent. The various methods above mentioned have been uſed in their turns; but perpetual annuities have been granted for the greateſt part; and, even when the money was originally advanced on other conditions, the lenders have been ſometimes induced, by ſubſequent offers, to accept of perpetual annuities, inſtead of the former terms. The debt for which perpetual annuities are granted, is called the *redeemable debt*, and the other is called the *irredeemable debt*. Although the debts thus contracted by government are ſeldom paid for a long term of years; yet, any creditor of the public may obtain money for what is due to him when he pleaſes, by transferring his property in the funds to another; and regular methods are appointed for tranſacting theſe transfers, in an eaſy manner. By means of this, the ſtocks become a kind of circulating capital; and have the ſame effect, in ſome reſpects, as the circulating money in the nation. When a ſtockholder transfers his ſhare, he may ſometimes be able to obtain a greater price than the original value, and at other times be obliged to accept of a leſs one. The value of the funds depends on the proportion between the intereſt they bear, and the benefit which may be obtained by applying the money to other purpoſes. It is influenced by the plenty or ſcarcity of money, and by the quantity of the public debt; and it is impaired by any event which threatens the ſafety, or weakens the credit, of the government.

Theſe *funds*, in Britain, have been all formed into the four following claſſes or diviſions: the *Aggregate fund*, the *South Sea fund*, and the *Sinking fund*. Of all theſe, but more eſpecially the laſt, *the general fund*, we ſhall give an account in the order in which they have been now named. The *aggregate fund* was eſtabliſhed by an act of Geo. I. cap. 12. in 1715. It had this name given it, becauſe it conſiſted of a great variety of taxes and ſurpluſſes of taxes and duties which were in that year conſolidated, and given as a ſecurity for the diſcharge of the intereſt and principal of debts due to the Bank of England, and ſome other public debts; and alſo for the payment of 120,000*l*. per ann. to the civil liſt. Into this *fund* are brought the two thirds and one half ſubſidy of tonnage and poundage; half the inland duties on tea and coffee; the houſe-money granted by the 7th of Will. III. the duty on hops; the duties on low wines, brandy, and Britiſh ſpirits; all arrears of land taxes; all public monies not appropriated; the ſurpluſſes of the ninepenny exciſe, of the five ſevenths of the Bank nine penny exciſe, of the revenues in the annuity acts of the 4th, 5th, and 6th of queen Anne, &c. and, by an act of the 1ſt of Geo. III. all the duties conſtituting the revenue of the civil liſt. The whole produce or income of this *fund* had been for a few years before 1778 about 2,600,000*l*. per annum.

The *South Sea fund* was eſtabliſhed, by ſtat. 3. Geo. I. cap. 9. in 1716; and is ſo called, becauſe appropriated to pay the intereſt of the South Sea company's capital. It conſiſts of a duty on candles, and certain impoſts on wines, vinegar, tobacco, and Eaſt India goods. Its produce of late has been about half a million per ann. The *general fund* was alſo eſtabliſhed, by ſtat. of Geo. I. cap. 7. in 1716, and conſiſt of a ſubſidy on goods exported; a tax on hackney coaches and chairs; duties on ſoap, hides, ſtamps, and policies of inſurance; 700*l*. per week letter money; a moiety of the inland duties on tea and coffee; 39,855*l*. per annum out of the hereditary exciſe on beer for bankers annuities. All theſe taxes and payments have for ſome years amounted to a little more than a million per ann. and are appropriated to the diſcharge of the intereſt of 7,808,087*l*. (originally 10,000,000*l*.) capital ſtock of South Sea annuities, together with charges of management.

All that remained of the produce of the taxes thus digeſted into theſe three *funds*, after ſatisfying the charges upon them, was in the ſame year (or 1716) carried into a fourth *fund*, to which was given the name of the *ſinking fund*, becauſe appropriated to the purpoſe of ſinking the public debts. The words of the act of the 3d of Geo. I. which eſtabliſhed this *fund*; are, "All the monies to be raiſed from time to time, as well of the exceſs and ſurplus of an act made this ſeſſion for redeeming the *funds* of the Bank of England; and of the exceſs or ſurplus by virtue of one other act made likewiſe this ſeſſion for redeeming the *funds* of the South Sea company; as alſo, for the exceſs or ſurplus of the duties and revenues by this act appropriated as aforeſaid; aud the overplus monies of the ſaid *general fund* by this act eſtabliſhed; ſhall be appropriated to the diſcharging the principal and intereſt of ſuch national debts as were incurred before the 25th of December, 1716, and are declared to be national debts: and to or for no other uſe, intent, or purpoſe whatſoever." The operations and progreſs of this *ſinking fund* form ſo important a part of the hiſtory of Britain, that a more particular account of it will be here proper. Before its eſtabliſhment there had exiſted many ſmaller *funds* of the ſame nature: that is, ſuch duties or taxes had been provided for paying the intereſts of particular loans, as afforded ſurpluſſes by which the principal itſelf was to be gradually redeemed; this was the common practice in the reigns of king William and queen Anne. Moſt of the public duties were given for terms of years; and at the end of thoſe terms they ceaſed of courſe, unleſs continued for farther terms by new acts of parliament; and, in general, it was provided, when any money was raiſed, that the principal ſhould be cancelled either by time, as in the caſe of the ſale of long and ſhort annuities, or by the ſurpluſſes of the duties charged with the payment of the intereſt. This was an excellent plan; but it was by no means carried ſteadily into execution. In the year 1720, moſt of the long and ſhort annuities were converted into redeemable perpetuities, at the expence of above three millions; and the ſurpluſſes of the duties charged with particular loans were often ſo broken into, by being either charged with new loans before they had cancelled the old, or ſpent on current ſervices, as to be rendered incapable of anſwering the end intended by them. In conſequence partly of this bad management, the public debts at the acceſſion of the houſe of Hanover were ſo much increaſed as to be generally reckoned inſupportable: and their reduction was made one of the firſt objects of parliamentary attention. This gave riſe, in 1716, to the inſtitution of the *fund* of which we are giving an account, the father of which was (as has been generally ſaid) ſir Robert Walpole, but, in reality, the earl of Stanhope. All the taxes, except the land-tax, and five pence per buſhel malt-tax, were now made perpetual, and diſtributed into the three *funds* which have been deſcribed, the ſurpluſſes of which, for ever afterwards, were to be held ſacred, and to be applied inviolably, according to the words of the act juſt recited, to the redemption of the national debt. Theſe taxes have been always voted by parliament from year to year; they are, on this account, diſtinguiſhed by the name of the annual taxes, and wholly employed, as far as they will go, in bearing the current expences of every year. A conſiderate perſon might have ſuſpected, that the ſame cauſes which had rendered former partial appropriations ineffectual, would deſtroy the efficacy of this. There ſeemed, however, to be reaſon for hoping the contrary: for, Firſt, the future happineſs and glory of the kingdom, were thought to depend on this appropriation; and the law which eſtabliſhed it was declared to be a fundamental law of this realm. In conformity to this, ſecondly, the words of this law were made as ſtrong as they could well be; and in order to give additional force to it, a repetition of it, in the ſame words, was inſerted in an act of the 5th of Geo. I. cap. 3. Particular notice ſhould be taken of theſe words: they order that all the ſurpluſſes of the taxes then made perpetual, ſhall be applied to the diſcharge of the public debts, and "to no other uſe or intent whatever." When, therefore, a debt had been paid off, the addition ariſing from that payment to the ſurpluſſes (or the annuity diſengaged by it) became a part of the *fund*, and, together with it, was to be employed in diſcharging farther debts. And the ſame being true of every ſucceſſive annuity diſengaged by every payment, the *fund*, if never miſapplied, muſt neceſſarily have operated in ſinking the public debt, in the ſame manner that money accumulates, when put out to bear compound intereſt. And in this way this *fund* did in fact operate for a few years. While in its infancy, it was watched over with great care; the improvement, and the inviolable application of it were recommended in moſt of the ſpeeches from the throne, and echoed back in the addreſſes of the houſe of commons. It is particularly obſervable, that ſo well did our miniſters then underſtand the nature and importance of this *fund*, that rather than encroach upon it, they frequently borrowed money in order to defray the neceſſary expences of government. From ſome publications in 1726 it appears, that ſome perſons had been led to apprehend this zeal of the miniſtry would not be permanent, becauſe it was not their intereſt to pay off the public debt, on account of the dependence and influence created by it. In anſwering this objection, the writers on the ſide of the court called ſuch an apprehenſion an indecent jealouſy, and took upon them to aſſure the public, "that in no poſſible exigence of affairs could our miniſters ever approve of or recommend the alienation of the *ſinking fund*." Happy would it have been for Britain had this proved true; but in a little time it appeared, that the apprehenſions which had been ſtyled indecent jealouſies, were too well grounded. Men in power came ſoon to ſee, that this *fund* was advancing too faſt in its operations, and to change their zeal for it into a reſolution to deſtroy it; this will abundantly appear from the following facts.

Charging the income of the *ſinking fund* with the payment of the intereſt of new loans, is an encroachment upon it, no leſs ſubverſive of its efficacy than depriving it of groſs ſums; there being no difference between taking from it the annual intereſt of a ſum, and that ſum itſelf. Between the years 1727 and 1732 ſeveral encroachments of this kind had been made upon it; but, being of a leſs obvious nature, they paſſed without meeting with any particular oppoſition. The finiſhing blow was given it in the year 1733. In that year, in order to keep the land-tax at one ſhilling in the pound, as it had been the year before, it was neceſſary either to borrow half a million for the current ſervice, or to take this ſum from the *ſinking fund*. The laſt method was choſen, and propoſed by ſir Robert Walpole to the houſe of commons. Long and warm debates enſued. A propoſal to alienate, in a time of profound peace, a *fund* which the law had made ſacred, and the alienation of which *no poſſible exigence of public affairs* could juſtify, only for the ſake of keeping the land-tax for one year at one ſhilling in the pound, juſtly kindled the indignation of the patriotic party. They urged the prohibition of the law, the faith of parliament, and the ſecurity of the kingdom. The propoſer of the alienation was reminded of his inconſiſtency and treachery, in endeavouring to beat down that very monument of glory which he had boaſted of having erected for himſelf; and ſir John Barnard warned him, that he was drawing upon himſelf the curſes of poſterity. But all arguments were vain. The miniſtry pleaded that the landed intereſt wanted eaſe: that there was no occaſion for being in a hurry to pay the national debt; and that the circumſtances of the kingdom had altered ſo much ſince the eſtabliſhment of the *ſinking fund*, that the competition then among the public creditors was, not who ſhould be firſt, but who ſhould be laſt paid. Thus argued, among others, ſir Robert Walpole. His reaſons prevailed; and the houſe of commons, not uſed to refuſe him any thing, conſented.

The practice of alienating the *ſinking fund* having been thus begun, went on of courſe. In the next year, or 1734, 1,200,000*l.* was taken from it. In 1735, and 1736, it was anticipated and mortgaged. Thus expired, after an exiſtence of a few years, the *ſinking fund*; that ſacred bleſſing (as it was once thought) and the nation's only hope. Could it have eſcaped, it would long before this time have eaſed Britain of all its debts, and left it a ſafe and happy country. In order to obtain a juſter ſenſe of this, let us here compare what it would have done had it never been miſapplied, with what it has done. Though the act that eſtabliſhed it was paſſed, as already ſaid, in 1716, it did not begin its operations till 1719, when three quarters of a million in old exchequer bills were paid off with it. The intermediate time had been employed in laying the foundations of this *fund*, and providing an income for it, by a general reduction of the public debts, from an intereſt of ſix per cent. and other higher intereſts, to five per cent. What made this reduction then practicable was a rapid fall of the intereſt of money, which begun (in conſequence of an increaſe of trade producing an influx of money) a little before the acceſſion. The legal intereſt of money was reduced in 1714, from ſix to five per cent. and the means uſed by government for accompliſhing this reduction were, firſt, the addition (at Michaelmas 1717) of the intereſt of ſome debts bearing five per cent. to the principal in order to make uſe of the produce of the taxes which ſhould have paid the intereſt, in diſcharging the bankers debt and ſome other debts bearing ſix per cent. Secondly, loans of five per cent. obtained chiefly from the Bank, and the South Sea company, to pay off ſuch of the public creditors as did not chuſe to accept a lower intereſt than ſix per cent.

After this reduction, the three *funds*, before deſcribed, produced a ſurplus of above half a million per annum. In 1727 this ſurplus was increaſed to 939,103*l.* and in 1733 (the year when the practice of alienating it begun) it had been increaſed ſo much by the redemptions made with it, and by a ſecond reduction of intereſt in 1727 from five to four per cent. that its medium for five years had been 1,212,000*l.* per annum. Had it, from the year 1732, been allowed to increaſe beyond this (except from the intereſt of debts paid by it), and been applied for the firſt twenty five years to the payment of debts bearing four per cent. intereſt, and afterwards to the payment of debts bearing three per cent. it would in the year (1779) have completed the redemption of one hundred and forty nine millions of debt, leaving the public, during this whole period, in poſſeſſion of all the ſurpluſſes which have ariſen in the revenue beyond 1,212,000*l.* except thoſe produced by redemptions. It is not poſſible to conceive the beneficial effects with which this would have been attended, or the vigour which would have been all along given to public credit by ſuch a *fund*, and by the proſpect it would have given of a ſpeedy annihilation of almoſt all the public debts, and the diſengagement of taxes bringing in above five millions per annum, to be either aboliſhed, or (ſhould a war prove neceſſary) to be continued a few years longer for carrying it on without making any addition to the public burdens. No perſon who duly attends to this, and wiſhes well to England, can avoid execrating the policy which firſt produced, and has ſince continued, the alienation of the *ſinking fund*, and converted an expedient for ſaving the kingdom, into a ſupply for extravagance, and a ſupport of corruption and deſpotiſm. This, however, is a policy which it may be expected men in power will always uſe when they can; for few of them have ever ſhewn themſelves ſuperior to the temptations of power, or virtuous enough to avoid uſing all means to ſtrengthen and extend it.

Many ſchemes of different kinds have been formed for paying the public debts; and certain it is, that nothing can be of more importance. But the nature of things doth not admit of any method of doing this ſo expeditiouſly and effectually as an unalienable *ſinking fund*; for in ſuch a *fund* (it has been ſhewn) money is improved at compound intereſt, and therefore in the moſt perfect manner. The writers, therefore, who have employed themſelves in contriving ſuch ſchemes might have ſpared their labour. The beſt of all ſchemes has been long known and eſtabliſhed, and received all the weight and efficiency which could be given it by the moſt ſolemn acts of legiſlature. But no legiſlature can give ſecurity againſt itſelf. No parliament can do any thing which it may not undo, eſpecially if under any undue influence. We have now ſeen what the *ſinking fund* would have done, had it ſuited the views of the Britiſh miniſtry in 1733, to ſuffer it to go on with its operations. Let us next compare this with what it has done. In 1737 and 1738, a million of the ſtock of Bank annuities and two millions of the ſtock of South Sea annuities were redeemed with it. For twelve years after 1738, it was wholly applied to the current expences of every year. In 1749, the intereſt of near fifty eight millions of the public debts was reduced from four to three one half per cent. intereſt for ſeven years, and afterwards to three per cent. for ever; and by this third reduction, an addition was made to the *ſinking fund* of near 600,000*l.* per ann. But notwithſtanding this addition, no more than three millions of the public debts were redeemed by it, during the interval of peace between the years 1748 and 1756.

By an act of the 25th of Geo. II. 1752, a change was made in the *ſinking fund*, which it is neceſſary to mention. Before this act the *ſinking fund* conſiſted only of the clear ſurpluſſes of the aggregate, the general, and the South Sea company's *funds*. By the war, which began in 1740, there was an addition made to the public debt of near thirty two millions. This occaſioned a great increaſe of taxes; and the practice was, whenever any new tax produced leſs than the intereſt with which it was charged, to make good the deficiency out of the *ſinking fund*, and afterwards to replace the ſum taken from it out of the ſupplies for the following year. But whenever a tax produced more than the charge upon it, the overplus, inſtead of being carried to the *ſinking fund*, was made a part of the ſupplies for the year. By the act juſt mentioned, all the new taxes, together with all the annuities to the payment of which they had been appropriated, were ordered to be carried into the *ſinking fund*, and formed into one general account. Moſt of the new taxes having proved deficient, this *fund* at firſt loſt more than it gained by the change, but the loſs was afterwards more than made up; firſt, by the ſaving which was produced by the reduction of intereſt from three one half per cent. to three per cent. in 1757; and ſecondly, by the addition, in the ſame year, of the ſalt duties to this *fund*, after they had completed the redemption of a million with which they had been charged in 1745.

The war which began in 1756, added ſeventy one millions and a half to the public debts. This produced a new increaſe of taxes, which (in conformity to the conſolidating act juſt mentioned) have been brought to the general *ſinking fund* account, together with the annuities or intereſts with the payment of which they are charged. And it is now the conſtant practice, whenever a new *fund* or tax is created for paying the intereſt of a loan, to carry both into the *ſinking fund*; in conſequence of which this *fund* gains when the tax happens to produce more, but loſes when it produces leſs than the intereſt which it has been given to pay. The *ſinking fund*, therefore, which, before the conſolidating act, conſiſted only of the ſurpluſſes of the aggregate, general, and South-ſea company's *funds*, conſiſts now of the clear ſurplus of all the appropriated taxes. There is but one tax excepted; and that is, the additional tax upon houſes and windows, granted in 1758, towards paying the intereſt of four millions and a half then borrowed. This tax has never been made a part of the *ſinking fund*; and, having always proved deficient to the amount of about 45,000*l.* per ann. the deficiency is conſtantly made good by the *ſinking fund*, and afterwards replaced from the ſupplies.

Before the laſt reduction of the intereſt of the public debts, the *ſinking fund*, having ſuffered greatly from various encroachments upon it, produced little more than a million per ann. But after this reduction, and its increaſe by the addition of the ſalt-duties, it produced near two millions per ann. In 1764 it produced at Michaelmas, after making good deficiencies, 2,105,000*l.* nearly. For five years after 1764, its average produce, reckoned to Chriſtmas in every year, was 2,234,780*l.* For five years, ended in 1774, its average produce was 2,610,759*l.* In 1775, it produced 2,917,869*l.* In 1776, 2,166,517*l.* In 1777 it was charged with an annuity of 100,000*l.* per ann. to the civil liſt; and, after paying this annuity and half a year's intereſt of five millions borrowed in that year, it produced nearly 2,700,000*l.* In 1778 it was taken at three millions: but did not produce, after paying the ſaid annuity, and making good the intereſts of the new loans in 1777 and 1778, more than two. It appears from this detail, that ſince the peace in 1763 the income of the *ſinking fund* has increaſed conſiderably. The cauſes of this have been partly the falling in of life-annuities, and the greater productiveneſs of the taxes occaſioned by the increaſe of luxury. But the principal cauſe has been the falling in of the intereſt of about ten millions and a half of the public debts, which had been diſcharged during the twelve years of peace between 1763 and 1775. This diminution of the public debts has been made not by the *ſinking fund*, but by a contribution from the Eaſt India company of 400,000*l.* per ann. begun in 1768, and continued for five years; by the profits of ten lotteries; by the compoſition for maintaining French priſoners; ſale of French prizes taken before the declaration of war in 1756; and other extraordinary receipts, amounting in all to above eight millions. This *fund*, therefore, did not pay off more than two millions and a half, the reſt of its produce having been employed in bearing the expences of the peace eſtabliſhment, which, during this period, was nearly double to what it had been in any former period.

To the ſum juſt mentioned, add three millions paid off in the peace between 1748 and 1756, and three millions paid off in 1736 and 1737, and it will appear that the whole amount of the public debts paid off by the *ſinking fund*, ſince its firſt alienation in 1733, is only eight millions and a half; whereas it has been ſhewn, that had only 1,212,000*l.* per ann. of it been applied inviolably to the redemption of the public debts, one hundred and forty-nine millions would have been paid, and conſequently, the nation extricated and ſaved. It has been ſaid, that when money is wanted for defraying public expences, it makes no difference whether it is obtained by diverting the *ſinking fund*, or by a new loan. There cannot be a worſe fallacy than this. Money in a *ſinking fund*, if never alienated, is improved at compound intereſt; but, when procured by a loan, bears only ſimple intereſt. A nation, therefore, whenever it applies the income of ſuch a *fund* to current expences rather than the redemption of its debts, chuſes to loſe the benefit of compound intereſt in order to avoid paying ſimple intereſt; and the loſs in this caſe is equal to the difference between the increaſe of money at compound and ſimple intereſt. The following calculation will ſhew what this difference is.

One penny put out at our Saviour's birth to five per cent. compound intereſt, would, before the preſent year, have increaſed to a greater ſum than would be contained in a hundred and fifty millions of earths, all ſolid gold. But, if put out to ſimple intereſt, it would, in the ſame time, have amounted to no more than ſeven ſhillings and ſix pence. All governments that alienate *funds* deſtined for reimburſements, chuſe to improve money in the laſt rather than the firſt of theſe ways. See, on the ſubject of this article, Dr. Price's Appeal to the Public on the Subject of the National Debt. Alſo his Obſervations on Reverſionary Payments, &c. chap. iii. And additional Obſervations on Civil Liberty, part iii.

The term *ſtock* is uſed in the ſame ſenſe, as that of funds, and is alſo applied to the ſums which form the capital of the bank of England, the Eaſt India and South-Sea companies; the proprietors of which are entitled to a ſhare of the profits of the reſpective companies. The buſineſs of ſtock-jobbing is founded on the variation of the prices of ſtock. Perſons poſſeſſed of real property may buy or ſell ſtock, according to their notion that the value is likely to riſe or fall, in expectation of making profit by the difference of price. And a practice has taken place among perſons who often poſſeſs no property in the funds, to contract for the ſale of ſtock againſt a future day, at a price now agreed on. For inſtance: A agrees to ſell B 1000*l.* of bank-ſtock, to be transferred, in 20 days, for 1200*l.* A has, in fact, no ſuch ſtock; but, if the price of bank-ſtock, on the day appointed for the transfer, ſhould be only 118 *per cent.* A may purchaſe as much as will enable him to fulfil his bargain for 1180*l.* and thus gains 20*l.* by the tranſaction; on the contrary, if the price of bank-ſtock be 125 *per cent.* he will loſe £. 50. The buſineſs is generally ſettled without any actual purchaſe or transfer of ſtock, by A paying to B, or receiving from him, the difference between the current price of the ſtock on the day appointed, and the price bargained for. This practice, which is really nothing elſe than a wager concerning the price of ſtock, is contrary to law; yet it is carried on to a great extent. In the language of Exchange-alley, where matters of this kind are tranſacted, the buyer is called a *bull*, and the ſeller a *bear*. As neither party can be compelled by law to implement theſe bargains, their ſenſe of honour, and the diſgrace and loſs of future credit, which attend a breach of contract, are the principles by which the buſineſs is ſupported. When a perſon declines to pay his loſs, he is called a *lame duck*, and dare never afterwards appear in the Alley. This opprobrious treatment, however, is not beſtowed on thoſe whoſe failure is owing to want of ability, providing they make the ſame ſurrender of their property voluntarily, which the law would have exacted if the debt had been entitled to its ſanction.

The capital advanced to the public, in the form of transferable ſtocks, and bearing intereſt from taxes appropriated for that purpoſe, is called the *funded debt*. Beſides, there is generally a conſiderable ſum due by government, which is not diſpoſed of in that manner, and therefore is diſtinguiſhed by the appellation of the *unfunded debt*. This may ariſe from any ſort of national expence, for which no proviſion has been made, or for which the proviſion has proved inſufficient. The forms of the unfunded debts are various, according to the circumſtances by which they are occaſioned. But there are two regular branches of this debt, which always ſubſiſt, to a greater or leſſer extent.

1ſt, *Exchequer Bills*. Theſe are iſſued from the exchequer, generally by appointment of parliament, and ſometimes without ſuch appointment, when exigencies require. They bear intereſt from the time when iſſued, and are taken in by the bank of England, which promotes their circulation.

2d, *Navy Bills*. The ſums annually granted for the navy have always fallen ſhort of what that ſervice required. To ſupply that deficiency, the admiralty iſſues bills in payment of victuals, ſtores, and the like, which bear intereſt ſix months after the time iſſued. The debt of the navy thus contracted is diſcharged, from time to time, by parliament. In time of war, the public expences, ſince the revolution, have always been much greater than the annual revenue; and large ſums have conſequently been borrowed. In time of peace, the revenue exceeds the expence, and part of the public debts have frequently been paid off. But, though there have been more years of peace than of war ſince the funds were eſtabliſhed, the debts contracted during each war have much exceeded the payments during the ſubſequent peace.

FUNDAMENT, the anus or aperture, through which an animal voids his excrements.

FUNDAMENTAL, in general, ſomething that ſerves as a baſe or foundation for another.

FUNDAMENTAL, in muſic. A *fundamental ſound* is that which forms the loweſt note of the *chord*, and from whence are deduced the harmonical relations of the reſt; or, which ſerves for a key to the tone. The *fundamental baſs* is that which ſerves for a foundation to the harmony. A *fundamental chord* is that whoſe baſs is fundamental, and in which the ſounds are ranged in the ſame order as when they are generated, according to the experiment ſo often repeated by M. d'Alembert in his Preliminary Diſcourſe and Elements of Muſic. But as this order removes the parts to an extreme diſtance one from the other, they muſt be approximated by combinations or inverſions; but if the baſs remains the ſame, the chord does not for this reaſon ceaſe to bear the name of *fundamental*. Such an example is this chord, *ut mi ſol*, included in the interval of a fifth: whereas, in the order of its generation, *ut ſol mi*, it includes a tenth, and even a ſeventeenth; ſince the fundamental *ut* is not the fifth of *ſol*, but the octave of that fifth.

FUNERAL *Rites*, ceremonies accompanying the interment or burial of any perſon. Theſe rites differed among the ancients according to the different genius and religion of each country. The

Egyptians, among the reſt of their funeral rites, embalmed their dead. Among the ancient Greeks it was uſual ſometimes, before the interment, to put a piece of money into the mouth of the deceaſed, which was thought to be Charon's fare for wafting the departed ſoul over the infernal river. This ceremony was not uſed in thoſe countries which were ſuppoſed to be ſituated in the neighbourhood of the infernal regions, and to lead thither by a ready and direct road. The corpſe was likewiſe furniſhed with a cake, compoſed of flour, honey, &c. which was deſigned to appeaſe the fury of Cerberus the door-keeper of hell, and to procure the ghoſt a ſafe and quiet entrance.

During the time the corpſe continued in the houſe, there ſtood before the door a veſſel of water: the deſign of which was, that thoſe concerned about the body might purify themſelves by waſhing; it being the opinion of the Greeks, as well as of the Jews, that pollution was contracted by touching a dead body. The ceremonies by which they expreſſed their ſorrow for the death of their friends, were various; but it ſeems to have been a conſtant rule to recede as much as poſſible in habit and behaviour from their ordinary cuſtoms. For this reaſon they abſtained from banquets and entertainments; they diveſted themſelves of all ornaments; they tore, cut off, or ſhaved their hair, which they caſt into the funeral pile, to be conſumed with the body of their deceaſed friend. Sometimes they threw themſelves on the ground, and rolled in the duſt, or covered their head with aſhes; they beat their breaſts, and even tore their fleſh with their nails, upon the loſs of a perſon they much lamented. When perſons of rank, ſuch as public magiſtrates or great generals, died, the whole city put on a face of mourning; all public meetings were intermitted; the ſchools, baths, ſhops, temples, and all places of concourſe, were ſhut up. Interring or laying the dead on the ground, ſeems to have been the moſt ancient practice among the Greeks; though burning came afterwards to be generally uſed among them. It was cuſtomary to throw into the funeral pile, thoſe garments the deceaſed uſually wore. The pile was lighted by one of the deceaſed's neareſt relations or friends, who made prayers and vows to the winds to aſſiſt the flames, that the body might quickly be reduced to aſhes; and during the time the pile was burning, the dead perſon's friends ſtood by it, pouring libations of wine, and calling upon the deceaſed. When Numa reformed the religion of Rome, he ordered that the pontiffs ſhould have the care of the funeral ceremonies; which, in moſt reſpects, were like thoſe of the Greeks already deſcribed.

The funeral rites among the Hebrews were ſolemn and magnificent. When any perſon was dead, his relations and friends rent their cloths; which cuſtom is but faintly imitated by the modern Jews, who only cut off a bit of their garment, in token of affliction. It was uſual to bend the dead perſon's thumb into the hand, and faſten it in that poſture with a ſtring; becauſe the thumb then having the figure of the name of God, they thought the devil would not dare to approach it. When they came to the burying place, they made a ſpeech to the dead in the following terms: "Bleſſed be God, who has formed thee, fed thee, maintained thee, and taken away thy life. O dead! he knows your numbers, and ſhall one day reſtore your life, &c." Then they ſpoke the elogium, or funeral oration, of the deceaſed; after which they ſaid a prayer, called the *righteouſneſs of judgment*; then turning the face of the deceaſed towards heaven, they called out, "Go in peace."

The ancient Chriſtians teſtified their abhorrence of the Pagan cuſtom of burning the dead; and always depoſited the body entire in the ground: and it was uſual to beſtow the honour of embalming upon the martyrs at leaſt, if not upon others. They prepared the body for burial, by waſhing it with water, and dreſſing it in a funeral attire. The exportation or carrying forth of the body was performed by near relations, or perſons of ſuch dignity as the circumſtances of the deceaſed required. Pſalmody, or ſinging of pſalms, was the great ceremony uſed in all funeral proceſſions among the ancient Chriſtians. In the Romiſh church, when a perſon is dead, they waſh the body, and put a crucifix in its hand. At its feet ſtands a veſſel full of holy water, and a ſprinkler, that they who come in may ſprinkle both themſelves and the deceaſed. In the mean time ſome prieſt ſtands by the corpſe, and prays for the deceaſed till it is laid in the earth. In the funeral proceſſion, the exorciſt walks firſt, carrying the holy water; next the croſs bearer, afterwards the reſt of the clergy, and laſt of all the officiating prieſt. They all ſing the *miſerere*, and ſome other pſalms; and at the end of each pſalm a *requiem*. We learn from Alet's ritual, that the faces of deceaſed laymen muſt be turned away towards the altar, when they are placed in the church; and thoſe of the clergy towards the people. The corpſe is placed in the church ſurrounded with lighted tapers: after the office for the dead, maſs is ſaid; then the officiating prieſt ſprinkles the corpſe thrice with holy water, and as often throws incenſe on it. The body being laid in the grave, the friends and relations of the deceaſed ſprinkle the grave with holy water.

The funeral ceremonies of the Greek church, are much the ſame with thoſe of the Latin. It need only to be obſerved, that, after the funeral ſervice, they kiſs the crucifix, and ſalute the mouth and forehead of the deceaſed: after which each of the company eats a bit of bread and drinks a glaſs of wine in the church, wiſhing the ſoul a good repoſe, and the afflicted family all conſolation.

FUNERAL *Games*, a part of the ceremony of the ancient funerals. It was cuſtomary for perſons of quality, among the ancient Greeks and Romans, to inſtitute games, with all ſorts of exerciſes, to render the death of their friends more remarkable. This practice was generally received, and is frequently mentioned by ancient writers. Patroclus's funeral games take up the greateſt part of one of Homer's Iliads; and Agamemnon's ghoſt is introduced by the ſame poet telling the ghoſt of Achilles, that he had been a ſpectator at a great number of ſuch ſolemnities. The celebration of theſe games among the Greeks, moſtly conſiſted of horſe-races; the prizes were of different ſorts and value, according to the quality and magnificence of the perſon that celebrated them. The garlands, given to victors on this occaſion, were uſually of parſly, which was thought to have ſome particular relation to the dead.

Thoſe games, among the Romans, conſiſted chiefly of proceſſions; and ſometimes of mortal combats of gladiators around the pile. They, as well as the Greeks, had alſo a cuſtom, though very ancient, of cutting the throats of a number of captives before the pile, as victims to appeaſe the manes of the deceaſed. Cæſar relates, that the Gauls had this cuſtom. The funeral games were aboliſhed by the emperor Claudius.

FUNGI, from σφογγος, *fungus*, one of the ſeven families or tribes of the vegetable kingdom, according to Linnæus, comprehending all thoſe who are of the muſhroom kind. See Syſtem of BOTANY, Claſs XXIV. Order IV. Plate VI.

FUNGUS, in ſurgery, a fleſhy *tumor*, or excreſcence, very ſpongeous, ſoft, and pale; ariſing on the membranes, tendons, and other nervous parts, in conſequence of ulcers, wounds, contuſions, and ſtrains. See Syſtem of SURGERY.

FURIES, in Pagan antiquity, certain goddeſſes whoſe office it was to puniſh the guilty after death. They were three in number; *Alecto*, *Megæra*, and *Tiſiphone*; who were deſcribed with ſnakes inſtead of hair, and eyes like lightning, carrying iron chains and whips in one hand, and in the other flaming torches; the latter to diſcover, and the former to puniſh, the guilty: and they were ſuppoſed to be conſtantly hovering over ſuch perſons as had been guilty of any enormous crime.

FURLONG, an Engliſh long meaſure, containing the eighth part of a mile. The Engliſh *furlong* is equal to forty poles or perches, and the perch to 16½ feet. In Scotland the *furlong* is equal to forty *falls*.

FURNACE, an utenſil, or veſſel, proper to contain fire, or to raiſe and maintain a vehement fire in, whether of coal or wood. There are divers kinds of furnaces, of various forms, and for various uſes. For a deſcription of different Furnaces for Practical Chymiſtry, and particularly *Dr. Black's* new invented one, ſee Syſtem of CHYMISTRY, under the Article *Chymical Apparatus*. For a repreſentation of them, ſee the Plate.

FUROR *Uterinus*, a ſpecies of madneſs, peculiar to women, exciting them to a vehement deſire of venery, and rendering them inſatiate therewith, and manifeſting itſelf by obſcene ſpeech and wanton behaviour. As the diſorder increaſes, the patient ſcolds, laughs, and cries by turns. The immediate cauſes of this diſeaſe are an inflammation, tenſeneſs, and irritability of the uterus and pudenda of women, and particularly of the clitoris and vagina, in which the venereal ſtimulus reſides, or the too great abundance or acrimony of the humours of theſe parts. See Syſtem of MEDICINE.

FURR, or **FUR**, in commerce, the ſkins of divers kinds of wild beaſts, dreſſed with the hair on; to be uſed as a lining, or doubling, of garments, robes, &c. either for warmth, ornament, or diſtinction of rank and dignity. The robes of kings, dukes, and peers, are lined with divers kinds of *furrs*, and, in particular, ermine, to render them more magnificent. The ſame may be obſerved of ſeveral chief magiſtrates, judges, and doctors of different faculties, in the univerſities.

FURR, in heraldry, a repreſentation of the ſkins of certain wild beaſts, ſeen, both in the doublings of the mantles of coat-armour, and in the armour itſelf. The heralds uſe two metals, five colours, and two *furrs*, or hairy ſkins: viz. ermine and vair.

FUSEE, **FUZE**, or **FUSE**, in war, an appendage of a bomb or granado-ſhell, by which the powder, or compoſition, in the ſhell, is ſet on fire, to do the deſigned execution. The word is French, and literally denotes a *ſpindle*. *Fuzee*, or *Fuſee*, is alſo ſometimes uſed to denote a *fire-lock*.

FUSIBILITY, that quality in metals, and minerals, which diſpoſes them for *fuſion*. Gold is more *fuſible* than iron, or copper; but leſs ſo than ſilver, tin, and lead. Borax is frequently mixed with metals, to render them more *fuſible*.

FUSION, the ſolution, or melting, of metals, minerals, &c. by means of fire; or the act of changing them from their ſolid ſtate to a fluor. See Syſtem of CHYMISTRY, Part II.

FUTURE, ſomething to come hereafter. We ſay a *future* ſtate, a *future* contingency; there is none but God to whom *future* things are preſent.

FUTURE, or **FUTURE** *Tenſe*, in grammar, denotes an inflexion of verbs, whereby they denote, that a thing will be in ſome time yet to come. As, the laſt day will come: I ſhall ſee an end.

G

G, The ſeventh letter in our alphabet, and the fifth conſonant: though in the alphabets of all the oriental languages, the Hebrew, Phœnician, Chaldee, Syriac, Samaritan, Arabic, and even Greek, *G* is the third letter. The Hebrews call it *ghimel*, or *gimel*, q. d. *camel*; becauſe it reſembles in its form the neck of that animal; and the ſame appellation it bears in the Samaritan, Phœnician, and Chaldee; in the Syriac it is called *gomel*, in Arabic *giim*, and in Greek *gamma*. The letter *G* is of the mute kind, and cannot be any way ſounded without the help of a vowel. It is formed by the reflection of the air againſt the palate, made by the tongue, as the air paſſes out of the throat; which Martianus Capella expreſſes thus, *G ſpiritus cum palato*, ſo that the *G* is a palatal letter. *G* in Engliſh has two ſounds, one from the Greek Γ, and the Latin, which is called that of the hard *G*, becauſe it is formed by a preſſure ſomewhat hard of the fore-part of the tongue againſt the upper gum; which ſound it retains before *a, o, u, l, r*; as *gate, go, gull*. At the end of a word it is always hard, as *ring, ſing*, &c. The other ſound, called that of the ſoft *G*, reſembles that of *j*, and is commonly, though not always, found before *e* and *i*, as in *gem* and *gibbet*. To this rule, however, there are many exceptions; *G* is often hard before *i*, as *give*, &c. and ſometimes before *e*, as *get*, &c. It is alſo hard in derivatives from words ending in *g*, as *ſinging, ſtronger*, &c. and generally before *er*, at the end of words, as *finger*. *G* is mute before *n*, as *gnaſh, ſign*. *Gh* has the ſound of the hard *G* in the beginning of a word, as *ghoſtly*; in the middle, and ſometimes at the end, it is quite ſilent, as *right, though*. At the end of a word *Gh* has often the ſound of *f*, as *laugh*. Johnſon.

The form of our *G* is taken from that of the Latins, who borrowed it from the Greeks; the Latin *G* being certainly a corruption of the Greek gamma, Γ, as might eaſily be ſhewn, had our printers all the characters and forms of this letter, which we meet with in the Greek and Latin MSS. through which the latter paſſed from Γ to *G*. As to the gamma of the Greeks, it is manifeſtly the ג of the Hebrews or Samaritans. All the difference between the gamma and ghimel conſiſts in this, that the one is turned to the right, and the other to the left, according to the different manners of writing and reading, which obtained among thoſe different nations; ſo that all the pains Salmaſius has taken on Solinus, to prove that the *G* was derived from the Greek kappa, are loſt. G is alſo uſed, in muſic, to ſignify one of the clefs; viz. that of the higheſt part, called the *treble* or *alt*.

GABEL, or Gabelle in the French cuſtoms, a duty or impoſition on ſalt. The *gabel* is let out to farm; and makes the ſecond article in the king's revenue. There are three farms of *gabels*. The produce of this impoſt is ſo conſiderable, that it is computed to make one fourth of the whole revenue of the kingdom.

GABIONS, in fortification, &c. are large cylindric baſkets, open at both ends, made of ozier twigs, about three feet high, and as much in diameter: having nine or ten ſtakes about an inch and a half in diameter, which exceeds the baſket-work about five or ſix inches, and are pointed. Theſe ſerve in ſieges to carry on the approaches under cover, when they come pretty near the fortification.

GABLE, or Gable *End* of a houſe, is the upright triangular end; from the cornice, or eaves, to the top of its roof.

GABRES, or Gavres, a religious ſect in Perſia and India; called alſo *Gebres, Gevres*, &c. See Magi. The Turks call the Chriſtians *Gabres*, q. d. infidels, or people of a falſe religion; or, rather, as Leunclavius obſerves, Heathens, or Gentiles: the word *Gabre*, among the Turks, having the ſame ſignification as Pagan, or Infidel, among the Chriſtians; and denoting any thing not Mahometan.

GAD *Fly*, in entomology, called œſtrus bovinus or ox-fly, a creature very troubleſome to cows, horſes, &c. This creature, examined by the microſcope, has ſeveral peculiarities worthy obſervation. It has, like the gnat, a long proboſcis, with a ſharp dart, and two darts ſheathed within it; the uſe of which is to penetrate the fleſh of animals, and feed on their blood; whereas the proboſcis ſerves to ſuck the juices, &c. from fruits, flowers, and leaves of plants. The eggs of this fly are laid in the water, and there produce a remarkable maggot, of a brown colour and long flatted figure, with a pencil of fine downy hairs at its tail, which it ſpreads into a circular form at the ſurface of the water, whilſt its head is plunged under it in ſearch of food. In deſcending, theſe hairs are drawn together in an oval form, and made to encloſe a bubble of air, by means of which the maggot is able to riſe again; and if this bubble happens to eſcape, the creature ſqueezes another out of his body to ſupply its place. The ſnout of this maggot has three diviſions, whence are thruſt out three little pointed bodies, like ſerpents tongues. Thoſe maggots are very common on the ſurface of ditch water, and the motion of their inteſtines is very ſingular and obſervable. Baker's Microſ. p. 207.

GADUS, in ichthyology, a genus belonging to the order called *Jugulares*. There are 18 ſpecies of which the following are the moſt remarkable. The *morhua*, or *common cod*, is found only in the northern parts of the world; it is, as Rondeletius calls it, an ocean fiſh, and never met with in the Mediterranean ſea. It affects cold climates, and ſeems confined between the latitudes 66° and 50°: what are caught north and ſouth of thoſe degrees being either few in quantity or bad in quality. The Greenland fiſh are ſmall, and emaciated through want of food; being very voracious, and having in thoſe ſeas a ſcarcity of proviſion. This locality of ſituation is common to many other ſpecies of this genus, moſt of them being inhabitants of the cold ſeas, or ſuch as lie within regions that can juſt claim the title of *temperate*. There are certain ſpecies found near the Canary iſlands, called *cherney*, of which we know no more than the name; but which, according to Captain Glaſs, are better taſted than the Newfoundland kind. Many of theſe ſwarm on the coaſts of Norway in the Baltic, off the Orkney and the Weſtern iſles: after which their numbers decreaſe, in proportion as they advance towards the ſouth, when they ſeem quite to ceaſe before they reach the mouth of the Straits of Gibraltar.

In our ſeas they begin to ſpawn in January, and depoſite their eggs in rough ground, among rocks. Some continue in roe till the beginning of April. The cod-fiſh in general recover quicker after ſpawning than any other fiſh, therefore it is common to take ſome good ones all the ſummer. When they are out of ſeaſon, they are thin-tailed and louſy; and the lice chiefly fix themſelves on the inſide of their mouths. The fiſh of the middling ſize are moſt eſteemed for the table; and they are choſen by their plumpneſs and roundneſs, eſpecially near the tail, by the depth of the ſulcus or pit behind the head, and by the regular undulated appearance of the ſides, as if they were ribbed. The glutinous parts about the head loſe their delicate flavour after it has been 24 hours out of the water, even in winter, in which theſe and other fiſh of this genus are in higheſt ſeaſon.

The *Egleſinus*, or *Haddock*. Large haddocks begin to be in roe in the middle of November, and continue ſo till the end of January; from that time till May they are very thin tailed, and much out of ſeaſon. In May they begin to recover; and ſome of the middling-ſized fiſh are then very good and continue improving till the time of their greateſt perfection. The ſmall ones are extremely good from May till February, and ſome even in February, March, and April, viz. thoſe which are not old enough to breed. The fiſhermen aſſert, that in rough weather haddocks ſink down into the ſand and ooze in the bottom of the ſea, and ſhelter themſelves there till the ſtorm is over; becauſe in ſtormy weather they take none, and thoſe that are taken immediately after a ſtorm are covered with mud on their backs. In ſummer they live on young herrings and other ſmall fiſh; in winter, on the ſtone-coated worms which the fiſhermen call *haddock-meat*. The grand ſhoal of haddocks comes periodically on the Yorkſhire coaſts. It is remarkable that they appeared in 1766 on the 10th of December, and exactly on the ſame day in 1767: theſe ſhoals extended from the ſhore near three miles in breadth, and in length from Flamborough-head to Tinmouth-caſtle, and perhaps much farther northwards. An idea may be given of their numbers by the following fact: Three fiſhermen, within the diſtance of one mile from Scarborough harbour, frequently loaded their coble or boat with them twice a-day, taking each time about a ton of fiſh: when they put down their lines beyond the diſtance of three miles from the ſhore, they caught nothing but dog fiſh, which ſhows how exactly theſe fiſh keep their limits. The beſt haddocks were ſold from eightpence to a ſhilling per ſcore; and the poor had the ſmaller ſort at a penny and ſometimes a halfpenny per ſcore. The large haddocks quit the coaſt as ſoon as they go out of ſeaſon, and leave behind great plenty of ſmall ones. It is ſaid that the large ones viſit the coaſts of Hamburgh and Jutland in the ſummer. It is no leſs remarkable than providential, that all kinds of fiſh (except mackerel) which frequent the Yorkſhire coaſt, approach the ſhore, and as it were offer themſelves to us, generally remaining there as long as they are in high ſeaſon, and retire from us when they become unfit for uſe. It is the commoneſt ſpecies in the London markets. They do not grow to a great bulk, one of fourteen pounds, being of an uncommon ſize, but thoſe are extremely coarſe; the beſt for the table weighing from two to three pounds. The body of the haddock is long: the head ſlopes down to the noſe: the ſpace between the hind part of the firſt dorſal fin is rigid: on the chin is a ſhort beard. On the back are three fins reſembling thoſe of the common cod fiſh: on each ſide beyond the gills is a large black ſpot. Superſtition aſſigns this mark to the impreſſion St. Peter left with his finger and thumb when he took the tribute out of the mouth of a fiſh of this ſpecies, which has been continued to the whole race of haddocks ever ſince.

The *carbonarius* or *coal fiſh*, takes its name from the black colour that it ſometimes aſſumes. Belon calls it the colfiſch, imagining that it was ſo named by the Engliſh, from its producing the ichthyocolla; but Geſner gives the true etymology. Theſe fiſh are common on moſt of our rocky and deep coaſts, but particularly thoſe of the north of Great Britain. They ſwarm about the Orkneys, where the fry are the great ſupport of the poor. The young begin to appear on the Yorkſhire coaſt the beginning of July in vaſt ſhoals, and are at that time about an inch and an half long. In Auguſt they are from three to five inches in length, and are taken in great numbers with the angling rod: they are then eſteemed a very delicate fiſh; but grow ſo coarſe when they are a year old, that few people will eat them. Fiſh of that age are from eight to fifteen inches long, and begin to have a little blackneſs near the gills and on the back, and the blackneſs increaſes as they grow older. The fry is known by different names in different places: they are called at Scarborough *parrs*, and when a year old, *billets*. About nine or ten years ago ſuch a glut of parrs viſited that part, that for ſeveral weeks it was impoſſible to dip a pail into the ſea without taking ſome. Though this fiſh is ſo little eſteemed when freſh, yet it is ſalted and dried for ſale. It is of a more elegant form than the cod fiſh: they generally grow to the length of two feet and an half, and weigh about 28 or 30 pounds at moſt.

The *merlucius*, or *hake*, is found in vaſt abundance on many of our coaſts, and of thoſe of Ireland. There was formerly a vaſt ſtationary fiſhery of hake on the Nymph Bank off the coaſt of Waterford. Mr. Smith, who wrote the hiſtory of the county of Waterford, complains even in his time (1746) of its decline. Many of the gregarious fiſh are ſubject to change their ſituations, and deſert their haunts for numbers of years, and then return again. Mr. Smith inſtances the loſs of the haddock on the Waterford ſhores, where they uſed to ſwarm; and we can bring the capriciouſneſs of the herrings, which ſo frequently quit their ſtations, as another example. Sometimes the irregular migration of fiſh is owing to their being followed and haraſſed by an unuſual number of fiſh of prey, ſuch as the ſhark kind; ſometimes to deficiency of the ſmaller fiſh, which ſerved them as food; and laſtly, in many places to the cuſtom of trawling, which not only demoliſhes a quantity of their ſpawn, that is depoſited in the ſand, but alſo deſtroys or drives into deeper waters numberleſs worms and inſects, the repaſt of many fiſh. The hake is in England eſteemed a very coarſe fiſh, and is ſeldom admitted to table either freſh or ſalted. When cured, it is known by the name of *Poor John*. Theſe fiſh are from a foot and an half to near twice that length: they are of a ſlender make, of a pale aſh colour on their backs, and of a dirty white on their bellies.

The *molva* or *ling*, takes its Engliſh name from its length, being corrupted from the word *long*. It abounds about the Scilly Iſles, on the coaſts of Scarborough, and thoſe of Scotland and Ireland, and forms a conſiderable article of commerce. This branch of trade was conſiderable ſo long ago as the reign of Edward III. an act for regulating the price of lob, *ling*, and cod, being made in his 31ſt year. In the Yorkſhire ſeas they are in perfection from the beginning of February to the beginning of May, and ſome till the end of that month. In June they ſpawn, depoſiting their eggs in the ſoft ouzy ground of the mouth of the Tees: at that time the males ſeparate from the females, and reſort to ſome rocky ground near the Flamborough-head, where the fiſhermen take great numbers without ever finding any of the female or roed-fiſh among them. While a ling is in ſeaſon its liver is very white, and abounds with a fine-flavoured oil; but as ſoon as the fiſh goes out of ſeaſon, the liver becomes red as that of a bullock, and affords no oil. The ſame happens to the cod and other fiſh in a certain degree, but not ſo remarkably as in the ling. When the fiſh is in perfection, a very large quantity of oil may be melted out of the liver by a ſlow fire; but if a violent ſudden heat be uſed for that purpoſe, they yield very little. The oil which nature hoards up in the cellular membranes of the fiſhes, returns into their blood, and ſupports them in the engendering ſeaſon, when they purſue the buſineſs of generation with ſo much eagerneſs as to neglect their food. The uſual ſize of a ling is from three to four feet; but they have been heard of ſeven feet long. The body is very ſlender; the head flat; the upper jaw the longeſt; the teeth in that jaw ſmall and very numerous; in the lower, few, ſlender, and ſharp.

The *muſtela*, or *five-bearded cod*, very much reſembles the former. The beards on the upper jaw are four, viz. two at the very end of the noſes and two a little above them; on the end of the lower jaw is a ſingle one. The fiſh are of a deep olive brown, their belly whitiſh. They grow to the ſame ſize as the former. The Corniſh fiſhermen are ſaid to whiſtle, and make uſe of the words *bod*, *bod*, *vean*, when they are deſirous of taking this fiſh, as if by that they falicitated the capture. In the ſame manner the Sicilian fiſhermen repeat their *mamaſſu di pajanu*, &c. when they are in purſuit of the ſword-fiſh.

The *torſk*, or, as it is called in the Shetlands, *tuſk* or *briſmak*, is a northern fiſh; and yet is undiſcovered lower than about the Orkneys, and even there it is rather ſcarce. In the ſeas about Shetland, it ſwarms, and forms (barrelled or dried) a conſiderable article of commerce. For the claſſification of this Genus called *Gadus*, ſee the Syſtem. For a further account of the *cod*, ſee the Articles COD and FISHERY.

GAGE, in the ſea language. When one ſhip is to windward of another, ſhe is ſaid to have the weather gage of her.

Sliding GAGE, is a tool uſed by mathematical inſtrument makers, for meaſuring and ſetting off diſtances: it conſiſts of a beam, tooth, ſliding ſocket, and the ſhoulder of the ſocket.

GALANTHUS, the *Snow Drop*; a genus of the monogynia order, belonging to the hexandria claſs of plants. There is but one ſpecies, viz. the nivalis; which is a bulbous rooted flowery perennial, riſing but a few inches in height, and adorned at top with ſmall tripetalous flowers of a white colour. There are three varieties, viz. the common ſingle flowered ſnow drop, the ſemi-double ſnow drop, and the double ſnow drop. They are beautiful little plants; and are much valued on account of their early appearance, often adorning the gardens in January or February, when ſcarce any other flower is to be ſeen. They frequently burſt forth when the ground is covered with ſnow, and continue very often till the beginning of March, making a very ornamental appearance, eſpecially when diſpoſed in cluſters towards the fronts of the borders, &c. The ſingle kind comes firſt into bloom, then the ſemi-double, and after that the double. They will ſucceed any where, and multiply exceedingly by off-ſets from the roots.

GALAXY, in aſtronomy, that long, white, luminous track, which ſeems to encompaſs the heavens like a ſwath, ſcarf, or girdle; and which is eaſily perceivable in a clear night, eſpecially when the moon does not appear. The Greeks call it γαλαξιας, *galaxy*; of γαλα, γαλακτος *milk*; on account of its colour, and appearance. The Latins, for the ſame reaſon, call it *via lactea*; and we, the *milky-way*. It paſſes between Sagittary and Gemini, and divides the ſphere into two parts. It is unequally broad; and in ſome parts is ſingle, in others double. The ancient poets, and even philoſophers, ſpeak of the *galaxy* as the road, or way, by which the heroes went to heaven. Ariſtotle makes it a kind of meteor, formed of a croud of vapours, drawn into that part by certain large ſtars diſpoſed in the regions of the heavens anſwering hereto. Others, finding that the *galaxy* was ſeen all over the globe, that it always correſponded to the ſame fixed ſtars, and that it tranſcended the height of the higheſt planets, ſet aſide Ariſtotle's opinion, and placed the *galaxy* in the firmament or region of the fixed ſtars; and concluded it to be nothing but an aſſemblage or an infinite number of minute ſtars. Since the invention of the teleſcope, this opinion has been abundantly confirmed. By directing a good teleſcope to any part of the milky way, where, before, we only ſaw a confuſed whiteneſs; we now deſcry an innumerable multitude of little ſtars. Theſe ſtars are ſo remote, that a naked eye confounds them: the like we obſerve in other ſpots, called *nebuloſe ſtars*; which, when examined with the teleſcope, are diſtinctly perceived to be cluſters of little ſtars, too faint to affect the eye ſingly.

GALBANUM, in pharmacy, a gum iſſuing from the ſtem of an umbelliferous plant growing in Perſia and many parts of Africa. In medical virtue, and ſenſible qualities, it reſembles the gum ammoniacum; but is leſs efficacious than it is in aſthmas, though more efficacious in hyſteric diſorders. When aſſa fetida is too ſtrong, galbanum may be tried; and, if it diſagrees, give ammoniacum.

GALE, a ſea phraſe, for the blowing of the wind. When the ſea is not blown ſo hard, but that a ſhip can carry her top-ſails a-trip, that is, hoiſted up to the higheſt, they ſay it is a *loom gale*. When it blows very ſtrong they ſay it is a *ſtiff gale*, or, at leaſt a *freſh gale*; but when it blows ſo hard and violently, that a ſhip cannot bear any ſail, they ſay it blows a *ſtorm*. When two ſhips are near one another at ſea, and there being but little wind blowing, one feels more of it than another, they ſay the ſhip *gales* away from the other.

GALENIC, or GALENICAL, in pharmacy; a manner of treating diſeaſes, founded on the principles of Galen. The diſtinction of *galenical* and *chymical*, was occaſioned by a diviſion of the practitioners of medicine into two ſects, which happened on the introduction of chymiſtry into medicine. Then the chymiſts, arrogating to themſelves every kind of merit and ability, ſtirred up an oppoſition to their pretenſions, founded on the invariable adherence of the other party to the ancient practice. And though this diviſion into the two ſects of galeniſts and chymiſts has long ceaſed, yet the diſtinction of medicines, which reſulted from it, is ſtill retained. Galenical medicines are thoſe which are formed by the eaſier preparations of herbs, roots, &c. by infuſion, decoction, &c. and by combining and multiplying ingredients; while thoſe of chymiſtry draw their more intimate and remote virtues by means of fire and elaborate preparations, as calcination, digeſtion, fermentation, &c.

GALILEANS, GALILÆI, a ſect among the ancient Jews, denominated from Judas of *Galilee*, their chief; who, eſteeming it unworthy that the Jews ſhould pay tribute to ſtrangers, raiſed up his countrymen againſt the edict of Auguſtus, which had ordered a cenſus, or enumeration, to be made of all his ſubjects. Their pretence was, that God alone ſhould be owned as maſter, and called by the name of the *Lord*; in other reſpects they had much the ſame doctrine as the Phariſees; but as they judged it unlawful to pray for infidel princes, they ſeparated themſelves from the reſt of the Jews, and performed their ſacrifices apart. As our Saviour, and his apoſtles, were of *Galilee*, they were ſuſpected to be of the ſect of *Galileans*; and it was on this principle, as St. Jerome obſerves, that the Phariſees laid a ſnare for him; aſking, whether it was lawful to give tribute to Cæſar; that in caſe he denied it, they might have an occaſion for accuſing him. Maynard's Joſeph. Ant. Jud. lib. xviii.

GALL, in the animal œconomy. See BILE.

A great number of experiments have been made upon the gall of different animals, but few concluſions can be drawn from them with any certainty. Dr. Percival, however, hath ſhewn, that putrid bile may be perfectly corrected and ſweetened by an admixture of the vegetable acids, vinegar and juice of lemons. Theſe, he obſerves, have this effect much more completely than the mineral ones; and hence, he thinks ariſes the great uſefulneſs of the vegetable acids in autumnal diſeaſes; which are always attended with a putreſcent diſpoſition of the bile, owing to the heat of the preceding ſummer. On this occaſion he takes notice of a common miſtake among phyſicians, who frequently preſcribe elixir of vitriol in thoſe diſeaſes, where vinegar or lemon juice would be much more effectual. From this effect of acids on the gall, he alſo thinks, we may ſee why the immoderate uſe of acids is ſo pernicious to digeſtion. It is neceſſary to health that the gall ſhould be in ſome degree acrid and alkaleſcent; but as acids have the property of rendering it perfectly mild and ſweet, they muſt be proportionably pernicious to the due concoction and aſſimilation of the food; which without an acrid bile cannot be accompliſhed. Hence the body is deprived of its proper nouriſhment and ſupport, the blood becomes vapid and watery, and a fatal cachexy unavoidably enſues. This hath been the caſe with many unfortunate perſons, who, in order to reduce their exceſſive corpulency, have indulged themſelves in the too free uſe of vinegar. From the mild ſtate of the gall in young children, Dr. Percival alſo thinks it is, that they are ſo much troubled with acidities.

Gall, in natural hiſtory, denotes any protuberance or tumour produced by the puncture of inſects on plants and trees of different kinds. The general hiſtory of the gall is this. An inſect of the fly kind is inſtructed by nature to take care for the ſafety of her young, by lodging her eggs in a woody ſubſtance, where they will be defended from all injuries; ſhe for this purpoſe wounds the leaves or tender branches of a tree; and the lacerated veſſels, diſcharging their contents, ſoon form tumours about the holes thus made. The external coat of this excreſcence is dried by the air: and grows into a figure which bears ſome reſemblance to the bow of an arch, or the roundneſs of a kernel. The little ball receives its nutriment, growth, and vegetation, as the other parts of the tree, by ſlow degrees, and is what we call the *gall-nut*. The worm that is hatched under this ſpacious vault, finds in the ſubſtance of the ball, which is as yet very tender, a ſubſiſtence ſuitable to its nature; gnaws and digeſts it till the time comes for its tranſformation to a nymph, and from that ſtate of exiſtence changes into a fly. After this, the inſect, perceiving itſelf duly provided with all things requiſite, diſengages itſelf ſoon from its confinement, and takes its flight into the open air. The caſe, however, is not ſimilar with reſpect to the gall-nut that grows in autumn. The cold weather frequently comes on before the fly can pierce through its incloſure. The nut falls with the leaves: and although you may imagine that the fly which lies within is loſt, yet in reality it is not ſo: on the contrary, its being covered up ſo cloſe, is the means of its preſervation. Thus it ſpends the winter in a warm houſe, where every crack and cranny of the nut is well ſtopped up; and lies buried as it were under a heap of leaves, which preſerves it from the injuries of the weather. This apartment, however, though ſo commodious a retreat in the winter, is a perfect priſon in the ſpring. The fly, rouſed out of its lethargy by the firſt heats, breaks its way through, and ranges where it pleaſes. A very ſmall aperture is ſufficient, ſince at this time the fly is but a diminutive creature. Beſides, the ringlets whereof its body is compoſed, dilate and become pliant in the paſſage. The male of this is a two-winged fly of a very particular kind. There ſeems a great reſemblance between theſe flies in all the *gall inſect* claſs, and that of the *peach gall inſect* may give a proper idea of all the reſt. This little creature, examined with the help even of the beſt glaſſes, ſhews, on the under part of its head, nothing analogous to the organs of other flies, deſtined to convey their nouriſhment; nothing that at all reſembles the trunks of the other two-winged flies, nor any thing that can be compared to teeth. The want of theſe organs is nothing ſingular in the inſect world, ſince the moths and butterflies afford us inſtances of it. Many of theſe may be ſeen, as ſoon as produced from their chryſalis, in a ſtate to propagate their ſpecies, and depoſit their eggs; and this great end atchieved, they have no farther occaſion for life, nor any means for its ſupport; and probably the caſe is the ſame with theſe flies, which as ſoon as looſe from their ſhell, ſeek out and fecundate the females, and have after this no farther uſe for life. It is another ſingularity in this ſpecies, that they are produced from their ſhell by their hinder part firſt; whereas all other ſpecies of the two-winged flies are produced with the forepart of their body firſt; and if we cannot ſay what may be the reaſons for this ſingularity in the production of this fly, we can however eaſily perceive that every thing is prepared and deſtined accordingly for it. In the nymphs of other flies, all the legs are conſtantly applied cloſe to the body, whereas on the contrary, in the nymph of the *gall inſect fly*, the legs placed next the head, or the firſt pair, are conſtantly ranged upward, and each of them embraces one ſide of the head; the conſtant poſition of theſe legs in this direction, is a proof that it is the order and courſe of nature in the production of the animal; nor is it without reaſon that they are thus placed in a ſpecies which, contrary to all others, is to force itſelf backward out of its ſhell, ſince they ſerve very properly for the creature to puſh himſelf backward by. Reaumur. Hiſt. Inſect. vol. iv. p. 40.

Gall-Bladder, *veſicula*, or *folliculus fellis*, is a membranous receptacle, in figure ſomewhat like a pear; ſituate at the lower margin of the liver, on the concave ſide; being about the bigneſs of a pullet's egg. For deſcription, ſee Syſtem of Anatomy, Part V. Sect. IX. For repreſentation, ſee Plate III. *Fig.* 4. let. C.

Gall-*Stones*, or thoſe concretions of earthy matter and bile that are found in the *gall* bladder, or bile ducts of beaſts, are uſed in the arts: when theſe are rubbed with water, and treated as *gamboge*, they yield a deep warm yellow, which, on account of its brightneſs and dark ſhade, as well as durableneſs, is very valuable. A fictitious kind of *gall-ſtones* may be prepared in the following manner; take a quart of the freſh bile of oxen; boil it with a quarter of an ounce of clear gum-arabic in a pewter veſſel in *balneo Mariæ*; evaporate the whole to about an eighth, and remove the remainder into a china cup or baſon, and evaporate it to dryneſs, collecting it into a maſs as it becomes of a ſtiff conſiſtence. This being more tranſparent, will be found of very great advantage in water-painting.

Oak-galls put, in a very ſmall quantity, into a ſolution of vitriol in water, though but a very weak one, give it a purple or violet colour; which, as it grows ſtronger, becomes black; and on this property depends the art of making our writing-ink, as alſo the arts of dying and dreſſing leather, and other manufactures. See Ink. Galls are very ſtrong aſtringents, and give out their aſtringent virtue very readily both to water and ſpirit. From two ounces of galls, 14 drachms of aſtringent extract were obtained by water, and between 12 and 13 with ſpirit. In medicine they are rarely uſed.

GALLANT, or **Galant**, a French term, ſignifying civil, polite, well-bred; or a perſon of wit and addreſs, who does every thing with a good grace: in fine, a civil perſon, ſomewhat brighter, gayer, and more agreeable than ordinary. It is difficult to define all the qualities annexed to the idea of a *gallant* man. It ſometimes implies one who has what the French call the *bon ton*; but it generally means one who has a great devotion for the fair ſex, with the manners adapted to pleaſe them. The French authors are very nice on this point; they diſtinguiſh *galant homme*, and *homme galant*.

GALLERY, in architecture, a covered place in a houſe, much longer than broad; and which is uſually placed in the wings of the buildings, and ſerves to walk in. The *galleries* of the Louvre are magnificent; a *gallery* of painting; a complete apartment is to conſiſt of a hall, ante chamber, chamber, cabinet and *gallery*. The *gallery* of a church is a kind of continued tribune, with a baluſtrade, built along the ſides, or lower-end of a church, to make it hold the more people; and, in the Greek churches, to ſeparate the women from the men.

Gallery, in fortification, a covered walk, or paſſage, made acroſs the ditch of a town beſieged, with timbers faſtened on the ground, and planked over.

GALLEY, a kind of low flat-built veſſel furniſhed with one deck, and navigated with ſails and oars, particularly in the Mediterranean. The largeſt ſort of theſe veſſels is employed only by the Venetians. They are commonly 162 feet long above, and 133 feet by the keel; 32 feet wide, with 23 feet length of ſtern-poſt. They are furniſhed with three maſts, and 32 banks of oars; every bank containing two oars, and every oar being managed by ſix or ſeven ſlaves, who are uſually chained thereto. In the fore part they have three little batteries of cannon. They are eſteemed extremely convenient for bombarding or making a deſcent upon an enemy's coaſt, as drawing but little water; and having by their oars frequently the advantage of a ſhip of war, in light winds or calms, by cannonading the latter near the ſurface of the water; by ſcouring her whole length with their ſhot, and at the ſame time keeping on her quarter or bow, ſo as to be out of the direction of her cannon. There are very few galleys now beſides theſe in the Mediterranean, which are found by experience to be of little utility except in fine weather; a circumſtance which renders their ſervice extremely precarious. They generally keep cloſe under the ſhore, but ſometimes venture out to ſea to perform a ſummer cruiſe. All the *galleys*, both antient and modern, are of a finer and ſlenderer make than ſhips. Formerly they made divers kinds; at preſent the *galleys* are all alike; all the difference between them is as to ſize, and nothing as to figure. They uſually keep towards the coaſts; though ſometimes they croſs the ſea.

Condemnation to the **Galleys**, is a penalty impoſed on criminals and delinquents, particularly in France; whereby they are adjudged to ſerve the king, or ſtate, as ſlaves on board the *galleys*, either for ever, or for a limited time.

Galley, in printing, a wooden frame, or inſtrument, formed of an oblong ſquare board, with a ledge on three ſides, and a groove to admit a falſe bottom called a galley ſlice, into which the compoſitor empties the letters out of his compoſing ſtick, as often as it is filled. The *galley*, when filled, contains the matter of one page; and when they have compoſed as many pages as are required for a whole ſheet, half ſheet, or the like, they impoſe them, i. e. they take the ſeveral pages out of the *galleys*; put them into a chaſe; lock them up with the furniture; and ſo make forms ready for the preſs. See Treatiſe on the Art of Printing.

GALLICISM, a phraſe or conſtruction, peculiar to the French language; or which has ſomething contrary to the ordinary rules of grammar or other languages. Thus, *Cet homme eſt ſur la bouche*, is a *Galliciſm*, having no regular conſtruction; and the ſame may be ſaid of *Fair de la terre le foſſe*; which no grammar could ever find out. With us it is uſed to denote ſuch phraſes or modes of ſpeech in Engliſh, as are formed after the French idiom.

GALLINÆ, in the Linnæan ſyſtem of ornithology, the name of a large order of birds, the general character of which is, that their beak is conic and bent; the upper mandible is arched, and extends beyond the lower; the noſtrils are half covered with a cartilaginous convex membrane; the feathers of the tails are more than twelve, and the feet are cloven; but the outermoſt and inner toes are connected by the firſt joint of the middle toe by a ſmall membrane. The DODO, PEACOCK, the *meleagris*, or TURKEY, the CRAX, the PHEASANT, the *meleagris Numida*, or GUINEA *Hen*, and TETRAO, are of this order. See Syſtem of ORNITHOLOGY.

GALLINACEOUS, in ornithology, the name of a ſpecies of birds of the pheaſant kind, including the common cock and hen, the characters of which are theſe. The beak is ſhort, ſtrong, and a little crooked, proper for the picking up of corn, which is the food of the whole ſpecies; the body is large, thick, and fleſhy; the wings are ſhort and hollowed, and not calculated for much flying; they all breed a numerous progeny; they build on the ground; the young are not fed by the parent, but immediately ſhift for themſelves; and ſome have long ſpurs behind their legs. See Syſtem of ORNITHOLOGY.

GALLING, in medicine, *Intertrigo*. Children are ſubject to inflammations and excoriations in ſeveral parts of their bodies, particularly behind the ears, in the neck, and thighs. Thoſe in the lower parts uſually proceed from the acrimony of the urine, which ſometimes frets off the epidermis, and leaves the cutis bare. The cure may be accompliſhed by waſhing the parts gently with warm water, twice or thrice a day, which diſſolves and drinks up the acrimonious ſalts of the urine lodged therein. Nurſes uſually diſſolve a little fuller's earth in the water, and apply it to the part after being well waſhed. Ceruſs, chalk, or calcined ſlate, finely powdered, will alſo ſerve for the ſame purpoſe. But where the inflammation and excoriation are conſiderable, it is proper to uſe, by way of fomentation, a ſolution of *trochiſcii albi Rhaſis*, in plantain water, twice or thrice a day. In the mean time the parts ſhould by all means be kept dry; or prevented from rubbing againſt each other, by the interpoſition of fine linen rags, or the uſe of a little red deſiccative ointment, or diapompholygos, ſpread thin upon it. James's Med. Dict.

GALLION, or GALLEON, in naval affairs, a ſort of ſhips employed in the commerce of the Weſt Indies. The Spaniards ſend annually two fleets; the one for Mexico, which they call the *flota*, and the other for Peru which they call the *gallions*. See FLOTA. By a general regulation made in Spain, it has been eſtabliſhed, that there ſhould be twelve men of war, and five tenders, annually fitted out for the armada or galleons; eight ſhips of ſix hundred tons burden each, and three tenders, one of an hundred ton, for the iſland Margarita, and two of eighty each; to follow the armada; for the New Spain fleet, two ſhips of ſix hundred tons each, and two tenders of eighty each; and for the Honduras fleet, two ſhips of five hundred tons each; and, in caſe no fleet happened to ſail any year, three gallions and a tender ſhould be ſent to New Spain for the plate. They are appointed to ſail from Cadiz in January, that they may arrive at Porto-Bello about the middle of April; where, the fair being over, they may take aboard the plate, and be at Havannah with it about the middle of June; where they are joined by the flota, that they may return to Spain with the greater ſafety.

GALLIOT, a ſmall galley or a ſort of brigantine, built very ſlightly, and deſigned only for chaſe. She hath but one maſt, and can both ſail and row. She uſually carries two or three pattereroes, and hath ſixteen or twenty oars. Some call the bombketches, *galliots*.

GALLON, an Engliſh meaſure, for things both liquid and dry, containing two pottles, or four quarts. The *gallon* always contains eight pints, or four quarts; but thoſe pints and quarts, and conſequently the *gallon* itſelf are different, according to the quality of the things meaſured: the wine *gallon*, for inſtance, contains 231 cubic inches, and holds eight pounds, avoirdupois, of pure water; the beer, and ale *gallon*, contain 282 ſolid inches, and holds ten pounds three ounces and a quarter; and the *gallon* for grains, meals, &c. 272¼ inches, and holds nine pounds thirteen ounces of pure water. See MEASURE.

GALLOWAYS, is the name of a peculiar ſort of horſes, ſo called from the county of Galloway in Scotland, where they are bred. Tradition reports that this kind of horſes ſprung from ſome Spaniſh ſtallions, which ſwam on ſhore from ſome of the ſhips of the famous Spaniſh armada, wrecked on the coaſt; and coupling with the mares of the country, furniſhed the kingdom with their poſterity. They were much eſteemed, and of a middling ſize, ſtrong, active, nervous, and hardy.

GALLOWS, an inſtrument of puniſhment, whereon perſons convicted capitally of felony, &c. are executed by hanging. Among our anceſtors it was called *furca*, a *fork*; a name by which it is ſtill denominated abroad, particularly in France and Italy. In this latter country, the reaſon of the name ſtill ſubſiſts; the *gallows* being a real fork driven into the ground, acroſs the legs, whereof is laid a beam to which the rope is tied.

GALLUS, or COCK, in ornithology. See PHASIANUS.

GAMBOGE, is a concreted vegetable juice, the produce of two trees, both called by the Indians *caracapulli*, and is partly of a gummy and partly of a reſinous nature. It is brought to us either in form of orbicular maſſes, or of cylindrical rolls of various ſizes; and is of a denſe, compact, and firm texture, and of a beautiful yellow. It is chiefly brought to us from Cambaja, in the Eaſt Indies, called alſo *Cambodja*, and *Cambogia*; and from thence it has obtained its names of *cambadium*, *cambogium*, and *gambogium*. As a pigment, it makes a beautiful yellow, which is much uſed by the painters. Dr. Lewis ſays, that it makes a beautiful and durable citron-yellow ſtain upon marble, whether rubbed in ſubſtance on the hot ſtone, or applied, as dragon's-blood ſometimes is, in form of a ſpirituous tincture. When it is applied on cold marble, the ſtone is afterwards to be heated, to make the colour penetrate. Gamboge is commonly called a *gum*, but improperly. It appears to be wholly reſinous or ſulphureous; ſince ſpirit of wine diſſolves it almoſt entirely, and water, though it ſeparates its parts and keeps them ſuſpended, yet does not diſſolve them at all, nor is by any means a ſolvent for it. It is alſo very inflammable, and melts with a very gentle heat. If mixed with an equal quantity of ſalt of tartar, it readily diſſolves in common water by a few hours digeſtion. This ſolution, if kept over the fire, ſoon becomes a ſort of ſmooth glue or jelly. This is ſometimes done with a view to correct the deleterious qualities of gamboge taken inwardly, in which caſe it occaſions violent vomitings and purgings. But the moſt effectual method of correcting this and other reſinous purgatives, is by triturating them well with three or four times their weight of white ſugar, by which means they are rendered ſoluble in water, and incapable of adhering to the villous coats of the inteſtines.

GAME, in general, ſignifies any diverſion, or ſport, that is performed with regularity, and reſtrained to certain rules. See GAMING. Games are uſually diſtinguiſhed into thoſe of exerciſe and addreſs, and thoſe of hazard. To the firſt belong cheſs, tennis, billiards, &c. and to the latter thoſe performed with cards or dice, as backgammon, ombre, picquet, whiſt, &c. Games, in antiquity, were public diverſions, exhibited on ſolemn occaſions. Such, among the Greeks, were the Olympic, Pythian, Iſthmian, Nemean, &c. games; and, among the Romans, the Apollinarian, Circenſian, Capitoline, &c. games. See OLYMPIC, PYTHIAN, &c.

GAME, in law, ſignifies birds, or prey, taken or killed by fowling or hunting. The property of ſuch animals *feræ naturæ* as are known under the denomination of *game*, with the right of purſuing, taking, and deſtroying them, is veſted in the king alone, and from him derived to ſuch of his ſubjects as have received the grants of a chace, a park, or a free warren.

By the law of nature, indeed, every man, from the prince to the peaſant, has an equal right of purſuing, and taking to his own uſe all ſuch creatures as are *feræ naturæ*, and therefore the property of nobody, and very liable to be ſeiſed by the firſt occupant. But it follows from the very end and conſtitution of ſociety, that this natural right, as well as many others belonging to man as an individual, may be reſtrained by poſitive laws enacted for reaſons of ſtate, or for the ſuppoſed benefit of the community. This reſtriction may be either with reſpect to the place in which this right may, or may not, be exerciſed; with reſpect to the animals that are the ſubjects of this right; or with reſpect to the perſons allowed or forbidden to exerciſe it. And, in conſequence of this authority, we find that the municipal laws of many nations have exerted ſuch power of reſtraint; have in general forbidden the entering on another man's grounds, for any cauſe, without the owner's leave; have extended their protection to ſuch particular animals as are uſually the objects of purſuit; and have inveſted the prerogative of hunting and taking ſuch animals, in the ſovereign of the ſtate only, and ſuch as he ſhall authorize. Many reaſons have concurred for making theſe conſtitutions: as, 1. For the encouragement of agriculture and improvement of lands, by giving every man an excluſive dominion over his own ſoil. 2. For the preſervation of the ſeveral ſpecies of theſe animals, which would ſoon be extirpated by a general liberty. 3. For prevention of idleneſs and diſſipation in huſbandmen, artificers, and others of lower rank; which would be the unavoidable conſequence of univerſal licence. 4. For prevention of popular inſurrections and reſiſtance to the government, by diſarming the bulk of the people; which laſt is a reaſon oftener meant than avowed, by the makers of foreſt or game laws. Nor, certainly, in theſe prohibitions is there any natural injuſtice, as ſome have weakly enough ſuppoſed: ſince, as Puffendorf obſerves, the law does not hereby take from any man his preſent property, or what was already his own; but barely abridges him of one means of acquiring a future property, that of occupancy; which indeed the law of nature would allow him, but of which the laws of ſociety have in moſt inſtances very juſtly and reaſonably deprived him. Yet, however defenſible theſe proviſions in general may be, on the footing of reaſon, or juſtice, or civil policy, we muſt, notwithſtanding, acknowledge, that, in their preſent ſhape, they owe their immediate original to ſlavery. It is not till after the irruption of the northern nations into the Roman empire, that we read of any other prohibitions, than that natural one of not ſporting on any private grounds without the owner's leave.

With regard to the riſe and original of our preſent civil prohibitions, it will be found, that all foreſt and game laws were introduced into Europe at the ſame time, and by the ſame policy, as gave birth to the feodal ſyſtem; when thoſe ſwarms of barbarians iſſued from their northern hive and laid the foundation of moſt of the preſent kingdoms of Europe, on the ruins of the weſtern empire. For when a conquering general came to ſettle the œconomy of a vanquiſhed country, and to part it out among his ſoldiers or feudatories, who were to render him military ſervice for ſuch donations; it behoved him, in order to ſecure his new acquiſitions, to keep the *ruſtici* or native of the country, and all who were not his military tenants, in as low a condition as poſſible, and eſpecially to prohibit them the uſe of arms. Nothing could do this more effectually than a prohibition of hunting and ſporting: and therefore it was the policy of the conqueror to reſerve this right to himſelf, and ſuch on whom he ſhould beſtow it; which were only his capital feudatories, or greater barons. And, accordingly, we find, in the feudal conſtitutions, one and the ſame law prohibiting the *ruſtici* in general from carrying arms, and alſo proſcribing the uſe of nets, ſnares, or other engines for deſtroying the game. This excluſive privilege well ſuited the martial genius of the conquering troops, who delighted in a ſport which in its purſuit and ſlaughter bore ſome reſemblance to war. *Vita omnis* (ſays Cæſar, ſpeaking of the ancient Germans) *in venationibus atque in ſtudiis rei militaris conſiſtit.* And Tacitus in like manner obſerves, that *quoties bella non inuent; multum venatibus, plus per otium tranſigunt.* And indeed, like ſome of their modern ſucceſſors, they had no other amuſement to entertain their vacant hours; they deſpiſing all arts as effeminate, and having no other learning, than was couched in ſuch rude ditties as were ſung at the ſolemn carouſals which ſucceeded theſe ancient huntings. And it is remarkable, that, in thoſe nations where the feodal policy remains the moſt uncorrupted, the foreſt or game laws continue in their higheſt rigour. In France, all game is properly the king's; and in ſome parts of Germany it is death for a peaſant to be found hunting in the woods of the nobility.

With us in Britain, alſo, hunting has ever been eſteemed a moſt princely diverſion and exerciſe. The whole iſland was repleniſhed with all ſorts of game in the times of the Britons; who lived in a wild and paſtoral manner, without incloſing or improving their grounds; and derived much of their ſubſiſtence from the chaſe, which they all enjoyed in common. But, when huſbandry took place under the Saxon government, and lands began to be cultivated, improved, and encloſed, the beaſts naturally fled into the woody and deſart tracts; which were called the *foreſts*, and, having never been diſpoſed of in the firſt diſtribution of lands, were therefore held to belong to the crown. Theſe were filled with great plenty of game, which our royal ſportſmen reſerved for their own diverſion on pain of a pecuniary forfeiture on ſuch as interfered with their ſovereign. But every freeholder had the full liberty of ſporting upon his own territories provided he abſtained from the king's foreſts.

However, upon the Norman conqueſt, a new doctrine took place; and the right of purſuing and taking all beaſts of chaſe or venary, and ſuch other animals as were accounted *game*, was then held to belong to the king, or to ſuch only as were authoriſed under him. And this, as well upon the principles of the feodal law, that the king is the ultimate proprietor of all the lands in the kingdom, they being all held of him as the chief lord, or lord paramount of the fee; and that therefore he has the right of the univerſal ſoil, to enter thereon, and to chaſe and take ſuch creatures at his pleaſure: as alſo upon another maxim of the common law, that theſe animals are *bona vacantia,* and having no other owner, belong to the king by his prerogative. As therefore the former reaſon was held to veſt in the king a right to purſue and take them any where; the latter was ſuppoſed to give the king, and ſuch as he ſhould authorize, a *ſole* and *excluſive* right. This right, thus newly veſted in the crown, was exerted with the utmoſt rigour, at and after the time of the Norman eſtabliſhment; not only in the ancient foreſts, but in the new ones which the conqueror made, by laying together vaſt tracts of country, depopulated for that purpoſe, and reſerved ſolely for the king's royal diverſion; in which were exerciſed the moſt horrid tyrannies and oppreſſions, under colour of foreſt-law, for the ſake of preſerving the beaſts of chaſe; to kill any of which, within the limits of the foreſt, was as penal as the death of a man. And, in purſuance of the ſame principle, king John laid a total interdict upon the *winged* as well as the *fourfooted* creation: *capturam avium per totam Angliam interdixit.* The cruel and inſupportable hardſhips, which theſe foreſt laws created to the ſubject, occaſioned our anceſtors to be as zealous for their reformation, as for the relaxation of the feodal rigours and the other exactions introduced by the Norman family; and accordingly we find the immunities of *carta de foreſta* as warmly contended for, and extorted from the king with as much difficulty, as thoſe of *magna carta* itſelf. By this charter, confirmed in parliament, many foreſts were diſafforeſted, or ſtripped of their oppreſſive privileges, and regulations were made in the regimen of ſuch as remained; particularly killing the king's deer was made no longer a capital offence, but only puniſhed by a fine, impriſonment, or abjuration of the realm. And by a variety of ſubſequent ſtatutes, together with a long acquieſcence of the crown without exerting the foreſt-laws, this prerogative is now become no longer a grievance to the ſubject.

But, as the king reſerved to himſelf the *foreſts* for his own excluſive diverſion, ſo he granted out from time to time other tracts of lands to his ſubjects under the names of *chaſes* or *parks*; or gave them licence to make ſuch in their own grounds; which indeed are ſmaller foreſts in the hands of a ſubject, but not governed by foreſt-laws; and by the common law no perſon is at liberty to take or kill any beaſts of chaſe, but ſuch as hath an ancient chaſe or park; unleſs they be alſo beaſts of prey. As to all inferior ſpecies of game, called *beaſts and fowls of warren*; the liberty of taking or killing them is another franchiſe or royalty, derived likewiſe from the crown, and called *free-warren*; a word which ſignifies preſervation or cuſtody: as the excluſive liberty of taking and killing fiſh in a public ſtream or river is called a *free fiſhery*; of which, however, no new franchiſe can at preſent be granted, by the expreſs proviſion of *magna carta*, c. 16. The principal intention of granting a man theſe franchiſes or liberties was in order to protect the game, by giving him a ſole and excluſive power of killing it himſelf, provided he prevented other perſons. And no man, but he who has a chaſe or free warren, by grant from the crown, or preſcription, which ſuppoſes one, can juſtify hunting or ſporting upon another man's ſoil; nor indeed, in thorough ſtrictneſs of common law, either hunting or ſporting at all.

Upon the whole, it appears, that the king, by his prerogative, and ſuch perſons as have, under his authority, the royal *franchiſe* of *chace, park,* or *free-warren* are the *only* perſons who may acquire any property, however fugitive and tranſitory, in theſe animals *feræ naturæ*, while living; which is ſaid to be veſted in them *propter privilegium*. And it muſt alſo be obſerved, that ſuch perſons as may thus lawfully hunt, fiſh, or fowl, *ratione privilegii*, have only a qualified property in theſe animals; it not being abſolute or permanent, but laſting only ſo long as the creatures remain within the limits of ſuch reſpective franchiſe or liberty, and ceaſing the inſtant they voluntarily paſs out of it. It is held indeed, that if a man ſtarts any game within his own grounds, and follows it into another's, and kills it there, the property remains in himſelf. And this is grounded on reaſon and natural juſtice; for the property conſiſts in the poſſeſſion: which poſſeſſion commences by the finding it in his own liberty, and is continued by the immediate purſuit.

GAMING, the art of playing or practiſing any game, particularly thoſe of hazard; as cards, dice, tables, &c. Gaming has at all times been looked upon as a thing of pernicious conſequence to the commonwealth; and is therefore ſeverely prohibited by law. In China, *gaming* is equally prohibited by the common people, and the mandarins; and yet this does not hinder their playing and frequently loſing all they have; their lands, houſes, children, and even wives, which are all ſometimes laid on a ſingle card. F. le Compte. It is conſidered as a practice generally intended to ſupply, or retrieve, the expences occaſioned by *luxury*; it being a kind of tacit confeſſion, that the company engaged therein do, in general, exceed the bounds of their reſpective fortunes; and therefore they caſt lots to determine upon whom the ruin ſhall at preſent fall, that the reſt may be ſaved a little longer. But, taken in any light, it is an offence of the moſt alarming nature; tending, by neceſſary conſequence, to promote public idleneſs, theft, and debauchery, among thoſe of a lower claſs; and, among perſons of ſuperior rank, it hath frequently been attended with the ſudden ruin and deſolation of ancient and opulent families, an abandoned proſtitution of every principle of honour and virtue, and too often hath ended in ſelf-murder. To reſtrain this pernicious vice among the inferior ſort of people, the ſtatute 33 Hen. VIII. *c.* 9. was made; which prohibits, to all but gentlemen, the games of tennis, tables, cards, dice, bowls, and other unlawful diverſions there ſpecified, unleſs in the time of Chriſtmas, under pecuniary pains and impriſonment. And the ſame law, and alſo the ſtatute 30 Geo. II. *c.* 24. inflict pecuniary penalties, as well upon the maſter of any public houſe wherein ſervants are permitted to game, as upon the ſervants themſelves who are found to be gaming there. But this is not the principal ground of modern complaint; it is the gaming in high life, that demands the attention of the magiſtrate; a paſſion to which every valuable conſideration is made a ſacrifice, and which we ſeem to have inherited from our anceſtors the ancient Germans; whom Tacitus deſcribes to have been bewitched with the ſpirit of play to a moſt exorbitant degree. "They addict themſelves, (ſays he,) "to dice, (which is wonderful) when ſober, and as a ſerious employment; with ſuch a mad deſire of wining or loſing, that, when ſtript of every thing elſe, they will ſtake at laſt their liberty, and their very ſelves. The loſer goes into a voluntary ſlavery; and, though younger and ſtronger than his antagoniſt, ſuffers himſelf to be bound and ſold. And this perſeverance in ſo bad a cauſe they call the point of honour: *ea eſt in re prava pervicacia, ipſi fidem vocant.*" One would almoſt be tempted to think Tacitus was deſcribing a modern Engliſhman. When men are thus intoxicated with ſo frantic a ſpirit, laws will be of little avail; becauſe the ſame falſe ſenſe of honour, that prompts a man to ſacrifice himſelf, will deter him from appealing to the magiſtrate. Yet it is proper that laws ſhould be, and be known publicly, that gentlemen may conſider what penalties they wilfully incur, and what a confidence they repoſe in ſharpers; who, if ſucceſful in play, are certain to be paid with honour, or, if unſucceſsful, have it in their power to be ſtill greater gainers by informing. For, by ſtat. 16 Car. II. *c.* 7. if any perſon by playing or betting ſhall loſe more than 100*l.* at one time, he ſhall not be compellable to pay the ſame; and the winner ſhall forfeit treble the value, one moiety to the king, the other to the informer. The ſtatute 9 Ann. *c.* 14. enacts, that all bonds and other ſecurities, given for money won at play, or money lent at the time to play withal, ſhall be utterly void; that all mortgages and incumbrances of lands, made upon the ſame conſideration, ſhall be and enure to the heir of the mortgager; that, if any perſon at one time loſes 10*l.* at play, he may ſue the winner and recover it back by action of debt at law; and, in caſe the loſer does not, any other perſon may be the winner for treble the ſum ſo loſt; and the plaintiff in either caſe may examine the defendant himſelf upon oath; and that in any of theſe ſuits no privilege of parliament ſhall be allowed. The ſtatute, farther enacts, that if any perſon cheats at play, and at one time wins more than 10*l.* or any valuable thing, he may be indicted thereupon, and ſhall forfeit five times the value, ſhall be deemed infamous, and ſuffer ſuch corporal puniſhment as in caſe of wilful perjury. By ſeveral ſtatutes of the reign of king George II. all private lotteries by tickets, cards, or dice, (and particularly the games of faro, baſſet, ace of hearts, hazard, paſſage, and all other games with dice, except back-gammon) are prohibited under a penalty of 200*l.* for him that ſhall erect ſuch lotteries, and 50*l.* a-time for the players. Public lotteries, unleſs by authority of parliament, and all manner of ingenious devices, under the denomination of *ſales* or otherwiſe, which in the end are equivalent to lotteries, were before prohibited by a great variety of ſtatutes under heavy pecuniary penalties. But particular diſcriptions will ever be lame and deficient, unleſs all games of mere chance are at once prohibited; the invention of ſharpers being ſwifter than the puniſhment of the law, which only hunts them from one device to another. The ſtat. 13 Geo. II. *c.* 19. to prevent the multiplicity of horſe-races, another fund of gaming, directs, that no plates or matches under 50*l.* value ſhall be run, upon penalty of 200*l.* to be paid by the owner of each horſe running, and 100*l.* by ſuch as advertiſe the plate. By ſtatute 18 Geo. II. *c.* 34. the ſtatute 9 Ann. is farther enforced, and ſome deficiencies ſupplied; the forfeitures of that act may now be recovered in a court of equity; and, moreover, if any man be convicted, upon information or indictment, of winning or loſing at any ſitting 10*l.* or 20*l.* within 24 hours, he ſhall forfeit five times the ſum; Thus careful has the legiſlature been to prevent this deſtructive vice, which may ſhew that our laws againſt gaming are not ſo deficient. as ourſelves and our magiſtrates in putting thoſe laws in execution

Chance, or Hazard, in GAMING. Hazard, or chance, is a matter of mathematical conſideration, becauſe it admits of more and leſs. Gameſters either ſet out upon an equality of chance, or are ſuppoſed to do ſo. This equality may be altered in the courſe of the game, by the greater good-fortune or addreſs of one of the gameſters, whereby he comes to have a better chance, ſo that his ſhare in the ſtakes is proportionably better than at firſt. This more and leſs runs through all the ratios between equality and infinite difference, or from an infinitely little difference till it come to an infinite great one, whereby the game is determined. The whole game, therefore, with regard to the iſſue of it, is a chance of the proportion the two ſhares bear to each other.

CALCULATIVE TREATISE ON GAMING.

Calculations in Gaming and all other Events of a contingent nature, and for which there are certain Probabilities for happening or failing, come, in a mathematical conſideration, under what is termed the DOCTRINE OF CHANCE, which we ſhall here treat of.

It is the very nature of chance to be ignorant of its own operations and effects, and conſequently to be ever inconſtant and full of uncertainty, which renders it impoſſible to determine how any event, conſidered as merely under its blind and fickle direction, ſhall poſitively happen. But as the happening of any event has its previous degrees of probability or improbability, which appear within certain limits, it is the buſineſs of a mathematician to aſcertain thoſe bounds, and, by computation, to determine the exact meaſure of ſuch probability, or improbability.

This doctrine is extremely uſeful to perſons engaged in play, as thereby they may diſcover what advantage or diſadvantage each has in reſpect of the other, and how to manage their points with the leaſt riſk. It is alſo uſeful in calculating the value of Life Annuities and Reverſionary Eſtates; in forming plans for Benefit Societies and Lotteries; and in laying political ſchemes for the defence and ſafety of a nation. It may likewiſe be applied to a variety of other purpoſes too tedious to mention. In treating of the ſubject, I ſhall premiſe the following

DEFINITIONS.

1ſt. CHANCE. — An event which is brought about or effected by the mere operations of nature without any apparent *deſign* or *direction* of an *intelligent* agent is uſually attributed to CHANCE. Therefore chance has a natural but not a final cauſe.

2d. PROBABILITY, or IMPROBABILITY, of the happening of an event, is the number of ways or chances there are for the happening or failing of an event compared with the number of chances there are for both its happening and failing, and is expreſſed in a fractional manner, the chances denoting the probability or improbability being the numerator, and the total number of chances, the denominator. Thus if there are 5 poſſible ways for an event's happening, and 3 for its failing, the Probability of its happening will be $\frac{5}{5+3}$, or $\frac{5}{8}$; and the improbability, or probabity, of its failing will be $\frac{3}{5+3}$, or $\frac{3}{8}$. Likewiſe, if b be the chances for the happening of an event; and c the chances for its failing, then the probability of that event's happening will be $\frac{b}{b+c}$; and of its failing, $\frac{c}{b+c}$; where it is obvious that the probability of both happening and failing make together an unit, which therefore expreſſes a certainty; and hence, if the probability of an event be given, the improbability is alſo had by ſubtraction and vice verſa.

3d. ODDS, is a compare between the probability and improbability of an event. Thus, if there be 6 chances for the happening of an event, and but 4 for its failing, we ſay the odds in favour of its happening are 6 to 4, or 3 to 2.

4th. EXPECTATION in play, is the value of a man's chance in the thing played for, and is equal to the product of the abſolute value of the thing by the probability of obtaining it. Thus, if the real value of the prize be 1£. and my probability of obtaining it be $\frac{5}{8}$, the value of my chance, or my expectation, is 1£. × $\frac{5}{8}$ = $\frac{5}{8}$£. For EXPECTATION OF LIFE, ſee ANNUITIES, chap. II.

5th. ADVANTAGE, in play, is equal to the *expectation*, leſs the *ſtake*. Thus if the expectation is 5£. and the ſtake be 3£. the advantage in that ſituation is = 2£; this is the reverſe of *diſadvantage* in play, which is equal to the *ſtake*, leſs the *expectation*.

6th. RISK, is the value of the ſtake conſidered with reſpect to the probability of loſing it, and is equal to the product of ſuch probability by the real value of the ſtake. Thus if the ſtake be 5£. and the probability of winning be $\frac{5}{8}$, in that caſe the probability of loſing is $\frac{3}{8}$, and 5£. × $\frac{3}{8}$ = $\frac{15}{8}$£. = 1£. 17*s.* 6*d*; which therefore is equal to the true value of inſurance in ſuch a caſe.

7th. INDEPENDENT EVENTS, are ſuch as have no connection with each other; or, as that the happening of one neither promotes nor obſtructs the happening of the other. Thus if *A* undertakes with one die to throw an ace at two caſts, it is plain that the firſt caſt he has 1 chance to win and 5 to loſe; and the ſecond caſt he has alſo the very ſame, and conſequently the event of each caſt is independent of the other.

8th. DEPENDENT EVENTS, are ſuch, as the happening or failing of one, does in ſome meaſure promote or hinder the happening or failing of the other. Thus if A undertakes at two trials to draw the ace out of 13 cards of one ſuit; then at the firſt trial he has one chance to win and 12 to loſe, but if he miſſes in this, then the next trial he has 1 chance to win and only 11 to loſe, and ſo the ſecond event is affected by the firſt. In like manner if more trials were made each ſucceeding event would be affected by the preceding one, and therefore ſuch events are ſaid to be dependent.

SCHOLIUM. As 1 repreſents a certainty, or an infinitely great probability of the happening of an event, ſo $\frac{1}{2}$ repreſents an equal probability for happening or failing. For $1 - \frac{1}{2} = \frac{1}{2}$.

AXIOMS.

1ſt. In the computation of chances it is ſuppoſed, unleſs ſpecified to the contrary, that all the chances are equal to one another, or come up with equal facility.

2d. The whole expectation for any prize is equal to the ſum of all the expectations upon the particulars.

PROP. 1. The probability of the happening of ſeveral independent events is equal to the total probability, made by the product of the ſeveral probabilities of each. Thus, if $\frac{a}{a+b}$, $\frac{c}{c+d}$, $\frac{e}{e+f}$, &c. be the reſpective probabilities of ſeveral independent events; then the probability of their all happening will be $\frac{a}{a+b} \times, \frac{c}{c+d} \times \frac{e}{e+f} \times \&c. = \frac{ace, \&c.}{\overline{a+b} \times \overline{c+d} \times \overline{e+f}. \&c.}$ For ſuppoſe the 1ſt event to have already happened, then that the ſecond event ſhould alſo happen, the probability would be $\frac{c}{c+d}$, but before the play commences, the happening of the firſt event, not being a certainty (or 1) as here ſuppoſed, but only $\frac{a}{a+b}^{\,th}$ part thereof; therefore the probability, that both the firſt and ſecond event happens, will not be $\frac{c}{c+d}$, as above, but only the $\frac{a}{a+b}^{\,th}$ part of it, or $\frac{a}{a+b} \times \frac{c}{c+d} = \frac{ac}{\overline{a+b} \times \overline{c+d}}$. Again ſuppoſe both the firſt and ſecond events to have happened, then that the third event ſhould alſo happen, the probability would be $\frac{e}{e+f}$; but before the firſt event happens, the probability that both the firſt and ſecond happens is not a certainty as here ſuppoſed, but only $\frac{ac}{\overline{a+b} \times \overline{c+d}}^{\,th}$ part thereof, and conſequently the probability that all the three events happen is not $\frac{e}{e+f}$ but the $\frac{ac}{\overline{a+b} \times \overline{c+d}}^{\,th}$ part of $\frac{e}{c+f} = \frac{ace}{\overline{a+b}\times\overline{c+d}\times\overline{e+f}}$; and ſo on for 4 or more events, the whole probability being ever equal to the continual product of the reſpective probabilities of each.

Cor. 1. If a, c, e, &c. be the number of chances for happening, and b, d, f, &c. thoſe for failing, in three or more independent events. Then will $\overline{a+b}\times\overline{c+d}\times\overline{e+f}$, &c. be the number of all the chances or poſſible caſes, in which they can either happen or fail.

Cor. 2. In two ſuch events, the number of caſes for the happening of the firſt is $ac+ad$; for the failing thereof, $bc+bd$; for their both happening, ac; for the contrary, $ad+bc+bd$; for one happening, $ac+ad+bc$; for their both failing, bd; for the firſt happening and the latter failing, $ac+bc+bd$; and ſo for others.

Prop. 2. If a be the number of chances for the happening, and b thoſe for the failing of an event, the probability of its happening at leaſt t times in n trials will be $\frac{a^n + na^{n-1}b + n.\frac{1}{2}\overline{n-1}\,a^{n-2}b^2 +}{\overline{a+b}|^n}$ continued till the index of a be t.

For by the laſt propoſition and its corollaries, if a, b, and c, d, and e, f, &c. be the chances for happening and failing of three or more events, then the terms (of the multiplication) where a is concerned will be the numerator of a fraction, exhibiting the probability of the firſt event's happening. And the terms where both a and c are concerned, give the numerator of a fraction, ſhewing the probability of both the firſt and ſecond events happening, and ſo on; the denominator being $\overline{a+b}\times\overline{c+d}\times$, &c.

Now let the events denoted by the chances $c+d$ $e+f$, &c. be each the ſame as that denoted by $\overline{a+b}$, ſo will the continual product $\overline{a+b}\times\overline{c+d}\times\overline{e+f}$, &c. $= \overline{a+b}\times\overline{a+b}\times\overline{a+b}$, &c. $= \overline{a+b}|^n$; n, being the number of events, and c, e, &c. being each equal to a. In this point of view it is plain, that the happening of a and c is equivalent to the happening of a twice, and the happening of a, c, e, is equivolent to the hapening of a thrice, and ſo on. Therefore in the binomial $a+b$ raiſed to the power n, the terms with a, relate to the happening of the event once; thoſe with aa to its happening twice, and thoſe with a^3 to its happening thrice. Hence all the terms with a as far as a^t muſt be taken into the numerator for happening t times, and the denominator will be $\overline{a+b}^n$, and conſequently the fraction expreſſing the probability of happening t times in n, trials will be as above laid down.

Cor. 1. If a and b be the chances for the happening and failing of an event, then $1 - \overline{\frac{b}{a+b}}|^n$ will be the probability of its happening, and $\overline{\frac{b}{a+b}}|^n$ that of its failing once in n trials.

Prop. 3. If a perſon has an equal chance for the two prizes A and B, the value of his expectation is $\frac{A+B}{2}$. For the probability in each caſe being $\frac{1}{2}$, the expectation on the prize A is $= \frac{1}{2}A$; and the expectation on the prize B, is $\frac{1}{2}B$; and the value of the whole is $= \frac{1}{2}A + \frac{1}{2}B$, or $\frac{A+B}{2}$.

Like the probability of taking any one of three things, as A, B, C, (on equality of chance) is $\frac{1}{3}$; and the expection on A is $\frac{1}{3}A$; on B $= \frac{1}{3}B$; and on C, $= \frac{1}{3}C$; and the whole value $= \frac{1}{3}\times\overline{A+B+C}$. Alſo the expectation for four things, on the like equality, as A, B, C, D, is $\frac{A+B+C+D}{4}$; and ſo for others.

Prop. 4. If there be a chances for the prize A; and b chances for the prize B and no blanks, then the value of the expectation is $\frac{aA+bB}{a+b}$. For by definition 2, the probability of getting the prize A is $= \frac{a}{a+b}$, and of getting the prize B, $= \frac{b}{a+b}$; and by definition 4, the reſpective expectations are $\frac{aA}{a+b}$ and $\frac{bB}{a+b}$; and their ſum $= \frac{aA+bB}{a+b}$ as above.

Cor. In like manner, if there be 3 prizes A, B, C, and the chances for each be a, b, c, reſpectively, then the value of the whole expectation $= \frac{aA+bB+cC}{a+b+c}$ and ſo on.

Prop. 5. If a and b be two numbers of particular caſes relating to A and B reſpectively, and p, be ſome number of chances alike related to a and b; then the ſhare of p as belonging to A, is $\frac{a}{a+b}p$, and as belonging to B, is $\frac{b}{a+b}p$.

For ſince p is alike related to the whole a and b, it muſt be divided between them in proportion to the numbers a and b; the greater number having the greater ſhare, and the leſs number the leſs. Hence as $a+b : a :: p : \frac{a}{a+b}p$, the ſhare belonging to A; and as $a+b : b :: p : \frac{b}{a+b}p$, the ſhare belonging to B.

Cor. If there be ſeveral ſubjects, A, B, C, D, &c. whoſe numbers are a, b, c, d, &c. and the number of chances or things p, be alike related to them all; and if $\overline{a+b+c+d}$, &c. be put $= s$, then the ſhares of A, B, C, D, &c. are reſpectively $\frac{ap}{s}$, $\frac{bp}{s}$, $\frac{cp}{s}$, $\frac{dp}{s}$, &c.

Prop. 6. If a, be the chances for the happening, and b, thoſe for the failing of an event, to find at how many trials it is equally probable to happen or fail.

Let x be the number of trials, then (Cor. Prop. 2.) $\frac{1-b^x}{a+b^x} =$ the probability of happening, $=$ (per propoſition) $\frac{1}{2}$: whence $\overline{a+b}|^x = 2b^x$. And $x\times\log:\overline{a+b} = \log:2 + \overline{x\times\log:b.}$; and therefore $x\times\log:\overline{a+b} - \overline{x\times\log.b} = \log:2 = .30103$; and $x = \frac{.30103}{\log:\overline{a+b}-\log:b} = \frac{.30103}{\log:\frac{a+b}{b}}$.

Cor. 1ſt. If $a=b$ then $x=1$; for $\log:\frac{a+b}{b} = \log:\frac{2a}{a} = \log:2 = .30103$, and conſequently $x = \frac{.30103}{.30103} = 1$.

Cor. 2d. When b is very great in reſpect of a, Mr. Emerſon has ſhewn that x will be to $.693\times\frac{b}{a} = .7\frac{b}{a}$ nearly.

Cor. 3d. When b is very ſmall or nothing, then x becomes very ſmall or nothing. For if $1+\frac{a}{b} = 10, 100, 1000$, &c. then will $x = .3, \frac{3}{2}, \frac{.3}{3}$, &c.

Prop. 7th. If there be a chances for happening, and b chances for failing of an event at one trial, to find in how many trials it is equally probable or improbable to happen t times.

Put $x =$ the number of trials, the (by Prop. 2.) we ſhall have $\frac{a^x + xa^{x-1}b + x\frac{x-1}{2}a^{x-2}b^2 + \&c.}{\overline{a+b}|^x} = \frac{1}{2}$, the ſeries being continued till the index of a be equal to t; — or, make $\frac{b^x + xb^{x-1}a + x\frac{x-1}{2}b^{x-2}a^2 + \&c.}{\overline{a+b}|^x} = \frac{1}{2}$ continuing the ſeries till the index of a be $t, -1$; from either of which the value of x, may be found; the former ſeries however being more commodious when t is great; but when t is ſmall, the latter will claim the preference.

Having laid down the fundamental propoſitions of the doctrine of chances, I proceed to ſhew the application thereof in the ſolution of certain queſtions, referring thoſe who would wiſh to ſee the ſubject more copiouſly handled to that excellent treatiſe written by M. de Moivre, and the tracts of Meſſrs. Simpſon and Emerſon, on this ſubject.

THE APPLICATION OF CHANCE.

Question 1. If I have 3 chances for 4 ſhillings, 6 chances for 8 ſhillings, and 5 chances for 5 ſhillings, what is the value of my expectation, theſe 14 being all the chances poſſible?

By Prop. 3. *A*, *B*, and *C*, are reſpectively equal to 4, 8, and 5 ſhillings; and a, b, and c, $=$ 3, 6, 5, and therefore my expectation is worth $\frac{\overline{3\times4}+\overline{6\times8}+\overline{5\times5}}{14} = \frac{12+48+25}{14} = \frac{85}{14} = 6\frac{1}{14}$ ſhillings.

Question 2. To find the probability of throwing an ace in three caſts with one die; or which is the ſame, in one caſt with three dice.

By Prop. 2. put $a=1$, $b=5$, $n=3$ and $t=1$; and the general expreſſion will become $\frac{a^3+3a^2b+3ab^2}{\overline{a+b}|^3} = \frac{1+15+75}{216} = \frac{91}{216}$. the probability required; Or, $\frac{b^3}{\overline{a+b}|^3} = \frac{125}{216}$. $=$ the probability of failing, and therefore the probability of happening $= \frac{91}{216}$ as before.

Question 3. In how many caſts with one die may one undertake upon an even wager to throw an ace?

Let $x =$ the number of throws, $a =$ chance to hit $= 1$; $b =$ chances to miſs $= 5$. Then (per Cor. Prop. 2) $\frac{b^x}{\overline{a+q}|^x} =$ probability of failing, which (in an equal wager) is equal to the probability of happening: conſequently $\overline{\frac{b}{a+b}}|^x = \frac{1}{2}$; and $2b^x = \overline{a+b}|^x$. Whence the log 2, $+\overline{x\times\log.b} = x\times\log.\overline{a+b}$. Therefore $x = \frac{\text{Log. }2.}{\text{Log.}\,\overline{a+b}-\log.\,b} = \frac{\text{Log }2.}{\text{Log}:6.-\log:5.} = \frac{.30103}{.07918} = 3.82$; that is between 3 and 4 throws; or at four throws one may undertake on an even wager to throw an ace.

Lemma. To find the number of ways for throwing a given number of points with any number of dies? Let the given number of points $= p+1$, and $n =$ the number of dice, then the number of ways, according to Mr. Emerſon's laws of chance, will be

$$+\frac{p}{1}\times\frac{p-1}{2}\times\frac{p-2}{3}, \text{ \&c. (to } n-1 \text{ terms)}$$

$$-\frac{p-6}{1}\times\frac{p-7}{2}\times\frac{p-8}{3}, \text{ \&c.}\times\frac{n}{1}$$

$$+\frac{p-12}{1}\times\frac{p-13}{2}\times\frac{p-14}{3} \text{ \&c.}\times\frac{n}{1}\times\frac{n-1}{2}$$

$$-\frac{p-18}{1}\times\frac{p-19}{2}\times\frac{p-20}{3} \text{ \&c.}\times\frac{n}{1}\times\frac{n-1}{2}\times\frac{n-2}{3}$$

$$+ \text{ \&c.}$$

Which rows of ſeries muſt be continued downwards till ſome of the factors in each become *o*, or negative; taking $n-1$ terms in each. The demonſtration of a ſeries ſimilar to this may be ſeen in M. De Moivre's doctrines of chances, and in a treatiſe on this ſubject written by profeſſor Simpſon.

QUESTION 4. How many chances are there for throwing 16 with 4 dice?

Here $p=1$, and $n=4$, whence the above ſeries will be

$$+\tfrac{15}{1}\times\tfrac{14}{2}\times\tfrac{13}{3} = +455$$
$$-\tfrac{9}{1}\times\tfrac{8}{2}\times\tfrac{7}{3}\times\tfrac{4}{1} = -336$$
$$+\tfrac{3}{1}\times\tfrac{2}{2}\times\tfrac{1}{3}\times\tfrac{4}{1}\times\tfrac{3}{2} = +\ 6$$

Sum 125 the chances required; and the whole number of chances $=6^4=1296$.

QUESTION 5. *A* undertakes to throw 10 with three dice, before *B* throws 12 with four dice. What are the odds of the game?

1ſt. For the probability of caſting 10 with 3 dice; here $p=g$, and $n=3$; and conſequently (by the ſeries) the number of chances for throwing 10 are 27; and the whole number of chances $=6^3=216$; therefore the probabilty of throwing $10=\frac{27}{216}$.

2d. For the probability of caſting 12 with 4 dice. Here $p=11$ and $n=4$; and therefore the number of chances for throwing 12 will be found $=125$; and the whole number of chances being $6^4=1296$; the probability of throwing 12 is therefore $\frac{125}{1296}$.

Whence *A*'s chance is to that of *B*'s, as $\frac{27}{216}$ to $\frac{125}{1296}$, or in whole numbers, as 162 to 125, which are the true odd's in *A*'s favour.

QUESTION 6. Any number of dice being given, to find the probability of caſting two faces of a ſort at one throw?

The following general expreſſion for performing this, is given by Mr. Emerſon, and is deduced from the doctrine of combinations, of which we have treated in our new Syſtem of Arithmetic. If $n=$ the number of dice, then the probability of not caſting 2 faces of a ſort will be $\frac{6\times5\times4\text{ (to } n \text{ terms)}}{6\times6\times6\text{ (to } n \text{ terms)}}$, $=$ the probability of failing; and therefore the probability of performing it will be $1-\frac{6.5.4.}{6.6.6.}$ (to *n* terms.)

EXAMPLE. What is the probability of caſting 2 faces of a ſort, with 4 dice?

Here $\frac{6.5.4.3}{6.6.6.6}=\frac{360}{1296}$, the probability of failing; and $\frac{1296-360}{1296}=\frac{936}{1296}$, the probability of happening.

QUESTION 7. To find the probability of throwing *m* aces only, at *n* throw with 1 die, or at 1 throw with *n* dice. From the doctrine of combinations it is eaſy to demonſtrate that $\frac{n}{1}.\overline{\frac{n-1}{2}}.\overline{\frac{n-2}{3}}$ (to *m* terms) $\times\, 5^{n-m}$ is the number of all the caſes whereby *m* aces only can be caſt, and conſequently $\frac{n}{1}\cdot\frac{n-1}{2}\cdot\frac{n-2}{3}$ (to *m* terms) $\times\, \frac{5^{n-m}}{6^{n}}=$ the probability required.

EXAMPLE. Let $m=3$ and $n=10$, then $\frac{10}{1}, \frac{9}{2}, \frac{8}{3}, \times 5^7 = 120\times78125=9375000$, the number of chances for throwing 3 aces in 10 caſts, and the required probability is therefore $\frac{9375000}{6^{10}}$, $\frac{9375000}{60466176}=\frac{2}{3}$ nearly.

QUESTION 8. To find how many ways a perſon may caſt *p* aces, *q* duces, *r* trays, *s* fours, &c. (or any other faces) with *n* dice.

Anſwer, $\frac{1.2.3.4\text{ (to } n \text{ terms)}}{1.2.3.\text{ (to } p \text{ terms)} \times 1.2.3\text{ (to } q \text{ terms)} \times 1.2\ 3\text{ (to } r \text{ terms) \&c.}}$

EXAMPLE. How many ways can 3 aces, 2 duces, 1 tray, and 1 four, be caſt with 7 dice; Here $p=3$, $q=2$, $r=1$, $s=1$, $n=7$, which ſubſtituted in the above general expreſſion, we have $\frac{1.2.3.\ 4.\ 5.\ 6.\ 7}{1.2.3.\times1.2.\times1.\times1}=420$ the Anſwer, and $6^7=279936$ being the whole number of chances on 7 dice, the probability of performing the above at 1 throw, is $\frac{420}{279936}=\frac{2}{1333}$ nearly.

QUESTION 9. *A* and *B* playing together, *A* wants 2 games of winning the ſet, and *B* wants 3 games of it. What are the odds in favour of *A*?

It is evident the play will be ended in four games at moſt; therefore raiſe a binomial as $a+b$ to the fourth power, $=a^4+4a^3b+6a^2b^2+4ab^3+b^4$, and take the coefficients of all the terms wherein the power of *a* is 2 or more, for the chances of A, $=1+4+6=11$, and the coefficients of all the terms in which the power of *b* is 3 or more, for the chances of B $=1+4=5$; then the odds in A's favour are as 11 to 5; and the probability of A's winning is $\frac{11}{16}$, and that of B's $\frac{5}{16}$.

QUESTION 10. Suppoſing the ſame caſe as the laſt, but with this conſideration, that *A*'s ſkill is to that of *B*'s, in proportion of 4 to 3, what are the odds of the game? Here in the above involved binomial, make $a=4$, and $b=3$; and inſtead of the coefficients take the terms themſelves; and ſo the chances in *A*'s favour are 1888, and in *B*'s favour 513, which numbers denote the true proportion of the odds.

QUESTION 11. A gentleman at whiſt undertakes to pay a guinea every time the dealer has the moſt trumps, on condition of receiving a crown whenever any one of the reſt ſhall have more trumps than the dealer; *Quere*, whether he has the advantage or diſadvantage, and how much?

Here the probability of any one card's proving a trump (ſave the laſt) is $\frac{12}{51}$. But with regard to the laſt card, it is a certainty, or $\frac{51}{51}$. Therefore, rejecting the denominator which is common, the dealer has 12 cards of 12 chances each, and 1 card of 51 chances $=$ in the whole 195: and each of the reſt has 13 cards of 12 chances each $=$ in the whole 156. Whence it appears that the dealer has an expectation in point of trumps above any other player alone, in the ratio of 195 to 156, or of 5 to 4. But in the preſent caſe, the other three players are collectively oppoſed to him. Now $\frac{5}{9}$ being his probability againſt any one player, it is plain that $\left.\frac{5}{9}\right|^{3}=$ his probability againſt the whole $=\frac{125}{729}$. Conſequently, the odds againſt the dealer's winning, are 604 to 125; or as 24 to 5 nearly. In money, as one guinea to 4*s.* 4*d.* And the gentleman's advantage every deal, is equal to 8*d.* $\times\frac{604}{729}=$ 6*d.* $\frac{3}{4}$, nearly.

QUESTION 12. In a lottery of 100000 tickets, of which 90000 are blanks, and the reſt prizes, it is required to determine the probability of having a prize among the firſt ſix tickets.

Here the probability of the firſt tickets failing $=\frac{9}{10}$, and of the firſt and ſecond's failing $\frac{9}{10}\times\frac{89999}{99999}$; of the firſt, ſecond and third failing $\frac{9}{10}\times\frac{89999}{99999}\times\frac{89998}{99998}$, &c.; and laſtly, their all ſix failing $\frac{9}{10}\times\frac{89999}{99999}\times\frac{89998}{99998}\times\frac{89997}{99997}\times\frac{89996}{99996}\times\frac{89995}{99995}$; which fractions being actuallly multiplied, (and that is eaſily done by logarithms) we have the product $=.53143$, the probability of failing, and conſequently its complement $=.46857$, the probability of taking one prize, or more, in 6 tickets.

QUESTION 13. To find at hazard the advantage of the ſetter upon all ſuppoſitions of main and chance?

1ſt. Let it be ſuppoſed that the main is VII; then if the chance of the caſtor be VI or VIII, the ſetter will have 6 chances to win, and 5 to loſe, and his expectations will be $\frac{6}{11}$ of the ſtake, but the probability of the ſetter's chance being VI. or VIII. is only $\frac{10}{36}$, and therefore $\frac{10}{36}\times\frac{6}{11}=\frac{5}{33}=$ his expectation.

2d. If the chance of the caſtor be 5 or 9, when the main is VII.; the expectation of the ſetter will be $\frac{24}{5\times36}=\frac{2}{15}$.

3d. If the chance of the caſtor be IV. or X. the expectation of the ſetter will be $\frac{4}{36}$ or $\frac{1}{9}$.

4th. The main being as before, if the caſtor ſhould throw II. III. or XII. then the ſetter would of courſe win, but there being 4 chances for throwing II. III. or XII. it follows that before the caſtor has thrown, the expectation of the ſetter, as reſulting from the probability of the caſtor's being II. III. or XII. will be $\frac{4}{36}=\frac{1}{9}$.

Laſtly, if the caſtor ſhould throw VII. or XI. the ſetter loſes his expectation.

From the foregoing caſes, the main being VII. it follows that the expectation of the ſetter $=\frac{5}{33}+\frac{2}{15}+\frac{1}{9}+\frac{1}{9}=\frac{251}{495}$, and conſequently the expectation of the caſtor $=1-\frac{251}{495}=\frac{244}{495}$. Hence the odds for winning is in favour of the ſetter, as 251 to 244; and his gain therefore $=\frac{7}{495}=$ about 3*d.* $\frac{1}{2}$ in a guinea. By a like proceſs, it will be found that when the main is VI. or VIII. the gain of the ſetter will be $\frac{167}{7128}$; ſomething more than 5*d.* $\frac{3}{4}$ in a guinea.

When the main is V. or IX. the gain of the ſetter, is $\frac{43}{2835}=$ about 3*d.* $\frac{3}{4}$ in a guinea; ſo that in each caſe the ſetter has the advantage, and before a main is thrown, the expectation of his advantage amounts to about 4*d.* $\frac{1}{2}$ in a guinea.

COR. The probability of a main is to the probability of no main, as 111 to 107.

Mr. Emerſon, at the concluſion of his treatiſe, draws this inference, that chance, on account of its perpetual approximation to ſome certain law, very little diſturbs ſuch events as *were deſigned to happen by ſome determinate law*, and ſays, that it is wonderful to obſerve how regularity ariſes out of irregularity, and order out of diſorder. He adds, we may conclude, that all ſuch laws, by which the various effects and productions of *chance* are regulated, are the effects of *intelligence* and *deſign*, and were conſtituted by ſome *powerful agent*, and *intended* to ſerve *wiſe* and *uſeful purpoſes*; neceſſary for the *preſervation*, *order* and *œconomy* of the *Univerſe*. So the Great Author of Nature can make *even Chance* execute his deſigns.

The doctrine of Chances may be applied to the aſcertaining of the probabilities and odds in all poſſible occurrences of Gaming, or Riſk, provided the principles of the caſe are rightly underſtood. But in ſome inſtances, the calculations are extremely intricate; and require the utmoſt invention and ſubtle penetration to manage them properly; and therefore thoſe who wiſh to excel in calculations of this kind, ſhould firſt acquire a ſtrict and true method of reaſoning, admitting of nothing as fact what carries with it it's due evidence; and then perfect themſelves in the various kinds of algebraic operations, and the doctrine of infinite ſeries, &c. which done, I am perſuaded that by carefully going through this ſhort fundamental Treatiſe, they will be enabled, without further inſtruction, to purſue the ſubject to any extent, let the matter be as difficult as it may; but without thoſe previous accompliſhments, nothing of conſequence can be ſucceſsfully undertaken.

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TREATISE ON GARDENING.

GARDENING, in the perfection to which it has been lately brought in Britain, is entitled to a place of conſiderable rank among the liberal arts. It is as ſuperior to landſcape-painting, as a reality to a repreſentation: it is an exertion of fancy; a ſubject for taſte; and being releaſed now from the reſtraints of regularity, and enlarged beyond the purpoſes of domeſtic convenience, the moſt beautiful, the moſt ſimple, the moſt noble ſcenes of nature, are all within its province. For it is no longer confined to the ſpots from which it takes its name; but regulates alſo the diſpoſition and embelliſhments of a park, a farm, or a riding; and the buſineſs of a gardener is to ſelect and apply whatever is great, elegant, or characteriſtic, in any of them; to diſcover and to ſhew all the advantages of the place upon which he is employed; to ſupply its defects, to correct its faults, and to improve its beauties. For all theſe operations, the objects of nature are ſtill his only materials. His firſt inquiry, therefore, muſt be into the means by which thoſe effects are attained in nature, which he is to produce; and into thoſe properties in the objects of nature, which ſhould determine him in the choice and arrangement of them.

In the choice, of a place proper for a garden, the moſt eſſential points to be conſidered are the ſituation, the ſoil, the expoſure, water and proſpect.

1ſt, As to the ſituation, it ought to be ſuch a one as is wholeſome, and in a place neither too high nor too low; for if a garden be too high, it will be expoſed to the winds, which are very prejudicial to trees; and if it be too low, the dampneſs, the vermin, and the venomous creatures that breed in ponds and marſhy places, add much to their inſalubrity. The moſt happy ſituation is on the ſide of a hill, eſpecially if the ſlope be eaſy, and in a manner imperceptible; if a good deal of level ground be near the houſe; and if it abounds with ſprings of water; for, being ſheltered from the fury of the winds, and the violent heat of the ſun, a temperate air will be there enjoyed; and the water that deſcends from the top of the hill, either from ſprings or rain, will not only ſupply fountains, canals, and caſcades for ornament, but, when it has performed its office, will water the adjacent valleys, and, if it be not ſuffered to ſtagnate, will render them fertile and wholeſome. Indeed, if the declivity of the hill be too ſteep, and the water be too abundant, a garden on the ſide of it may frequently ſuffer, by having trees torn up by torrents and floods; and by the tumbling down of the earth above, the walls may be demoliſhed, and the walks ſpoiled. It cannot, however, be denied, that the ſituation on a plain or flat has ſeveral advantages which the higher ſituation has not; for floods and rain commit no damage; there is a continued proſpect of champaigns, interſected by rivers, ponds, and brooks, meadows, and hills covered with woods or buildings: beſides, the level ſurface is leſs tireſome to walk on, and leſs chargeable than that on the ſide of an hill, ſince terrace-walks and ſteps are not there neceſſary: but the greateſt diſadvantage of flat gardens, is the want of thoſe extenſive proſpects which riſing grounds afford.

2dly, A good earth or ſoil is next to be conſidered; for it is ſcarce poſſible to make a fine garden in a bad ſoil. There are indeed ways to meliorate ground, but they are very expenſive; and ſometimes, when the expence has been beſtowed of laying good earth three feet deep over the whole ſurface, a whole garden has been ruined, when the roots of the trees have come to reach the natural bottom. To judge of the quality of the ſoil, obſerve whether there be any heath, thiſtles, or ſuch-like weeds growing ſpontaneouſly in it; for they are certain ſigns that the ground is poor. Or if there be large trees growing thereabouts, obſerve, whether they grow crooked, ill-ſhaped, and grubby, and whether they are of a faded green, and full of moſs, or infeſted with vermin; if this be the caſe, the place is to be rejected; but, on the contrary, if it be covered with good graſs fit for paſture, you may then be encouraged to try the depth of the ſoil. To know this, dig holes in ſeveral places, ſix feet wide, and four deep; and if you find three feet of good earth, it will do very well; but leſs than two will not be ſufficient. The quality of good ground is, neither to be ſtony, nor too hard to work; neither too dry, too moiſt, nor too ſandy and light; nor too ſtrong and clayey, which is the worſt of all for gardens.

3dly, The next requiſite is water; the want of which is one of he greateſt inconveniencies that can attend a garden, and will bring certain mortality upon whatever is planted in it, eſpecially in the reater droughts that often happen in a hot and dry ſituation in ſummer; beſides its uſefulneſs in fine gardens for making fountains, anals, caſcades, &c. which are the greateſt ornaments of a garden.

4thly, The laſt thing to be conſidered, is the proſpect of a fine ountry; and though this is not ſo abſolutely neceſſary as water, et it is one of the moſt agreeable beauties of a fine garden: beſides, a garden be planted in a low place that has no kind of proſpect, it ill not only be diſagreeable, but unwholeſome. In the laying out nd planting of gardens the beauties of nature ſhould always be udied: for the nearer a garden approaches to nature, the longer it ill pleaſe. The area of a handſome garden, may take up thirty r forty acres, but not more; and the following rules ſhould be obrved in the diſpoſition of it. There ought always to be a deſcent f at leaſt three ſteps from the houſe to the garden; this will render e houſe more dry and wholeſome, and the proſpect on entering the arden more extenſive. The firſt thing that ought to preſent itſelf view, ſhould be an open lawn of graſs, which ought to be conſiderably broader than the front of the building; and if the depth be one half more than the width, it will have a better effect; if on the ſides of the lawn there are trees planted irregularly, by way of open groves, the regularity of the lawn will be broken, and the whole rendered more like nature. For the convenience of walking in damp weather, this lawn ſhould be ſurrounded with a gravel walk, on the outſide of which ſhould be borders three or four feet wide, for flowers; and from the back of theſe the proſpect will be agreeably terminated by a ſlope of ever-green ſhrubs; which, however, ſhould never be ſuffered to exclude agreeable proſpects, or the view of handſome buildings. Theſe walks may lead through the different plantations, gently winding about in an eaſy natural manner; which will be more agreeable than either thoſe long ſtraight walks, too frequently ſeen in gardens, or thoſe ſerpentine windings, that are twiſted about into ſo many ſhort turns, as to render it difficult to walk in them: and as no garden can be pleaſing where there is a want of ſhade and ſhelter, theſe walks ſhould lead as ſoon as poſſible into plantations, where perſons may walk in private, and be ſheltered from the wind. Where the borders of the gardens are fenced with walls or pales, they ſhould be concealed with plantations of flowering ſhrubs, intermixed with laurels and other ever-greens; which will have a good effect, and at the ſame time conceal the fences, which are diſagreeable when left naked and expoſed to the ſight. Groves are the moſt agreeable parts of a garden, ſo that there cannot be too many of them; only that they muſt not be too near the houſe, nor be ſuffered to block up agreeable proſpects. To accompany parterres, groves opened in compartments, quincunxes, and arbour-work with fountains, &c. are very agreeable. Some groves of ever-greens ſhould be planted in proper places, and ſome ſquares of trees of this kind may alſo be planted among the other wood.

Narrow rivulets, if they have a conſtant ſtream, and are judiciouſly led about a garden, have a better effect than many of the large ſtagnating ponds or canals, ſo ftequently made in large gardens. When wilderneſſes are intended they ſhould not be cut into ſtars and other ridiculous figures, nor formed into mazes or labyrinths, which in a great deſign appear trifling. Buildings, ſtatues, and vaſes, appear very beautiful; but they ſhould never be placed too near each other: magnificent fountains are alſo very ornamental; but they ought never to be introduced, except there be water to keep them conſtantly running. The ſame may alſo be obſerved of caſcades and other falls of water.

In ſhort, the ſeveral parts of a garden ſhould be diverſified; but in places where the eye takes in the whole at once, the two ſides ſhould be always the ſame. In the buſineſs of deſigns, the aim ſhould be always at what is natural, great, and noble. The general diſpoſition of a garden, and of its parts, ought to be accommodated to the different ſituations of the ground, to humour its inequalities, to proportion the number and ſorts of trees and ſhrubs to each part, and to ſhut out from the view of the garden no objects that may become ornamental. And before a garden is planned out, it ought ever to be conſidered, what it will be when the trees have had 20 years growth. But for a more extended view of this ſubject, ſee the following general diſplay.

PART I. ORNAMENTAL GARDENING.

ARTICLE I. THE CONSTITUENT PARTS OF THE SCENES OF NATURE.

Nature, always ſimple, employs but four materials in the compoſition of her ſcenes; *ground, wood, water, and rocks.* The cultivation of nature has introduced a fifth ſpecies, the *buildings* requiſite for the accommodation of men. Each of theſe again admits of varieties in figure, dimenſion, colour, and ſituation. Every landſcape is compoſed of theſe parts only; every beauty in a landſcape depends on the application of their ſeveral varieties.

SECT. I. GROUND.

The ſhape of ground muſt be either a *convex*, a *concave*, or a *plane*; in terms leſs technical called a *ſwell*, a *hollow*, and a *level*. By combinations of theſe are formed all the irregularities of which ground is capable; and the beauty of it depends on the degrees and the proportions in which they are blended.

Of a Level Ground.

Both the convex and the concave are forms in themſelves of more variety, and may therefore be admitted to a greater extent than a plane. But levels are not totally inadmiſſible. The preference unjuſtly ſhewn to them in the old gardens, where they prevailed almoſt in excluſion of every other form, has raiſed a prejudice againſt them.

It is frequently reckoned an excellence in a piece of made ground, that every part of it is uneven; but then it wants one of the three great varieties of ground, which may ſometimes be intermixed with the other two. A gentle concave declivity falls and ſpreads eaſily on a flat; the channels between ſeveral ſwells degenerate into mere gutters, if ſome breadth be not given to the bottoms by flattening them; and in many other inſtances, ſmall portions of an inclined or horizontal plane may be introduced into an irregular compoſition. Care only muſt be taken to keep them down as ſubordinate parts, and not to ſuffer them to become principal.

There are, however, occaſions on which a plane may be principal: a hanging level often produces effects not otherwiſe attainable. A large dead flat, indeed, raiſes no other idea than of ſafety:

the eye finds no amuſement, no repoſe on ſuch a level: it is fatigued, unleſs timely relieved by an adequate termination; and the ſtrength of that termination will compenſate for its diſtance. The greatneſs and the beauty of the boundary are not, however, alone ſufficient; the form of it is of ſtill more conſequence. A continued range of the nobleſt wood, or the fineſt hill, would not cure the inſipidity of a flat: a leſs importment, a leſs pleaſing boundary, would be more effectual, if it traced a more varied outline; if it advanced ſometimes boldly forward, ſometimes retired into deep receſſes; broke all the ſides into nine parts, and marked even the plain itſelf with irregularity.

Convex or Concave Shapes of Ground.

A plain is not, however, in itſelf intereſting; and the leaſt deviation from the uniformity of its ſurface changes its nature: as long as the flat remains, it depends on the objects around for all its variety, and all its beauty. But convex and concave forms are generally pleaſing, and the number of degrees and combinations into which they may be caſt is infinite: thoſe forms only in each which are perfectly regular muſt be avoided. A ſemicircle can never be tolerable: ſmall portions of large circles blended together, or lines gently curved, which are not parts of any circle, a hollow ſinking, but little below a level, and ſwell very much, flattened at the top, are commonly the moſt agreeable figures. There are, however, ſituations where the convex form ſhould be preferred: a hollow juſt below the brow of a hill reduces it to a narrow ridge, which has a poor meagre appearance; and an abrupt fall will never ſeem to join with a concave form immediately above it: a ſharp edge divides them; and to connect them, that edge muſt be rounded, or at leaſt flattened; which, is, in fact, to interpoſe a convex or a level.

Connection between the Parts in Ground.

In made ground, the connection is, perhaps, the principal conſideration. A ſwell which wants it is but a heap, a hollow but a hole, and both appear artificial: the one ſeems placed upon a ſurface to which it does not belong; the other, dug into it. On the great ſcale of nature, indeed, either may be ſo conſiderable in itſelf, as to make its relation to any other almoſt a matter of indifference; but, on the ſmaller ſcale of a garden, if the parts are disjointed, the effect of the whole is loſt; and the union of all is not more than ſufficient to preſerve an idea of greatneſs and importance, to ſpots which muſt be varied, and cannot be ſpacious. Little inequalities are beſides in nature uſually well blended together: all lines of ſeparation have, in a coarſe of time, been filled up; and therefore, when in made ground they are left open, that ground appears artificial.

Even where artifice is avowed, a breach in the connection offends the eye. The uſe of a foſſe is merely to provide a fence, without obſtructing the view. To blend the garden with the country is no part of the idea: the cattle, the objects, the culture, without the ſunk fence, are diſcordant to all within, and keep up the diviſion. A foſſe may open the moſt poliſhed lawn to a cornfield, a road, or a common, though they mark the very point of ſeparation. It may be made on purpoſe to ſhew objects which cannot, or ought not to be in the garden; as a church, or a mill, a neighbouring gentleman's ſeat, a town, or a village; and yet no conſciouſneſs of the exiſtence can reconcile us to the ſight of this diviſion.

If, where no union is intended, a line of ſeparation is diſagreeable, it muſt be diſguſting when it breaks the connection between the ſeveral parts of the ſame piece of ground. The manner of concealing the ſeparation ſhould itſelf be diſguiſed: and different degrees of cavity and rotundity; different ſhapes and dimenſions to the little parts thus diſtinguiſhed by degrees; and thoſe parts breaking, in one place more in another leſs, into the principal forms which are to be united; produce that variety with which all nature abounds, and without which ground cannot be natural.

Relation of the Parts to the Whole.

The relation of all the parts to the whole, when clearly marked, facilitates their junction with each other: for the common bond of union is then perceived, before there has been time to examine the ſubordinate connections; and if theſe ſhould be deficient in ſome niceties, the defect is loſt in the general impreſſion. But any part which is at variance with the reſt, is not rarely a blemiſh in itſelf: it ſpreads diſorder as far as its influence extends; and the confuſion is in proportion as the other parts are more or leſs adapted to point out any particular direction, or to mark any peculiar character in the ground. If, in ground all deſcending one way, a piece is twiſted another, the general fall is obſtructed by it; but if all the parts incline in the ſame direction, it is hardly credible how ſmall a declivity will ſeem to be conſiderable. An appearance even of ſteepneſs may be given to a very gentle deſcent, by raiſing hillocks upon it, which ſhall lean to the point, whither all the reſt are tending; for the eye meaſures from the top of the higheſt, to the bottom of the loweſt ground; and when the relation of the parts is well preſerved, ſuch an effect from one is transfuſed over the whole.

The general idea muſt however, be preſerved, clear even of a doubt. A hillock which only intercepts the ſight, if it does not contribute to the principal effect, is at the beſt an unneceſſery excreſcence; and even an interruption in the general tendency, though it hide nothing, is a blemiſh. On a deſcent, any hollow, any fall, which has not an outlet to lower ground, is a hole: the eye ſkips over it; inſtead of being continued along it; it is a gap in the compoſition.

As ſcenes increaſe in extent, they become more impatient of controul; they are not only leſs manageable, but ought to be leſs reſtrained; they require more variety and contraſt. But ſtill the ſame principles are applicable to the leaſt, and to the greateſt, though not with equal ſeverity; neither ought to be rent to pieces: and though a ſmall neglect, which would diſtract the one, may not diſturb the other, yet a total diſregard of all the principles of union is alike productive of confuſion in both.

Character of Ground.

The *ſtyle* alſo of every part, muſt be accommodated to the character of the whole. A large, deep, abrupt break, among eaſy ſwells and falls, ſeems at the beſt but a piece left unfiniſhed, and which ought to be ſoftened; it is not more natural, becauſe it is more rude; nature forms both the one and the other, but ſeldom mixes them together. On the other hand, a ſmall fine poliſhed, form, in the midſt of rough, miſhapen ground, though more elegant than all about it, is generally no better than a patch, itſelf diſgraced, and disfiguring the ſcene. A thouſand inſtances might be adduced to ſhew, that the prevailing idea ought to pervade every part, ſo far at leaſt indiſpenſably as to exclude whatever diſtracts it, and as much further as poſſible to accommodate the character of the ground to that of the ſcene it belongs to.

On the ſame principle, the *proportion* of the parts may often be adjuſted. For though their ſize muſt be very much governed by the extent of the place, and a feature which would fill up a ſmall ſpot may be loſt in a large one; though there are forms of a particular caſt, which appear to advantage only within certain dimenſions, and ought not therefore to be applied where they have not room enough, or where they muſt occupy more ſpace than becomes them; yet, independent of theſe conſiderations, a character of greatneſs belongs to ſome ſcenes, which is not meaſured by their extent, but raiſed by other properties, ſometimes only by the proportional largeneſs of their parts. On the contrary, where elegance characteriſes the ſpot, the parts ſhould not only be ſmall, but diverſified beſides with ſubordinate inequalities, and little delicate touches every where ſcattered about them. Striking effects, forcible impreſſions, whatever ſeems to require effort, diſturb the enjoyment of a ſcene intended to amuſe and to pleaſe.

Variety in Grounds.

Ground is ſeldom beautiful or natural without *variety*, or even without contraſt; and the precautions which have been given, extend no farther than to prevent variety from degenerating into inconſiſtency, and contraſt into contradiction. Within the extremes, nature ſupplies an inexhauſtible fund; and variety thus limited, ſo far from deſtroying, improves the general effect; Each diſtinguiſhed part makes a ſeparate impreſſion; and all bearing the ſame ſtamp, all concurring to the ſame end, every one is an additional ſupport to the prevailing idea; that is multiplied, it is extended, it appears in different ſhapes, it is ſhewn in ſeveral lights, and the variety illuſtrates the relation. But variety wants not this recommendation; it is always deſirable where it can be properly introduced: and an accurate obſerver will ſee in every *form* ſeveral circumſtances by which it is diſtinguiſhed from every other. If the ſcene be mild and quiet, he will place together thoſe which do not differ widely; and he will gradually depart from the ſimilitude. In ruder ſcenes, the ſucceſſion will be leſs regular, and the tranſitions more ſudden. The character of the place muſt determine the degree of difference between forms which are contiguous. Beſides diſtinctions in the ſhapes of ground, differences in their *ſituations* and their *dimenſions* are ſources of variety. Sometimes a very diſagreeable effect, produced by too cloſe a reſemblance of ſhapes, may be remedied only by an alteration in the ſize. If a ſteep deſcends in a ſucceſſion of abrupt falls, nearly equal, they have the appearance of ſteps, and are neither pleaſing nor wild; but if they are made to differ in height and length, the objection is removed; and at all times a difference in the dimenſions will be found to have a greater effect than in ſpeculation we ſhould be inclined to aſcribe to it, and will often diſguiſe a ſimilarity of figure.

Extraordinary Effects of Grounds.

The application of any of the foregoing obſervations to the ſtill greater ſcenes of nature, would carry us at preſent too far. Many of the above remarks are, however, ſo far of uſe in ſcenes the fartheſt from our reach, as they may aſſiſt in directing our choice of thoſe parts which are in our power to ſhew, or to conceal, though not to alter. But in converting them to this purpoſe, a caution, which has more than once been alluded to, muſt always be had in remembrance: never to ſuffer general conſiderations to interfere with ***extraordinary great effects***, which riſe ſuperior to all regulations, and perhaps owe part of their force to their deviation from them. Singularity cauſes at leaſt ſurpriſe, and ſurpriſe is allied to aſtoniſhment. Theſe effects are not, however, attached merely to objects of enormous ſize; they frequently are produced by a greatneſs of ſtyle and character, within ſuch an extent as ordinary labour may modify, and the compaſs of a garden include. The caution therefore may not be uſeleſs within theſe narrow bounds; but nature proceeds ſtill further, beyond the utmoſt verge to which art can follow; and, in ſcenes licentiouſly wild, not content with contraſt, forces even contradictions to unite. The groteſque diſcordant ſhapes which are often there confuſedly jumbled together, might ſufficiently juſtify the remark. But the caprice does not ſtop here; to mix with ſuch ſhapes a form perfectly regular, is ſtill more extravagant; and yet the effect is ſometimes ſo wonderful, that we cannot wiſh the extravagance corrected.

SECT. II. Wood.

Characteriſtic Differences in Trees and Shrubs.

In the above inſtances the ground is the principal conſideration; but previous to any enquiry into the greater effects of wood, when it is itſelf an object of examination of the *characteriſtic differences* of trees and ſhrubs is neceſſary. We do not mean botanical diſtinctions: we mean apparent, not eſſential varieties; and theſe muſt be obvious and conſiderable, to merit regard in the diſpoſition of the objects they diſtinguiſh. Trees and ſhrubs are of different *ſhapes, greens,* and *growths.* The varieties in their ſhapes may be reduced to the following heads. Some thick with branches and foliage have almoſt *an appearance of ſolidity*; as the beach and the elm, the lilac and ſyringa. Others thin of boughs and of leaves ſeem *light and airy*; as the aſh and the arbele, the common arbor vitæ and the tamariſk. There is a *mean betwixt the two extremes*, very diſtinguiſhable from both; as in the bladder-nut, and the aſhen-leaved maple. They may again be divided into thoſe whoſe *branches begin from the ground*, and thoſe which *ſhoot up in a ſtem before their branches begin.* Trees which have ſome not much clear ſtem, as ſeveral of the firs, belong to the former claſs; but a very ſhort ſtem will rank a ſhrub, ſuch as the althæa, in the latter. Of thoſe whoſe branches begin from the ground, ſome riſe in a *conical figure*, as the larch, the cedar of Lebanon, and the holly; ſome *ſwell out in the middle of their growth, and diminiſh at both ends*, as the Weymouth pine, the mountain aſh, and the lilac: and ſome are *irregular and buſhy* from the top to the bottom, as the evergreen oak, the Virginian cedar, and Guelder roſe. Theſe are the moſt obvious great diſtinctions in the ſhapes of trees and ſhrubs. The differences between ſhades of green cannot be ſo conſiderable; but theſe alſo will be found well deſerving of attention. Some are of a *dark green*, as the horſe-cheſnut and the yew; ſome of a *light green*, as the lime and the laurel; ſome of a *green tinged with brown*; as the Virginian cedar; ſome of a *green tinged with white*, as the arbele and the ſage-tree; and ſome of a *green tinged with yellow*, as the aſhen-leaved maple and the Chineſe arbor vitæ. The variegated plants alſo are generally entitled to be claſſed with the white, or the yellow, by the ſtrong tincture of the one or the other of thoſe colours on their leaves.

The preſent enquiry is only into great fixed diſtinctions. Thoſe in the ſhapes and the greens of trees and ſhrubs have been mentioned: there are others, as great and as important, in their growths; but they are too obvious to deſerve mentioning. Every gradation, from the moſt humble to the moſt lofty, has, in certain ſituations, particular effects; it is unneceſſary to divide them into ſtages.

Variety ariſing from thoſe Differences.

One principal uſe in ſettling theſe characteriſtic diſtinctions, is to point out the ſtores whence varieties may at all times be readily drawn, and the cauſes by which ſometimes inconſiſtencies may be accounted for. There are intermediate degrees, by which the moſt diſtant may be reconciled: the upright branches of the almond mix very ill with the falling boughs of the weeping willow; but an interval filled with other trees, in figure between the two extremes, renders them at leaſt not unſightly in the ſame plantation. Thoſe, on the contrary, which are of one character and are diſtinguiſhed only as the characteriſtic mark is ſtrongly or faintly impreſſed upon them, as a young beech and a birch, an acacia and a larch, all pendant, though in different degrees, form a beautiful maſs, in which unity is preſerved without ſameneſs; and ſtill finer groupes may often be produced by greater deviations from uniformity into contraſt. To range the ſhrubs and ſmall trees ſo that they mutually ſet off the beauties, and conceal the blemiſhes, of each other; to aim at no effects which depend on a nicety for their ſucceſs, and which the ſoil, the expoſure, or the ſeaſon of the day, may deſtroy; to attend more to the groupes than to the inviduals; and to conſider the whole as a plantation, not as a collection of plants; are the beſt general rules which can be given concerning them.

Mixture of Greens.

The different tints of greens may ſeem at firſt ſight to be rather minute varieties than characteriſtic diſtinctions: but upon experience it will be found, that from ſmall beginnings they lead to material conſequences; that they are more important on the broad expanſe, than along the narrow outline of a wood; and that by their union, or their contraſt, they produce effects not to be diſregarded in ſcenes of extent and of grandeur.

A hanging wood in autumn is enriched with colours, whoſe beauty cheers the approaches of the inclement ſeaſon they forebode; but when the trees firſt droop, while the verdure as yet only begins to fade, is the time to learn the ſpecies, the order, and the proportion of tints, which blended will form *beautiful maſſes*; and, on the other hand, to diſtinguiſh thoſe which are *incompatible*, near together. The peculiar beauty of the tints of red cannot then eſcape obſervation, and the want of them throughout the ſummer-months muſt be regretted; the red is aſſumed in ſucceſſion by the bud, the bloſſom, the berry, the bark, and the leaf. Sometimes it profuſely overſpreads, at other times it dimly tinges the plant; and a *reddiſh green* is generally the hue of thoſe plants, on which it laſts long, or frequently returns. Admitting this, at leaſt for many months in the year, among the characteriſtic diſtinctions, a large piece of red green, with a narrow edging of dark green along the the further ſide of it, and beyond that a piece of light green larger than the firſt, will be found to compoſe a beautiful maſs. Another, not leſs beautiful, is a yellow green neareſt to the eye, beyond that a light green, then a brown green, and laſtly a dark green. The dark green muſt be the largeſt, the light green the next in extent, and the yellow green the leaſt of all. From theſe combinations, the agreements between particular tints may be known. A light green may be next either to a yellow or a brown green, and a brown to a dark green, all in conſiderable quantities; and a little rim of dark green may border on a red or a light green. Further obſervations will ſhew, that the yellow, and the white greens, connect eaſily; but that a large quantity of the light, the yellow, or the white greens, does not mix well with a large quantity alſo of the dark green; and that to form a pleaſing maſs, either the dark green muſt be reduced to a mere edging, or a brown or an intermediate green muſt be interpoſed.

In maſſing theſe tints, an attention muſt be conſtantly kept up to their *forms*, that they do not lie in large ſtripes one beyond another; but that either they be quite intermingled, or, which is generally more pleaſing, that conſiderable pieces of different tints, each a beautiful figure, be, in different proportions, placed near together. Exactneſs in the ſhapes muſt not be attempted, for it cannot be preſerved; but if the great outlines be well drawn, little variations, afterwards occaſioned by the growth of the plants, will not ſpoil them. While the union of tints is productive of pleaſing effects, ſtrong effects may, on the other hand, be ſometimes produced by their *diſagreements*. Oppoſites, ſuch, for inſtance, as the dark and light greens, in large quantities cloſe together, break to pieces the ſurface upon which they meet; every oppoſition of tints is a break in a continued line; the depth of receſſes, may be deepened by darkening the greens as they retire; a tree which ſtands out from a plantation, may be ſeparated by its tint as much as by its poſition; the appearance of ſolidity or airineſs in plants depends not ſolely on the thickneſs or thinneſs, but partly on the colour of the leaves; clumps at a diſtance may be rendered more or leſs diſtinct by their greens; and the fine effect of a dark green tree, or groupe of trees, with nothing behind it but the ſplendor of a morning or the glow of an evening ſky, cannot be unknown to any who was ever delighted with a picture of Claude, or with the more beautiful originals in nature. Another effect attainable by the aid of the different tints, is founded on the firſt principles of *perſpective.* Objects grow faint as they retire from the eye; a detached clump, or a ſingle tree, of the lighter greens, will therefore, ſeem farther off than one equidiſtant of a darker hue; and a regular gradation from one tint to another will alter the apparent length of a continued plantation, according as the dark or light greens begin the gradation. Experiments will ſupport the principle, if they are made on plantations not very ſmall, nor too cloſe to the eye; the ſeveral parts may then be ſhortened or lengthened, and the variety of the outline be improved by a judicious arrangement of greens. Other effects ariſing from mixtures of greens will occaſionally preſent themſelves in the *diſpoſition* of a wood, which is the next conſideration.

Of the ſeveral Species of Wood.

Wood, as a general term, comprehends all trees and ſhrubs in whatever diſpoſition; but it is ſpecifically applied in a more limited ſenſe, and in that ſenſe we ſhall now uſe it. Every plantation muſt be either a *wood*, a *grove*, or a *clump.* A wood is compoſed both of trees and underwood; covering a conſiderable ſpace. A grove conſiſts of trees without underwood. A clump differs from either only in extent; it may be either cloſe or open; when cloſe, it is ſometimes called a *thicket*; when open, a *groupe of trees*; but both are equally clumps, whatever may be the ſhape or ſituation. One of the nobleſt objects in nature is the *ſurface of a large thick wood,* commanded from an eminence, or ſeen from below, hanging on the ſide of a hill. The latter is generally the more intereſting object. Its aſpiring ſituation gives it an air of greatneſs; its termination is commonly the horizon; and, indeed, if it is deprived of that ſplendid boundary, if the brow appears above it, (unleſs ſome very peculiar effect characteriſes that brow), it loſes much of its magnificence: ſingle trees in the midſt of a wood, though ſeldom of uſe to diverſify a ſurface, often deſerve particular regard as individuals, and are important to the greatneſs of the whole. A few large trees, not eminent above all about them, but diſtinguiſhed by ſome ſlight ſeparation, are noble objects in themſelves; become the ſituation; and ſerve as a meaſure to the reſt. On the ſame principle, trees which are thin of boughs and of leaves, thoſe whoſe branches tend upwards, or whoſe heads riſe in ſlender cones, have an appearance more of airineſs than of importance; and are blemiſhes in a wood, where greatneſs is the prevailing idea. Thoſe, on the contrary, whoſe branches hang directly down, have a breadth of head, which ſuits with ſuch a ſituation, though their own peculiar beauty be loſt in it. Theſe decorations are natural graces, which never derogate from greatneſs; and a number of ſhades playing on the ſurface, over a variety of thoſe beautiful forms into which it may be caſt, enliven that ſameneſs, which, while it prevails, reduces the merit of one of the nobleſt objects in nature to that of mere ſpace. To fill that ſpace with objects of beauty, to delight the eye after it his been ſtruck, to fix the attention where it has been caught, and to prolong aſtoniſhment into admiration, are purpoſes not unworthy of the greateſt deſigns; and, in the execution, productive of embelliſhments, which in ſtyle are not unequal to ſcenes of richneſs and magnificence.

The Surface of a Romantic Wood.

When, in a romantic ſituation, very broken ground is overſpread with wood, it may be proper on the ſurface of the wood, to mark the inequalities of the ground. *Rudeneſs*, not greatneſs, is the prevailing idea; and a choice directly the reverſe of that which is productive of unity, will produce it. Strong contraſts, even oppoſitions, may be eligible; the aim is rather to disjoint than to connect; a deep hollow may ſink into dark greens; an abrupt bank may be ſhewn by a riſing ſtage of aſpiring trees, a ſharp ridge by a narrow line of conical ſhapes; firs are of great uſe upon ſuch occaſions; their tint, their form, their ſingularity, recommend them. It is but a number of regularities put together in a diſorderly manner, and equally diſtant from the beautiful both of art and of nature. The true beauty of an outline conſiſts more in breaks than in ſweeps; rather in angles than in rounds; in variety, not in ſucceſſion. The parts muſt not be multiplied till they are too minute to be intereſting, and ſo numerous as to create confuſion. A few large parts ſhould be ſtrongly diſtinguiſhed into their forms, their directions, and their ſituations; each of theſe may afterwards be decorated with ſubordinate varieties.

Character of Groves.

The character of a grove is *beauty*. Fine trees are lovely objects: a grove is an aſſemblage of them; in which every individual retains much of its own peculiar elegance, and whatever it loſes is transferred to the ſuperior beauty of the whole. To a grove, therefore, which admits of endleſs variety in the diſpoſition of the trees, differences in their ſhapes and their greens are ſeldom very important, and ſometimes they are detrimental. But the ſurface and the outline are not the only circumſtances to be attended to. Though a grove be beautiful as an object, it is beſides delightful as a ſpot to walk or to ſit in; and the choice and the diſpoſition of the trees for effects within, are therefore a principal conſideration. A regular plantation gives no ſatisfaction, becauſe we know that the ſame number of trees might be more beautifully arranged: neither in wild nor in cultivated nature do we ever ſee trees equi-diſtant from each other: that regularity belongs to art alone. The diſtances, therefore, ſhould be ſtrikingly different: the trees ſhould gather into groupes, or ſtand in various irregular lines, and deſcribe ſeveral figures: the intervals between them ſhould be contraſted both in ſhape and in dimenſions: a large ſpace ſhould in ſome places be quite open; in others the trees ſhould be ſo cloſe together, as hardly to leave a paſſage between them; and in others as far apart as the connection will allow. In the forms and the varieties of theſe groupes, theſe lines, and theſe openings, principally conſiſts the interior beauty of a grove. If the planter has not the patience to wait till the trees arrive at their full growth, it is poſſible to ſecure both a preſent and future effect, by fixing firſt on a diſpoſition which will be beautiful when the trees are large, and then intermingling another which is agreeable while they are ſmall. Theſe occaſional trees are hereafter to be taken away; and muſt be removed in time, before they become prejudicial to the others.

Uſes and Situations of Clumps.

The occaſions on which independent clumps may be applied, are many. They are often deſirable as beautiful objects in themſelves; they are ſometimes neceſſary to break an extent of lawn, or a continued line, whether of ground or of plantation; but on all occaſions a jealouſy of art conſtantly attends them, which irregularity in their figure will not always alone remove. Though elevations ſhew them to advantage, yet a hillock evidently thrown up on purpoſe to be crowned with a clump, is artificial to a degree of diſguſt: ſome of the trees ſhould therefore be planted on the ſides, to take off that appearance. The ſame expedient may be applied to clumps placed on the brow of a hill, to interrupt its ſameneſs: they will have leſs oſtentation of deſign, if they are in part carried down either declivity. The objection already made to planting many along ſuch a brow, is on the ſame principle: a ſingle clump is leſs ſuſpected of art; if it be an open one, there can be no finer ſituation for it, than juſt at the point of an abrupt hill, or on a promontory into a lake or a river. It is in either a beautiful termination, diſtinct by its poſition, and enlivened by an expanſe of ſky or of water about and beyond it. Such advantages may balance little defects in its form: but they are loſt if other clumps are planted near it; art then intrudes, and the whole is diſpleaſing. The figure of the glade, of the lawn, or of the wood, are principally to be attended to: the fineſt clumps, if they do not fall eaſily into the great lines, are blemiſhes; their connections, their contraſts, are more important than their forms. A line of clumps, if the intervals be cloſed by others beyond them, has the appearance of a wood, or of a grove; and in one reſpect the ſemblance has an advantage over the reality. In different points of view, the relations between the clumps are changed, and a variety of forms is produced, which no continued wood or grove, however broken, can furniſh. Theſe forms cannot all be equally agreeable; and too anxious a ſolicitude to make them every where pleaſing, may, perhaps, prevent their being ever beautiful.

SECT. III. WATER.

In conſidering the ſubjects of gardening, ground and wood firſt preſent themſelves; water is the next; which, though not abſolutely neceſſary to a beautiful compoſition, yet occurs ſo often, and is ſo capital a feature, that it is always regretted when wanting; and no large place can be ſuppoſed, a little ſpot can hardly be imagined, in which it may not be agreeable. It accommodates itſelf to every ſituation; is the moſt intereſting object in a landſcape, and the happieſt circumſtance in a retired receſs; captivates the eye at a diſtance, invites approach, and is delightful when near: it refreſhes an open expoſure; it animates a ſhade; cheers the dreerineſs of a waſte, and enriches the moſt crowded view. In form, in ſtyle, and in extent, it may be made equal to the greateſt compoſitions, or adapted to the leaſt: it may ſpread in a calm expanſe to ſoothe the tranquility of a ſpaceful ſcene; or hurrying along a devious courſe, add ſplendor to a gay, and extravagance, to a romantic ſituation. So various are the characters which water can aſſume, that there is ſcarcely an idea in which it may not concur, or an impreſſion which it cannot enforce.

A gently murmuring rill, clear and ſhallow, juſt gurgling, juſt dimpling, impoſes ſilence, ſuits with ſolitude, and leads to meditation; a briſker current, which wantons in little eddies over a bright ſandy bottom, or babbles among pebbles, ſpreads cheerfulneſs all around: a greater rapidity, and more agitation, to a certain degree are animating; but in exceſs, inſtead of wakening, they alarm the ſenſes: the roar and the rage of a torrent, its force, its violence, its impetuoſity tend to inſpire terror.

A ſtraight line of conſiderable length may find a place in that variety; and it is ſometimes of ſingular uſe to prevent the ſemblance of a river in a channel formed between iſlands and the ſhore. But no figure perfectly regular ought ever to be admitted; it always ſeems artificial, unleſs its ſize abſolutely forbid the ſuppoſition. A ſemicircular river, though the ſhape be beautiful, is not natural, and any rectilinear figure is abſolutely diſguſtful; but if one line be curved, another may ſometimes be almoſt ſtraight, the contraſt is agreeable. A ſtraight piece of water has the appearance of a cut canal, unleſs great breadth, a bridge acroſs it, and ſtrong contraſts between the objects on the banks, diſguiſe the formality. A very ſmall curvature obliterates every idea of art and ſtagnation; and a greater is often miſchievous; for an acceſs of deviation from a ſtraight towards a circular line, ſhortens the view, weakens the idea of continuation, and though not chargeable with ſtiffneſs, yet approaches to regularity; whereas the line of beauty keeps at a diſtance from every figure which a rule can determine or a compaſs deſcribe.

Caſcades.

The roar of caſcade belongs only to larger ſtreams; but it may be produced by a rivulet to a conſiderable degree, and attempts to do more have generally been unſucceſsful. A vain ambition to imitate nature in her great extravagancies betrays the weakneſs of art. A noble river, throwing itſelf headlong down a precipice, is an object truly magnificent, but the height, not the breadth, is the wonder: when it falls no more than a few feet, the regularity prevails; and its extent only ſerves to expoſe the vanity of affecting the ſtyle of a cataract in an artificial caſcade. Several little falls in ſucceſſion are preferable to one great caſcade which in figure or in motion approaches to regularity. A great caſcade fills us with ſurpriſe: and the motion, the agitation, the rage, the froth, and the variety of the water, are finally the objects which engage the attention: for theſe a rivulet is ſufficient; and they may there be produced without that appearance of effort which raiſes a ſuſpicion of art.

Bridges.

To give to bridges their full effect, the connection between them and the river muſt be attended to: from the want of it, the ſingle wooden arch, now much in faſhion, ſeems to us generally miſplaced. Elevated without occaſion, ſo much above, it is totally detached from, the river: it is often ſeen ſtraddling in the air, without a glimpſe of the water to account for it: and the oſtentation of it as an ornamental object, diverts all that train of ideas which its uſe as a communication might ſuggeſt. The vaſtneſs of Walton bridge cannot without affectation be mimicked in a garden, where the magnificent idea of including the Thames under one arch is wanting, and where the ſtructure itſelf reduced to a narrow ſcale retains no pretenſions to greatneſs. Unleſs the ſituation make ſuch a height neceſſary, or the point of view be greatly above it, or wood or riſing ground inſtead of ſky behind it, fill up the vacancy of the arch, it ſeems an effort without a cauſe, forced and prepoſterous.

In wild and romantic ſcenes may be introduced a ruined ſtone-bridge, of which ſome arches may be ſtill ſtanding, and the loſs of thoſe which are fallen may be ſupplied by a few planks, with a rail, thrown over the vacancy. It is a pictureſque object; it ſuits the ſituation; and the antiquity of the paſſage, the care taken to keep it ſtill open though the original building is decayed, the apparent neceſſity which thence reſults for a communication, give it an impoſing air of reality. In every ſcene of magnificence; in ſome, where elegance chiefly prevails, a bridge with a colonnade, or other ornamental ſtructure upon it, is characteriſtically proper, and it has a peculiarity which recommends it to many ſituations.

SECT. IV. Rocks.

Mere rocks, unleſs they are peculiarly adapted to certain impreſſions, may ſurpriſe, but can hardly pleaſe: they are too far removed from common life, too barren, and unhoſpitable; rather deſolate than ſolitary, and more horrid than terrible. So auſtere a character cannot be long engaging, if its rigour be not ſoftened by circumſtances which may belong either to theſe or to more cultivated ſpots.

Deſcription of Middleton-Dale, near Chatſworth.

Middleton dale is a cleft between rocks, aſcending gradually from a romantic village, till it emerges, at about two miles diſtance, on the vaſt moor lands of the Peake. It is a diſmal entrance to a deſart: the hills above it are bare; the rocks are of a grey colour; their ſurfaces are rugged, and their ſhapes ſavage; frequently terminating in craggy points, ſometimes reſembling vaſt unwieldy bulwarks, or riſing in heavy buttreſſes one above another; and here and there a miſhappen maſs bulging out hangs lowering over its baſe. No traces of men are to be ſeen, except in a road which has no effect on ſuch a ſcene of deſolation, and in the lime-kilns conſtantly ſmoking on the ſide; but the labourers who occaſionally attend them live at a diſtance; there is not a hovel in the dale; and ſome ſcanty withering buſhes are all its vegetation: both theſe appearances make it probable, that Middleton-dale is a chaſm rent in the mountain by ſome convulſion of nature, beyond the memory of man, or perhaps before the iſland was peopled: the ſcene, though it does not prove the fact, yet juſtifies the ſuppoſition; and it gives credit to the tales of the country people, who, to aggravate its horrors, always point to a precipice, down which they ſay that a poor girl of the village threw herſelf head-long, in deſpair, at the neglect of the man whom ſhe loved; and ſhew a cavern, where a ſkeleton was once diſcovered, but of what wretch is unknown, his bones were the only memorial left of him. All the drearineſs however of the place, which accords ſo well with ſuch traditions, abates upon the junction of another valley, the ſides of which are ſtill of rock, but mixed and crowned with fine wood; and Middleton-dale becomes more mild by ſharing in its beauties: near this junction a clear ſtream iſſues from under the hill, and runs down the dale, receiving as it proceeds many rills and ſprings, all as tranſparent as itſelf. The principal rivulet is full of little water-falls: they are ſometimes continued in ſucceſſion along a reach of conſiderable length, which is whitened with froth all the way; at other times the brook wreathes in frequent windings, and drops down a ſtep at every turn; or ſlopes between tufts of graſs, in a briſk, though not a precipitant deſcent; when it is moſt quiet, a thouſand dimples ſtill mark its vivacity; it is every where active, ſometimes rapid, ſeldom ſilent, but never furious or noiſy: the firſt impreſſions which it makes are of ſprightlineſs and gaiety, very different from thoſe which belong to the ſcene all around; but by dwelling upon both, they are brought nearer together; and a melancholy thought occurs, that ſuch a ſtream ſhould be loſt in watering a waſte; the wilderneſs appears more forlorn which ſo much vivacity cannot enliven; as the idea of deſolation is heightened by reflecting that the

> Flower is born to bluſh unſeen,
> And waſte its ſweetneſs on the deſart air;

and that

> The nightingale attunes her notes,
> Where none are left to hear.

If ſuch a ſcene occurs within the precincts of a park or a garden, no expence ſhould be ſpared to meliorate the ſoil, wherever any ſoil can be found. Without ſome vegetation among the rocks, they are only an object of curioſity, or a ſubject of wonder: but verdure alone will give ſome relief to the drearineſs of the ſcene; and ſhrubs or buſhes, without trees, are a ſufficiency of wood: the thickets may alſo be extended by the creeping plants, ſuch as pyracantha, vines, and ivy, to wind up the ſides, or cluſter on the tops of the rocks; the licentious irregularity of wood and of rocks, and a fantaſtic conduct of the ſtreams, neither of which would be tolerated in the midſt of cultivation, become and improve romantic ſpots; even buildings, partly by their ſtyle, but ſtill more by their poſition, in ſtrange, difficult, or dangerous ſituations, diſtinguiſh and aggravate the native extravagancies of the ſcene.

In the choice and the application of theſe accompaniments, conſiſts all our power over rocks; they are themſelves too vaſt and too ſtubborn to ſubmit to our controul; but by the addition or removal of appendages, which we can command, parts may be ſhewn or concealed, and the characters with their impreſſions may be weakened or enforced: to adapt the accompaniments accordingly is the utmoſt ambition of art when rocks are the ſubject. Art may interpoſe to ſhew theſe large parts to the eye, and magnify them to the imagination, by taking away thickets which ſtretch quite acroſs the rocks, ſo as to diſguiſe their dimenſions; or by filling with wood the ſmall intervals between them, and thus, by concealing the want, preſerving the appearance of continuation. A thicket, on other occaſions, makes the rocks which riſe out of it ſeem larger than they are. If they ſtand upon a bank overſpread with ſhrubs, their beginning is at the leaſt uncertain; and the preſumption is, that they ſtart from the bottom.

Deſcription of Matlock Bath, in Derbyſhire.

Many of the circumſtances which have been mentioned concur at Matlock Bath, which is ſituated in a vale near three miles long, ſhut up at one end by a riſing moor, and at the other end by vaſt cliffs of rock: the entrance into it is hewn through one of them, and is indeed a noble rude portal to a ſcene of romantic magnificence. One ſide of the valley is a very high range of hill, rough with buſhes, and great blocks or ledges of ſtone. The other ſide is waſhed by the Derwent, and conſiſts chiefly of rocks; which, however, are often interrupted by ſteep declivities of green ſward, large thickets, and gentle deſcents of fine fields from the adjacent country. From ſome ſuch ſcene probably was conceived the wild imagination in ancient mythology of the giants piling Pelion upon Oſſa: in this, all is vaſt; height, breadth, ſolidity, boldneſs of idea, and unity of ſtyle, combine to form a character of greatneſs, conſiſtent throughout, not uniform, unmixed with any littleneſs, unallayed with any extravagance. The direction of the courſe of the river Derwent, is exactly ſuch as might be wiſhed; but it is a torrent, in which force and fury prevail: the caſcades in it are innumerable; before the water is recovered from one fall, it is hurried down another; and its agitation being thus increaſed by repeated ſhocks, it puſhes on with reſtleſs violence to the next, where it daſhes againſt fragments of rocks, or foams among heaps of ſtones which the ſtream has driven together. The colour all along is of a reddiſh brown; even the foam is tinged with a duſky hue: and where there are no caſcades, ſtill the declivity of the bed preſerves the rapidity, and a quantity of little breakers continue the turbulence of the current. Many of theſe circumſtances are certainly great: but a more temperate river, rolling its full tide along with ſtrength and activity, without rage; falling down one noble caſcade, inſtead of many; and if animated ſometimes by reſiſtance, yet not conſtantly ſtruggling with obſtructions; would have been more conſiſtent with the ſedate ſteady dignity of theſe noble piles of rock, whoſe brightneſs, together with the verdure of a vigorous and luxuriant, though humble vegetation, and ſome appearances of culture, give to the whole an air of cheerful ſerenity, which is diſturbed by the impetuoſity of the Derwent.

Rocks characteriſed by Terror.

This river would be better ſuited to a ſcene characteriſed by that terror, which the combination of greatneſs with force inſpires, and which is animating and intereſting, from the exertion and anxiety attending it. The terrors of a ſcene in nature are like thoſe of a dramatic repreſentation: they give an alarm; but the ſenſations are agreeable, ſo long as they are kept to ſuch as are allied only to terror, unmixed with any that are horrible and diſguſting. Art may therefore be uſed to heighten them, to diſplay the objects which are diſtinguiſhed by greatneſs, to improve the circumſtances which denote force, to mark thoſe which intimate danger, and to blend with all here and there a caſt of melancholy.

Rocks characteriſed by Fancy.

The different ſpecies of rocks often meet in the ſame place, and compoſe a noble ſcene, which is not diſtinguiſhed by any particular character: it is only when one eminently prevails, that it deſerves ſuch a preference as to exclude every other. Sometimes a ſpot, remarkable for nothing but its wildneſs, is highly romantic: and when this wildneſs riſes to fancy, when the moſt ſingular, the moſt oppoſite forms and combinations are thrown together, then a mixture alſo of ſeveral characters adds to the number of inſtances which there concur to diſplay the inexhauſtible variety of nature.

Deſcription of Dovedale, near Aſhbourne in Derbyſhire.

So much variety, ſo much fancy, are ſeldom found within the ſame extent as in Dovedale. It is about two miles in length, a deep, narrow, hollow valley: both the ſides are of rock; and the river Dove in its paſſage between them is perpetually changing its courſe, its motion and appearance. In one particular ſpot, the valley almoſt cloſing, leaves hardly a paſſage for the river, which pent up, and ſtruggling for a vent, rages and roars and foams, till it has extricated itſelf from the confinement. In other parts, the ſtream, though never languid, is often gentle; flows round a little deſart iſland, glides between bits of bulruſhes, diſperſes itſelf among tufts of graſs or of moſs, bubbles about a water-dock, or plays with the ſlender threads of aquatic plants which float upon the ſurface. The rocks all along the dale vary as often in their ſtructure, as the ſtream in its motion. In one place, an extended ſurface gradually diminiſhes by a broad baſe almoſt to an edge; in another, a heavy top hanging forwards, overſhadows all beneath: ſometimes many different ſhapes are confuſedly tumbled together; and ſometimes they are broken into ſlender ſharp pinnacles, which riſe upright, often two or three together, and often in more numerous cluſters. On this ſide of the dale, they are univerſally bare; on the other, they are intermixed with wood; and the vaſt height of both the ſides, with the narrowneſs of the interval between them, produces a further variety: the rocks never continue long in the ſame figure or ſituation, ſometimes they form the ſides of the valley, in precipices, in ſteeps, or in ſtages; ſometimes they ſeem to riſe in the bottom, and lean back againſt the hill; and ſometimes they ſtand out quite detached, heaving up in cumbrous piles, or ſtarting into conical ſhapes, like vaſt ſpars, an 100 feet high; ſome are firm and ſolid throughout, ſome are cracked, and ſome, ſplit and undermined, are wonderfully upheld by fragments apparently unequal to the weight they ſuſtain. The changes in their diſpoſition are infinite; every ſtep produces ſome new combination; they are continually croſſing, advancing, and retiring: the breadth of the valley is never the ſame 40 yards together: at the narrow paſs which has been mentioned, the rocks almoſt meet at the top, and the ſky is ſeen as through a chink between them: juſt by this gloomy abyſs, is a wider opening, more light, more verdure, more cheerfulneſs, than any where elſe in the dale. Nor are the forms and the ſituations of the rocks their only variety: many of them are perforated by large natural cavities, ſome of which open to the ſky, ſome terminate in dark receſſes, and through ſome are to be ſeen ſeveral more uncouth arches, and rude pillars, all detached, and retiring beyond each other, with the light ſhining in between them, till a rock far behind them cloſes the perſpective: the noiſe of the caſcades in the river echoes amongſt them; the water may often be heard at the ſame time gurgling near, and roaring at a diſtance; but no other ſounds diſturb the ſilence of the ſpot: the only trace of men is a blind path, but lightly and but ſeldom trodden, by thoſe whom curioſity leads to ſee the wonders they have been told of Dovedale. It ſeems, indeed, a fitter haunt for more ideal beings: the whole has the air of enchantment. The perpetual ſhifting of the ſcenes; the quick tranſitions, the total changes; then the forms all around, groteſque as chance can caſt, wild as nature can produce, and various as imagination can invent; the force which ſeems to have been exerted to place ſome of the rocks where they are now fixed immoveable, the magic by which others appear ſtill to be ſuſpended; the dark caverns, the illuminated receſſes, the fleeting ſhadows, and the gleams of light glancing on the ſides, or trembling on the ſtream; and the lonelineſs and the ſtillneſs of the place, all crowding together on the mind, almoſt realize the ideas which naturally preſent themſelves in this region of romance and of fancy.

ARTICLE II.

OF THOSE PROPERTIES IN THE OBJECTS OF NATURE, WHICH SHOULD DETERMINE THE CHOICE AND ARRANGEMENT OF THEM IN GARDENING.

SECT. I. OF ART.

The ſeveral conſtituent parts of the ſcenes of nature having now been conſidered, the next inquiry is into the particular principles and circumſtances which may affect them when they are applied to the ſubjects of gardening.

It has always been ſuppoſed, that *art* muſt then interfere: but art was carried to exceſs, when ground, wood, and water, were reduced to mathematical figure, and ſimilarity and order were preferred to freedom and variety. Theſe miſchiefs, however, were occaſioned, not by the uſe, but the perverſion of art; it excluded, inſtead of improving upon nature, and thereby deſtroyed the very end it was called in to promote. The truth is, that both propoſitions are erroneous: architecture requires ſymmetry; the objects of nature freedom; and the properties of the one cannot with juſtice be transferred to the other. But if, by the term, no more is meant than merely *deſign*, the diſpute is at an end: choice, arrangement, compoſition, improvement, and preſervation, are ſo many ſymptoms of art, which may occaſionally appear in ſeveral parts of a garden, but ought to be diſplayed without reſerve near the houſe: nothing there ſhould ſeem neglected; it is a ſcene of the moſt cultivated nature: it ought to be enriched, it ought to be adorned; and deſign may be avowed in the plan, and expence in the execution. Even regularity is not excluded: a capital ſtructure may extend its influence beyond its walls: but this power ſhould be exerciſed only over its immediate appendages. Works of ſculpture are not, like buildings, objects familiar in ſcenes of cultivated nature; but vaſes, ſtatues, and termini, are uſual appendages to a conſiderable edifice: as ſuch, they may attend the manſion, and treſpaſs a little upon the garden, provided they are not carried ſo far into it as to loſe their connection with the ſtructure.

Delightful Scene in a Picture.

The greateſt beauties of nature will often ſuggeſt the remembrance; for it is the buſineſs of a landſcape painter to ſelect them: and his choice is abſolutely unreſtrained; he is at liberty to exclude all objects which may hurt the compoſition; he has the power of combining thoſe which he admits in the moſt agreeable manner; he can even determine the ſeaſon of the year, and the hour of the day, to ſhew his landſcape in whatever light he prefers. The works therefore of a great maſter, are fine exhibitions of nature, and an excellent ſchool wherein to form a taſte for beauty: but ſtill their authority is not abſolute; they muſt be uſed only as ſtudies, not as models; for a picture and a ſcene in nature, though they agree in many, yet differ in ſome particulars, which muſt always be taken into conſideration, before we can decide upon the circumſtances which may be transferred from the one to the other. Painting, with all its powers, is ſtill more unequal to ſome ſubjects, and can give only *a faint, if any, repreſentation* of them: but a gardener is not therefore to reject them: he is not debarred from a view down the ſides of a hill, or a proſpect where the horizon is lower than the ſtation, becauſe he never ſaw them in a picture. Even when painting exactly imitates the appearances of nature, it is often weak in conveying the ideas which they excite, and on which much of their effect ſometimes depends.

Many more inſtances might be alledged to prove that the ſubjects for a painter and a gardener are not always the ſame. Some which are agreeable in the reality, loſe their effect in the imitation; and others, at the beſt, have leſs merit in a ſcene than in a picture. The term pictureſque is therefore applicable only to ſuch objects in nature, as, after allowing for the differences between the arts of painting and of gardening, are fit to be formed into groupes, or to enter into a compoſition where the ſeveral parts have a relation to each other, and in oppoſition to thoſe which may be ſpread abroad in detail, and have no merit but as individuals.

SECT. II. GENERAL SUBJECT.

Differences between a Farm, a Garden, a Park, and a Riding.

The ſcenes of nature are alſo affected by the general ſubject to which they are applied, whether that be a *farm*, a *garden*, a *park*, or a *riding*. Theſe may all indeed be parts of one place; they may border on each other; they may, to a degree, be intermixed: but each is ſtill a character of ſuch force, that, which-ever prevails, the propriety of all other characters, and of every ſpecies of beauty, muſt be tried by their conformity to this. And circumſtances neceſſary to one may be inconſiſtencies in the reſt: *elegance* is the peculiar excellence of a garden, *greatneſs* of a park, *ſimplicity* of a farm, and *pleaſantneſs* of a riding. Theſe diſtinguiſhing properties will alone exclude from the one, many objects which are very acceptable in the others; but theſe are not the only properties in which they eſſentially differ. A garden is intended to walk or to ſit in, which are circumſtances not conſidered in a riding; a park comprehends all the uſes of the other two; and theſe uſes determine the *proportional extent* of each. A large garden would be but a ſmall park; and the circumference of a conſiderable park but a ſhort riding. A farm is in ſome meaſure denominated from its ſize: if it greatly exceed the dimenſions of a garden, ſo that its bounds are beyond the reach of a walk, it becomes a riding.

Proſpects are agreeable to either of the four general ſubjects, but not equally neceſſary to all. In a garden, or in a farm, ſcenes within themſelves are often ſatisfactory; and, in their retired ſpots, an opening would be improper. A park is defective, if confined to its incloſure; a perpetual ſucceſſion of home-ſcenes, through ſo large an extent, wants variety; and fine proſpects are circumſtances of greatneſs; but they are not required in every part. By concealing, therefore, much of the proſpects, we deſtroy the amuſement of a riding. The view of the country ſhould not be hurt by the improvements of the road. In a garden, on the contrary, continuation of ſhade is very acceptable; and if the views be ſometimes interrupted, they may ſtill be caught from many points; we may enjoy them there whenever we pleaſe; and they would pall if conſtantly in ſight. The beſt ſituation for a houſe is not that which has the greateſt command; a cheerful look-out from the windows is all that the proprietor deſires. He is more ſenſible to the charms of the greater proſpects, if he ſees them only occaſionally, and they do not become inſipid by being familiar; for the ſame reaſon he does not wiſh for them in every part of his garden; and temporary concealments give them freſh ſpirit whenever they appear. But the views of a riding are not viſited ſo often, as thereby to loſe any of their effect. Plantations, therefore, in a country, ſhould be calculated rather for objects to look at, than for ſhades to paſs through. In a park, they may anſwer both purpoſes; but in a garden, they are commonly conſidered as places to walk or to ſit in.

A park is ſometimes not much hurt by being turned to account. The uſe of a riding is to lead from one beauty to another, and be a ſcene of pleaſure all the way; made avowedly for that purpoſe only, it admits more embelliſhment and diſtinction than an ordinary road through a farm. See the articles FARM, PARK, and RIDING.

Many gardens are nothing more than a *walk round a field*; that field is often raiſed to the character of a lawn; and ſometimes the incloſure is, in fact, a paddock. Whatever it be, the walk is certainly a garden; it is a ſpot ſet apart for pleaſure; it admits on the ſides a profuſion of ornament; it is fit for the reception of every elegance; and requires the niceſt preſervation; it is attended alſo with many advantages; may be made and kept without much expence; leads to a variety of points; and avails itſelf, in its progreſs, of the ſeveral circumſtances which belong to the incloſure it ſurrounds, whether they be the rural appurtenances of a farm, or thoſe more refined which diſtinguiſh a paddock. This ſpecies of garden, therefore, ſeems proper only for a place of a very moderate extent; if it be ſtretched out to a great length, and not mixed with other characters, its ſameneſs hurts that variety, which is its peculiar merit to diſcover. For a further account of this ſpecies of garden, ſee the article FARM ORNAMENTAL.

The ſides of a gravel walk muſt correſpond, and its courſe be in ſweeps gently bending all the way. It preſerves its form, though conducted through woods, or along glades, of the moſt licentious irregularity. But a graſs walk is under no reſtraint: the ſides of it may be perpetually broken, and the direction frequently changed: ſudden turns, however, are harſh; they check the idea of progreſs; they are rather diſappointments than varieties; and if they are ſimilar, they are in the worſt ſtyle of affectation. The line muſt be curved, but it ſhould not be wreathed: if it be truly ſerpentine, it is the moſt unnatural of any. It ought conſtantly to proceed; and wind only juſt ſo much, that the termination of the view may differ at every ſtep, and the end of the walk never appear; the thickets which confine it ſhould be diverſified with ſeveral mixtures of greens; no diſtinctions in the forms of the ſhrubs or the trees will be loſt, when there are opportunities to obſerve them ſo nearly; and combinations and contraſts without number may be made, which will be there truly ornamental. Minute beauties are proper in a ſpot precluded from great effects; and yet ſuch a walk, if it be broad, is by no means inſignificant; it may have an importance which will render it more than a mere communication. If the ſpace be divided into little ſlips, and made only a collection of walks, it forfeits all its advantages, loſes its character, and can have no other excellence than ſuch as it may derive from ſituation; whereas, by a more liberal diſpoſition, it may be made independent of whatever is external; and though proſpects are no where more delightful than from a point of view which is alſo a beautiful ſpot, yet if in ſuch a garden they ſhould be wanting, the elegant, pictureſque, and various ſcenes within itſelf, almoſt ſupply the deficiency.

SECT. III. SEASON.

Every ſcene and every object is in its higheſt beauty only at particular hours of the day; and every place is, by its ſituation or its character, peculiarly agreeable in certain months of the year. The *ſeaſons* thus become ſubjects of conſideration in gardening; and when ſeveral of thoſe circumſtances which diſtinguiſh a ſpot more at one time than another happen to concur, it will often be worth the while to add to their number, and to exclude ſuch as do not agree with them, for no other purpoſe than to ſtrengthen their effect at that particular time.

Occaſional Effects.

Different parts may thus be adapted to different ſeaſons, and each in its turn will be in perfection. But if the place will not allow of ſuch a ſucceſſion, ſtill *occaſional effects* may often be ſecured and improved, without prejudice to the ſcene when they are paſt, and without affectation while they continue. The temple of Concord and Victory at Stowe is one of the nobleſt objects that ever adorned a garden: but there is a moment when it appears in ſingular beauty. The ſetting ſun ſhines on the long colonnade which faces the weſt: all the lower parts of the building are darkened by the neighbouring wood; the pillars riſe at different heights out of the obſcurity. On the ſtatues which adorn the ſeveral points of the pediment, a deep ſhade is contraſted to ſplendor: the rays of the ſun linger on the ſide of the temple long after the front is overcaſt with the ſober hue of evening; and they tip the upper branches of the trees, or glow in the openings between them, while the ſhadows lengthen acroſs the Grecian valley. Such an occaſional effect, however tranſient, is ſo exquiſitely beautiful, that it would be unpardonable to neglect it. Others may be produced at ſeveral hours of the day; and the diſpoſition of the buildings, of the ground, the water, and the plantations, may often be accommodated to ſupport them. There are alſo occaſional effects in certain months, or only weeks, of the year, ariſing from ſome particular bloom, ſome occupation then carrying on, or other incident which may ſo far deſerve attention as to recommend a choice and arrangement of objects, which at that time will improve the compoſition, though at another they may have no extraordinary merit. The ſame conſiderations direct the choice alſo of their appendages; and in conſequence of a judicious aſſemblage and arrangement of ſuch as are proper for the purpoſe, the *ſpirit* of the morning, the *exceſs* of noon, or the *temperance* of evening, may be improved or corrected by the application of the ſcene to the ſeaſon.

In a *morning*, the freſhneſs of the air allays the force of the ſunbeams, and their brightneſs is free from glare: the moſt ſplendid objects do not offend the eye, nor ſuggeſt the idea of heat in its extreme; but they correſpond with the glitter of the dew which beſpangles all the produce of the earth, and with the cheerfulneſs diffuſed over the whole face of the creation. A variety of buildings may therefore be introduced to enliven the view; their colour may be the pureſt white, without danger of exceſs, though they face the eaſtern ſun; and thoſe which are in other aſpects ſhould be ſo contrived, that their turrets, their pinnacles, or other points, may catch glances of the rays, and contribute to illuminate the ſcene. The trees ought in general to be of the lighteſt greens, and ſo ſituated as not to darken much of the landſcape by the length of their ſhadows. Vivacity in the ſtreams, and tranſparency in a lake, are more important at this than at any other hour in the day: and an open expoſure is commonly the moſt delightful, both for the effect of particular objects, and the general character of the ſcene.

At *noon*, every expedient ſhould be uſed to correct the exceſs of the ſeaſon. Grottos, caves, and cells, agreeable circumſtances in a ſequeſtered receſs; and though the chill within be hardly ever tolerable, the eye catches only an idea of coolneſs from the ſight of them. Other buildings ought in general to be caſt into ſhade, that the glare of the reflection from them may be obſcured. The large expanſe of a lake is alſo too dazzling: but a broad river moving gently, and partially darkened with ſhadow, is very refreſhing; more ſo perhaps than a little rill, for the vivacity of the latter rather diſturbs the repoſe which generally prevails at midday. Every breeze then is ſtill; the reflection of an aſpen-leaf ſcarcely trembles on the water: the animals remit their ſearch of food, and man ceaſes from his labour: the ſteam of heat ſeems to oppreſs all the faculties of the mind, and all the active powers of the body; and any very lively motion diſcompoſes the languor in which we then delight to indulge. To hear, therefore, the murmurs of a brook purling underneath a thicket, or the echo of falling waters through a wood, is more agreeable than the ſight of a current; the idea conveyed by the ſound is free from any agitation: but if no other ſtream than a rill can be introduced, the refreſhment which attends the appearance of water muſt not be denied to the ſcene.

In the evening, all ſplendor fades: no buildings glare; no water dazzles. The calmneſs of a lake ſuits the quiet of the time: the light hovers there, and prolongs the duration of day. An open reach of a river has a ſimilar, though a fainter, effect: and a continued ſtream all expoſed, preſerves the laſt rays of the ſun along the whole length of its courſe, to beautify the landſcape: but a briſk current is not ſo conſiſtent as a lake with the tranquility of evening. And other objects ſhould in general conform to the temper of the time. Buildings of a duſky hue are moſt agreeable to it: but a very particular effect from a ſetting ſun will recommend thoſe of a brighter colour; and they may alſo be ſometimes uſed, among other means, to correct the uniformity of twilight. No contraſt of light and ſhade can then be produced: but if the plantations, which by their ſituation are the firſt to be obſcured, be of the darkeſt greens, if the buildings which have a weſtern aſpect be of a light colour, and if the management of the lawns and the water be adapted to the ſame purpoſe, a diverſity of tints will be preſerved long after the greater effects are faded.

Of the Seaſons of the Year.

The delights, however, of the morning and evening are confined to a few months of the year; at other times, two or three hours before, and as much after, noon, are all that are pleaſant; and even then the heat is ſeldom ſo extreme as to require relief from its exceſs. The diſtinctions, therefore, between the three parts of the day may in general be reckoned among the characteriſtics of ſummer. A degree of importance may be given even to the flowers of a border. By collecting into one ſpot ſuch plants as have at the ſame time their accidental colours, as conſiderable effects may be produced from the concurrence of many little cauſes. Thoſe which ariſe from bloom are the moſt ſtriking, and the moſt certain; and they abound chiefly in the

Spring.

Bloom is a characteriſtic of the ſeaſon; and a villa near town, which is deſigned principally for that time of the year, is not adapted to its uſe if this property be not amply provided for. In ſuch a place, therefore, ſhrubberies, with an intermixture of flowers, are peculiarly proper. In the ſummer months, a border between the thicket and the greenſward, breaks the connexion, and deſtroys the greater effect: it ought not to be then introduced, except to enliven ſmall ſpots, and as the beſt ſpecies of parterre. But in the ſpring, the thicket is hardly formed: its principal beauty is bloom; and flowers before or among the ſhrubs, are agreeable to the character of the ſeaſon. An orchard, which at other times, is unſightly, is then delightful; and if a farm joins to the garden, ſhould not be forgotten. But evergreens appear in general to great diſadvantage. Moſt of them have a ruſſet or a dark hue, which ſuffers by being contraſted to the lively verdure of the young ſhoots on the deciduous trees. That verdure is, however, ſo light, and ſo univerſal, that effects, from a mixture of greens, can ſeldom be produced; and thoſe which depend on a depth of ſhade will often be diſappointed. But buildings, views of water, and whatever tends to animate the ſcene, accord with the ſeaſon; which is full of youth and vigour, freſh and ſprightly, brightened by the verdure of the herbage and the woods, gay with bloſſoms and flowers, and enlivened by the ſongs of the birds in all their variety, from the rude joy of the ſky lark, to the delicacy of the nightingale.

Summer.

The plantations ſhould be calculated at leaſt as much for places of retreat, as for ornaments of the view; and a continuation of ſhade be preſerved, with very few and ſhort interruptions, through all the parts of the garden. Communications by gravel walks are of leſs conſequence: they do not ſuggeſt that idea of utility which attends them in winter or autumn; and their colour, which in ſpring is a lively contraſt to the verdure through which it winds, is in the intemperate blaze of a ſummer day glaring and painful. They ſhould, therefore, be concealed as much as poſſible; and the other conſiderations which belong to the noon-tide hour ſhould be particularly attended to, at the ſame time that the delights of the morning and the evening are alſo liberally provided for. But, excluſive of all ſuch incidental circumſtances, the ſcenes of nature in general appear at this ſeaſon to the greateſt advantage: though the bloom of the ſpring be faded, and the verdure of the herbage may be ſometimes affected by drought; yet the richneſs of the produce of the earth, and the luxuriance of the foliage in the woods; the ſenſations of refreſhment, added to the beauty of water; the ideas of enjoyment which accompany the ſight of every grove, of every building, and every delightful ſpot; the characters of rocks, heightened by their appendages, and unallayed by any diſconſolate reflections; the connexion of the ground with the plantations, the permanency of every teint, and the certainty of every effect; all concur in ſummer, to raiſe the ſeveral compoſitions to their higheſt ſtate of perfection.

Autumn.

But maturity is always immediately ſucceeded by decay: flowers bloom and fade; fruits ripen and rot; the graſs ſprings and withers; and the foliage of the woods ſhoots, thickens, and falls. In the latter months of *autumn*, all nature is on the decline; it is a comfortleſs ſeaſon: not a bloſſom is left on the ſhrubs or the trees; and the few flowers which ſtill remain in the borders, dripping with wet and ſickening even as they blow, ſeem hardly to ſurvive the leaves of the plant which are ſhrivelling beneath them. But the change of the leaf precedes the fall; and thence reſults a variety of colours, ſuperior to any which the ſpring or the ſummer can boaſt of. To ſhew and to improve that variety ſhould be principally attended to, in a place, ſuch as a ſporting ſeat, which is frequented only in autumn. It appears to advantage, whenever the ſurface of a wood can be commanded; and it may be produced to a conſiderable degree, even in a ſhrubbery, if the plants are ſo diſpoſed as to riſe in gradation one behind another. By obſerving the tints which the leaves aſſume when they change, the choice may be directed to the improvement of their variety; and by attending to the times when they fall, a ſucceſſion of theſe tranſitory beauties may be provided, from the earlieſt to the lateſt in the ſeaſon. Many ſhrubs and trees are at this time alſo covered with berries, which furniſh ſtill further varieties of colour; both evergreens and deciduous plants abound with them; and the verdure of the former is beſides a welcome ſubſtitute to that which is daily fading away. Open buildings, airy groves, views of water, and the other delights of ſummer, now loſe their charms; and more homely circumſtances of comfort and convenience are preferable to all their beauties.

A place which is the reſidence of a family all the year is very defective, if ſome portion of it be not ſet apart for the enjoyment of a fine day, for air, and exerciſe, in *winter*. To ſuch a ſpot ſhelter is abſolutely eſſential; and evergreens being the thickeſt covert, are therefore the beſt; their verdure alſo is then agreeable to the eye; and they may be arranged ſo as to produce beautiful mixtures of greens, with more certainty than deciduous trees, and with almoſt equal variety; they may be collected into a wood; and through that wood gravel-walks may be led, along openings of a conſiderable breadth, free from large trees which would intercept the rays of the ſun, and winding in ſuch a manner as to avoid any draft of wind, from whatever quarter it may blow. The few hours of cheerfulneſs and warmth which its beams afford are ſo valuable, as to juſtify the ſacrifice even of the principles of beauty to the enjoyment of them; and therefore no objections of ſameneſs or formality can prevail againſt the pleaſantneſs of a ſtraight walk, under a thick hedge or a ſouth wall. The eye may, however, be diverted from the ſkreen, by a border before it, where the aconite and the ſnowdrop, the crocus and hepatica, brought forward by the warmth of the ſituation, will be welcome harbingers of ſpring; and on the oppoſite ſide of the walk, little tufts of lauruſtines, and of variegated evergreens, may be planted. The ſpot thus enlivened by a variety of colours, and even a degree of bloom, may be ſtill further improved by a green-houſe. The entertainment which exotics afford peculiarly belongs to this part of the year; and if amongſt them be interſperſed ſome of our earlieſt flowers, they will there blow before their time, and anticipate the gaiety of the ſeaſon which is advancing. The walk may alſo lead to the ſtoves, where the climate and the plants are always the ſame. And the kitchen-garden ſhould not be far off; for that is never quite deſtitute of produce, and always an active ſcene; the appearance of buſineſs is alone engaging; and the occupations there are an earneſt of the happier ſeaſons to which they are preparative. By theſe expedients even the winter may be rendered cheerful in a place, where ſhelter is provided againſt all but the bittereſt inclemencies of the ſky, and agreeable objects and intereſting amuſements are contrived for every hour of tolerable weather.

Extent and Study of Gardening.

To conclude: Whatever contributes to render the ſcenes of nature delightful, is amongſt the ſubjects of gardening; and animate as well as inanimate objects, are circumſtances of beauty or character. Several of theſe have been occaſionally mentioned; others will readily occur; and nothing is unworthy of the attention of a gardener, which can tend to improve his compoſitions, whether by immediate effects, or by ſuggeſting a train of pleaſing ideas. The whole range of nature is open to him, from the parterre to the foreſt; and whatever is agreeable to the ſenſes or the imagination, he may appropriate to the ſpot he is to improve: it is a part of his buſineſs to collect into one place, the delights which are generally diſperſed through different ſpecies of country. But in this application, the genius of the place muſt always be particularly conſidered: to force it, is hazardous; and an attempt to contradict it, is always unſucceſsful. The beauties peculiar to one character, cannot be transferred to its oppoſite: even where the characters are the ſame, it is difficult to copy directly from the one into the other; and by endeavouring to produce a reſemblance of a ſcene which is juſtly admired, the proper advantages of the place are often neglected for an imitation much inferior to the original. The excellence of the latter probably depends on the happy application of the circumſtances to the ſubject; and the ſubjects of both are never exactly alike. The art of gardening, therefore, is not to be ſtudied in thoſe ſpots only where it has been exerciſed; though they are in this country very numerous, and very various. Yet all together they contain but a ſmall proportion of the beauties which nature exhibits: and unleſs the gardener has reſtored his mind with ideas from the infinite variety of the country at large, he will feel the want of that number which is neceſſary for choice; he will have none ready to apply to the ſubject immediately before him; and will be reduced to copy an imitation. But improved places are of ſingular uſe to direct the judgment in the choice, and the combinations of the beauties of nature: an extenſive knowledge of them is to be acquired in the country where they caſually occur; diſcernment of their excellencies, and a taſte for the diſpoſition of them, is to be formed in places where they have been ſelected, and arranged with deſign.

ARTICLE III.

MONTHLY KALENDAR OF ORNAMENTAL FLOWERS, SHRUBS, &C. WITH PARTICULAR DIRECTIONS FOR CULTIVATING AND PRESERVING THEM.

JANUARY.

Great care ſhould be taken to protect the choiceſt flowers at this unfavourable ſeaſon.

Auriculas. — The beſt auriculas in pots ſhould be well protected from exceſſive rains, ſnow, or ſharp froſts; all of which would injure them. The choiceſt varieties of theſe plants ſhould always be removed in their pots, about the end of October, or beginning of November, and placed in frames, or in a bed arched over with hoops, in a warm dry ſituation in the full ſun, where they can be occaſionally covered when the weather is unfavourable; but let the covers be conſtantly off when the weather is mild and dry.

Planting Ranunculuſes, Anemones, &c. — Plant ranunculuſes and anemones, in mild dry open weather, if you have any now out of the ground: theſe now planted will ſucceed thoſe which were put in the ground in October or November. For the particular method of preparing the beds, and planting the roots, ſee the work of *September* and *October*.

Planting Tulips. — Tulips, if you have any out of the ground, ſhould now be planted the firſt ſettled open weather, to blow late, and to ſucceed thoſe planted in laſt autumn. Let this work be done as ſoon as the weather will permit, for if theſe roots are kept much longer out of the ground, they will blow very poorly.

Planting Crocuſes. — Any ſorts of crocuſes may ſtill be planted for an early ſpring bloom, if dry mild weather; generally planting them along the edges of the flower borders next the walks, and in flower beds, &c. commonly within five or ſix inches of the edge; though thoſe deſigned for the borders appear to greater advantage when diſpoſed to ſmall patches, than in a continued row. Draw a ſmall circle with your finger, about four or five inches diameter; in the middle plant one root, and plant three or four round the edge of the circle: about twenty inches, or two or three feet farther, make another circle, and plant the roots as above; and ſo proceed to the end of the border, &c. obſerving, if you have different kinds, to plant each ſort ſeparate; that is, if you plant the firſt patch with yellow crocuſes, plant the next with blue, and ſo proceed with others of different ſorts.

Planting various Sorts of Bulbs. — Jonquils, narciſſuſes, hyacinths, bulbous iris, crown imperials, or any other kind of bulbous flower roots, that yet remain above ground, ſhould now be planted as ſoon as the weather will permit. Mild dry weather muſt be choſen to plant theſe, and all other kinds of bulbous roots, and ſee that the ground is not too wet. When it is intended to plant any of the common ſorts of the above, or other kinds of bulbous roots, in the borders, it will be the beſt way to plant them in little clumps or patches, in the manner mentioned above for the common tulips, ranunculuſes, &c.

Planting Flowering Shrubs. — In ſettled open weather, you may now plant, where wanted, moſt ſorts of hardy flowering ſhrubs. Such as roſes, honey ſuckles, lilacs, and ſyringas, althea and ſpiræa frutex, gelder-roſe, Perſian lilacs, laburnums, privets, and jaſmines, the cinquefoil ſhrub, and bladder-ſcna, the double hawthorn, double-bloſſom cherry, and dwarf almond, with double and ſingle flowers, the mezereon and double-flowering peach, with the double and ſingle ſweet-briar, flowering raſpberry, and double bramble; and many other ſuch like hardy kinds of ſhrubs may at this time be tranſplanted, provided the weather be any thing mild.

Tranſplant Suckers for Propagation. — Tranſplant ſuckers from the roots of roſes, lilacs, ſpiræas, ſyringas, and other ſhrubs, to raiſe a ſupply of new plants; for by ſuckers many ſorts of ſhrubs may be propagated: let theſe ſuckers be taken off carefully, with roots to each, and planted in rows eighteen inches aſunder; they will make good plants in two years time.

Propagating by Cuttings. — Cuttings of the young ſhoots of many ſorts of hardy deciduous ſhrubs, may alſo now be planted in open weather, eſpecially towards the latter end of the month, and they will ſucceed, take root in ſpring and ſummer, ſhoot at top, and form good rooted young plants by next autumn.

FEBRUARY.

Tender Annual Flowers. — About the middle, or towards the latter end of this month, it will be time to begin to prepare for ſowing ſome of the more curious ſorts of tender annuals. The choiceſt kinds are, the double balſams, cockſcombs, and tricolors, the globe amaranthus, marvel of Peru, diamond ficoides, or ice plant, egg plant, ſtramonium, browallia, &c. All theſe require the aſſiſtance of a hot-bed to bring them forward, in order that they may blow early, and in ſome tolerable perfection. When the plants appear, admit freſh air to them every day, when the weather is any thing mild; and let them have, now and then, little ſprinklings of water. Mind to cover the glaſſes every night with mats. But in raiſing the above annuals, if it is required to be ſaving of hot dung and trouble, and that if there are cucumber or melon hot beds at work, you may ſow them in pots, and place them in thoſe beds to raiſe the plants, which may be afterwards, tranſplanted in the ſame, or into a nurſery hot bed, to forward them to a proper ſize. See *April* and *May*. For the further management of theſe plants, and directions for ſowing a general ſupply of the ſame ſorts, together with ſeveral other tender annuals, ſee the work of the *Flower Garden*, in *March*.

Sow Ten-week Stocks and Mignonette. — The ten-week ſtock is a pretty annual; none make a more agreeable appearance in the borders or clumps, and it continues a long time in bloom; and the mignionette imparts a ſweet odour. It is now time, about the beginning, and towards the middle or latter end of this month, to ſow a little of the ſeed, to raiſe a few plants to blow early in the ſummer; and cover them with mats every night, and in bad weather. But if the above bed of natural earth could be covered with a frame and glaſs, or with hand-glaſſes, it would be a greater advantage to the plants. When the plants have been up about a month or ſix weeks, they ſhould be tranſplanted where they are to remain.

Hardy Annual Flower Seeds. — About the end of this month, if the weather be mild and dry, you may ſow many ſorts of hardy annual flower ſeeds in the borders, and other parts of the pleaſure garden. The ſorts proper to ſow at this time are lark ſpur and flos adonis, convolvulus, lupines, ſweet ſcented and Tangier peas, candy tuſt, dwarf-lychnis, Venus' looking glaſs, Lobel's catch fly, Venus' navel-wort, dwarf-poppy, nigella, annual ſun-flower, oriental mallow, lavatera, and hawk-weed, with many other ſorts. All the above ſeeds muſt be ſowed in the places where you intend the plants ſhall flower, in beds, borders, pots, &c. they muſt not be tranſplanted, for theſe ſorts will not ſucceed ſo well by that practice.

Blowing Annuals early in a Hot-houſe. — Any ſorts of deſireable annuals of moderate growth may be flowered early in a hot-houſe with little trouble, ſowing the ſeeds in pots and placing them in the bark-bed, &c.

Plant hardy fibrous-rooted Flowering Plants. — Now you may plant, where wanted, moſt ſorts of hardy fibrous-rooted flowering-plants both of perennials and biennials, ſuch as polyanthuſes, primroſes, London-pride, violets, double daiſies, double chamomile, thrift, gentianella, hepaticas, and ſaxifrage. Plant alſo roſe-campion, rockets, campanula, catch-fly, ſcarlet-lychnis, double feverfew, batchelor's-button, carnations, pinks, ſweet Williams, columbines, Canterbury-bells, monks-hood, Greek valerian, tree-primroſe, fox-glove, golden rods, perennial aſters, perennial ſun-flowers, holly-hocks, French honey-ſuckles, and many others. In planting the above, or any other ſorts, obſerve to diſpoſe them regularly, and intermix the different kinds in ſuch order as there may be a variety of colours, as well as a regular ſucceſſion of flowers in every part during the flowering ſeaſon.

Dreſs the Auricula Plants. — Now dreſs the auricula plants in pots, and add ſome freſh earth to them, provided it was not done the latter end of January. But this is now a more proper ſeaſon for performing this neceſſary work. The choiceſt kinds of auriculas in pots muſt now be treated with more than ordinary care, for their flower-buds will ſoon begin to appear; therefore the plants ſhould be defended from froſt and cold heavy rains; but every mild and dry day, the plants muſt be uncovered.

Sow Auricula and Polyanthus Seed. — Auricula and polyanthus ſeed may be ſown any time in this month; they will grow freely, and the plants from this ſowing will riſe well. Theſe ſeeds may be ſowed in a warm ſpot in the common ground, or in boxes or large pots filled with light rich earth; but the pots or boxes are often preferred, becauſe they can readily be removed to different ſituations, as the ſeaſon may require.

Tranſplant Carnation Plants. — Tranſplant the carnation plants in mild weather, which were raiſed laſt year from layers, into the large pots where you intend them to remain to blow, if not done in autumn; let this be done about the latter end of the month. When all is planted, ſet the plants in a ſituation well ſheltered from cold winds. Likewiſe plant carnations in the flower borders, in open weather, the middle or latter end of the month.

Tulips, Hyacinths, &c. — Defend the beds of the more curious or valuable tulips, hyacinths, anemones, and ranunculuſes, from froſt and exceſſive rains. This ſhould not now be omitted to the choiceſt kinds, when required to have them blow in their ultimate perfection; for although they are hardy enough, yet being protected this and next month from inclement weather, the blow will be much finer than if full expoſed; however, the more common kinds, either in beds or borders, may be permitted to take their chance.

Planting Flowering-Shrubs. — Moſt ſorts of flowering ſhrubs may now be ſafely removed any time in this month when it is open weather. But particularly the gelder roſe, ſyringas, laburnums, lilacs, honey-ſuckles, roſes, ſpiræas, and althæa-frutex, hypericum frutex, Perſian lilac, double-bloſſom cherry, double bramble, cornelian, cherry, and double hawthorn; you may likewiſe plant bladder-ſena, ſcorpion-ſena, privet, Spaniſh broom, jaſmines, ſumach, cityſuſes, and acacias, with many other ſorts of hardy deciduous ſhrubs, which may now be ſafely tranſplanted; for moſt ſorts will take root very freely and ſoon at this ſeaſon.

Planting Evergreens. — About the middle or any time in this month, if mild weather, you may tranſplant philyreas, alaternus, yews, evergreen-oaks, junipers, hollies, firs, cypreſs, cedars, laurels, lauruſtinus, pyracantha, arbutus, arbor-vitæ, ciſtuſes, with moſt other kinds of evergreens ſhrubs and trees.

Forcing early Flowers, &c. — Where early flowers are required, you may, in the beginning of this month, place various ſorts in pots, in hot-houſes, forcing-houſes, &c. now at work: and in hot-beds; ſuch as pots of pinks, carnations, ſweet-williams, anemones, ranunculuſes, narciſſus, early tulips, hyacinths, jonquils and any other ornamental and ſweet ſmelling ſpring flowers, both of the fibrous, bulbous, and tuberous rooted kinds, and they will blow early, and in good perfection. Likewiſe may have pots of roſes, and other deſireable flowering plants placed now in the hot-houſe, or any forcing department. About London the gardeners often force various flower plants for market, in boarded forcing frames, with the aſſiſtance of hot dung applied to the back part thereof; theſe frames being conſtructed of ſtrong inch and a half boards, made five, ſix, or ſeven feet high behind, the ends in proportion, and fronted with glaſs ſaſhes ſloping to the top of the back; may be four, five, or ſix, feet wide, at bottom, by one foot at top, the length at pleaſure; and in which placing pots of plants and ſhrubs, hot dung is piled againſt the back, and ends half a yard wide at bottom, and gradually narrowed to a foot width at top. The dung will throw in a fine heat, and the plants will flower agreeably at an early time; keeping up the heat when decreaſed by the application of freſh hot dung.

MARCH.

Sowing tender Annuals. — A hot bed may be made the beginning or any time of this month, to ſow the ſeeds of any kind of tender annual flowers in, ſuch as cockſcomb, amaranthus, tricolor, double balſamine, globe-amaranthus, ice plant, ſenſitive plant, &c. Remember they are not to remain in the hot-bed where raiſed, but are to be tranſplanted, ſome into pots, and ſome into the borders.

Sowing leſs tender Kinds of Annuals. — A ſlight hot-bed ſhould be made in the ſecond or third week of this month, wherein to ſow the ſeeds of the leſs-tender or hardier kinds of annual flowers. Such as the ſeeds of China aſter, India pink, marvel of Peru, balſam, palma Chriſti, capſicum mignonette, baſil, French and African marigolds, and ten-week ſtocks, chryſanthemum, tree and purple amaranthus, perſicarias, love-apple, ſcabiouſes, convolvulus major, ſtramoniums, and Chineſe hollyhocks, with ſeveral other ſorts. Obſerve, they are only to be raiſed in the hot-bed, and afterwards tranſplanted into the borders, &c. Or, for want either of a hot-bed or any of the other above mentioned conveniences, moſt of the ſeeds will ſucceed in a warm border next month, without any protection.

Hardy Annual Flowers. — Sow in the borders and other parts of the garden, the ſeeds of all ſorts of hardy annual flowers. The ſorts are large and dwarf annual ſun-flower, orential mallow, lavatera. Venice mallow, larkſpur, flos Adonis, ſweet ſultan, large fleſh-coloured and blue and yellow lupines. Sow alſo convolvulus major, ſweet-ſcented and Tangier peas, and naſturtiums. Likewiſe ſow the ſeeds of the Spaniſh nigella, purple and white candy-turf, Venus looking glaſs, Venus navel-wort, dwarf double poppy, Lobel's catchfly, dwarf annual lychnis, ſnails, caterpillars, convolvulus minor, and ſome others.

Auricula Plants. — If the auriculas in pots were not dreſſed laſt month, let it now be done early in this, as formerly directed. The fine auricula plants in pots ſhould now be guarded from too much wet, cold winds and froſt; ſuch weather being hurtful to their flower-buds, which are now in forwardneſs. The plants ſhould not be debarred from a warm and moderate ſhower of rain, which will now prove beneficial in promoting a free growth, and will ſtrenthen their advancing flower-buds. When the weather is dry, let them be refreſhed moderately with water at times, juſt enough to keep the earth a little moiſt about their roots.

Carnations. — The carnations which were raiſed from layers laſt year, and which are not yet planted into the large pots, borders, &c. where you intend them to flower, ſhould be planted therein the beginning of this month.

Planting Ranunculuſes and Anemones. — Finiſh planting all ranunculus and anemones; they will blow and make a fine appearance in May and June, after the early planted ones are gone. In dry weather, let the beds be frequently watered after the plants are up, and they will flower tolerably ſtrong.

Sowing various kinds of fibrous-rooted perennial and biennial Plants. Perennial and biennial flower-ſeeds, of moſt kinds, may be ſown towards the middle and latter end of the month. It is to be obſerved, that theſe kinds do not flower the ſame year they are ſown; but all the ſorts of them will flower ſtrong, and in the greateſt perfection the year after. As every one may not know the meaning of perennial and biennial plants, the perennial plants are theſe which continue many years, ſuch as everlaſting ſun-flower, perennial aſters, &c. The biennials are only of two years duration, being ſown one year, and flower and perfect their ſeeds the next, and ſoon after die: ſuch as the French honey-ſuckle, Canterbury bell-flower, &c. The kinds proper to be ſowed now, are carnations, pinks, ſweet-williams, wall-flowers, and ſtock July-flowers, of all ſorts. Sow alſo ſingle roſe-campion, catch-fly, ſcarlet lychnis, columbines, Greek valerian, ſcabiouſes, and Canterbury bells.

Tranſplanting Perennial Plants.—Where there are vacancies in any of the beds, borders, or other parts of the garden, they may now be filled up with many different kinds of flower plants, which will yet ſucceed, if planted ſoon in the month. The principal ſorts proper to plant now, are lychniſes, roſe-campions, rockets, catch-fly, campanulas, carnations, pinks, and ſweet-williams, wall-flowers, both double and ſingle; bachelors-buttons, and double fever-few; golden-rod, perennial ſun flowers, perennial aſters, and French honey-ſuckles; alſo columbines, Canterbury bells, monks-hood, fox-gloves, tree-primroſes, and moſt others of the like ſort. Plant alſo dwarf fibrous-rooted flowers, where wanted, in the borders; they will take root freely in a ſhort time. Such as polyanthuſes, auriculas, double daiſes, double chamomile, London pride, violets, hepaticus, thrift, primroſes, and gentianella; and any other of the like kinds, which ſucceed well, if planted any time this month. Give them ſome water when firſt planted, and at times till they are well rooted, and they will grow freely. Finiſh making plantations of all ſuch diciduous, ornamental, and foreſt-trees as are intended; moſt ſorts may ſtill be ſucceſsfully removed; but it is adviſeable to compleat it as ſoon as poſſible.

Planting Roſes.—Roſe-trees of moſt ſorts may ſtill be removed. Thoſe that are planted any time this month, will produce flowers the ſame year; but the ſooner they are planted the better they will take root, and the ſtronger they will flower. But by tranſplanting theſe ſhrubs late in the ſeaſon, you may obtain a late bloom. They may be planted in April and May, and they have flowered in July, Auguſt and September.

APRIL.

Tender Annual Flower Plants.—Make a new hot-bed, wherein to tranſplant the beſt kinds of early tender annuals, which were ſown in February, or any time in March. Such as cocks-combs, tricolors, double balſams, and globe aramanthus, egg plant, double ſtramonium, ſenſitive plant, and diamond ficoides, or ice plant. Where theſe curious plants are required in any tolerable degree of perfection, they muſt, at this time, be brought forward, by the aſſiſtance of a regular and due degree of hot-bed heat under frames and glaſſes; and where that is properly attended to, the plants will be large and beautiful by the end of June, or beginning of July. Remember to refreſh the plants often with moderate waterings, for it will greatly promote their growth.

Leſs tender Kinds of Annual Plants.—A ſlight hot-bed ſhould alſo be made now to prick ſome of the ſecond claſs or tender or hardier kinds of annual plants upon, which were raiſed laſt month. The principal ſorts are, marvel of Peru, China aſters, India pinks, ten-week ſtocks, mignonette, French and African marigolds, and chryſanthemums, likewſſe common balſams, baſil capſicums, and love apples, yellow ſweet ſultan, perſicaria, tree-amaranthus, purple amaranthus, prince's feather amaranthus, love-lies bleeding amaranthus, convolvulus major, ſcarlet convolvulus, palma-chriſti, ſcabious, alkekengi or winter-cherry, tobacco plant, zinnia, Indian corn, gourds in variety.

Hardy Annuals.—Hardy annual flower-ſeeds may yet be ſown in the borders, and other parts of this garden, in the places where they are to remain to flower, and in pots, &c. The ſorts which will yet ſucceed, are convolvulus major and minor; the Tangier and ſweet-ſcented peas, and the ſeeds of naſturtiums. Likewiſe lupines, larkſpur, flos Adonis, and common ſweet ſultans, poppy, hawk-weed, alſo Candy-tuft, dwarf lychnis, nigella or devil in a buſh, and Lobel's catchfly, Venus navel-wort and looking-glaſs, Virgin ſtock, ſnails, hedge-hogs, caterpillars, crown pea, winged pea, dwarf and large annual ſun-flower, perſicaria, belvidere, or ſummer cypreſs, lavateras, oriential mallow, blite, or ſtrawberry ſpinach, and other kinds of hardy annuals may ſtill be ſown.

Ten-week Stocks and Mignonette.—Sow ten-week ſtocks and mignonette, in any warm border, and rake them in, or ſow them thin in drills; they will readily grow; and be fit for tranſplantation in May and June.

Sowing Polyanthus.—Polyanthus ſeed may ſtill be ſown, and it will readily grow. But it muſt be ſown in the firſt or ſecond week in the month, otherwiſe the plants will not get ſtrength enough to flower next year. Such polyanthuſes as were raiſed laſt year from ſeed will many of them be now in bloom, and ſhould be carefully looked over, and the beſt flowers ſhould be marked, in order to their being tranſplanted to a place by themſelves.

Sowing Perennials and Biennials.—Sow ſuch perennial and biennial flower-ſeeds as are intended to be ſown this ſeaſon. The ſorts proper to ſow now, are wall-flowers, ſtock July flowers, ſweet williams, columbines, campanula, tree-primroſe, and Greek valerian; likewiſe the hollyhocks, and French honey-ſuckles, with the ſingle catch fly, roſe campion, ſcarlet lychnis, and the ſeeds of moſt other ſorts of hardy fibrous-rooted perennials and biennials.

Propagating Auriculas by Slips.—Auriculas are alſo increaſed by the off-ſets or ſuckers which riſe from the roots and ſides of the old plants; and this is a proper time to ſlip them off and plant them. They will now readily take root, and as the plants are now in bloom, you have the opportunity of ſeeing the flowers, and taking the ſlips from the plants of thoſe you like beſt, obſerving to ſlip them off cloſe with as much root as poſſible. The propagating theſe plants by ſlips is the only method to increaſe the ſorts you like; for the ſlips or ſuckers, will produce exactly the ſame kind of flowers as thoſe of the plants from whence they were taken; which is not ſo with the ſeedling plants; for the principal intention of floriſts, by raiſing them from ſeed, is to procure new ſorts; for there are always new varieties obtained from ſeed; and, perhaps, out of ſome hundreds ſo raiſed, not one prove exactly like the original from whence the ſeeds were ſaved.

Balm of Gilead.—This is the time to ſow ſeeds of balm of Gilead; theſe plants are of the perennial kind, and the ſtems and leaves remain all the year if protected in winter; are much eſteemed for the agreeable ſcent of their leaves, and make very proper furniture for the beds and borders of this garden, in ſummer; their ſtems riſing two or three feet high, they make a handſome appearance. The ſeed may be ſown either on a hot bed, or in a bed or border of natural earth, in a warm ſituation; but it will be moſt adviſeable to ſow them on a moderate hot bed, as the plants raiſed by this method will be brought greatly forward in the ſpring. The balm of Gilead may likewiſe be propagated by cuttings of the ſtalks, and that where they have been plants preſerved in frame, or in green houſes, all winter.

Planting Evergreens. Evergreen ſhrubs and trees of many ſorts, may yet be planted. But this ſhould be done in the firſt or ſecond week in the month. The ſorts which will yet bear removal, are hollies, bays, and yews; laurel, Portugal laurel, and lauriſtinus; phillyreas, alaternuſes, and pyracantha: cyſtiſuſes, and ciuſes, of all ſorts; alſo the arbutus, or ſtrawberry-tree; evergreen caſſine and magnolias; likewiſe pines, firs, cyprus, and junipers of all ſorts, cedars, &c.

Flowering Shrubs.—Where flowering ſhrubs are much wanted, they may yet be removed; but this muſt be done in the firſt or ſecond week of the month, or as ſoon as poſſible. The althea frutex, and Perſian lilac, will yet bear tranſplanting tolerably well: alſo the bladder and ſcorpion ſenas; honey ſuckles and jaſmines; ſyringas and laburnums; and moſt other hardy ſhrubs and trees.

MAY.

Continue to defend the beds of the more curious and capital kinds of hyacinths, and tulips now in flower, from the full ſun, heavy rains, cold nights, and all inclement weather; and alſo the choice kinds of ranunculuſes and anemones, which are now in bloom. Where this ſhading and ſheltering theſe kinds of flowers is duly practiſed, it will preſerve them a long time in their fulleſt beauty, at leaſt a fortnight or three weeks longer than if they were to be fully expoſed; and they will alſo be much finer.

Hyacinths paſt Flowering.—When hyacinths are paſt flowering, and the leaves juſt beginning to decay, let the roots then be taken up; but in particular the fine double kinds. As ſoon as they are taken up they ſhould be ſpread to dry and harden properly for keeping without danger of rotting.

Tulips done Blowing.—When tulips are paſt flowering, let the ſeed pod be immediately ſeparated from the top of the flower ſtalk; for the fine kinds of tulips ſhould never be permitted to ripen ſeeds, for theſe would draw nouriſhment and exhauſt the root. When the leaves and ſtalks of tulips begin to wither and decay, the roots ſhould then be taken up.

Bulbous Flowers in general done Blowing.—Spring crocus roots of all ſorts, and ſnow drops, and all other bulbous flower roots as have done blowing, ſhould be taken up when their leaves decay. When the roots are taken up, all the ſmall roots or off-ſets, are to be immediately ſeparated from the principal ones, and reſerve only the largeſt roots by themſelves, to plant again in the proper places, to blow next year, and by the off-ſets you obtain a conſiderable encreaſe. The roots when taken up muſt be properly dried in the ſhade, and afterwards put up till planting time, which is September, October, and November, or any time in open weather till February.

Autumn Flowering Bulbs.—The leaves of ſuch bulbs as blow in autumn, will, about the latter end of this month, be decayed; which, when it is intended to take up or tranſplant any of the ſorts, is the only proper time to remove them, and which may be done any time from about the end of May to the ſame time in June, as the roots then do not grow or draw nouriſhment from the ground. It is neceſſary that theſe bulbs, be taken up every two or three years at leaſt, to ſeparate the increaſed off-ſets from the main bulbs; and by theſe off-ſets you gain an increaſe of roots, ſome of which will flower the following autumn, and moſt of them the next year; and by diveſting the main root of the off-ſets, it will conſequently flower much ſtronger. They may then be put up till the laſt week in July, or the firſt week in Auguſt; when they are to be planted again for flowering the ſame year, in Auguſt and September, &c.

Carnations.—Carnation-plants in pots ſhould, at this time, have all the aſſiſtance of art, to encourage them to ſhoot with vigour.

Obſerve, that in order to have large and handſome flowers, all buds which riſe from the ſides of the ſtalks below, ſhould now be taken off, leaving none but the top buds; this is the method practiſed by floriſts. The pots ſhould now be placed where the midday ſun does not come; and in dry weather they muſt be watered once in two days.

Management of tender Annuals.—The cocks-combs, tricolors, balſams, globes, egg-plants, and other curious annuals, muſt now be removed, once more, into another new hot bed. Be ſure to admit air every day to the plants; and particularly when there is a good heat, and when there is much ſteam; for if this is not obſerved, the ſteam will deſtroy the leaves of the plants, and would, in that caſe, ſhake an aukward and unſightly appearance.

Prick out tender Annuals which were ſown laſt Month.—Where any of the above tender annual plants, ſuch as combs, tricolors, &c. were ſown laſt month, they ſhould now be pricked out. They muſt be pricked out on a hot bed, obſerving the method directed in the former months.

Leſs tender Annual Flower Plants.—Plant out the leſs tender or hardier annuals into the natural ground; this may be done any time after the middle of the month, if the weather is ſettled tolerably warm, taking advantage of a moiſt ſeaſon, if rain happens. The African and French marigold, and chryſanthemums, are of theſe kinds; alſo the marvel of Peru, China-aſter, India pink, ten week ſtocks, and the common kinds of balſams, capſicums, and mignonette; likewiſe perſicaria, and the tree and purple amaranthuſes; ſcabiouſes, egg-plant, love apples, and Chineſe hollyhocks, &c. All theſe may now be planted out in the beds, borders, and other parts of the garden, and they will make an agreeable appearance in two months time.

Sowing Hardier Annuals.—The ſeed of ten week ſtocks, mignonette, China-aſter, and Indian pink may ſtill be ſown. You may alſo, where omitted in the two laſt months, ſtill ſow the ſeeds of African and French marigold, balſams, chryſanthemums, and any other annuals of this claſs; but this ſhould be done the firſt or ſecond week in the month. Theſe ſeeds may now be ſown in natural ground.

Sow Seeds of hardy Annuals.—Sow the ſeed of hardy annual flowers in the borders; there are ſeveral ſorts that will ſtill ſucceed. Theſe are lupines, ſweet ſultan, and flos Adonis, the white and purple candy-tuft; Lobel's catchfly, and dwarf lychnis; dwarf poppy, and Virgin ſtock; Venus navel-wort, and Venus looking glaſs; ſnails and catterpillars; the ſeeds of dwarf and large annual ſun-flower; lavatera and oriental mallow, may alſo be ſown now; likewiſe naſturtiums, and convolvulus major and minor, the Tangier and ſweet-ſcented peas, and any other of the tribe of hardy annuals.

Auriculus.—Take good care of the auricula plants in pots, when they are paſt flowering. Off-ſets of auriculas may be now detached and planted in a ſhady border till autumn, then tranſplanted in pots, &c. Remove the boxes, or tubs of ſeedling auriculas and polyanthuſes, to a ſhady place, provided it was not done before: the place muſt be open to the morning ſun only.

Double Wall Flowers.—Propagate double wall flowers, by ſlips of the young ſhoots of the head; the plants raiſed by this method will retain the double property and colour of the flowers, in all reſpects the ſame as the parent plant, from which they were ſlipped. The wall flowers which were raiſed laſt year from ſeed, will now be in flower, not one plant in ten, or perhaps twenty or thirty, or thereabouts, will come double: and at other times not one in a hundred, and ſometimes in five hundred, or more, will prove multiple. Therefore where double flowers of a deep blood colour offer among the ſeedling plants, now is the time to propagate that ſort, by ſlips, as before directed.

Sow Biennial and Perennial and Flower Seeds.—Many ſorts of perennial and biennial flower-ſeeds may yet be ſown; but this ſhould be done in the firſt or ſecond week in the month, and the plants will come up ſtrong, and attain a proper growth, to produce flowers abundantly the next ſummer. The ſorts which will ſtill ſucceed, are the different ſorts of ſtock July flowers, wall-flowers, ſweet-williams, and columbines, carnations and pinks, and the ſeeds of ſcabiouſes; Canterbury or pyramidal bell flowers may alſo be ſown now; likewiſes hollyhocks, and French honey-ſuckles, and ſome other ſorts.

JUNE.

Tranſplanting Annuals.—Now plant out all the hardier kinds of annual flowers, into the different parts of the garden where they are to remain. The ſorts proper to plant out now, are French and African marigolds, chryſanthemums, perſicaria, the tree and purple amaranthuſes, and ſcabiouſes; the egg plant, ſtramonium, palma Chriſti, love-apple, and the tobacco plant. Plant out alſo the marvel of Peru; balſams, and capſicums; the China aſters, Indian pinks, Chineſe holly-hocks, mignonette, and ten-week ſtocks, with the large convolvulus, and ſuch like ſorts; but the laſt generally ſucceeds beſt when ſown where it is to remain.

Tender Annuals.—The cocks-combs and tricolors, globes, double balſams, double ſtramoniums, and egg-plant, and ſuch other curious annuals as were, in order to draw them up tall, placed in drawing-frames, or glaſs-caſes, will now need to be often refreſhed with water. The balſams that are in flower, and grown to any tolerable ſize, and alſo the combs and tricolors, and ſuch like, as are pretty ſtrong, may be brought into the open air, in the laſt week in this month; but if not arrived by that time to a proper ſize required, let them remain a week or two longer.

Hardy Annuals.—If any of the patches of hardy annuals in the borders remain too thick, let them now be thinned in the order directed laſt month, and give water. May ſtill ſow ſome quick flowering annuals to blow in autumn, ſuch as ten-week ſtocks, candytuft, virgin-ſtock, mignonette.

Tulips, Crown Imperials, Jonquils, &c.—Tulips will be now, in general, paſt flowering, and their leaves will be decayed; it is then proper time to take up the roots where intended, and to ſeparate the off-ſets. When they are thoroughly dried, put up each ſort ſeparately, in bag, or boxes, till September, October, or November; at which time plant them again.

Guernſey Lily Roots.—Tranſplant Guernſey and Belladona lily-roots; the leaves will now be decayed, which is the proper time to remove them. But theſe need not be taken up oftener than once in two or three years, eſpecially the Guernſey lily, which is then moſt neceſſary to be done, to ſeparate them from the increaſed parts, or off-ſets. The off-ſets ſhould alſo be planted in a bed, or pots, or boxes by themſelves, and will be ſtrong enough to flower in two or three years.

Ranunculus and Anemone Roots.—The ranunculus and anemone roots, that are paſt flowering, ſhould alſo, as ſoon as their leaves begin to wither, be taken out of the ground. When properly dried and cleaned, put them up in boxes, and place them in a dry room, till the time for planting them again in autumn and ſpring.

Management of Antumnal Flowering Bulbs.—The beginning or middle of this month you may ſtill take up, or tranſplant, moſt kinds of bulbous roots as blow in autumn. In particular, colchicums, autumnal-crocuſes, and narciſſus, and ſuch other autumnal flowering bulbs, or tuberoſe roots, whoſe leaves are decayed, and the roots not in a growing ſtate. When the roots are taken up, let all the off-ſets be taken away; the roots may then be planted again directly, or may be kept out of the ground ſome time; but not longer than the end of July, or till the firſt or ſecond week in Auguſt; becauſe, if kept longer out the ground, they will not blow with any tolerable degree of ſtrength in autumn.

Tranſplanting Seedling Perennials and Biennials.—Tranſplant from the ſeed-beds the wall-flowers, ſtock July flowers, ſweet williams, aud columbines, &c. which were ſown in March or April. Tranſplant alſo the hollyhocks, tree-primroſe, fox-gloves and pyramidal campanulas, Canterbury bells, and Greek valerian; ſingle roſe-campion, rockets, ſcarlet lychnis, and ſuch other perennial and biennial plants as were ſown two or three months ago. They will all flower next ſummer, and will make a beautiful appearance, provided they are properly placed in different parts of the garden.

Care of Blowing Carnations.—Take care of the choice ſtage carnations; ſome of the forwardeſt will probably, towards the latter end of the month, begin to break their flower pods for flowering, at which time ſuch as are required to blow in the utmoſt perfection, muſt be well attended. One great article in the beauty of this curious flower, is to have it open regularly; but this the larger flowers will not always do, without the help of an ingenious hand, and therefore in the capital varieties of theſe or other choice carnations, that in order to favour the equal opening of the flower pod, and more regular expanſion of the petals, which diſcover a tendency to burſt open irregularly, you may carefully ſlit the pod or cut the flower a little way down at the top, on the oppoſite ſide, in two or three different parts, ſo as to promote the flower ſpreading regularly each way round. Remember that the capital carnation plants in pots, which you deſign for ſtage flowers, ſhould, if not done in May, be now placed upon the ſtage; but the top of the ſtage muſt not be covered until the flowers are open, and then the cover muſt be conſtantly kept on, to defend them from the fiercer ſun, and from heavy rains; and keep the earth always moderately moiſt.

Planting Carnations and Pink Seedlings.—The carnation plants and pinks, raiſed this year from ſeed, will be ready, by the middle of the month, to be removed from the ſeed-bed into the nurſery-bed. In ten or twelve weeks time, they ſhould be removed into the borders among other plants.

Laying Carnation.—Propagate carnations by layers. This work is generally begun about the middle of this month and continued, according as the plants are fit, till the end of the next; the proper parts for laying, are principally the young ſhoots of the ſame year, when about five or ſix inches long. After you have planted them, in ſix weeks time, the layers will be finely rooted, and are then to be taken off from the old roots and planted, ſome of the beſt into ſmall pots, and the reſt into nurſery-beds, there to remain till October; at which time part may be taken up with balls of earth about their roots, and planted in the flower-borders.

Propagating Pinks and Carnations, by Pipings or Cuttings.—Propagate alſo pinks and carnations, by cuttings or pipings of the young ſhoots which is a neat and expeditious method of propagation, and is more peculiarly adapted for pinks; by which they may be very quickly raiſed in great abundance, as is the practice of the London gardeners, who raiſe great quantities annually of all the capital ſorts for market. The operation is commonly called piping, and is performed as follows. About the middle or latter of this, or beginning of next month the plants will have made proper ſhoots for this operation; however, any time between the the middle of June and the end of July, the cuttings may be taken off, obſerving you are to take only the upper, young, tender part of each ſhoot; and if the piping, or cutting hath, when taken off, two or three joints, it is ſufficient; either take them off with a knife, cutting them cloſe below a joint; otherwiſe take them off with the hand only; the method is this: take the head of the ſhoot between the ends of your fingers and thumb of one hand, and with the other hold the lower part of the ſhoot; then pulling the head of the ſhoot gently, it will readily part and come out of its pocket, about the third joint from the top; hence it is called piping. Or you may detach them more expeditiouſly with a knife, cutting them off about the third joint.

Double ſweet-williams and Pinks. — Double ſweet-williams and pinks may alſo be encreaſed by laying down the young ſhoots. The ſhoots of thoſe plants will be ready for laying towards the latter end of the month; and are to be prepared and layed in the ſame manner as the carnations. The layers of carnations, pinks, double ſweet-williams, and the like, raiſed this year, will all blow next ſummer.

Support Flowering Plants. — Continue to ſupport with ſticks all the tall growing plants, according as they grow up and require it. This work ſhould be duly attended to, for there is none more neceſſary, and nothing looks better than to ſee all the plants ſtanding firmly in their places, and neatly trained in an upright growth. Likewiſe to climbing plants, give proper ſupport of ſticks, &c. for they will now require that aſſiſtance.

JULY.

Cockſcombs, Tricolors, and other curious Annual Plants.—Bring out now the cockſcombs, tricolors, double balſams, and all other curious annuals as have been kept till this time in drawing frames, or in glaſs-caſes. When they are brought out, let them be immediately well cleared from all decayed leaves; and at the ſame time ſtir the earth a little in the top of the pots, and then add a ſprinkling of ſifted earth over it. They muſt, in dry weather, be very duly ſupplied with water: and this muſt be practiſed in general to all ſuch annuals as are planted in pots.

Tranſplant Annuals into the Borders, &c.—Where there are any kinds of tranſplanting-annual plants ſtill remaining in the ſeed bed, or in the nurſery bed, wherein they were prickled from the ſeed-bed, they ſhould in the beginning of the month be taken up with balls, or at leaſt with as much earth as you can about their roots, and planted in the borders or places allotted for them to blow.

Senſitive Plants.—The ſenſitive plants, if you raiſed any, ſhould now be again plunged in a moderate heat, or kept under glaſſes, to forward them, except you have the conveniency of a hot houſe, where you may keep them conſtantly. But thoſe who have no ſuch conveniency, ſhould, as above, place the pots containing them continually under glaſſes, either in a green houſe, glaſs caſe, or garden frame; but in winter they muſt be kept conſtantly in a hot houſe, or on any hot bed where a conſtant good heat is kept up. Thoſe plants are ſingularly curious on account of their leaves, which on the leaſt touch immediately drop, and quickly contract themſelves, and do not riſe and recover again in leſs than an hour.

Tranſplant Carnation Layers.—Take off and tranſplant ſuch carnation layers as were layed about the middle or towards the latter end of June. They will, by the laſt week in this month, be tolerably well rooted. They are to remain in the ſmall pots till the beginning of March, and then to be planted into the large pots, where they are to remain to blow. But the layers of the common kinds of carnations, ſhould, when taken off, be planted in a bed of rich earth. Let them remain in this bed to get ſtrength till October, November, or February, or March, obſerving to weed and water them occaſionally till that time; they are then to be taken up with balls, and planted in the borders.

Propagate Pinks by Piping, &c. — Still you may plant cuttings or pipings of pinks, &c. the beginning or middle of this month for propagation, in the manner related in June, taking the young ſhoots of the year: they will yet take root freely.

Tranſplanting Perennial Plants. — Tranſplant, where it was not done in June, the perennial and biennial plants, which were ſown in March or April, &c. The wall-flowers and ſtock July flowers, in particular, will now want tranſplanting from the ſeed-bed, and alſo the ſweet-williams, columbines, Canterbury, or pyramidal bell-flowers, with the Greek valerian, tree-primroſe, ſingle ſcarlet-lychnis, and roſe-campions; French honey-ſuckles and holly-hocks, and all others of the perennial and biennial kinds. Let them remain here to acquire a proper growth and ſtrength for a final tranſplantation, next October, and November, or in the ſpring; then taken up with balls, and planted in the borders, or where intended; or ſome of the more curious may alſo be planted in pots: all of which will flower in perfection next year.

Tranſplant the ſeedling Ariculas and Polyanthuſes. — Tranſplant the ſeedling ariculas which were ſown laſt autumn, or early in the ſpring, as alſo the polyanthuſes that were ſown in the ſpring ſeaſon, for it is now time to remove them out of the ſeed-bed.

Take up bulbous Roots. — Take up bulbous roots where neceſſary to be done, agreeable to the hints given the two former months. Many ſorts will now be paſt flowering, and their leaves will be decayed, and may then be taken up in order to ſeparate the off-ſets from the principal roots. The crown imperials, lillies, bulbous iriſes, and narciſſuſes, and many other bulbs, will now be in a condition for this practice, and put them up till October or November, when the borders may be conveniently dug, and the roots regularly planted.

Trimming Flowering Shrubs and Evergreens. — Look at this time over the flowering-ſhrubs and evergreens; and, with a knife, let ſuch as are grown rude be trimmed. What is meant by this is, where the ſhrubs have produced ſtrong and rambling ſhoots, ſo that the different ſhrubs interfere with each other, let the ſhoots of ſuch ſhrubs be now either cut out, or ſhortened in ſuch a manner as to form the head of the plant ſomewhat regular; and alſo that every ſhrub may be ſeen diſtinctly without crouding upon one another.

Cutting down decayed Flower Stems. — Go now and then round the borders, and cut down the ſtems of ſuch flower plants as are paſt flowering. But this is now principally to be underſtood of the perennial and biennial fibrous rooted plants: the bloom of many of theſe kinds will now be paſt; and the ſtems ſhould always, according as the flower decays, (except where ſeed is wanted) be immediately cut down; then the plant, though paſt flowering, will appear decent. Let therefore the decayed ſtalks be cut down cloſe to the head of the plants, and at the ſame time clear each plant from any decayed leaves.

AUGUST.

Watering and general Care of Annual Plants in Pots. — Take care now of the annual plants in pots; they muſt in dry weather, be well ſupplied with water: let them be watered at leaſt three or four times a week: but in very hot dry weather they will need watering every day.

Propagate fibrous-rooted Plants. — Now is the proper time to encreaſe many of the double flowered and other deſirable fibrous rooted plants done flowering, by ſlipping and parting the roots; and the proper time to begin to do it is about the middle or latter end of the month. Many ſorts may now be encreaſed by that method; particularly the double roſe-campion and catchfly, double ſcarlet lychnis and double rocket; alſo the double ragged robin, batchelor's button, gentianella, polyanthuſes, auriculas, and ſeveral other ſuch like kinds of fibrous rooted perennials. The method is this: where the plants have grown into large tufts, let the whole of each root be taken up entirely out of the earth; then let it be parted, or divided into as many ſeparate plants as you ſhall ſee convenient, but not into very ſmall ſets; but in parting them, take care to do it in ſuch a manner as every plant or ſlip ſo ſeparated may be properly furniſhed with roots. Theſe will all take root in a very ſhort time, get ſtrength and make tolerable good plants by the latter end of October and November: at that time, or in the ſpring, they may be taken up with balls, and planted ſome in pots, and the reſt into borders. They will all blow next ſummer.

Saxifrage.—This is now a proper time to propagate ſaxifrage. The double white ſaxifrage flowers in the ſpring ſeaſon, and makes a beautiful appearance. They are eaſily propagated by ſmall off-ſets from the roots, which they produce plentifully: they are generally planted in pots, but may alſo be planted in the borders or beds, planting ſeveral of its ſmall roots in a place that the flowers may come up in bunches: otherwiſe they will make but little ſhew; and they will flower next year.

Aricula and Polyanthus Seed. — This is a good time to ſow ariculas ſeed; and it will alſo be proper to ſow the ſeed of polyanthuſes. Let the ſeeds be ſown pretty thick, and cover them about a quarter of an inch deep. The boxes or pots muſt then be ſet where only the morning ſun comes, ſtand there till the end of next month, and then be removed where they can have the full ſun.

Plant out Pink Pipings, &c.—When the pink pipings or cuttings, planted in June, are well rooted and advanced in growth, let them be thinned out and planted, and give proper waterings; the reſt will be fit to plant out next month, and they will all acquire proper ſtrength for flowering moderately the following year, but in greater perfection the ſecond ſummer. They will obtain a good buſhy growth by the end of October, when, or in November, or the following ſpring, ſome of the ſtrongeſt may be tranſplanted with balls into the borders, &c.

Sow Seeds of bulbous Flowers. — Sow ſeeds of bulbous flower-roots, to obtain new varieties. The proper time to do this, is ſome time between the twentieth and laſt day of the month. The ſorts proper to be ſown are, tulips, hyacinths, narciſſus, iris, crown imperials, fritillaris, and lilies, the ſeeds of martagons, crocuſes, and other bulbs. Theſe ſeeds may be ſown either in beds or in boxes, &c. The convenience of boxes or pots is, they can be removed readily to a different ſituation as the ſeaſon requires. The boxes for this purpoſe muſt be about fifteen or eighteen inches broad, and ten or twelve deep, or large wide pots. They muſt be filled within an inch and an half of the top, with fine light earth, making the top ſmooth; then ſow the ſeeds thereon moderately thick, and cover them with ſifted earth about half an inch deep. The next ſummer, at the ſame time, the roots are to be removed again, and muſt then be ſet three or four inches each way apart. Thus theſe ſeedlings are to be treated every ſummer till they are brought to a ſtate of perfect flowering; obſerving, at each removal, to allow more and more room. When they are brought to a condition of flowering, they are then to be managed as the other old roots. Though it will be ſeveral years before ſome of the roots arrive to that ſtate, particularly the tulips, which never begin to ſhew a flower till the ſixth or ſeventh year; the advantage of raiſing this and other choice bulbs from ſeed, is, that when the ſeedlings are raiſed to a flowering ſtate, and begin to break into ſtripes or variegations, there will every year appear among them many new flowers. This is the advantage of raiſing them from ſeed; and likewiſe among the new flowers, there will ſometimes be ſome that greatly excel, by the luſtre of colour, tinges, and regularity of ſtripes, &c.

Sow Anemone Seeds, &c.—Sow anemone ſeed, and the ſeed of ranunculaſes, and ſpring cyclamens. It will be moſt adviſeable to ſow theſe ſeeds principally in boxes or large wide-mouthed pots. The pots or boxes to be filled with rich, but very light earth.

Remove bulbous Roots.—This is ſtill a proper time to remove, where required, ſeveral ſorts of late flowering bulbous roots, now out of bloom, ſuch as the roots of martagons and red lilies; the ſtalks and leaves of white lilies alſo now decay; and that is alſo the moſt proper time to remove theſe bulbs. When the roots are taken up, the off-ſets muſt be all ſeparated from them; and when this is done, the principal roots may either be planted again now in the proper places, or may be dried and cleaned, and put up till October, and then planted.

Tranſplant Perennials.—Tranſplant into nurſery-beds, ſuch ſeedlings of wall-flowers, ſtocks, and ſweet-williams: alſo columbines, ſcabiouſes, and other ſeedling perennial and biennial plants as are ſtill remaining in the ſeed-bed. Theſe ſhould be tranſplanted in moiſt weather; and the ſooner the better, that the plants may have time to root, and get ſome ſtrength before winter. When the plants have ſtood in the above beds or borders, two months, or thereabouts, or till the end of October, or November, &c. or next ſpring, a quantity may then be tranſplanted into the flower borders; and other parts of the pleaſure ground to remain to blow next year.

Gather Flower Seeds.—Gather the ſeeds of ſuch flowers as are now ripe, in a dry day; ſpread them on mats to dry in an airy place where the ſun can come. When they are well hardened, beat or rub them out, and put them in paper or canvas bags, or into boxes, till the ſeaſon for ſowing them.

SEPTEMBER.

Planting Hyacinths and Tulip Roots, &c.—In the third or fourth week in this month, it will be time to begin to plant the choice hyacinth and tulip roots for an early ſpring bloom. Any other bulbous roots may likewiſe be planted towards the middle and end of this month.

Ranunculuſes, &c.—About the middle or towards the latter end of this month, begin to prepare the beds for the beſt ranunculuſes and anemone roots; and any time after the twentieth of the month to the end of October, is the time to plant them; but they ſhould not be planted cloſe, for when the plants ſhoot up in a crouded manner, they draw each other up weak, and the flowers never grow ſo large, nor the different varieties ſhew themſelves to ſuch advantage, as when they ſtand more diſtant.

Sow Anemone and Ranunculus Seed.—This is ſtill a proper time to ſow the ſeeds of anemones and ranunculuſes, where it was not done in Auguſt. For that purpoſe, fill ſome pots, boxes, or tubs, with rich light earth, and cover them not more than a quarter of an inch thick. The plants ſhould be protected in winter, in time of great rain or hard froſt. About the Michaelmas twelvemonth, they ſhould be tranſplanted into a bed of common earth, and in the ſpring following they will flower; when perhaps, they will afford you ſeveral new flowers that are double, and of fine colours.

Carnation Layers.—Take care now of the carnation layers: where there are any ſtill remaining on the old plants, let them be tranſplanted ſome time before the middle of the month, that they may have time to take good root before winter.

Auricula Seed.—The ſeed of auricula may ſtill be ſown when not done in Auguſt. Theſe ſeeds ſhould at this time be ſown in large wide pots, or in boxes filled with earth. Theſe auricula plants raiſed from this ſowing, will flower the next ſpring twelvemonth.

Tranſplant Perennial Plants—Tranſplant into borders, towards the latter end of this month, ſome of the ſtrongeſt perennial plants which were ſown in the ſpring or the beginning of the ſummer. Theſe may be ſafely tranſplanted any time after the middle of the month: particularly carnations, pinks, and ſweet-williams; and alſo the ſeedling wall-flowers, ſtock July flowers, and columbines, with many other ſorts.

Sowing Seeds of bulbous Flower Roots.—The ſeeds of tulips may ſtill be ſown, and alſo the ſeeds of hyacinths and crown imperials, with the ſeeds of fritillarias, and of moſt other bulbs. Then ſow the ſeeds ſeparately on the ſurface, and tolerably thick, and cover them with light ſifted earth, near half an inch deep or thereabouts.

Plant Box.—Now is the time to begin to plant box where new edgings are to be made; but this ſhould not be done principally in any conſiderable extent till towards and after the middle of the month. There is no time in the year in which box will take root better than this; but as ſoon as an edging is planted it will be proper to give an hearty watering. This is alſo a good time to repair any former planted box edgings where wanting.

Propagate Fibrous-rooted Plants.—This is the time to ſlip and plant out many kinds of fibrous-rooted plants, to encreaſe them; ſuch as roſe-campion, ſcarlet lychnis, catchfly, and campanulas. When theſe plants are grown into large tufts, it will be proper to take the roots entirely up, and part them, and plant ſome of the beſt ſlips again in the borders or places where they are to flower.

Tranſplanting Pionies and other knob-rooted Plants.—This is alſo a good time to tranſplant pionies, and alſo to part their roots; and the different ſorts of flag iriſes, monk's-hood, fraxinella, and all other ſuch like plants, may now be taken up and parted where neceſſary, and tranſplanted into places where wanting.

The Care of Plants in Pots.—Take good care now of all ſuch ſhrubs as are in pots, particularly the more tender kinds, to defend them in ſevere weather. In order to protect the roots the better from froſt, let the pots of ſhrubs in general, if not done before, be plunged to their rims in a dry warm ſpot. And the more tender and curious kinds, ſuch as any ſmall arbutus, magnalias, ciſtus, &c. in pots, ſhould be placed in deep frames to have occaſional ſhelter of covering in froſty weather. By plunging theſe plants in the earth it prevents the froſt entering the ſides of the pots to hurt their roots; and in very hard froſts it will be proper to lay ſome dry long litter lightly over all their tops; but this muſt always be taken immediately off when the froſt is leſs ſevere. But where there are any frames to ſpare, and the pots with the above fibrous-rooted plants placed in them, and defended occaſionally with glaſſes or other covering, it will be of great advantage. If the pots where the auricula plants are in, are not protected, they may, in very wet weather, be occaſionally laid down on one ſide, with the tops towards the ſun, to protect the plants better from too much moiſture, which, though but a ſimple expedient, is better than to leave them upright to receive the rain, &c. all the winter.

Carnation Layers.—Carnation layers, which were in Auguſt, or the laſt month, planted in ſmall pots, ſhould in the laſt week in this month, be placed where they can be readily defended in bad weather; but when the weather is dry and mild, let the plants at ſuch times have the advantage of the open air conſtantly.

Tranſplanting fibrous-rooted Flowering Plants.—Now tranſplant into the borders or places where wanted, all ſorts of fibrous-rooted perennial and biennial plants. Theſe ſorts of plants will now take root freely, and in a ſhort time. The ſorts proper to plant now are roſe campions and ſweet-williams, campanulas and catchfly, and you may alſo plant rockets, bachelor's buttons, double feverfew, ſcarlet lychnis and lychnideas. Double ſweet-williams, double rockets, double roſe campion, and the like, ſhould be planted in pots, and removed to ſome place where the plants can be ſheltered in ſevere weather. Theſe double flowers deſerve particular care. Now alſo ſlip and plant polyanthuſes where wanted; alſo double daiſies, double chamomile, violets, London pride, thrift, hepaticas, gentianelli, ſaxafrage, columbines, monk's-hood, Canterbury bells, fox gloves, tree primroſe, Greek valerian, ſcabiouſes, and ſuch like kinds. This is a good ſeaſon to plant golden rod, Michaelmas daiſies, everlaſting ſun-flowers, French honeyſuckles, and hollyhocks. The laſt mentioned plants grow very tall, and are fitter to be planted in the clumps among flowering ſhrubs, than in narrow borders.

Parting the Roots, and propagating various fibrous and knob-rooted Plants.—Where golden rod, everlaſting ſun-flowers, Michaelmas daiſies, and ſuch like rampant growing fibrous-rooted perennial plants, have ſtood in one place ſeveral years without tranſplanting, their roots will have ſpread conſiderably, and will be increaſed to very large bunches. Where that is the caſe, the roots ſhould now be taken up, and every main root divided into ſeveral parts, or ſeparate plants; and then ſome of the beſt ſhould be immediately planted again in the places allotted them. This is alſo ſtill a good time, where not done before, to part the roots of many other fibrous-rooted plants that have grown into large bunches.

Planting all Kinds of bulbous Flower Roots.—This is now a moſt eligible ſeaſon to plant almoſt all ſorts of bulbous and tuberous flower roots which were taken up when their leaves decayed, which by this time, when any bulbous roots are to be planted in aſſemblage with other flowers, it is much the beſt way to place them in patches; that is to ſay, in a ſmall ſpot of ſix or eight inches diameter, to plant four or five roots; placing one in the middle, and three round the edge; and ſo to plant the different ſorts in ſeparate patches, at the diſtance of one, two, or three yards. This method of planting bulbous rooted flowers in patches in the common borders, makes a very pleaſing variety in the flowering ſeaſon.

OCTOBER.

This is a very good time to plant the roots of ranunculuſes and anemones; alſo crocuſes and ſnow drop roots which were taken out of the ground in ſummer. Plant narciſſus and jonquils; and this is alſo a proper time to put in the roots of bulbous and Perſian iriſes, frittillarias, and the roots of martagons and orange lilies, and all other ſuch like bulbous roots as were taken up when their leaves decayed in ſummer.

Prune Flowering Shrubs, Evergreens, &c. — Prune roſes and honeyſuckles ; and this is alſo a proper time to prune all other ſorts of flowering ſhrubs and evergreens. Where any branch advances in a ſtraggling manner from the reſt, let that be cut ſhorter ; obſerving, if poſſible, to prune it cloſe to a young ſhoot, leaving that ſhoot for a leader to the branch ; and let every ſhrub be kept to a ſingle ſtem.

Plant and tranſplant hardy deciduous Flowering Shrubs and Ornamental Trees. — Now is the time to begin to plant, in places where wanted, all ſorts of hardy flowering ſhrubs ; ſuch as roſes, gelderroſes, lilacs, and honeyſuckles. Plant alſo where wanted, laburnums, ſyringas, althæa, frutex, jaſmines, privets, double-bramble, flowering raſpberry, the double bloſſom cherry, bladder-ſena, ſcorpion-ſena, ſpiræas, and hypericum frutex ; it is now alſo a proper time to plant mezereons, the double-flowering peach and almonds, the cornelian cherry, double hawthorn, and ſcarlet horſe cheſnuts. You may alſo now plant bladder ſena, ſcorpion ſena, althæa frutex, and ſpiræa frutex, with the double flowering cherry, jaſmines, gelder-roſe, and all other hardy ſhrubs and trees. But more particularly evergreens, will have finiſhed their years growth, determinable by their leaves decaying : and from that time to the middle or end of March, you may in open weather, tranſplant all kinds. Where it is intended to plant them in clumps, or any continued plantations, in the ſhrubbery order, let the ſhrubs in general be ſet at leaſt five or ſix feet diſtant from one another ; and ſuch plants as are of an humble growth, ſhould not be planted promiſcuouſly among tall growing plants ; for was that to be practiſed, the low plants would be loſt to view. This is the method of order that ſhould be practiſed in planting and decorating the clumps or quarters of the ſhrubbery ; ſtrait lines are not to be regarded, but rather to be avoided ; but ſome regularity muſt, notwithſtanding, be obſerved both with regard to the diſtance and advantageous diſpoſition of the different ſorts of plants.

Planting Evergreens Trees and Shrubs. — Evergreen ſhrubs or trees of moſt ſorts may alſo now be planted ; or may be removed any time of this month, and the ſooner the better. But, in particular, the ſtrawberry-tree or arbutus, laurel, Portugal laurel, lauruſtinus, pyracantha, phillyreas, alaternus, bays, ciſtuſes, evergreen-oaks, hollies, and magnolias, pines, firs, cedars, cypreſs, and many others.

Planting Evergreens to hide Walls, &c. — Phillyreas, lauruſtinus, and laurel, are proper ſhrubs to plant any where near a houſe, &c. to hide any rugged or unſightly naked walls, or other buildings. Theſe plants are a beautiful evergreen, ſummer and winter, they are alſo very hardy, and their growth is quick and regular ; and where wanted for the above purpoſe, this is a proper time to plant them. They muſt be planted cloſe to the wall, three or four feet aſunder, and their branches muſt be regularly ſpread and trained to the wall in the manner of a wall-tree ; they will ſhoot in a quick but regular manner, and their beautiful green leaves will effectually hide the moſt deformed or ill-looking wall, &c. The pyracantha is alſo a pretty ſhrub to plant againſt a wall, by reaſon of its cluſters of beautiful and red berries, which make a handſome and very agreeable appearance in autumn and winter. The arbutus, or ſtrawberry-tree is alſo ſometimes planted to hide a diſagreeable looking wall. This is a beautiful plant, and makes an agreeable figure in any place, and at all ſeaſons, but particularly in this and the two preceding months, when it is loaded with its fine red ſtrawberry-like fruit. But theſe plants make the beſt appearance when planted detached in the clumps or borders, lawns, &c. and ſuffered to grow in their natural way. Or theſe arbutus ſhrubs, being planted, detached or ſingly, upon graſs lawns, &c. kept to ſingle clean ſtems, and regular heads, they have a beautiful effect.

General Method of planting Trees and Shrubs. — In planting the various kinds of ſhrubs and trees in the ſhrubbery, &c. one general method ſerves for the whole ; open for every plant a circular hole wide enough to receive the roots freely every way, and about a ſpade deep, or as the root requires, and let the bottom be well looſened. Then get the plants and prune the end of all long and ſtraggling roots ; and cut away ſuch roots as are broken, damaged or dead : alſo any irregularities of the head ; then place the plant in the hole, and ſee that it ſtands upright.

Tranſplant Foreſt and Ornamental Trees. — Foreſt-trees of all ſorts may now be ſafely tranſplanted from the nurſery, &c. for any intended plantations, towards the latter end of this month ; ſuch as elm, oak, beech, birch, maple, aſh, lime, and plane trees ; alſo alder, poplar, pines, firs, cedars, cypreſs, larches, and almoſt all other ſorts, both of the deciduous and evergreen foreſt and ornamental trees. But theſe and all other foreſt trees, may be tranſplanted in mild weather any time between this and Chriſtmas: obſerve the ſame method in planting theſe ſorts, as obſerved in the general method of planting ; deſcribed in Auguſt and at the diſtance and order of arrangement as hinted in March.

Propagating by Layers, Hardy Trees and Shrubs. — Now make layers of all ſorts of hardy trees and ſhrubs to propagate them. This may be done any time in this month, and many ſorts of trees and flowering ſhrubs are to be propagated by that method ; the method is eaſy, and the trouble is not much ; beſides, it will be well repaid in a twelve-month's time with numbers of new plants. Almoſt any tree or ſhrub that ſheds its leaves in winter, may be raiſed by layers ; and in the hardy kinds, this is the beſt time to perform that operation. The method of laying is this : dig round the tree or ſhrub and bend down the pliable branches, lay them into the earth, and ſecure them there with hooked or forked ſticks ; lay down all the young ſhoots on each branch, and cover the body of them about four or five inches deep, leaving the tops of each at leaſt two, three or four inches out of the ground, according to their different lengths. Thus they are to remain till this time twelvemonth, by which time they will be well rooted, and muſt then be tranſplanted. Obſerve it is the laſt ſummer's ſhoots that are the moſt proper parts to lay ; accordingly let ſuch branches as are beſt furniſhed with young ſhoots be brought down and the ſhoots layed down in the earth.

Tranſplanting Layers. — Now is the time to take off and tranſplant the layers of all ſuch ſhrubs and trees as were layed laſt year ; let their roots be pruned.

Propagating Roſes aud other Shrubs by Suckers. — Tranſplant ſuckers of roſes ; it is by ſuckers from the root that moſt ſorts of theſe ſhrubs are increaſed ; theſe being digged up carefully with roots, will make good plants in one or two years time. Lilacs are alſo generally encreaſed by ſuckers, which ſhrub ſeldom fails to yield plenty every year.

Propagating Flowering Shrubs by Cutting. — Plant cuttings of honeyſuckles : all the ſorts of theſe ſhrubs may be propagated by that method, for the cuttings of the young ſhoots will put out roots very freely, and make pretty plants in one year. Many other ſorts of hardy ſhrubs and trees are to be raiſed from cuttings, and this is the time to plant them. Obſerve, it is the laſt ſummer's ſhoots that are to be uſed for cuttings ; let ſtrong ſhoots be choſen, and ſhorten them to about nine, ten or twelve inches in length. Let every cutting be got half way into the ground. Laurels and Portugal laurels are propagated principally by cuttings, and this is a very ſucceſsful time to plant them.

NOVEMBER.

General Care of Flower Plants. — Take care now to protect the choice flower plants and roots from froſt, great ſnows, and heavy rains ; all of which would damage many ſorts of curious roots and plants ; obſerving the following general directions in the particular ſorts. The choicer kinds of auricula and all the valuable plants in pots, muſt now be well defended in very wet weather, great ſnows, and hard froſts. If theſe plants are placed in frames, as was directed two months ago, let the glaſſes be kept conſtantly over them in bad weather, or if they are in a bed arched over with hoops, &c. let mats or canvas be drawn over them in ſuch weather, or in default of ſhelters, lay the pots down on one ſide in very wet or ſnowy weather. But when the weather is mild and dry, let the plants be conſtantly uncovered.

Clear the Borders. — Clear the borders from all dead annual plants, pulling them up by the roots ; ſuch as African and French marigolds, lavateras, China aſters, and all other of the like kinds, for theſe never ſurvive to flower again. Cut down all the dead ſtems or decayed flower-ſtalks of perennial plants, and let the borders be well cleared from leaves of trees and all ſorts of rubbiſh and litter. This prevents the growth of weeds, and renders the borders clean and decent for the winter ſeaſon. When the borders are perfectly clear, go round and ſee where any ſorts of perennial plants are wanting, and ſet down a ſtick in each place for a mark.

Planting Perennial Plants. — Many ſorts of perennial plants may ſtill be planted ; ſuch as the double ſcarlet lychnis, double roſe campion, double rocket, catchfly, campanula, bachelor's buttons, and the like. Likewiſe plant, where wanted, ſweet-williams, wall-flowers, ſtock July flowers, columbines, Canterbury bells, tree primroſe, Greek valerian, and honeſty. This is alſo a good time to tranſplant perennial ſun flower, golden rod, perennial aſters, hollyhocks, French honeyſuckles, monk's-hood, and pionees. Now you may likewiſe plant thrift, London pride, gentianella, double daiſies, winter aconite, polyanthuſes, auriculas, and primroſes, with many other ſorts. Obſerve to intermix the different ſorts in ſuch a manner that there may be an agreeable variety and regular ſucceſſion of flowers in every part.

Plant Tulips, &c. — This is ſtill a proper time to plant tulips, hyacinths, and various other hardy bulbous roots, and let it be done in dry open weather, and as early in the month as poſſible. Let theſe roots be planted in ſuch beds and borders as lie tolerably dry all winter ; for if the ground be too wet, the roots planted now would rot.

Plant Ranunculuſes and Anemones. The ranunculuſes and anemones ſhould alſo be planted in beds and borders of light dry earth, for a wet ſoil would be apt to rot theſe roots : let the choiceſt kinds of theſe roots be planted in beds for the convenience of protecting them in winter, and alſo in the ſpring, when they are in bloom. In planting theſe roots, let the ſame diſtance and manner be obſerved as in laſt month.

Planting Narciſſuſes and other Bulbs.—Narciſſuſes and jonquils, frittillarias, crown imperials, gladioles, bulbous-iris, ſtar of Bethlehem, lilies, and all other bulbous roots that are ſtill above ground, may now be planted, when time and dry open weather will permit.

Care of Seedling Plants.—Small young or tender ſeedling flower plants, or roots, alſo demand care at this unfavourable month, if it is not done in October. Such tenderiſh kinds as are in pots, or boxes, may now be protected, by placing the pots, tubs, or boxes, in a warm border, or may alſo plunge them in the earth; and in hard froſt, long ſtraw litter may be laid on the ſurface, and around the ſides; the ſame protection of covering may alſo be given to ſuch as are in beds. It will ſecure the young bulbs or other plants the better from hard froſts: and when the weather proves very ſevere, it will be adviſeable alſo to cover them with long litter or with mats.

The Care of New-planted Trees. — Take care now, if froſts ſhould ſet in, to protect the roots of the more curious new planted ſhrubs and trees, by laying ſtrawy mulch on the ſurface of the ground; but this is particularly to be underſtood of the more tender kinds. Likewiſe place ſtakes, and tie tall new planted trees and ſhrubs as ſtand in need of ſupport, eſpecially thoſe in expoſed ſituations; let this be done in due time, for it is a very material article; becauſe, while the wind rocks them at the roots, it prevents them putting out new fibres: or at leaſt, as ſoon as put out, where not ſecured with ſtakes, they are broken off, or much diſturbed by the firſt high winds.

Graſs Walks and Lawns.—Now let the graſs walks and lawns be poled and rolled, for at this ſeaſon the worms will throw up very faſt, and make the graſs every where very dirty. The long pliable pole ſhould therefore be often uſed in dry days, in order to break and ſcatter the worm-caſts about; and the graſs ſhould afterwards be rolled with a wooden or ſome other roller; which will not only render the ſurface firm and ſmooth, but will alſo make it extremely clean, for the ſcattered worm-caſts will all ſtick to the roller. This poling and rolling ſhould, in order to keep the graſs perfectly neat, be performed once a week, or a fortnight, during the winter ſeaſon. Chooſe the drieſt days to do this work. Now alſo let the graſs be thoroughly cleared every where from the fallen leaves of trees; and as there are now moſtly all down, let them be cleared away in every part of the garden.

DECEMBER.

Protecting New-planted Shrubs. — New-planted ſhrubs, and trees of the more tender, or choicer kinds, ſhould have their roots well protected in hard froſty weather, by laying mulch or long dungy litter a good thickneſs on the ſurface of the ground over the roots of each plant. This work is ſo neceſſary to ſuch of the more tender and curious kinds of ſhrubs and trees as were planted in autumn, that it ſhould not be omitted now, if it was in the former month.

Pruning Shrubs, Foreſt Trees, &c. and dig between them. — Now go over the flowering ſhrubs, and prune all ſuch as ſtand in need of that diſcipline; but let this be done in a ſkilful manner, with a knife, and not with garden ſhears. In doing this, all the very ſtrong long rambling ſhoots of the laſt ſummer's growth extending conſiderably beyond the general branches of the head, ſhould be taken off quite cloſe, or reduced to regularity; and where the branches are crowded in a very diſorderly manner, let them be pruned to ſome tolerable order; and cut out dead wood. Every plant ſhould be pruned in ſuch order, as it may ſtand clear of another: never ſuffering the branches of different ſhrubs to intermix with each other, for that ſpoils the beauty of all, except where any are intended to form a thicketty growth to overſpread the ground. When the ſhrubs are all pruned, let the ground be dug between the plants; and as you go on, take up all ſuckers, and ſhorten ſtraggling roots. It is now a proper time to prune all ſorts of foreſt trees where neceſſary, obſerving to trim up all large ſide ſhoots and boughs from the ſtem, and low ſtraggling under branches of the head, for that may be performed in froſty weather when little other buſineſs can be done.

Preparing Ground for Planting. — Now dig, when the weather will permit, the borders, beds, &c. in the flower-garden, and the clumps and other compartments in the ſhrubbery, where any kind of ſhrubs, trees, or plants are to be planted.

Preparing Compoſt for Flowers. — Break up and turn the heaps of compoſt for curious flowers, in pots, &c. obſerving to mix the parts well together. At this time you ſhould alſo bring in freſh ingredients to make new compoſt heaps, for theſe ſhould always lie the beſt part of a year before they are uſed for any purpoſe; the principal compoſts, for choice flowers, being any light rich earth, ſea ſand, &c. light ſandy loam and a ſmall portion of dry rotten dung; all well blended together in an heap.

Plaſh Hedges. — This is a proper time to plant any ſorts of hedges of the deciduous kinds particularly; ſuch as hawthorn, beech, elm, elder, horn-beam, herbery, privet, black-thorn, or ſloe; procure young ſets of two or three years old from the nurſery. Where fence hedges are grown up tall, rude, and thin, or naked at bottom, they ſhould now be plaſhed, or laid down in ſuch a manner as to render them thick in every part, performed by gaſhing the lower parts of the larger ſtems, &c. and lay them down horizontally between others left erect for growing ſtakes, cut even at top four or five feet high.

PART II. USEFUL GARDENING.

As the bounties of nature cannot be more beautifully diſplayed than in the vegetable creation, and as the utility of gardening amply compenſates for all our labour; we have in this conciſe practical treatiſe laid down in chronological order, directions not only for the gentleman, who exerciſes it for his amuſement, but likewiſe the induſtrious gardener, who follows it as a profeſſion. In order to effect which, we begin with January, and proceed forth a monthly diſplay of the buſineſs throughout the year.

Thus we hope to exhibit a pleaſing view of the product of every month in the vegetable creation, to the honour of the univerſal parent of nature, and benefit of mankind in general; many of whom may be thereby prompted to co-operate with a wiſe providence, in promoting his wiſe and ſalutary deſigns. In ſhort, it has been our care faithfully to ſelect the produce and inſtructions relative to the manures of each month in the year, as the moſt approved method of aſſiſting the memory without perplexing the mind.

MONTHLY CALENDER OF THE BUSINESS TO BE DONE IN THE FRUIT AND KITCHEN GARDEN.

JANUARY.—*FRUIT GARDEN.*

Pruning Apple and Pear Trees in Eſpaliers, and againſt Walls.—Where there are wall and eſpalier apple and pear trees yet unpruned, that work ſhould now be forwarded as much as poſſible, and may be ſafely performed upon all ſorts, without fearing any danger from froſt, even if it happens when performing the operation. Apple and pear trees being of the ſpur-bearing kind, and their mode of bearing ſimilar, one method of pruning anſwers for both; they producing their fruit upon ſhort natural ſpurs from the ſides and ends of the branches, and the ſame branches continue bearing for many years, increaſing their quantity of fruit ſpurs as they gradually advance in length; let it therefore be remarked, that in the general courſe of pruning thoſe trees, their branches and ſhoots are not to be ſhortened, but generally trained along horizontally to the eſpalier and wall, at their natural length, at leaſt as far as there is ſcope of room to extend them; never ſhortened except on particular occaſions, below explained; and the whole trained five or ſix inches aſunder. Keeping therefore this in mind, look over the general branches, and if the tree is young and in training, requiring a farther ſupply of young wood to form the head, retain a proper quantity of the beſt-placed laſt ſummer ſhoots at full length, and cut out all the ſuperfluous and irregular ones; but in full trained or old trees, ſtill retaining the former-trained or ſame individual bearing branches for many years, as long as they continue fruitful, extending them to the wall and eſpalier, without ſhortening, if room admits. In the courſe of this pruning have particular care to preſerve all the natural fruit-ſpurs; but cut away all thoſe formed of the remaining ſtumps of ſhortened ſhoots, for theſe rarely produce any thing but a confuſion of unneceſſary wood ſhoots every ſummer. Then train in all the remaining proper branches and ſhoots at full length, ſix inches aſunder, without reducing them in length either in the ſummer or winter pruning. By the above practice the ſhoots or branches of theſe trees, will about the ſecond or third year after they are laid in, begin to produce ſhort ſhoots or ſpurs (as they are generally termed) about an inch or two in length; ſome not above half an inch; and from theſe the fruit is produced. But if the branches of theſe trees were to be ſhortened, it would be cutting off the very part where bloſſom buds or ſpurs firſt begin to appear; and inſtead of thoſe fruitful parts, they would ſend forth a number of ſtrong wood ſhoots. This plainly ſhews, that the ſhoots which are intended for fruit-bearing muſt not be ſhortened; for if that is practiſed, the trees would conſtantly run to wood, and never produce any tolerable crop of fruit. If, indeed, there is a want of ſhoots in any part of theſe trees, then occaſional ſhortening is neceſſary. For inſtance, if there is any vacant part in the tree, and two, three, or more ſhoots, are requiſite to furniſh that vacancy, and only one ſhoot was produced in that part the preceding ſummer, that ſhoot, in ſuch a caſe, being now ſhortened to four or five buds, it, if ſtrong, will produce three or four lateral ſhoots the ſummer following.

Pruning and Nailing Plums and Cherries.—This is alſo a proper ſeaſon to prune and nail plums and cherries, either againſt walls or eſpaliers. Let it be obſerved, in the pruning of theſe trees againſt walls or eſpaliers, that, like the apples and pears, they being of the ſpur-bearing kind, producing the fruit upon ſhort natural ſpurs or ſtuds, emitted along the ſides of the branches, from two or three to many years old; you muſt accordingly retain the ſame branches many years for bearers, which muſt not be ſhortened in the courſe of pruning, but trained horizontally at full length, about five or ſix inches aſunder; and in every other reſpect the trees muſt be treated in the ſame manner as the apple and pear trees. But if ſhortening was generally practiſed to theſe kinds of fruit-trees, as is the caſe with many pruners, it would prove their manifeſt deſtruction in regard to preventing their fruitfulneſs.

General Obſervations in Pruning all the above Trees. — We obſerved above, that ſhortening the branches of apples, pears, plums, and cherry trees, was not proper in the general courſe of pruning; it however, in ſome particular caſes, is moſt neceſſary; for which take the following hints: For example then, when the trees, for walls and eſpaliers particularly, are only about one year old from the budding or grafting, either in the nurſery, or newly planted againſt walls or eſpaliers, with their firſt ſhoot immediately from the budding or grafting, at full length, it is proper to ſhorten or head down theſe ſhoots near the inſertion of the bud or graft, to force out lateral branches, which is called heading down the trees; but this ſhould not be done till ſpring, cutting them down to four or five eyes; which will procure lateral ſhoots near the ground, in order that the wall or eſpalier may be regularly furniſhed with branches from the bottom. After this the branches are to be trained along at their full length; if there appear to be ſtill more branches wanting, ſome of the moſt convenient of theſe laſt ſhoots may alſo be ſhortened, to promote their producing a farther ſupply of lateral branches, ſufficient to give the tree its proper form; for the great art is to encourage and aſſiſt young wall and eſpalier fruit trees in their firſt two or three years growth, to produce ſhoots in proper places, ſo as to cover the wall or eſpalier regularly with branches, from the bottom to the top.

But when the trees have acquired branches enough to effect the firſt proper formation of the head, they will afterwards naturally furniſh further ſupplies, to cover the wall or eſpalier regularly every way, to the allotted extent, without any farther ſhortening; except on particular occaſions, when a vacancy may happen in any part, according to the rule mentioned above, in the article of apples and pears. There is one thing farther to be obſerved in pruning apple, pear, plum, and cherry trees; and that is, when the trees have acquired branches enough to cover the wall or eſpalier, at the diſtance above mentioned, then all thoſe young ſhoots of the laſt ſummer's growth, that are not wanted in vacancies to form new bearers, muſt be cut off quite cloſe to the place from whence they ariſe, leaving no ſpurs but the fruit-ſpurs that are naturally produced, which every branch will be plentifully furniſhed with, if the above rules are obſerved.

Pruning and Nailing Peaches, Nectarines and Apricots. About the end of this month you may begin to prune peaches and nectarines, you may alſo prune and nail apricots. Before you begin to prune, it will be proper to un-nail the greateſt part of the ſmaller branches; then you can more readily uſe your knife, and alſo can conveniently examine the ſhoots, to ſee which are fit for your purpoſe, and which are not. In pruning theſe trees, obſerve to leave, in every part a due ſupply of the laſt ſummer ſhoots at moderate diſtances; that is, about four, five, or ſix inches aſunder, and in ſuch regular order as they may ſeem advancing one after another, quite from the bottom, as we have obſerved on former occaſions, in order that every part of the wall, from the bottom to to the extremity at every way of the tree, may be regularly furniſhed with them: for theſe ſhoots bear the fruit next year, and at the ſame time a proportionable ſhare of the two former years bearers, and naked old wood muſt be retrenched, to make room to train the young ſupply; for as theſe trees always produce their fruit upon the ſhoots of the laſt ſummer's growth, that is principally upon the one year's old ſhoots, and on no other, except occaſionally on ſmall ſpurs on the two or three years wood, but more generally the apricot; the pruner will by this know what he is to cut out, and what to leave, both in the young and old wood.

The next thing to be obſerved is, that all theſe retained ſhoots muſt now, for the general part, be more or leſs ſhortened; and this is done principally to encourage them to produce next ſummer, as well as fruit, a due ſupply alſo of bearing ſhoots, to bear fruit another year. For by ſhortening theſe ſhoots in the winter pruning, it makes them more certainly produce next ſummer a ſucceſſional ſupply of lateral ſhoots in proper places; and the ſhoots which are then produced, bear the fruit to be expected the year after that. But in ſhortening the ſhoots, mind to let every one be ſhortened according to its growth and original length; for inſtance, a ſhoot of about a foot long, may be pruned to about ſeven or eight inches, or a little more or leſs, according to its ſtrength; one of fifteen or eighteen inches, cut to about ten or twelve; and a ſhoot about two feet long, may be cut to about ſixteen or eighteen inches; and ſo in proportion to the length and ſtrength of the different ſhoots, leaving the ſtrong ſhoots the longeſt. Be careful, however, not to prune below all the bloſſom buds, except where you prune principally for wood. But ſuch peach, nectarine, and apricot trees as in general produce ſtrong and vigorous ſhoots, muſt be treated accordingly; the ſhoots of ſuch trees muſt be left ſomewhat cloſer than the diſtance above preſcribed, and muſt alſo be ſhortened leſs in proportion; ſome of the moſt vigorous ſhould be ſhortened but very little, and ſome not at all. This is the only method of pruning to bring a vigorous ſhooting tree, to a good order, ſo as to produce moderate ſhoots, ſuch as will bear fruit. By what is above hinted, the pruner will not be at a loſs to know in what manner peach, nectarine, and apricot trees are, according to their different growths, to be treated in the article of pruning; and the rule here mentioned is to be obſerved at all times in the winter pruning. Obſerve that where any of the ſhoots which are left to bear have produced any ſmall ſhoots from their ſides, they muſt be cut off: cut them cloſe to the principal ſhoot, for theſe would neither produce good fruit nor good wood.

Another thing is proper to be obſerved in pruning theſe trees, and that is, in ſhortening the ſhoots, to mind, if poſſible, to cut them off at a leaf or wood bud; diſtinguiſhable from the bloſſom buds by being long and flat, the others being round and ſwelling; or otherwiſe prune to a twin, bloſſom bud, meaning where two bloſſom buds ariſe at the ſame eye, having a wood bud between them; either of which rules being neceſſary to be obſerved in ſhortening, in order that each may produce a leading ſhoot next ſummer, forming a leader to the main ſhoots; for where there is a fair leading ſhoot produced at or near the extremity of a bearing ſhoot or branch, to draw the ſap more freely, ſuch a branch ſeldom fails to yield fair and well taſted fruit.

It will alſo be proper to remark one thing more in pruning theſe trees: that as we often ſee on the two-year old branches ſome ſhort ſhoots, or natural ſpurs, about an inch or two in length, and on the ſaid ſpurs there are frequently ſeveral bloſſom-buds, but in the apricot in particular, theſe fruit ſpurs frequently occur; now ſome people cut theſe ſpurs entirely off; but I declare againſt that practice; for ſome of theſe ſhort natural ſpurs will produce handſome fruit, both in apricots, peaches, and nectarines. But, on the other hand, it will be proper to leave only ſuch of theſe ſpurs as are well placed, and promiſe by the bloſſom-buds to bear fruit: and ſuch as are naked, and alſo ſuch as advance conſiderably in a fore-right direction, ſhould be removed. When you have finiſhed pruning any one of the above trees; let that be immediately nailed to the wall in a proper manner, before you begin to prune another; for it is much the beſt method to nail every tree according as you advance in the pruning.

But ſome direct to leave theſe trees un-nailed till the beginning of March; but this practice I would be far from recommending, for it not only looks ill to ſee the ſhoots hang dangling from the wall, but the froſt has alſo more power to affect the tender ſhoots, and the long vigorous ſhoots are liable to be broken by the winds; and, laſtly, by leaving the trees un-nailed till March, the bloſſom-buds will be then ſo much ſwelled, that many of them would be unavoidably diſplaced by nailing up the ſhoots. For the purpoſe of pruning and nailing wall trees in an effectual and neat manner, you ſhould be provided with a ſharp knife, moderately hooked at the point, and a ſmall narrow hand-ſaw, for the more readily cutting off uſeleſs old or large dead branches, and for the purpoſe of nailing, you ſhould have a very handy light hammer, a quantity of the proper garden-wall nails, made particularly for that purpoſe, which may be bought at any ironmonger's ſhop. The next requiſite is a quantity of cloth liſting, or ſhreds, and theſe ſhould be neatly cut into proper lengths and regular breadths; about half or three quarters of an inch is the proper breadth, but let none exceed an inch; for too broad ſhreds have a clumſy look, particularly on the ſmaller branches. Where neat nailing is obſerved, every ſhred ſhould be cut with even or ſquare ends, and not too long, for it looks ſlovenly to ſee long dangling ends hanging down.

Pruning and nailing Vines. — Vines either againſt walls or in the vineyard, ſhould now be pruned and nailed; and this may be done any time in this month. In pruning vines, you muſt obſerve to leave in every part a proper ſupply of the laſt ſummer's ſhoots to bear fruit the next year; and let all the irregular and ſuperabundant ſhoots, that are not wanted, be cut out cloſe; together with part of the former year's bearers, and old uſeleſs wood, which muſt now be cut out to make room for the bearing ſhoots or branches. For the laſt ſummer's ſhoots which are now left, will, in the ſpring, produce from every eye or bud, a young ſhoot, and on theſe young ſhoots the grapes are produced the ſame ſummer; for vines ſeldom produce bearing ſhoots from any but one year old wood. Therefore the main article to be obſerved now, is to leave a ſufficient ſupply of the laſt ſummer's ſhoots in every part regularly from bottom to top. Chooſe the ſtrongeſt and beſt ſituated ſhoots, with the ſhorteſt joints. The general rule is to ſhorten the ſhoots to three, four, five or ſix eyes or joints in length; which rule ſhould be always obſerved according to the ſtrength of the different ſhoots; and never leave the ſtrongeſt ſhoots more than five or ſix eyes, or joints; for when the ſhoots are left longer, they only fill the vines in the enſuing ſummer with more ſhoots than you can find room to lay in; and, beſides, the fruit upon ſuch ſhoots, would be ſmall and ill grown; in proportion, therefore it is beſt to ſhorten the ſhoots to the length above-mentioned; and the fruit upon theſe ſhoots will be found to grow large, and will ripen well, and one large bunch of grapes is at any time worth three ſmall ones. In ſhortening the ſhoots, mind to cut them about half an inch above an eye, and make the cut ſloping behind it. Let the branches or ſhoots in general be left ten or twelve inches apart, or more, but that at leaſt. Take care to prune in ſuch a manner as that there may always be a ſucceſſion of young branches towards the bottom to come in to ſupply the places of the old naked wood, which muſt be cut out occaſionally, as it becomes unſerviceable.

Fig-Trees. — Fig-tree pruning is adviſed to be deferred till next month, or *March*, where ſee the method explained.

Prune Gooſeberry and Currant Trees. — Gooſeberries and currants bear both on the young, one or two years wood, and upon the ſeveral year's branches, generally upon ſmall ſpurs emitted naturally all along the ſides; and in each winter pruning it will be required to cut out any caſual worn out, old, or irregular branches, and a proportionable ſupply of laſt ſummer's young ſhoots retained, and the reſt pruned out. In pruning gooſeberries, let them be always kept thin of branches, and theſe not permitted to grow ramblingly acroſs one another; but all pruned to regular order, ſo as the main bearers, or general branches and ſhoots ſtand ſix or eight inches diſtance at the extremities; and generally, either keep the middle ſomewhat hollow, cut out all the ſuperabundant lateral ſhoots of laſt ſummer, cloſe to the old wood, only retaining here and there a good one in vacancies, occaſionally towards the lower parts, to be advancing to a bearing ſtate, to ſupply the place of caſual worn-out bearers; and generally leave, where practicable, a terminating or leading ſhoot to each main branch: by no means ſhorten the ſhoots of theſe trees too much; for by cutting them very ſhort, they are made to produce a deal of wood, and but ſmall fruit, and being ſo full of wood as to exclude the ſun and free air in ſummer, the fruit cannot ripen well; and it likewiſe renders it troubleſome to get at the fruit, when fit to gather. Never clip the trees with garden ſhears, as is the practice of ſome ignorant perſons. Currant buſhes ſhould likewiſe be kept thin and regular, not ſuffering the branches to run promiſcuouſly acroſs each other; for when they are ſuffered to grow ſo irregular and thick, they deprive the fruit of the benefit of the ſun; for want of which it will be ſour and ill-flavoured obſerving nearly the ſame order of pruning as adviſed above for the gooſeberries.

Prune Raſpberries.—In pruning theſe plants, obſerve that a freſh ſupply of ſhoots ariſe from the roots every year in ſummer for bearing the ſucceeding year; for the ſhoots, when but one year old only, always produce fruit, and totally die in the winter following, thoſe of each year being ſucceeded by the ſucceſſional ſupply of young ſhoots of the laſt ſummer to bear the enſuing ſeaſon; therefore as the ſhoots which produced fruit laſt year will now be dead, they muſt be cut away cloſe to the ſurface of the ground, and leave ſtanding upon each root three or four of the ſtrongeſt ſhoots of the laſt ſummer's growth to bear fruit next year; but cut all the reſt off cloſe to the ſurface of the ground. Thoſe ſhoots which are left to bear muſt be each of them ſhortened; in doing of which you muſt cut off about one third or fourth of the length of each ſhoot, according to their ſtrength; obſerving, as they generally form a bend at top, it is proper to ſhorten them at or a little below the bending part; and if they are left longer, or that they ſtraggle wide and irregular from one another, may plait them together, either uprightly or archways, to ſupport them in an erect poſition. The ground ſhould then be digged between the rows; and, as you go on, the roots that do not belong to the ſtanding plants ſhould be taken away; and all ſhoots growing in the intervals dug up.

Prune Standard Fruit-trees.—Standard apple and pear-trees, and all other ſtandard fruit-trees, both in gardens and orchards, &c. may now have any neceſſary pruning, to reform caſual irregularities, very crouding branches, and to cut out any decayed wood and worn out bearers. Where any large branch grows in a rambling manner acroſs the reſt, let it be cut out. Where the main branches ſtand too cloſe ſo as to interfere with, and greatly crowd each other, let the moſt irregular growers be cut off. Let all dead wood and very old worn out branches be cut away in every part of theſe trees. By keeping the trees thin, and taking away all irregular growing and old caſual worn out branches, it is the only way to have large, fair, and well taſted fruit, and alſo to have handſome and laſting trees. Having cleared your trees from all uſeleſs branches, let the remaining ones be well cleared from moſs, if there be any on them.

JANUARY.—*KITCHEN GARDEN.*

The principal buſineſs at this ſeaſon in the kitchen garden is to continue to prepare ground for future crops, by manuring, digging, and trenching: protecting tender plants in frames and glaſſes, in froſty and other bad weather, making hot beds for early forcing, where required; and only a few articles are neceſſary to be ſowed and planted, and theſe principally in but ſmall portions on warm compartments, and in hot beds, for early crops. As it is the ambition of moſt gardeners, to excel each other in the production of early cucumbers and melons, all the preparations ſhould be attended to this month for that purpoſe; for being exotics of a very tender quality they require the aid of artificial heat under ſhelter of frames and glaſſes, until June or July, before they can bear the open air in this country. But by the aid of hot-beds, defended with frames and glaſſes, we obtain early fruit fit to cut in February, March, and April, &c. in the greateſt perfection. Obſerve, that in procuring theſe ſeeds for immediate ſowing, both of cucumbers and melons, it is adviſeable to have thoſe of two, three, or four years old, if poſſible, as the plants of which generally ſhew their fruit ſooner, as well as prove more fruitful than thoſe of new ſeeds, which are apt to run vigorouſly to vine, often advancing in conſiderable length before they emit a ſingle fruit.

Method of making up Hot Beds, and preparing the Dung for raiſing early Cucumbers, Melons, &c.

Provide a quantity of freſh horſe-dung, to make a ſmall hot bed for a ſeed bed, in which to raiſe the plants to a proper growth for ridging out into larger hot beds to remain to fruit: for this purpoſe a ſmall bed for a one or two light frame may be ſufficient, eſpecially for private uſe: in which caſe a good cart load of proper hot dung, or about twelve or fifteen large wheel barrows full, will be enough for making a bed of proper dimenſions for a one light box, and ſo in proportion for a larger. Having procured the dung, it muſt be previouſly prepared by ſhaking it up in a heap, mixing it well together, and let it remain eight or ten days to ferment; at the expiration of which time it will be arrived at a proper temperament for making into a hot bed.

Chooſe a place on which to make the hot bed, in a ſheltered dry part of the melon ground, &c. open to the morning and ſouth ſun: and it may be made either wholly on the ſurface of the ground, or in a ſhallow trench, of but from ſix to twelve inches deep, and four or five feet wide, according to the frame; but if made entirely on the ſurface, which is generally the moſt eligible method at this early ſeaſon, it affords the opportunity of lining the ſides of the bed with freſh hot dung quite down to the bottom, to augment the heat when it declines, and alſo prevents wet from ſettling about the bottom of the bed, as often happens when made in a trench, which chills the dung, and cauſes the heat ſoon to decay. Then, according to the ſize of the frame, mark out the dimenſions of the bed with four ſtakes; making an allowance for it to be two or three inches wider than the frame each way; this done, begin to make the bed according to the extent of the ſtakes, obſerving to ſhake and mix the dung well, as you lay it on the bed, and beat it down with the back of the fork, as you go on; but we would not adviſe treading it; for a bed which is trodden hard will not work ſo kindly as that which is ſuffered to ſettle gradually of itſelf: in this manner proceed till the bed is arrived at the height of three feet, or three and a half, which will not be too much, but let it be full three feet high: as ſoon as the bed is finiſhed to the intended height, let the frame and glaſs be put on; keep them cloſe till the heat comes up, then raiſe the glaſs behind, that the ſteam may paſs away.

Three or four days after the bed is made, prepare to earth it, previouſly obſerving if it has ſettled unequally; take off the frame and light, and level any inequalities; make the ſurface ſmooth, and put on the frame again, and lay in as much dry earth as will cover the bed all over about three inches thick: then fill ſome ſmall pots with rich dry earth, ſet them within the frame, put on the glaſs, and keep it cloſe, till the earth in the pots is warm.

Raiſing early Cucumbers and Melons.—The proper ſorts of cucumbers for early crops are: early ſhort prickly, early cluſter; the prickly, and early long prickly. The firſt two ſorts come earlieſt, but the laſt is conſiderably the handſomeſt fruit: if early melons are alſo required, the beſt are: romana melon, and Cantaloupe melon. Sow a few ſeeds in each pot, either of cucumbers or melons, or both, ſeparately, about half an inch deep. This done, place the pots in the middle of the bed, and draw ſome of the earth of the bed round each pot. Cover the glaſs every night with a ſingle mat only, for the firſt three or four nights after the ſeed is ſown, but as the heat decreaſes augment the covering: being careful in covering up, never to ſuffer the ends of the mats to hang down low over the ſides of the frame, which would draw up a hurtful ſteam, keep the plants too cloſe, and draw them up weak, and of a yellowiſh unhealthy like colour; obſerving likewiſe in covering up, that whilſt the great heat and ſteam continues in the bed, it may be proper, when the mats are put on in the evening, to raiſe one of the upper corners of the light half an inch, or a little more or leſs occaſionally, to give vent to the ſteam; ſuffering one end of the mat to hang down a little, juſt to defend the part where the glaſs is tilted.

Great care is requiſite that the earth in the pots have not too much heat, for the bed is yet very hot, which is the reaſon theſe ſeeds are adviſed to be ſown in pots; becauſe if any thing of burning ſhould appear, you can conveniently raiſe the pots farther from the dung, from which the danger proceeds, without diſturbing the ſeed or plants; and thereby prevent all injury from too much heat, provided you examine the bed every day, and give proper vent to the rank ſteam within the frame, while of a burning quality. In two, three, or four days after the ſeed is ſown, you may expect the plants to appear; when it will be proper to admit freſh air to them, by raiſing the upper end of the glaſs a little every day; and if the earth in the pots appears dry, refreſh it moderately with a little water that has ſtood in the bed all night, and nail a mat to hang down over the end of the glaſs that is raiſed, to break off the external cold air from the plants; but when the heat is more moderate, the glaſſes may be ſhut cloſe every night, obſerving to continue the admiſſion of freſh air at all opportunities in the day-time, and, if windy or a very ſharp air, to hang a mat before the place as above. On the day that the plants appear, ſow a little more ſeed in the the ſame bed, in the manner above-mentioned; for theſe tender plants being liable to ſuffer by different cauſes at this ſeaſon, it is proper therefore to ſow a little ſeed at three different times in the ſame bed, at ſhort intervals; for if one ſowing ſhould miſcarry, another may ſucceed. When the plants however, both of the firſt and ſucceeding ſowings, are two, three, or four days old, they ſhould be planted into ſmall pots, which pots muſt be placed alſo in the hot-bed, in the manner following:

Obſerve to fill the pots, the day before you intend to remove the plants, with ſome rich dry earth, and ſet them within the frame till the next day, when the earth in the pots will be warm; then let ſome of the earth be taken out, to the depth of an inch from the top of the pot; forming the middle of the remaining earth a little hollow; then with your finger carefully raiſe the plants up out of the ſeed-pots, with all the roots as entire as poſſible, and with as much earth as will hang about them, and place them in the other pots, in the hollowed part of the earth, with their roots towards the centre, and earth over their ſhanks near an inch thick, with ſome of the earth that was taken out of the pots; obſerving, if cucumbers, to plant three or four plants in each pot; if melons, two plants in each pot will be ſufficient, and if the earth is quite dry, give a very little water, juſt to the roots of the plants only; and directly plunge the pots into the earth on the bed cloſe to one another, filling up all the ſpaces between the pots with earth; and let every part of the bed within the frame be covered with as much earth as will prevent the riſing of the rank ſteam immediately from the dung, which would deſtroy the plants.

Be careful to examine the bed every day, to ſee that the roots of the plants do not receive too much heat: if any thing like that appears, draw up the pots a little, or as far as you ſee neceſſary for the preſervation of the plants, replunging them again to their rims when the danger is over. When the plants are fairly rooted, give them a little water in the warmeſt time of the day; and if performed when the ſun ſhines, it will prove more beneficial to the plants; let the watering be repeated moderately, according as the earth in the pots appear dry; and for this purpoſe, always have a quart bottle or two full of water ſet within the frame, to be ready to water the plants as you ſee them require it. If there is now a briſk growing heat in the bed, you ſhould, in order to preſerve it as long as poſſible, lay ſome dry long litter, ſtraw, waſte hay, or dried fern, round the ſides of the bed, and raiſing it by degrees as high on the outſides of the frame, as the earth is within. This will defend the beds from heavy rains or ſnow, if either ſhould happen: for theſe, if ſuffered to come at the bed, would chill it, and cauſe a ſudden decay of the heat, whereby the plants would certainly receive a great check. When there is a ſharp air or wind ſtirring, faſten a mat to the frame, ſo as to hang down over the place where the air enters; for this will alſo prevent the wind and cold air from entering immediately into the frame upon the plants, and they will reap the benefit of the air to a greater advantage than if the place was entirely expoſed.

About a fortnight, or a little more or leſs time after the bed is made, you will carefully examine the heat thereof, to ſee if it wants augmentation, and when the heat begins to decline conſiderably, remove the ſtraw, hay, or fern, from the front and back of the bed, if any was laid round it, as before adviſed, in which caſe apply a lining of freſh hot horſe-dung, to one or both ſides as it ſhall ſeem neceſſary: as ſoon as you have finiſhed the lining, cover the top with earth two inches thick; for this will prevent the rank ſteam of the new dung from coming up, and entering into the frame when the glaſs is tilted for the admiſſion of air, where it would prove very deſtructive to the plants; the lining will ſoon begin to work, when it will greatly revive the heat of the bed, and continue it in good condition a fortnight longer. Ten or twelve days after lining the ſides, remove the litter from the two ends of the bed, and apply alſo a lining of hot dung to each end, as above; it will again augment the heat for another fortnight to come.

By applying theſe linings of hot dung in due time, and renewing them as there ſhall be occaſion, you may preſerve the bed in a proper temperature of heat, of ſufficient duration to continue the plants in a free growing ſtate in the ſame bed, until they are of due ſize for ridging out into the larger hot-beds where they are to remain to produce their fruit. Obſerve, however, that where there is plenty of hot dung, and every proper convenience, you may, in order to forward the plants as much as poſſible, prepare a ſecond hot bed by way of a nurſery, about a fortnight after making the ſeed-bed in order to receive the plants therefrom in their pots when the heat begins to decline, plunging the pots in the earth as above directed; continuing to ſupport the heat of this bed as already explained, and in which the plants may be nurſed and forwarded, till they acquire a proper ſize for tranſplanting finally into the fruiting hot-beds. See *next Month*.

When the plants have formed their two firſt rough leaves, about two or three inches broad, and have ſhort runners, one or two joints, they are then of a proper ſize for ridging out into the large hot-beds, where they are finally to remain. See *next Month*. The plants muſt be ſtopt or topped at the firſt or ſecond joint, i. e. the top of the firſt advancing runner, when formed in the centre like a ſmall bud, ſhould be pinched off cloſe to the joint, as directed in February, which ſee.

Sowing Radiſhes.—At the end of this month, if the weather is open, ſow ſome ſhort topped radiſhes for an early crop, on a warm border, that lies well to the ſun, under a wall or other fence; and about the middle or latter end of the month, you may ſow more of the ſame ſort, and ſome ſalmon radiſhes to ſucceed the ſhort tops. But you ſhould not mix the ſeed of both ſorts together, but let each ſort be ſowed ſeparate; for the ſhort topped kind will come into uſe ſooner by a week than the ſalmon radiſh, even if both are ſown at the ſame time: beſides, the latter runs more to leaves than the former. There may be mixed and ſown with the radiſh, a ſprinkling of carrot-ſeed; for if the radiſhes ſhould fail, the carrots may ſucceed; and, if both ſucceed, there will be a double advantage; for when the radiſhes are drawn off for uſe, therere mains a crop of carrots, which will come in at an early ſeaſon: or, inſtead of the carrots you may ſow a ſprinkling of round-leaved ſpinach and a little lettuce, and when the radiſhes come off, theſe alſo come in. This is the common practice of the London gardeners. You ſhould ſow the radiſh ſeeds pretty thick at this ſeaſon, for when the plants begin to appear, the weather, if it ſhould prove ſharp, will cut off ſome, and the birds too being apt to attack them greedily, will deſtroy many; ſow the ſeed evenly over the ſurface, and either take it in with a large wide teethed rake, or, if ſowed in beds, cover it with fine earth, from the alleys, half an inch deep; then obſerving, eſpecially if appearance of froſt, that after the ſeed is ſowed, it will be of much advantage to ſpread ſome dry long litter over the ſurface, two inches thick, which will keep the ſurface warm, reſiſt the froſt, and greatly forward the germanation of the ſeed; which work of covering early radiſhes ſhould be continued occaſionally until the plants are farely in the rough leaves; this is the general practice of the London gardeners who thereby have them ready to draw for market plentifully in March.

Mint. — Make a ſmall hot bed for ſome mint, to come in early in the ſpring. The mint will appear in about a week or fortnight, and will be in a fine order for mint ſauce, &c. and either to uſe alone as a ſallad, or to mix among other ſmall herbs.

Parſley. — Sow ſome parſley ſeed, if open weather, about the middle, or towards the latter end of this month. There being two ſorts, the common plane leaved, and the curled leaved, the latter is preferable, the leaves being large, thick and buſhy, and is in much requeſt for garniſh to diſhes, though both ſorts are eligible, as pot herbs, &c. Theſe ſeeds may be ſowed in a ſingle drill round the edges of the kitchen garden quarters, or along the edge of the borders next the paths. This ſeed ſometimes lies ſix weeks or two months before it grows.

Carrots. — If the weather is open and dry, about the beginning, or any time of this month, let a warm ſpot of ground be prepared for a few early carrots: dig the ground a full ſpade deep, and break the earth well as you go on. In ſome families, young carrots are required as early as poſſible, and they may be forwarded by ſowing the ſeed in a moderate hot-bed; if you have no frame, or none at liberty, the bed may be arched over with hoops, and covered with mats occaſionally. When the plants come up, let them enjoy the free air in mild weather, and cover them in cold nights, whilſt young. And when an inch or two high, thin them to about three inches aſunder; and you will thus have young ſpring carrots for drawing in April and May.

Beans. — In the beginning of this month, if the weather is open, let ſome ground be got ready for a main crop of broad beans: The principal large ſorts are. Sandwich bean, toker bean, Windſor bean, broad Spaniſh bean, broad long podded bean. The Sandwich bean is an excellent ſort, and may be planted the firſt week in this month, if the weather permits. Alſo the toker bean, which is a very fine, and a good bearer. Set the beans either by a blunt-ended dibble, two or three inches deep, or drill them in that depth; and about four or five inches aſunder in the rows. For the early crops of beans, ſee *October*.

Peas. — Let ſome hot ſpur peas be ſowed the beginning of this month, for a full crop, on a warm piece of ground, to ſucceed the ſame ſorts which were ſown in October and November: the ſorts are: Charlton hot-ſpur, golden hot-ſpur, Reading hot-ſpur, Maſter's hot-ſpur, &c. But the two firſt are the earlieſt, and the others are proper to ſucceed them. At the ſame time alſo, you may ſow the firſt crop of marrowfat peas, and they will ſucceed the hotſpurs; for they will come into bearing as the others go off. This pea is much admired in moſt families: but the dwarf marrowfat is the propereſt for ſowing at this ſeaſon. See *October*.

Earthing up Peas and Beans. If you have peas and beans already up, one, two, or three inches high, or more, take advantage of a dry day, when the ſurface of the ground is dry, and draw ſome earth up to their ſtems. This ſhould not be omitted, for it will ſtrengthen the plants, and protect them greatly from the froſt.

FEBRUARY. — *FRUIT GARDEN.*

Forcing early Strawberries. About the latter end of this month, begin to make a hot-bed to raiſe early ſtrawberries: thoſe which are planted now in a hot-bed will produce fruit fit to gather in March and April. About the middle of this month, provide for that purpoſe as much new horſe-dung as will make a hot-bed about a yard high, for one or more three light frames. Let the dung be thrown in a heap, and let it lie about eight or ten days: in that time it will be in good condition to make the hot-bed. Previous to this, there ſhould be a proper quantity of ſtrawberry-plants potted, to place on the ſaid hot-bed; and this ſhould be done as directed in September: alpine and ſcarlet kinds are the beſt ſorts for this purpoſe, and ſhould be plants of two years old, of a full bearing ſtate. Having prepared the dung for the hot-bed, make it for one or more frames, about three feet high, and directly ſet on the frame and lights, to protect it from wet and draw up the heat ſooner: and when the violent heat is over, lay therein ſome earth, four or five inches thick; then bring in the plants, and plunge the pots into the earth up to the rims, and cloſe together as can be, filling up alſo all the interſtices between with earth. When all the pots are plunged, put on the glaſſes, and keep them cloſe till the ſteam ariſes in the bed, when it will be neceſſary to raiſe them a little behind, to let the ſteam paſs off. When the plants begin to puſh, let them have air at all opportunities, when the weather is favourable; for if they are kept too cloſe, the bloſſom will drop, without being ſucceeded to any tolerable crop of fruit, and let them be frequently refreſhed with a little water, and cover the glaſſes every night with mats.

In forcing ſtrawberries, the plants may be taken up out of the natural ground with balls of earth, and placed immediately in the earth of the hot-bed without potting them. However, when it is intended to force ſtrawberries, either in a common hot-bed, or in the hot-houſe, it would be a good method to plant ſome bearing plants in pots, in September, and ſo place the pots cloſe under ſome warm wall till the time they are to be placed in the hot-bed. But where there is the convenience of a pine-apple ſtove, or any kind of fruit forcing-houſe, or hot-wall, &c. you may raiſe plenty of early ſtrawberries in great perfection, with but very little trouble: having ſome bearing plants ready in pots, place them in the hot-houſe, any where near the glaſſes, giving frequent light waterings, they will fruit early in great abundance.

Tranſplanting Stocks to bud and graft upon. — Make new plantations of ſtocks to bud and graft the different kinds of choice fruit upon. Thoſe raiſed from ſeed, &c. laſt year, will now be ready for this practice. Let theſe be planted out as ſoon in the month as the weather will permit; plant them in rows thirty inches aſunder, and let them be planted at leaſt fifteen inches diſtance from one another in the row. They ſhould be planted by line, either dibbling in the ſmall plants, or the larger ones trenched, or holed in with the ſpade; or otherwiſe cut out ſmall trenches by line, placing the plants therein at the above diſtance, and turn the earth in upon their roots, and tread it gently to them all the way along.

Heading down budded Stocks. — Head down budded ſtocks, or ſuch young trees and ſhrubs that were budded the laſt ſummer: let this be done with a ſharp knife, obſerving to cut the head off about four inches above the place where the bud was inſerted. See the work of *Budding* and *Inoculating* in *July*.

Preparations for grafting. — Grafting may be begun any time after the fifteenth or twentieth of this month, provided the weather be mild. The ſorts proper to begin with are pears, plums, and cherries; and theſe kinds generally ſucceed beſt when grafted ſome time in the laſt fortnight of this month. Apples may alſo be grafted at the ſame time, or they may be deferred a fortnight longer. It ſhould be obſerved, that where grafting is to be done, you ſhould begin to prepare for it the beginning or middle of this month. The firſt thing to be done towards this work is to collect the grafts; and it muſt be obſerved theſe muſt be young ſhoots, ſuch only as were produced laſt year; for thoſe that are of more than one year's growth never take well. Theſe ſhoots or grafts you may begin to cut from the trees in the firſt or ſecond week of this month, in mild weather; and lay the lower ends of them in dry earth, in a warm border, till the grafting time, and if ſevere weather ſhould happen in the interim, cover them with long litter. The reaſon for cutting the grafts ſo ſoon, is, becauſe the buds will now begin to ſwell faſt; and if the grafts were not to be cut off in proper time, the buds would be too far advanced, and the grafts would by that means not take kindly with the ſtock, or at leaſt, not ſhoot ſo freely. Before we proceed to the methods of grafting it will firſt be neceſſary to mention what ſtocks are proper to graft the different kinds of fruit upon; for inſtance, apples ſhould be grafted upon ſtocks raiſed from the kernels of the ſame kinds of fruit, *i. e.* any kinds of apples; for the grafts or buds of theſe trees will not take well upon any other ſtocks.

It ſhould be obſerved, that for dwarf apple-trees, for walls or eſpaliers, or for ſmall ſtandards, they ſhould generally be grafted upon codlin apple-ſtocks, raiſed either from ſuckers from the root, or by cuttings or layers: for the ſtocks raiſed from theſe are never ſo luxuriant in growth as thoſe of the larger growing apple-trees; and, conſequently, trees grafted upon ſuch ſtocks, will be ſlower in growth, and can more eaſily be kept within due compaſs, ſo will anſwer the purpoſe for dwarfs, for eſpaliers, &c. much better than thoſe grafted on any other ſtock. Or if required to have them of ſtill more dwarfiſh growth for ſmall gardens, may uſe ſtocks of the Dutch paradiſe apple. But for the general ſupply of apple-ſtocks for common ſtandards, and large eſpalier trees, &c. they are raiſed principally from the ſeed of any ſort of apples or wild crabs. The time for ſowing the kernels of apples for ſtocks, is either in November or February; but if not ſown in November, they muſt be kept in ſand till this month. The plants will come up in five or ſix weeks, and in the autumn or ſpring following, ſome of the largeſt plants ſhould be drawn out and planted in nurſery-beds; and in the ſecond or third year after they will be in order to graft upon for dwarfs; but for ſtandards, let them be four or five years old, particularly if you intend to graft them at the height of four, five, or ſix feet; or may occaſionally graft for ſtandards, as low as is commonly practiſed for dwarfs, and to train up one ſtrong ſhoot from the graft, till it is five or ſix feet high, and then topped at that height to make it put out branches to form the head. Pears are generally grafted or budded upon ſtocks raiſed alſo from kernels of any of their own kinds of fruits; likewiſe by grafting them upon quince-ſtocks, which ſtocks are generally raiſed by ſeed, cuttings, layers, or ſuckers, and the pears grafted or budded upon theſe ſtocks are very proper for walls or eſpaliers. Sometimes alſo pears are grafted upon white-thorn ſtocks; but this is not ſo commonly practiſed, as theſe ſtocks have an ill effect on ſeveral ſorts of the fruit. The ſeaſon for ſowing the kernels of pears to raiſe ſtocks, and the tranſplanting, and time of grafting, is the ſame as mentioned above for apples.

Cherries are propagated by grafting or budding them upon ſtocks, raiſed from the ſtones of the common black or red cherry, or upon ſtocks raiſed from the ſtones, of any other kind of theſe fruit; but the two firſt are moſt eſteemed for that purpoſe, becauſe they generally ſhoot much freer than any other. The ſeaſon for ſowing the cherry-ſtones for raiſing ſtocks, is October or November, or in the ſpring; but when not ſown till ſpring, they muſt be laid in boxes of ſand all the winter, and muſt be ſown in this month. The ſtocks will be ready to tranſplant the firſt or ſecond year after ſowing, and the ſecond year after that will be fit to graft or bud, if for dwarfs, for walls, or for eſpaliers; but if for ſtandards, they muſt be ſeveral years old, run up with tall ſtems; for ſtandard cherries are generally grafted or budded at the height of five or ſix feet.

Plums are alſo grafted or budded upon plum ſtocks; that is ſtocks raiſed by ſowing the ſtones of any of the common ſorts of the ſame fruit; alſo raiſed occaſionally by ſuckers, ſent up from the roots of any kinds of plum-trees. The time for ſowing the ſtones to raiſe the ſtocks, is either in autumn or ſpring; but when they are not ſown till ſpring, they muſt be preſerved in ſand till that time, and the middle of this month is a good time to ſow them. Theſe ſtocks will be fit to bud or graft upon in the third, fourth, and fifth year after ſowing. It muſt be obſerved the ſtocks muſt be tranſplanted, ſome of the largeſt of them in the autumn or ſpring after ſowing, and in two or three years after will be fit to bud or graft upon. Let the ſtocks for grafting, both of fruit-trees and others, be always of the ſame family or genus as that of the reſpective trees which are to be grafted.

Note, Stocks raiſed from ſeed, being moſtly of a ſtronger growth, are commonly called free-ſtocks.

General Obſervations for performing the Work. — There are ſeveral methods of grafting, but we ſhall only take notice of three, which are practiſed with the greateſt ſucceſs, ſuch as Whip-grafting, Cleft grafting, and Crown-grafting. Previous to grafting, you muſt be provided with a proper grafting knife; a quantity of ſtrong baſs ſtrings for bandages, to tie the ſtocks and grafts firmly together; and ſome well wrought clay, to clay them round over the tying, to ſecure them from the air and wet. Obſerve, that the ſtocks intended to be grafted, muſt, previous to the inſertion of the graft, be headed down; which, if intended for dwarf trees, for walls or eſpaliers, muſt be headed pretty low; i. e. within five or ſix inches of the ground; but if for ſtandards, they may either be headed at five or ſix feet high; or at one, two, three, or four feet, for dwarf or half ſtandards: or occaſionally for ſtandards, ſome may be headed as low as directed for dwarfs, particularly apples and pears, and ſo train up one ſtrong ſhoot from the graft for a ſtem, till it is five or ſix feet high; then topped or cut off at that height, to cauſe it to throw out branches to form the head.

Whip-grafting. —This kind of grafting is practiſed with the greateſt ſucceſs, upon ſmall ſtocks, from about a quarter or one third of an inch; to half an inch, or near an inch in diameter: but commonly prefer ſmall ſtocks of about half an inch, or nearly equal in ſize with the grafts; and the method of performing the work is this:

Have your cions or grafts, &c. ready; then begin the work by cutting off the head of the ſtock, at a convenient height, according to rules above hinted; this done, fix upon a ſmooth part of the ſtock, where headed off, and there pare off the rind with a little of the wood in a ſomewhat ſloping manner upwards, about an inch, or near an inch and a half in length; then, having the cions cut into lengths of four or five eyes each, prepare one to fit the ſtock, as above, by cutting it alſo a little ſloping, ſo as to exactly fit the cut part of the ſtock, as if cut from the ſame place, that the rinds of both may join in every part; then cut a ſlit or tongue about half an inch in length upwards in the cion, and cut a ſlit the ſame length downwards, in the ſtock, to receive the ſaid tongue; in that manner fix the graft in the ſtock, taking care that the ſap or rind of both may meet, or join as exact as poſſible in every part. Having thus fixed the graft, let it be immediately tied with a ſtring of ſoft baſs, bringing it in a neat manner ſeveral times round the graft and ſtocks, taking care to preſerve the graft in its due poſition; and let the bandage be neatly tied, and immediately cover the place with ſome grafting clay, obſerving to bring the clay near an inch above the top of the ſtock, and a little lower than the bottom part of the graft, leaving a due thickneſs on every ſide of the graft and ſtock, making it in a roundiſh oval form, and take care to cloſe it well in every part that no wet, wind, or ſun can enter; to prevent which is the whole intention of the clay, for without that precaution, the operation would prove fruitleſs; and in this manner proceed with the reſt. In performing the operation of whip-grafting, ſome grafters firſt cut and prepare the cion, and then cut and fit the ſtock to that; but it is not material which, provided it be done in an exact and ſomewhat expeditious manner.

Next it muſt be noted, that the grafts muſt be now and then examined, to ſee if the clay any where falls off, or cracks: if it does it muſt be renewed with freſh clay. By the laſt week in May, or firſt week in June, the grafts and ſtocks will be well united, and then take off the clay, and looſen the bandages.

Cleft Grafting.—The next general method of grafting is that by clefting the ſtock, commonly called cleft or ſlit grafting; becauſe the ſtock is cleft, and the graft put into the cleft part; and is performed in the following manner:

The proper ſized ſtocks on which this kind of grafting is performed, are generally about an inch, or an inch and a half, and even two inches, or more, in diameter. Firſt, with a ſtrong knife or ſmall ſaw cut off the head of your ſtock, and pare it very ſmooth; this done, fix upon a ſmooth part of the ſtock, juſt below where headed, to place your graft; and on the oppoſite ſide to that, cut away part of the ſtock, about an inch and a half, in a ſloping manner upwards, ſo as the crown of the ſtock may not be more than about half an inch broad. This done, prepare your graft, or cion, which is done in this manner: obſerve to cut your grafts into due lengths, leaving four or five eyes to each: then take your ſharpeſt knife, and pare away the bark and ſome of the wood at the lower end of the graft in a ſloping manner, about an inch and a half or near two inches in length; and then cut the other ſide in the ſame form, making it to have a wedge-like ſhape; but let one ſide of it, which is to be placed outwards in the ſtock, be left near double the thickneſs of the other ſide. The graft being prepared, take your ſtrong knife, and place it on the middle of the ſtock, croſs-ways the top of the ſloped part, and with your mallet ſtrike the knife to the ſtock, obſerving to cleave it no farther than what is neceſſary to admit the graft readily; then place the grafting chiſſel, or ſome inſtrument, a little way into the cleft, at the ſloped part of the ſtock, to keep it open for the reception of the graft, which then directly introduce into the cleft on the uncut or upright ſide of the ſtock, at the back of the ſlope, inſerting it with great exactneſs, as far as it is cut, with the thickeſt edge outwards, and ſo that the rind may meet exactly every way with the rind of the ſtock. The graft being placed, then remove the grafting chiſſel, taking care not to diſplace the graft; this done, let it be tied and well clayed in the manner directed as above, in the work of whip or tongue grafting. Or, if in this cleft-grafting, you chooſe to put in two grafts, it may be performed on large ſtocks, and which muſt be twice cleft, and the clefts muſt not be acroſs, but parallel to each other, and ſo fix the grafts in the ſtock, obſerving to bind and clay them as above. This kind of grafting may likewiſe be performed on the branches of trees that already bear fruit, if you deſire to change the ſorts. The grafts will be united with the ſtocks by the laſt week in May, or the beginning of June, and then take off the clay, and looſen the bandages, and apply freſh clay at the top of the ſtock.

Crown-grafting.—The third kind of grafting, is known by the name of Crown-grafting. This way of grafting is commonly practiſed upon ſuch ſtocks as are too large and ſtubborn to cleave, and is often performed upon the branches of apple and large pear-trees, &c. that already bear fruit, when it is intended to change the ſorts, or to renew the tree with freſh bearing wood. The manner of doing this ſort of grafting is as follows: Firſt, cut off the head of the tree or ſtock level, or of any particular branch of a tree, which you intend to graft, and pare the top perfectly ſmooth, then prepare your grafts, which is done by cutting one ſide flat and a little ſloping about two inches in length, making a kind of ſhoulder at top of the cut, to reſt on the head of the ſtock; and pare off only a little of the bark towards each edge of the other ſide of the graft; then raiſe the bark of the ſtock, firſt by ſlitting it downwards, and then having a ſmall wedge of hard wood, or rather iron, one ſide of it formed ſomewhat roundiſh, the other flat; let this inſtrument be driven down gently between the bark and wood of the ſtock or branch, the flat ſide towards the wood, driving it far enough to make room for the graft; then drawing out the wedge, ſlip down the graft, placing the cut or ſloped ſide towards the wood, thruſting it down as far as cut, reſting the ſhoulder thereof upon the top of the ſtock; and in this manner you may put four, five or ſix grafts, or as many as may ſeem convenient upon each ſtock or branch, and bind them round with ſtrong baſs. When the grafts are all thus fixed, you muſt then immediately apply a good quantity of well-wrought clay, bringing it cloſe about the ſtock and grafts, obſerving to raiſe it at leaſt an inch above the top of the ſtock in a rounding manner, ſo as to throw the wet quickly off, and prevent its lodging or getting into the work, which would ruin all. Thoſe trees which are grafted this way, will take, and ſhoot very free; but there is, for the firſt year or two after grafting an inconvenience attending them, and that is the grafts being liable to be blown out of the ſtock by violent winds; but this muſt be remedied by tying two or three ſticks to the body of the ſtock, or branch that is grafted, and the grafts tied to the ſticks. The beſt time for performing this kind of grafting, is in the laſt week of March, or firſt week in April; for then the ſap will begin to be more in motion, which renders the bark of the ſtock much eaſier to be ſeparated from the wood to admit the grafts. Theſe grafts will be pretty well united with the ſtock by the end of May or beginning of June.

FEBRUARY.—*KITCHEN GARDEN.*

Cucumbers and Melons.—Where the raiſing of early cucumbers and melons was not begun laſt month, it may now be commenced the beginning or middle of this with a greater proſpect of ſucceſs; obſerving exactly the ſame method in making the ſeed hot-bed, ſowing the ſeed, and general management of the bed and plants, as directed under the head cucumbers, &c. in the kitchen garden of January.

Ridging out early Cucumbers and Melons raiſed laſt Month.—If the cucumber and melon plants which were raiſed the beginning or any time laſt month, have not ſuffered by any of the accidents that are attendant on them at this ſeaſon, they will now be arrived to a proper ſize for ridging out into a larger hot-bed, finally to remain; a new hot-bed for one or more larger frames, ſhould therefore be prepared in due time for their reception. Then when the bed is in order, lay about half a buſhel or rather more, of earth juſt under in the middle of each light, raiſing each parcel of earth in a round hillock, ten or twelve inches high; then let the ſpaces between the hills, and quite to the ſides of the frame, be covered with the ſame ſort of earth, only two or three inches thick at this time, but which is by degrees to be augmented till raiſed as high as the top of the hills, as hereafter directed.

The plants which were pricked out laſt month into ſmall pots are now to be turned out of theſe pots with the ball of earth entire, in order to have the whole ball of earth adhere cloſely about the roots, to give the pots ſome water the day before they are to be planted.

Of Stopping or Pruning the above Plants.—The young plants, both cucumbers and melons, ſhould be ſtopped or pruned, if not done before, at the firſt joint, by pruning off the top of the firſt runner-bud; this will cauſe them to ſend out fruitful runners. This operation ſhould be performed when the plants have two rough leaves, and when the ſecond rough leaf is about the breadth of a ſhilling, having the runner-bud at its baſe, and the ſooner this is detached, the ſooner the plants acquire ſtrength, and put out fruitful runners. It is to be done in the following manner: You will ſee ariſing at the bottom of the ſecond rough leaf, and as it were encloſed within it, the end of the firſt runner. This appears like a ſmall bud; which bud, or runner, being the top of the plant, is now to be taken off cloſe, and may be done either with the point of a pen-knife or ſmall ſciſſars, or pinched off carefully with the finger and thumb; but which ever way you take it off, be careful not to go ſo cloſe as to wound the joint from whence it proceeds.

Having thus pruned, or ſtopped the plants at the firſt joint, they will by that means very quickly get ſtrength, as will plainly appear in a few days; and in about a week, or ten or twelve days, after being thus treated, will each bgin to ſend forth two or three runners: which runners will probably ſhew fruit at their firſt, ſecond, or third joints; for if the main or firſt runner was not to be ſtopped as above, it would perhaps run half a yard, or two feet in length, without putting out more runners to fill the frame, or without ſhewing a ſingle fruit; ſo that it is upon theſe lateral ſhoots, or runners, produced after ſtopping the plants, that the fruit is moſt likely firſt to appear in any tolerable time in the ſeaſon; but let it be alſo obſerved, that when the ſaid lateral ſhoots have three joints, and that if any of them do not then ſhew fruit at either of the joints, it will be proper to pinch off the tops of ſuch ſhoots at the third joint, which will promote their putting forth a ſupply of two or three new ſhoots, ſome or all of which will moſt likely be fruitful: and after this, let the plants take their own courſe or growth: and if the bed is well managed, and the plants are forward, they will probably produce fruit the end of this month, or beginning, or middle of next.

Forcing Aſparagus.—Hot-beds for obtaining early aſparagus may be made any time in this month. For the purpoſe of forcing aſparagus, we muſt be provided with proper plants; theſe are previouſly raiſed in the natural ground from ſeed, as hereafter directed, which being tranſplanted from the ſeed-bed into other beds in the common ground, and having two or three years growth there, they are then in a proper ſtate for forcing; obſerving, that the neceſſary quantity is from about five to ſix or ſeven hundred for a bed for a three-light frame, and ſo in proportion for two or more ſuch frames; for theſe plants in hot-beds ſhould be crowded very cloſe, in order that by having as many plants as poſſible in each frame, they may produce a proportionable ſupply of aſparagus, to recompence ſufficiently for the great trouble and expence requiſite in forcing. The hot-beds, for this purpoſe of forcing aſparagus, are made as directed for cucumbers; but it muſt be made a yard high at leaſt, and when at its proper height, level the top even and ſmooth: then directly, without putting on the frame as yet, earth it all over ſix or ſeven inches thick, for the immediate reception of the plants, for no time muſt be loſt in making the moſt of the hot-bed in forcing aſparagus; but remarking, the frame muſt not yet be put on, for the heat of the bed being very ſtrong at firſt, the framing it would make it heat too violently. The bed being made, and earthed as above, proceed to place the plants on the ſurface of the earth, previouſly raiſing at one end a ſmall ridge of earth five or ſix inches high, againſt which to place the firſt courſe of plants. This done, then place others againſt theſe in the ſame manner; and ſo continue laying them with their tops or crowns all upright, and of an equal level: then, when the whole bed is thus planted, let ſome moiſt earth be directly banked up againſt the outſide roots, all around, as high as their tops; which done, cover the crowns of the roots all over with light rich earth, about two inches thick, which concludes the work for the preſent; till the buds or young ſhoots of the aſparagus begin to appear through the earth. When the buds therefore of the aſparagus begin to appear through the ſurface of the earth, then prepare to add another portion of three or four inches depth of more mould; for there muſt be a ſufficient depth of earth for the buds to ſhoot through, that they may be of a proper length. Having applied the ſecond addition of earth, then, if you judge that all danger from burning is over, it will be proper to put on the frame. Obſerve, that if during the time the bed is without the frame, there ſhould happen exceſſive rains, or great ſnow, it is proper to cover occaſionally with mats or ſtraw, &c. But it muſt be remarked, that for the firſt week or fortnight after the bed is made, and the aſparagus planted, that the ſtate of its warmth ſhould be every day carefully examined: for that purpoſe, thruſt two or three long ſticks down betwixt the roots into the dung, in different parts of the bed; when upon drawing up the ſticks, once or twice a day, and feeling the lower end, you can readily judge of the degree of heat: if it is found to be ſo violent as to threaten to burn the earth and ſcorch the roots, it will in that caſe be adviſeable to bore, with a long thick ſtake, ſeveral wide holes in the dung, on each ſide of the bed, alſo in the earth juſt under the roots, to admit the air, and to let the rank ſteam and burning quality of the dung paſs off more freely; but, when the heat is become moderate, the holes muſt be cloſed again.

Continue to cover the glaſſes every night with mats or ſtraw. The bed, if made and managed as above directed, will begin to produce aſparagus abundantly in four or five weeks; and, provided the heat be kept up, will continue producing buds in great plenty for about three weeks. A bed for a three-light-frame will, for that time, produce three or four hundred buds a-week. The method of gathering the aſparagus in hot-beds, is to thruſt your finger down gently into the earth, and break the buds off cloſe to the roots, which they will readily do; but the cutting them with a knife, as practiſed in the natural ground, would, by reaſon of the buds coming up ſo very thick one under another, deſtroy as many or more than you gather. When it is intended to have a conſtant ſupply of aſparagus in the winter and ſpring ſeaſon, till that in the natural ground comes in, you ſhould make a new hot-bed every three weeks or month. A quantity of freſh plants muſt alſo be procured for every new bed; for thoſe which have been once forced in a hot-bed are not fit for any uſe afterwards, either in a hod-bed or the natural ground. The ſeaſon to begin to make hot-beds for forcing theſe plants, is according to the time you deſire to have the plants fit for uſe; for inſtance, if you deſire them at Chriſtmas, begin in the ſecond or third week in November. Such perſons as do not chooſe to raiſe the plants themſelves for forcing, or ſuch as deſire to be furniſhed with plants for that purpoſe till their own are ready, may in either caſe be furniſhed with them, at moſt of the kitchen-gardeners near great cities, but particularly thoſe near London, many of whom raiſe great quantities purpoſely for forcing.

Care of Cauliflower Plants. —Cauliflower-plants in frames ſhould have the free air every mild day, by taking the glaſſes entirely off. About the end of the month, if mild ſettled weather, you may tranſplant ſome of the ſtrongeſt plants into the place where they are to remain. Plant them in a quarter of rich, well-dunged ground, thirty inches, or a yard diſtance each way. Cauliflowers under hand or bell-glaſſes, ſhould alſo be thinned out towards the end of the month, if fine weather; that is, if there are more than one or two under each glaſs, let all above that number be taken away. Obſerve to take up the weakeſt, and let the ſtrongeſt remain, and draw ſome earth up round their ſtems, ſtill continuing the glaſſes, and give air, by tilting one ſide. The plants which are taken up ſhould be planted in another ſpot of ground, the ſame diſtance as above.

Sow early Celery. — About the middle, or towards the latter end of the month, prepare a ſmall bed of light rich earth in a warm border, to ſow ſome upright celery ſeed, for an early crop. Break the earth very fine, and cover it with light earth, ſifted over it near a quarter of an inch deep; the ground muſt be formed into a three or four feet wide bed; trim the ſurface ſmooth. But thoſe who deſire to have the plants come in pretty forward, ſhould ſow the ſeed in a ſlight hot-bed, under a frame and lights, or hand-glaſſes; or in default of theſe, cover on nights and bad weather with mats. The plants for this ſowing come in for uſe in June and July. There ſhould not be many of theſe early ſown plants planted out, but only juſt a few to come in before the general crop; for they will ſoon pipe in the heart, and run up for ſeed. See *April* and *June*. Let it be obſerved there are two ſorts of celery; one known by the name of Italian or upright celery; the other called celeriac, or turnep-rooted celery. The firſt is that which is moſt commonly cultivated, and of which there are two varieties, viz. common upright celery with hollow ſtalks, and ſolid ſtalked celery.

Sow Turnip-rooted Radiſh.—Sow a few of the ſmall white turnip radiſh to draw for ſallads in April and May; they eat criſp, and are agreeably flavoured.

Sow Spring Spinach.--Winter ſpinach will now advance in growth: clear out all weeds, and thin the plants for uſe as wanted. Sow ſpinach about the beginning of this month, if mild weather; let ſome good ground be got ready for this ſeed, and ſow it thin and regular, and rake it in evenly. Spinach may be ſown between rows of cabbages, cauliflowers and beans, or the like, if ground be ſcarce. The ſmooth-ſeeded, round-leafed kind is the beſt to ſow now; and if deſired to have a conſtant ſupply, let the ſowings be repeated every fortnight or three weeks till Auguſt, when you may ſow for the winter crop. See *Auguſt*.

Sow Spring and Summer Lettuces. — About the beginning of this month, if the weather is mild, you may ſow ſeveral ſorts of lettuce-ſeeds, on warm borders. The white and green cos kind, and the Cilicia and cabbage lettuce, are proper ſorts to ſow now; you may alſo ſow ſome of the brown Dutch and Imperial lettuces, or any other ſorts: let the ſeeds be ſown tolerably thick, and rake them in lightly as ſoon as ſown. If the weather ſhould be cold at the beginning of the month, you may ſow cos, or other lettuce-ſeeds, in a frame, and cover them occaſionally with glaſſes or mats, on nights and ſharp weather; obſerving, that when of due ſize they are to be tranſplanted in the full ground. But, in order to have a few come in pretty forward for tranſplanting, there may be a little green and white cos ſown on a gentle hot-bed, which will be ready to tranſplant a fortnight ſooner than thoſe in the full ground. The green cos lettuce is the hardieſt, comes in ſooneſt for uſe, and is the beſt ſort to ſow early.

Tranſplant Lettuces ſown in November or December. — Lettuces which have ſtood the winter in warm borders, or in frames, ſhould, about the end of this month, if quite mild weather, be thinned out where they ſtand too cloſe: let them be thinned regularly leaving them a foot diſtance each way, for they will require ſo much room to grow to their full ſize: the plants which are drawn out, ſhould be planted in an open ſpot of rich ground, a foot aſunder; and give a little water as planted.

Sow Onions for Summer and Autumn Supply. — About the beginning or middle of this month, you may get ſome ground ready for ſowing onions and leeks: ſow the ſeed in a dry day, on the rough ſurface, moderately thick, and as regularly as poſſible: then tread them down evenly, and rake them in with regularity. Or there may be a thin ſprinkling of leek-ſeed ſown with the onions, the onions being generally at their full growth, and drawn off, in the middle of Auguſt; the leeks will then have full ſcope, and grow to a large ſize. The leeks are generally fit to tranſplant in June and July. Obſerve the directions there given. For the winter and ſpring ſupply, ſee *Auguſt*.

Tranſplant Cabbages, ſown in Auguſt. —Early ſugar-loaf cabbages, and other cabbage plants, ſhould be tranſplanted this month where they are to remain. But if they are weakly, or much cut by the froſt, do not put them out before the end of this month, or beginning or middle of March. And let ſome rotten dung be dug in. Put in the plants in rows, two feet and a half aſunder, and allow the ſame diſtance between the rows, if deſigned to ſtand to grow to full ſize for a main crop; but if intended to cut them up young, in May and June, plant them only half a yard or two feet aſunder.

Sow Cabbages and Savoys, for Autumn. —Sow ſome ſugar-loaf and other ſummer cabbages, and large autumnal kinds, about the middle or latter end of the month, for autumn and winter uſe. Theſe will ſucceed though ſown in Auguſt, for they will be fit to cut in July, Auguſt, and September, &c. But if the winter has been ſevere, and deſtroyed many of the plants which were ſown laſt Auguſt; to ſtand the winter for an early crop, it will, in that caſe, be proper to ſow ſome of the early ſeed as ſoon in the month as the weather will permit; and, if a few is forwarded by ſowing them in a ſlight hot-bed, it would be a great advantage. Sow alſo ſome red cabbages for next winter's ſupply. Savoy-ſeed may be ſown, for the firſt time, about the middle or latter end of this month. Thoſe which are now ſown will be ready in September, and they will be finally cabbaged by October, and will continue in good perfection all November and December, &c. See *April* and *May*.

Sow Cauliflower-Seed, to ſucceed the Early Crop. — Sow cauliflower-ſeed the beginning of this month, to raiſe ſome plants to ſucceed the early crops ſown in Auguſt; but in order to bring the plants up ſoon, and to forward them twelve days or a fortnight in the growth, it will be proper to ſow theſe in a ſlight hot-bed. Sow the ſeed on the ſurface, cover it with light earth, about a quarter of an inch thick, and then put on the glaſs. But where there is not the convenience of a frame for the above bed, you may cover it on nights, and in bad weather, with mats, fixing hoops, long ſticks, or poles, arch-ways acroſs, and over theſe draw the mats. Sprinkle them with water frequently, if moderate ſhowers of rain do not fall: the cauliflowers will be fit to cut in Auguſt: ſee *April* and *May*.

Sow Beets. — This is now the time to begin to ſow the different ſorts of beet; the red beet for its large root; and the green and white ſorts for their leaves in ſoups, ſtewing, &c. let drills be drawn with an hoe, about an inch deep, and ten or twelve inches aſunder: ſow the ſeed therein thinly, and earth it over an inch thick, and let the lines be a foot aſunder.

Earth up Beans and Peas. — Beans and peas which are up, and advanced from two or three to five or ſix inches high, ſhould have earth drawn up to their ſtems, which will ſtrengthen them, and protect them from froſt. Let this be done in a mild dry day.

Sow Coriander and Chervil.—Coriander and chervil for ſoups and ſallads, &c. may be ſown any time this month, when the weather is open. Draw ſome ſhallow drills, and ſow the ſeeds therein thinly, and cover them rather more than a quarter of an inch with mold, eſpecially the coriander ſeed. Theſe plants are always to remain where ſowed; and as they ſoon fly up to ſeed, muſt be ſowed every month, &c.

Plant Garlic, Rocambole, and Shallots. — Let the beds be four feet wide, and plant the roots length-wiſe in the beds: nine inches ſhould be allowed between the rows: the roots ſhould be planted ſix inches diſtant from each other in the row, and two or three inches deep. They may be planted either with a dibble, or in drills drawn with a hoe.

Plant Horſe-Radiſh. — It is propagated by cuttings of the root, either cut from the top an inch or two long, or ſome old roots cut into pieces of that length. The method is this; firſt procure a quantity of proper ſets, which may be either the ſmall off-ſets that ariſe from the ſides of the main roots, of which take cuttings of their tops an inch or two long; or you may uſe alſo the top or crowns of the old roots, when taken up for uſe, in cuttings of the above length; or in default of a ſufficiency of crowns or tops of either, you may divide a quantity of old knotty roots into cuttings of an inch or two long, as aforeſaid; which, if furniſhed each with two or three buds, or eyes, they will make tolerable ſets: but give preference to cuttings of the crowns or tops, if enough can be produced; obſerving, that when intended to make a freſh plantation, you ſhould, during winter, &c. when you take the plants up for uſe, reſerve all the beſt off-ſets for planting; alſo the crowns of the main roots; but this latter is only practicable in private gardens; for where the large roots are deſigned for ſale, their tops muſt not be taken off, which would render them unſaleable in market; therefore the market gardeners always reſerve the ſtrongeſt off-ſets ariſing either from the bottom, or emitted from the ſide of the main root; when you plant them make the holes ſix inches aſunder, dropping, as you go on, one ſet or cutting in each hole, with the crown, &c. upright, taking care to fill or cloſe the holes up properly with the earth, and let the rows be two feet aſunder. They muſt be kept clean from weeds about a month or ſix weeks; after which the leaves will cover the ground, and prevent the growth of weeds.

All the ſtools, or bottoms of the roots, muſt be left in the ground undiſturbed; for theſe yield a ſupply of fine roots the ſucceeding year; and when the roots are then dug up, the old ſtools ſtill remaining produce another ſupply the year after; and thus, if permitted to ſtand, they continue, as often as the produce is gathered, to furniſh a freſh ſupply the ſucceeding ſeaſon: and in that manner continue producing a full crop of fine roots for many years. But care muſt be taken when digging up the roots, always to clear the old ſtool from all ſtraggling or ſmall roots whatever; and, in the ſummer ſeaſon, to draw up all ſmall plants riſing between the rows.

Sow early Turneps for Spring and Summer. — Sow a little early Dutch turnep-ſeed about the middle or latter end of the month, in a warm-lying open ſpot of light ground; but as theſe early ſowed plants will ſoon run to feed before they attain any tolerable ſize, you ſhould ſow only a ſmall quantity at this time to come in early. You may continue to ſow turneps every month till July or Auguſt. See *July*.

Sow Scorzonera, Salſafy, and Hamburgh Parſley, to ſupply the Table for Summer and Autumn. — The latter end of this month you may ſow ſcorzonera, ſalſafy, and Hamburgh parſley. Theſe plants are in ſome families, much eſteemed for their roots, which are the only parts that are eaten. The roots run pretty deep in the ground, in the manner of carrots and parſneps, and are boiled and eaten either alone or with meat, like young carrots, &c. Theſe are fit for uſe from July till March. Sow the ſeed thin and even, on ſeparate beds, either in ſhallow drills ſix or eight inches diſtance, and earthed over half an inch, or ſowed on the rough ſurface, and rake them in equally; they are all to remain where ſowed, and the plants ſhould be thinned in May or June, to ſix inches diſtance.

MARCH. — *FRUIT GARDEN.*

Prune Fig-Trees. — Prune fig-trees, this being the beſt time of the year for performing that work. Some prune figs the latter end of autumn, but that is wrong; the young bearing ſhoots being tender, many of them are liable to be killed by the froſt in ſevere winters; therefore, if they were to be pruned in autumn, and no more ſhoots left than what would juſt furniſh the wall, and ſhould a ſevere froſt afterwards deſtroy many of the ſhoots, you have then no reſource left for ſhoots to ſupply theſe vacancies. The beſt way is to let theſe trees remain unpruned till this ſeaſon, leaving the whole ſupply of young ſhoots till this time; and if ſevere froſts ſhould happen in winter, there will be a chance, out of the whole, to find enough that have eſcaped the froſt, to lay in to furniſh the wall. In pruning fig-trees, obſerve, that as they bear only on the young wood you muſt leave a ſufficient ſupply of the laſt ſummer's ſhoots from the bottom to the extremity, in every part where poſſible, and prune out the ill-placed and ſuperfluous ſhoots with part of the old bearers and naked old wood, to have proper room to train the proper ſhoots, ſo as the tree may be equally furniſhed with bearers, at moderate diſtances, for theſe young ſhoots bear the figs the enſuing ſeaſon; fig-trees always producing their fruit on the one year old wood only. Take care always, in particular, to train in every year ſome young ſhoots, at or near the bottom, that there may be a ſupply of young branches coming up regularly one after another, to ſupply the places of long old naked branches, which will occur every ſeaſon in ſome part of the tree; for ſuch long-extended naked old branches or others not furniſhed properly with young wood ſhould now be cut out, that there may be ſufficient room to train the bearing branches regularly, and at proper diſtances. The young branches of fig-trees muſt not be ſhortened or topped, but leave each at full length; for if they were to be ſhortened, it would not only cut away the part where fruit would have appeared, but alſo occaſion them to run much to wood, and thereby never produce half a crop of fruit, ſo only cut off caſual dead ends. The tree being pruned, let every branch be immediately nailed ſtraight and cloſe to the wall, at equal diſtances, ſeven or eight inches from each other, or thereabout.

Preſerving the Bloſſoms and young Fruit of Wall-Trees. — When apricot, peach, and nectarine-trees are in bloom, ſome of the choice kinds ſhould be defended from froſt, if it ſhould happen at that time, by covering the trees with mats, &c. The mats for this purpoſe ſhould be of the largeſt ſize; one end of them ſhould be faſtened with nails or hooks, to the top of the wall, and let them hang down over the trees. The lower end of the mat ſhould alſo be faſtened down, to prevent their being blown to and fro by the wind, which would beat the bloſſoms off. When the weather is mild, the mats ſhould be taken off; for it is only in ſharp froſts that the bloſſom requires to be thus ſheltered. Or to preſerve the bloſſoms and young fruit, you may occaſionally ſtick the trees with the cuttings of the ſhoots or ſmall branches of laurel, yew, fir, and ſome other hardy evergreens, that are furniſhed with leaves, and obſerving to ſtick them between the branches, in ſuch a manner as to ſhelter all thoſe which are in bloſſom; and permitted to remain conſtantly, till the fruit is fairly ſet, as big as large peas. Or in default of evergreens, ſtick the trees, in time of their bloom, with branches of dried fern, which has a good effect in ſheltering the tender bloſſom.

Propagate Vines. — Plant cuttings of vines the beginning or middle of this month, by which means you may propagate any ſort you deſire, for the cuttings will take root freely. The cuttings muſt be ſhoots of the laſt year, which if cut from the trees laſt month, or the beginning of this, it will be the more eligible; ſhortening them to twelve inches in length, or each to about three joints, and let each cutting have about an inch, or ſo, of the former year's wood at its bottom. Though this is not abſolutely neceſſary, as they will ſucceed without old wood. They may be planted either in nurſery-rows, or in the places where they are finally to remain, either againſt walls, eſpaliers, or elſewhere; obſerve, to plant them ſomewhat ſlanting, and ſo deep that only one eye may appear above ground, which ſhould be cloſe to the ſurface. Vines are alſo propagated by layers, obſerving to lay the young ſhoots, or occaſionally with part of the branch they proceed from, laying them four or five inches deep in the earth, leaving three or four eyes of the ſhoot out of the ground, ſhortening the top accordingly, if too long.

MARCH. — *KITCHEN GARDEN.*

Care of early Cucumbers and Melons. — Examine the ſtate of the cucumber and melon hot-beds, and ſee if they are of a proper degree of heat, ſo as to preſerve the plants in a ſtate of free growth. Refreſh them now and then with water; let this be given very moderately, and in a mild ſunny day; the beſt time for doing this is from ten to two o'clock.

Sow Cucumber and Melon Seed. — Sow in any new made hot-beds, the ſeeds of cucumbers and melons at the beginning, and alſo about the middle, and towards the latter end of this month, to have a ſupply of young plants in readineſs, either to plant into new beds, or to ſupply the place of ſuch plants as may fail. The ſorts of cucumbers to ſow now are: the early ſhort prickly: the long green prickly: the white prickly: the long green Turky: the long white Turky: and the Smyrna. But the firſt two ſorts are commonly cultivated for the early and general crop, the ſhort prickly being the earlieſt, and is therefore often ſown for the firſt crop in the frames; but the long green prickly is the beſt to ſow for a main crop, either for the frames or hand-glaſſes, or in the natural ground. The white prickly, and the Turky and Smyrna kinds, are not eligible for any general crop, becauſe they are very indifferent bearers; therefore you ſhould ſow only a few by way of variety; the Turky kinds often grow fifteen or ſixteen inches long, or more.

Prick at the Cauliflowers ſown in February. — Where cauliflower plants were raiſed from ſeeds ſown the laſt month, they ſhould now be pricked out into a bed of rich earth, in a warm ſituation; but where a moderate hot-bed can be obtained, it will be moſt adviſeable to prick them therein, which will forward them greatly. By pricking out the plants on a little warmth, it will bring them forward to be fit to tranſplant for good, the middle or latter end of next month, and they will produce their heads in July.

Tranſplant Cauliflowers that have ſtood the Winter. — The cauliflowers which have ſtood in frames, or on warm-borders, all winter, muſt be planted in a rich ſpot of ground. The ground ſhould be well dunged with ſome good rotten dung, and afterwards neatly dug or trenched one ſpade deep; taking care to bury the dung in a regular manner, in the bottom of the trenches. Obſerve to plant the cauliflowers in rows thirty inches aſunder, allowing them the ſame diſtance between plant and plant in the rows. Draw ſome earth to the ſtems of the cauliflower-plants, which are under hand or bell-glaſſes: it will ſtrengthen them and promote their growth. The glaſſes may ſtill be continued over the plants, but muſt be kept conſtantly raiſed, on the ſouth ſide, at leaſt a hand's breadth high, on props; or in mild days the glaſſes may be taken off, and let the plants enjoy the benefit of warm ſhowers of rain. If there are more than one or two plants under each glaſs, let them be removed the beginning of this month; for two plants at moſt, under a glaſs, is ſufficient; but if the glaſſes are ſmall, one plant under each will be enough.

Sow Bore-cole, for Autumn, Winter, and Spring.—This uſeful plant called bore-cole, otherwiſe brown-cole, is of the open cabbage tribe, and very well worth raiſing in every kitchen-garden, for the ſervice of a family. There are two ſorts, the brown and the green, they have great merit for their extreme hardineſs to endure cold, and excellence for winter and ſpring uſe. Sow it in an open ſpot of ground, and rake it in. The plants will be large enough to plant out, in about ſix weeks after the ſeed is ſown; but when they have two or three leaves, it is eligible to thin, and prick out a quantity from the ſeed-bed four inches diſtance, that the whole may obtain proper ſtrength for final planting in June.

Italian Turnep-rooted Radiſhes.—Now ſow ſome ſmall round or Italian tnrnep-rooted radiſh; there are two ſorts, the white and the red, bnt the white is preferable to ſow for the general ſupply: it eats very agreeable in April, May, and June, both alone like common radiſhes, or to ſlice into ſallads. Let the ſeed of both ſorts be ſowed ſeparately in an open ſpace of light ground, and raked in evenly. When the plants have leaves half an inch or an inch broad, thin them to five or ſix inches.

Sow Parſneps for a general Crop.—Sow parſneps the beginning of this month, for the principal crop; that is, if they were not ſown the latter end of February. A ſpot of light ground, in an open ſituation, ſhould be choſen for theſe ſeeds, for the roots thrive conſiderably beſt in ſuch a ſoil and ſituation. The ground ſhould be trenched one good ſpade deep at leaſt, or rather double dig it: be careful to break all clods, that the roots may have full liberty to run down long and ſtraight; for if the earth is not well divided or ſeparated, the roots are apt to grow both ſhort and forked.

Forking and Spring dreſſing of Aſparagus Beds.—This is now the time to begin to dreſs aſparagus beds, which is done by forking or ſlightly digging them with a three-pronged fork. This work ſhould be begun about the middle, or latter end of the month. In forking the beds, be careful to looſen every part to a moderate depth, but taking great care not to go too deep to wound the crowns of the roots. The above work of forking theſe beds is moſt neceſſary to be done every ſpring, to improve and looſen the ground, and to give free liberty for the buds to ſhoot up: alſo to give free acceſs to the ſun, air, and ſhowers of rain. The beds being forked, they muſt afterwards be raked even; obſerving that if you do not rake them immediately after they are forked, to differ it no longer than the end of this month, or firſt or ſecond week in April, for by that time the buds will begin to advance towards the ſurface.

Sowing Aſparagus Seed.—This is now the ſeaſon to ſow aſparagus ſeed, to raiſe plants to make new plantations as above, or to raiſe plants for forcing in hot-beds. This ſeed ſhould be ſown in the beginning or middle of the month, on beds four feet wide of rich earth. Sow it broad-caſt on the ſurface, then tread it in, and caſt ſome of the earth out of the alleys evenly over the bed, and then rake them ſmooth. The plants will come up in a month or ſix weeks, when they muſt be kept very clean from weeds by a careful hand-weeding at different times in the ſummer. If the weather be very dry when the plants firſt come up, it will be proper to refreſh them now and then with water, which will forward them in their growth. They will be fit to plant out for good next ſpring in March. See the next Article.

Plant out Aſparagus into Beds.—New plantations of Aſparagus may now be made, this being the proper ſeaſon to remove theſe plants; but it may be done any time in the month, when the weather is mild. In making plantations of theſe plants, one great article to be conſidered is, to make choice of a proper ſoil; chooſe the beſt the garden affords; it muſt not be wet, nor too ſtrong or ſtubborn, but ſuch as is moderately light and pliable, and in a ſituation that enjoys the full ſun. The ground where you intend to make new aſparagus beds, ſhould be regularly trenched and a large quantity of good rotten dung buried equally in each trench, at leaſt twelve or fifteen inches below the ſurface of the dug ground. The ground being dug and laid level, divide it into beds four feet and a half wide, with alleys too feet wide between bed and bed. Four rows of aſparagus are to be planted in each bed, and ten or twelve inches diſtance to be allowed between plant and plant in the row, and let the outſide rows of each bed be nine inches from the edge. Next, let it be obſerved, that the plants for this plantation conſiſt now entirely of roots, no top; they muſt not be more than two years old; but moſt good gardeners prefer thoſe that are only one year, which are what I would chuſe to plant; as from experience I have found they generally take root much freer, and ſucceed every way better than two years old plants. If you chooſe to raiſe the plants yourſelf, it is done by ſowing the ſeed any time this month in a bed of rich earth; ſee the preceding Article; and they will be proper for planting out next ſpring. In planting theſe plants, obſerve that the crown of the plants may alſo ſtand upright, and two or three inches below the ſurface of the ground; at the ſame time drawing a little earth up againſt them with the hand as you place them, juſt to fix the plants in their due poſition, till the row is planted; then when one row is thus planted, immediately, with a rake, draw the earth into the drill over the plants, and then proceed to open another drill, or trench, as before directed, till the whole is planted. When they are all planted, let the ſurface of the beds be raked ſmooth, and clear them from ſtones.

The aſparagus being planted, the next care is, when the plants come up, which will be about the end of next month, to keep them clean from weeds, which muſt be well attended to, during the ſummer ſeaſon. For the farther management, ſee the work of *October*. Let it next be obſerved, that it will be three years from the time of planting before the aſparagus plants produce buds large enough to cut for uſe; though ſometimes a few of the largeſt buds may be cut the ſecond ſpring after planting; but I ſhould adviſe to let it be the third or fourth year before you make a general cutting. A plantation of aſparagus, if the beds are properly dreſſed every year, as directed in the ſpring and autumn months, will continue to produce good buds ten or twelve years. In making new plantations of aſparagus, it is the cuſtom of ſome gardeners, inſtead of putting in young plants, as above directed, to ſow the ſeed at once in the beds, where the plants are to remain; and it is not a bad way; for by that practice the plants are not diſturbed by a removal, and conſequently cannot fail of producing a regular crop. But it muſt be obſerved, that if two pieces of ground are to be laid down the ſame year in aſparagus, and ſuppoſe one piece to be planted with young plants, the other ſowed with ſeed, that piece which was planted will be ready to cut a year before that ſowed with ſeed. A plantation of aſparagus thus raiſed, will produce buds fit to cut the fourth ſpring after ſowing, but will be very large and fine the fifth year. As the method of cutting aſparagus may not be familiar to every one, I ſhall here explain it. You ſhould be provided with a ſtraight narrow, taper knife, whoſe blade is about eight or nine inches long, and about an inch and a half broad at the haft, narrowing to about half an inch at the point which ſhould be rounded off from the back, and made ſomewhat blunt, and the edge ſhould be made full of ſmall teeth like a ſaw; then obſerving, when the buds are from about two to three or four inches high, they ſhould be then cut, obſerving to ſlip the knife down cloſe to each bud, and cut it off ſlantingly about three or four inches within the ground, taking great care not to wound or break off any young buds coming up near it from the ſame root, for their are always ſeveral buds in different ſtages of growth, advancing at the ſame time from the ſame root. When you plant out aſparagus for forcing, ſee that article in *February*.

Spring-dreſſing of Artichokes, planted laſt March.—Make a general dreſſing of artichokes the beginning or middle of this month. Where the ground has been trenched up, and laid over theſe plants laſt winter, to protect them from froſts, let it now be levelled down, eſpecially if the plants have began to ſhoot tolerably ſtrong, otherwiſe defer it till next month; obſerving as you proceed in levelling down, to dig and looſen all the ground about the plants; at the ſame time examine the number of ſhoots or ſuckers ariſing on each ſtool or root, ſelecting two or three of the ſtrongeſt on every ſtool to remain, and all above that number to be ſlipped off cloſe with your hand; obſerving, in performing this work, to open the earth deep enough about each ſtock or root, that you may readily get to ſlip the ſuperabundant ſhoots off clean from the place from whence they ariſe; cloſe the earth in again about the root, and alſo about the young plants, preſſing it cloſe about them with your hand. The ſhoots which are ſlipped off, will do to make freſh plantations, where wanted; for artichokes are increaſed by planting the young ſhoots, and by no other method; and this is the ſeaſon to do it. ſee the next Article.

Planting Artichokes.—Where a plantation of artichokes are intended, let them be planted as ſoon in the month as you can procure good plants: obſerving that thoſe ſlips or ſuckers ſlipped off in ſpring-dreſſing the old plants as above directed, are the proper ſets for this purpoſe. There are two ſorts, the large globe artichoke, and the French or green oval artichoke; but the former is greatly preferable to plant for the general ſupply, the heads being conſiderably larger, and the eatable parts more thick and fleſhy. Plant the ſets ſingly with a dibble, in rows a yard and a half aſunder, and not leſs than two feet, nor more than a yard diſtant from one another in the row. Give them ſome water immediately after they are planted, to ſettle the earth properly about the plants, they will yield good artichokes the following autumn. But it is proper to obſerve, that you may ſow a thin crop of onions, lettuce, radiſhes or ſpinach, the firſt year between the rows of the artichokes. A plantation of artichokes will continue to produce good heads five or ſix years, and ſometimes longer; but it muſt be obſerved, that if required to have a ſucceſſion of theſe fruit, for four or five months in the ſummer, ſhould make a new plantation every ſpring; for the old ſtocks which have been planted a year or two, produce heads in June or July; and thoſe planted now, produce heads in Auguſt, September and October. See *Auguſt* and *November*.

Jeruſalem Artichokes.—Plant Jeruſalem artichokes where required. Theſe roots will thrive in almoſt any ſoil, and multiply ſo exceedingly, that it is not eaſy to clear the ground of them again, for the leaſt bit will grow. The root, the eatable part of the plant, being large fleſhy tubers, bearing ſome reſemblance to a potatoe, but of a more irregular form, and taſte ſomewhat like the bottom of an artichoke, (hence probably the name) are in perfection in autumn and all the winter, and are very good and wholeſome to boil and eat with butter, &c. Let them be planted in rows a yard aſunder, four or five inches deep, and eighteen inches, or two feet diſtant in the rows. Obſerve the ſame method in preparing the ſets and planting them, as directed for potatoes.

Sow Peas to ſucceed thoſe ſown in January. —Where a conſtant ſupply of peas are required, there ſhould be ſome ſown at leaſt every fortnight, till the month of July. The marrowfat and Spaniſh morottos, being of the large kinds, are both very fine eating peas and great bearers, and are very proper kinds to ſow at this ſeaſon; likewiſe the rouncival is a fine large pea for a late crop; but any other of the large kind of peas may be ſown any time this month. The hotſpurs, or any of the ſmaller kinds of peas, are alſo proper to be ſowed now, if required: for moſt ſorts will ſucceed if ſown any time in this month. Earthing up ſhould always be performed, for the firſt time, when the plants are about three or four inches high, and repeat this in a month's time, always taking care to keep the roots well covered.

Sow Small Salading. —Small ſallading, ſuch as creſſes, muſtard, radiſh, rape, and turnip, ſhould, when a conſtant ſupply is wanted, be ſown once a week at leaſt, in a warm border, obſerving to draw ſome flat ſhallow drills, three inches aſunder; ſow the ſeeds therein, each ſort ſeparate, and cover them lightly with fine earth. When the plants begin to come up, and if the earth cake, ſo as they cannot riſe freely, let the ſurface be lightly whiſked with the hand, or the end of the birch broom, or with a light rake. If theſe young herbs are attacked with a hoar froſt appearing on them in the morning, let them be watered to waſh it off before the ſun comes on them, which will prevent their turning black and ſpoiling. Small ſallad may be produced all the ſpring and ſummer months, by following the above directions, and alſo all autumn and winter months, by obſerving the rules of November. See *November.*

Sow and plant various Sorts of Pot and Medical Herbs. —The ſeeds of dill, fennel, borage, burnet, buglos, ſorrel, marygolds, orach and clary, together with the ſeeds of all other herbs of the like kinds, may be ſowed any time in this month, in a bed or border of common earth, and rake them in; moſt of which may remain where ſowed, if the plants are properly thinned; or ſome, as burnet, ſorrel, fennel, clary, marygolds, borage, may be planted out in beds a foot aſunder, in May, June, and July. Sow hyſſop, thyme, ſage, ſavory, and ſweet-marjorum, any time in this month; you may alſo plant them from ſlips and cuttings. Theſe ſlips or cuttings ſhould be of the laſt year's ſhoots, about five, ſix or ſeven inches long; obſerving to ſlip or cut them off cloſe to the place from whence they ariſe; but there are ſometimes off-ſet ſhoots ariſing from the bottom of the old plants that are often furniſhed with roots; which ſhould alſo be particularly choſen. Plant ſlips of baum, burnet, terragon, tanſey, pennyroyal, feverfew, and chamomile. In taking off the ſlips of theſe plants, be careful to preſerve ſome root to each; plant them nine or ten inches diſtance from each other, in beds of rich earth. Plant ſlips or cuttings of roſemary, rue, wormwood, and lavender, ſix inches apart; they will take root freely, by obſerving to water them in dry weather; they may be tranſplanted into a more open ſituation about Michaelmas, when they will be well rooted.

Plant Mint. —This is now a good time to plant mint. It is propagated either by parting the roots, or by ſlips of the young ſpring plants taken up with root fibres at the bottom; alſo by cuttings of the young ſtalks next month and May, &c, but at this ſeaſon the increaſing it by ſlips, or parting the roots, is moſt generally practiſed, and the method is this. In the third or fourth week in this month, have recourſe to ſuch old beds of mint as are well ſtocked with young ſpring plants, and there ſlip and draw up a due quantity of the beſt ſhoots properly rooted; draw them up gently, and with the help of your knife at times to raiſe or ſeparate them; every plant will riſe with tolerable good roots. Having procured the plants, let them be planted in rows about ſix inches aſunder, and five or ſix inches diſtant in the rows, and let them have immediately a tolerable watering, to ſettle the earth cloſe about the roots. Obſerve that all the ſorts of mint, ſuch as ſpearmint, pepper-mint, orange-mint, &c. may all be propagated by the above methods.

Sow Capſicums. —The ſeed-pods of theſe plants being of a hot ſpicy quality, are much eſteemed for pickling: the large podded kinds are beſt. They are tender plants, and the ſeeds require to be ſowed in a hot bed about the beginning, middle, or towards the latter end of this month: and when the plants appear, let them have a large portion of free air, and water them frequently. In the middle or latter end of May they will be fit to tranſplant, which muſt be into beds of rich earth in the common ground.

Sow Love Apples. —About the middle of this month is the time to ſow ſome tomato, or love apple ſeed; the fruit or apples of theſe plants are, in ſome families, much uſed in ſoups, and are alſo often uſed to pickle, both when they are green, and when ripe. The fruit, when ripe, is of a beautiful red colour. The plants are tender; and the ſeed muſt be ſowed in a ſlight hot bed, treating the plants as directed above for capſicums.

Plant Roſemary, Rue, Wormwood, Lavender, &c. —Plant ſlips or cuttings of roſemary, rue, wormwood and lavender, ſix inches apart; they will take root freely, by obſerving to water them in dry weather; they may be tranſplanted in a more open ſituation about Michaelmas, when they will be well rooted. Put each ſlip or cutting about two parts out of three into the ground. Or, if any off-ſet ſhoots or ſuckers riſe immediately from or near the roots of the old plants, theſe are particularly eligible for planting.

Plant Potatoes. —They may be planted any time this month, but about the middle of the month is a proper time to begin that work. In planting potatoes, be careful to procure ſome good ſets; theſe are to be prepared for planting by cutting each root into two, three or more pieces, minding particularly that each piece be furniſhed with at leaſt one or two eyes or buds, which is ſufficient. Being thus prepared, they are to be planted in rows not leſs than eighteen inches diſtance, but will be more eligible if two or three feet aſunder, and to be ſet twelve or fifteen inches diſtant in the row, and four or five deep. To plant them with dibbles, have the dibbles thick and blunt ended; or thoſe who plant large quantities in fields have dibbles about three feet long, with a croſs handle at top, to take hold on with both hands, and the lower end ſhod with iron, having a foot or ſhoulder of iron fixed at about five or ſix inches from the bottom, to put your foot upon to help to thruſt it into the ground, thruſting it always as far in the ground as the ſhoulder, by which means the holes are made all an exact depth. For large quantities in fields, one perſon may be employed in making the holes, and another to follow after to drop in the potatoe-ſets, which work of dropping them may be performed by women, or girls, or boys. See *November.*

Plant out Lettuce ſown in February laſt. —Thin and tranſplant lettuces; the cos, Cilicia, and all the ſorts of cabbage, and brown Dutch kinds, &c. which were ſown laſt month, will now all want to be thinned to a foot diſtance, and a quantity tranſplanted. For planting lettuces chooſe for them a ſpot of the richeſt ground; dig it neatly, and let the ſurface be raked even; then put in the plants by line: ſet them the diſtance of twelve or fifteen inches from one another at leaſt. Water them as ſoon as planted; and, at times, till they have all taken root.

Tranſplant Lettuces, that have ſtood the Winter. —Tranſplant cos, and Cilicia lettuce, or any other ſorts that require it. Chooſe a ſpot of good ground for theſe plants, and if moderately dunged, it will prove beneficial to their growth: dig the ground evenly one ſpade deep, and rake the ſurface ſmooth, then plant the lettuces about ten or twelve inches diſtant each way; water them immediately, and repeat it occaſionally in dry weather, till they have taken good root.

APRIL.—*FRUIT GARDEN.*

Dreſſing Strawberries. —Dreſs the ſtrawberry beds in the beginning of this month, if they were not done in the former month; the plants will now begin to puſh apace, and the ſooner this is done the better. Clear the bed from weeds, and the plants from ſtrings, and other litter; and if the main plants are crowded with young ones from the laſt year's runners, let them be thinned accordingly; for it is the beſt method to keep theſe plants in ſingle bunches, as it were, and clear of each other, ſo that there may be room to dig round them with a narrow ſpade or a trowel. The beds being cleared from litter, looſen the earth between the plants; and if you add a little freſh earth from the alleys, &c. to the beds, it will ſtrengthen the plants, and they will flower ſtrong, and produce large fruit. Strawberries may now be planted where required. A farther ſupply of pots of bearing ſtrawberry-plants may ſtill be placed in hot bed and hot houſes, &c. to produce a ſucceſſion of early ſtrawberries to ſucceed thoſe of the former months, and to afford a ſupply of ripe fruit till thoſe in the open ground ripen in June.

Examine new grafted Trees. —New grafted trees ſhould now be often looked over, to ſee if the clay keeps cloſe about the grafts; it being apt to crack, and ſometimes fall off. Where you find it any way defective, ſo as to admit the air and wet to the graft, let the old clay be taken off, and add ſome new in its ſtead. All thoſe ſhoots which riſe from the ſtock, below the graft, muſt be taken off conſtantly as they are produced; theſe, if permitted to remain, would rob the gtaft of nouriſhment, and prevent its ſhooting freely.

Examine new and old budded Trees for Inſects. —Look alſo over new budded trees; that is to ſay, thoſe that were budded laſt ſummer; they will now begin to ſhoot. Examine the young ſhoots, and look, with a careful eye, for inſects. If the leaves curl up, inſects are the cauſe of it: and if not prevented, will ſpoil the ſhoots in their firſt growth. Let the curling leaves be carefully picked off; it will prevent the miſchief ſpreading farther. Where ſmall iuſects annoy any of the wall-trees, let ſome means be uſed to deſtroy them, before they increaſe, and ſpread themſelves too far, for they would do conſiderable miſchief to the trees and fruit. When once theſe deſtructive ſmall vermin attack but one ſingle branch of a tree, they would, in a very ſhort time, over-run the whole if not ſtopped, and would ſpoil the young ſhoots, and deſtroy he leaves at a ſurpriſing rate; and when once the leaves of a tree are gone there is but little good to be expected from the fruit that year. Therefore, as ſoon as inſects or blights appear upon any part of the trees, it is adviſeable both to prune away ſuch part of the ſhoots, and to pull off all the worſt leaves that are infeſted with them; that is, ſuch as are ſhrivelled, or much curled up; then ſtrew ſome tobacco-duſt over all the branches and leaves; repeating it occaſionally, which will contribute conſiderably towards deſtroying and preventing the vermin from multiplying.

Watering wall-trees, &c. thus infeſted with inſects, often proves beneficial, provided it is often repeated in dry hot weather, and the water thrown againſt the trees with ſome force. For the purpoſe of watering the branches of wall-trees, there is nothing ſo uſeful and convenient as a hand-watering engine. This engine may alſo be uſed occaſionally in watering, in dry weather, the branches of eſpalier trees, and young or old ſtandard trees, where any of the branches are attacked by inſects of any ſort. Theſe engines are both uſeful and cheap. The beſt are thoſe made of tin and copper, and may be bought at moſt of the tin-ſhops, &c. from about eight or ten ſhillings to one or two guineas, &c. according to the ſize. New-planted trees, both ſtandards and dwarfs, againſt walls or eſpaliers, ſhould in very dry weather be well watered at the root about once a week: it will alſo be of great ſervice to water the branches of the new-planted trees, now and then, in dry weather.

APRIL.—*KITCHEN GARDEN*.

Management of Cucumbers and Melons.—Hot-beds for cucumbers and melons may ſtill be made, both for ſucceſſional crops to ſucceed the early ones; and if none were made in the former months, it may ſtill be done, with ſucceſs, to have early cucumbers in May and June, &c. and melons in Auguſt. Obſerve the ſame methods of making the bed, ſowing the ſeed, planting and managing the plants, as in the former months. Water the plants occaſionally; the cucumbers will require it often; that is, provided there be a good heat in the hot-bed, and the weather mild and ſunny; watering once every four or five days, or a week, will be requiſite, but let this be applied in moderate quantities.

Melons ſhould alſo be watered moderately, at times, for they will require it; but when theſe plants are about ſetting their fruit, they ſhould be watered very ſparingly at that time, as much humidity would retard its ſetting and prevent its ſwelling freely. Let decayed and damaged leaves be taken off as ſoon as they appear on the plants; either cucumbers or melons; alſo let all decayed male flowers be taken away, ſparing always a ſufficiency of the freſh bloſſoms for the office of impregnation, as below. In hot days, when the ſun is fierce, ſo as to occaſion the leaves of the melons or cucumbers to flag, it will be proper to ſhade them for two or three hours, during the greateſt heat, with a thin mat, or with a little looſe hay ſtrewed thinly over the glaſſes.

Impregnate, or ſet the young fruit of cucumbers with the farina of the male bloſſom. The flowers of cucumbers and melons are male and female, ſeparate, on the ſame plant, and the females produce the fruit; the males are often erroneouſly called falſe bloſſoms; and many perſons in conſequence of that notion, pull them off; but they are ſo far from being falſe bloom, that they are by nature deſigned to impregnate the female flowers, to render them fruitful; for the antheræ in the centre of the male bloſſom being furniſhed with a fine powder, which being diſperſed on the ſtigma in the centre of the female, the fecundation is effected, and the fruit in a day or two after will begin to ſwell, and in a fortnight will be arrived to a proper ſize for cutting; ſo that without the aſſiſtance of the male bloſſom, the female having the embryo fruit at their baſe, wither and decay; and the infant fruit turns yellow and drops off. Therefore it is of importance to preſerve a ſufficiency of the male flowers, for the purpoſe of impregnating the female; and in the early culture of cucumbers, &c. it is eligible to carry ſome of the male to the female flowers, obſerving for this purpoſe, to detach ſome new expanded male bloſſoms with the ſtalk to each, and holding the ſtalk between the finger and thumb, and pulling off the petal or flower-leaf ſurrounding the male organ; then with the remaining anthera, or central part, touch the ſtigma of the female, ſo as ſome of the farina or male powder of the anthera adheres to the ſtigma, a little of which being ſufficient to effect the impregnation.

This operation is eſſentially neceſſary to early plants that are ſhut up in frames, before the lights or glaſſes can be admitted ſufficiently open to give free acceſs to a large current of air, or flying inſects, ſuch as bees, &c. all of which aſſiſt in conveying the farina of the male bloſſom to the females; as is evident in plants expoſed to the open air. The above operation of fecundating, or, as the gardeners term it, ſetting the fruit, ſhould be performed the ſame day the flowers open; and as ſoon as they are fully expanded is the proper period. The female or fruit-bearing flowers, are readily diſtinguiſhed at ſight from the males; the former having always the germen or embryo fruit placed immediately under the baſe of the flower; or, in other words, the embryo-fruit iſſues forth with the flower-bud on its top, viſible from its firſt irruption from the ſtem of the plant; but the male bloſſom is placed immediately on the top of its foot-ſtalk, without any appearance of germen, or fruit under its baſe.

Make Ridges to plant out Cucumbers and Melons, under Bell or Hand Glaſſes.—Make hot ridges, about the middle or latter end of this month, for the cucumbers or melon plants raiſed laſt month, in order to be planted under hand or bell glaſſes. Theſe hot-beds or ridges for hand or bell-glaſſes, ſhould, at this time, be made the greateſt part above ground, not digging deep trenches, as is often practiſed, wherein to make them; for by that practice, you cannot readily line the beds quite down to the bottom when the heat declines. The making them in deep trenches in May, when but very moderate linings, or ſometimes none at all, will be required, is not improper; but at this ſeaſon do not make trenches deeper than about ſix inches. Each bed or ridge for the bell or hand-glaſſes, ſhould not be leſs than two feet and a half thick of dung, and ſhould be three or four feet wide. The beds being made as above directed, then in two, three, or four days after, when the dung will be ſettled, and the heat ariſen to the top of the bed, lay on the earth; this ſhould be laid ten inches thick on every part. Then ſet on the bell or hand-glaſſes, one over each hole or ridge, and keep them cloſe down till the dung has thoroughly warmed the earth; then proceed to put in the plants: turn them carefully out, with the ball of earth entire, and make a hole in the earth where each glaſs ſtands; place out the plants, with the ball into each hole; cloſe the earth very well about the ball, and alſo about the ſtems of the plants; give every hole a little water, and immediately put on the bell or hand glaſſes. Let two melon plants be ſet for each glaſs, but you may plant three or four cucumber plants under each: as ſoon as they are planted, let them be watered, to ſettle the earth about their roots, but let moderation be always obſerved in performing this work, eſpecially when newly planted. Shade the plants occaſionally from the ſun, when it is powerful, till they have taken good root in the new earth; but when the plants are able to bear the ſun without flagging, let them enjoy it freely. Let the glaſſes be covered every night with mats, till the end of May, or beginning or middle of June. Remember, if the plants have not been ſtopped or topped before, it muſt now done: this is to be done when the plants have two or three rough leaves; obſerving, at that time, to pinch off the top of the plant in the manner already directed.

Sowing Cucumber and Melon Seeds.—Sow the ſeeds of cucumbers and melons the beginning of this month, to raiſe ſome plants to ridge out, under hand or bell glaſſes, in May. See the directions of laſt month.

Plant early Kidney Beans.—Plant kidney beans, of the early kinds, the beginning of this month. Draw drills an inch deep, and thirty inches aſunder; drop the beans in the drills two inches apart, and draw the earth equally over them; do not cover them more than an inch deep; for, if covered too deep at this early time, they do not come up well, but riſe ſtraggling, and beſides they are very apt to rot. Theſe ſhould be planted in dry weather, for the ſeed cannot bear much wet at this early ſeaſon; it being apt to rot in the ground, if planted in rainy time. About the middle or twentieth of this month, you may plant ſome kidney beans for a principal crop. The ſpeckled dwarf kidney bean, and the Batterſea and Canterbury dwarfs, are proper kinds for this plantation, allowing two feet and a half, at leaſt, between the rows. You ſhould plant in May for a late crop, plant in July for a general crop. See *July*.

Prick out Cabbages ſown in February.—Some of the ſavoy and cabbage plants which were ſown in February, for a forward autumn crop, ſhould be thinned and pricked out into beds, to get ſtrength before they are planted out for good. Let this be done when the plants have leaves one or two inches broad: preparing beds of good earth about three feet and a half wide, in an open ſituation. Place them at four or five inches diſtance every way. Water them immediately, and repeat it occaſionally in dry weather.

Tranſplant Cabbages and Savoys which have ſtood the Winter.—Now tranſplant, if not done in March, all the cabbage plants yet remaining in their winter beds, or all that you intend planting out finally this ſpring, for the ſummer and autumnal crops; and let it be done in the beginning, or as ſoon as poſſible this month, that they may get good root before dry weather ſets in; give the plants a little water as ſoon as planted. Draw up ſome earth about the ſtems of forward cabbage plants; it will ſtrengthen them, and greatly encourage their growth.

Earth up Cauliflowers.—The early cauliflower plants under hand-glaſſes, ſhould have earth drawn up to their ſtems. This will be of great ſervice in promoting their growth; but in doing this, let care be taken that no earth is drawn into their hearts.

Sow Broccoli, for Autumn and Winter Supply.—Chooſe ſome early purple, to come in for autumn, and late purple to ſtand the winter for the general crop, and a proportionable ſupply of the white or cauliflower broccoli; ſow them in an open ſpace of light rich ground, each ſort ſeparate, and rake them in evenly; the plants will ſoon come up, and be fit to plant out in June.

Prick out Celery, ſown in February.—The young celery plants, which were ſown in February or March, for an early crop, will be fit to prick out towards the middle or latter end of this month, into a nurſery bed of rich light earth, or in a hot bed. Prepare a ſpot of rich light ground, and plant them into this, at about three inches diſtance every way; then give a moderate watering, and repeat it at times till the plants have taken freſh root. The plants ſhould remain in this bed a month or ſix weeks, to get ſtrength before they are planted out for good into the trenches in June. As theſe early ſown plants, after they become fit for uſe, will not continue long before they will run up for ſeed, there ſhould not be any large quantity of them planted out. Sow ſome celery ſeed, in the firſt or ſecond week of this month, to raiſe ſome plants for a general crop, and to ſucceed thoſe which were ſown in March.

Sow Carrots and Parſnips for Summer ſupply. — Carrots may yet be ſowed, if required; but in order to have tolerable ſized roots, in ſum reaſonable time in ſummer, let the ſeed be ſown the beginning of this month. Where, however, a ſupply of young carrots are required, it is proper to perform two different ſowings this month; the firſt ſowing ſhould be in the beginning, and the ſecond towards the latter end of the month. Parſnips may alſo ſtill be ſowed in the beginning of this month; but if ſowed later, the crop will not ſucceed.

Sow Purſlane.—Purſlane may be ſowed now, if warm dry weather, on a bed of light rich earth, in the common ground. Sow it evenly on the ſurface, and rake it in lightly. Water the bed often in dry weather, and ſhade it from the hot ſun till the plants are come up, and have got a little ſtrength. But if cold or very wet weather, ſow ſome in a warm dry border, and defended from cold, &c.

Sow Naſturtiums. — Naſturtiums are often uſed in families; their flowers and young leaves for ſallads, the flowers alſo to garniſh diſhes, and their green berries to pickle. This is now a good time to ſow them, and the ſooner in the month the better. Drills muſt be drawn for them as is practiſed for peas; the ſeeds muſt be dropped into the drills two or three inches aſunder, and be covered an inch deep with earth. When the plants are come up about ſix inches high, they ſhould have ſticks placed for them to run upon: for theſe plants are of the running or climbing kind; or for the ſake of ſupport, may ſow them near a hedge, rails or any other fence. This plant being of a moiſt cold nature, is by many people much eſteemed to uſe in ſummer ſallads.

MAY. — *FRUIT GARDEN.*

Rubbing off uſeleſs Buds and pruning of Wall Trees and Eſpaliers.

Wall trees will now, in general, begin to make ſtrong and numerous ſhoots; and they ſhould be regulated, and trained the right way, before they grow into confuſion. Apricots, peaches, and nectarines, in particular, demand this care now; and alſo plum and cherry-trees. Let all theſe trees be looked over ſome time in this month, as early as poſſible, before they advance conſiderably into diſorder in their firſt ſhoots, and cleared from all ſuch, of the new ſhoots as are uſeleſs and ill-placed; at the ſame time let all the well-placed uſeful ſhoots be retained, and when of due length, trained in cloſe and regular to the wall. In the early ſummer dreſſing of wall-trees this month, when the firſt ſhoots do not exceed one, two, or three inches long, moſt of the requiſite pruning may be performed, by rubbing off the uſeleſs ſhoots with the finger and thumb, without the uſe of a knife; but when more advanced, the knife only muſt be uſed. Apple, pear, plum, and cherry-trees, either againſt walls or eſpaliers, ſhould alſo be looked over ſome time towards the end of this month: for theſe trees ſhould alſo be diveſted of all uſeleſs and ill-growing ſhoots of the year, and the neceſſary regular ones trained in. This may be done next month if omitted in the preſent.

Thin Apricots, Peaches, Nectarines, &c. — Thin apricots, peaches, and nectarines, where they are ſet too thick upon the trees. Theſe trees, in favourable ſeaſons, will ſometimes ſet three times more fruit than their roots are capable of ſupplying with proper nouriſhment; and if the whole or too many of them were to be left, they would ſtarve one another, and the fruit, in general, be ſmall and ill-flavoured. Beſides, where there are too great a quantity of theſe ſorts of fruit permitted to remain upon the trees, the ill-conſequence does not terminate altogether in the badneſs of the fruit that year, but it extends to two or three years to come; for the too great quantity of fruit would draw the whole nouriſhment to themſelves, inſomuch that the trees would not be able to produce ſhoots capable of bearing fruit next year: and it would alſo exhauſt the trees ſo much, that they could not regain ſtrength to produce any good wood before the ſecond year after; and it would probably be the third before a tolerable crop could be expected.

Therefore, where theſe fruit are produced too thick upon the trees, let them now be reduced to a moderate quantity on each tree; and the ſooner this is done the better it will be for the trees, and alſo for the fruit that is to remain upon them. The moſt promiſing and beſt ſhaped fruit muſt be left, having ſome regard alſo to thoſe that are beſt ſituated on the branches. Each kind, according to its ſize, muſt be left at ſuch diſtances, that every one may have ſufficient room to ſwell, and grow freely to its full ſize every way, without touching another. For inſtance, ſuppoſe a tree to be in pretty good condition for ſtrength, and allowing the bearing ſhoots or branches to be of three different ſizes; that is, the ſtrong, middling, and weakly; the number of fruit to be left upon each of theſe branches are; upon the ſtronger ſhoots and branches three or four of the faireſt and beſt placed fruit; upon the middling ſhoots no more than two or three, and only one or two upon the weaker branches.

This ſhould be the method of thinning the common ſizes of theſe kinds of fruit; but the ſmall kinds may be left cloſer, and a greater number of each kind may be left upon the different branches. For inſtance, the early maſculine apricots, the nutmeg peaches, and early nectarines, being ſmall varieties of theſe kinds, there may be left upon each of the ſtrong ſhoots, about four or five of theſe fruit; and on a middle ſized ſhoot three; and ſo in proportion on the weaker ſhoots. The young fruit that are thinned off, are excellent for tarts, &c. particularly the apricots.

Deſtroy Snails.—Snails often make great havock among the choice kinds of wall-fruit, where they are not interrupted; they particularly infeſt the apricots, nectarines, and peach-trees, and will do miſchief to thoſe kinds of fruit, if not prevented. Theſe trees ſhould be often looked over early in a morning, and in an evening, and after ſhowers of rain, at which times theſe creeping vermin come forth from their holes, to feed upon the fruit, and may then be readily taken and deſtroyed: this caution ſhould be continued the two next months.

Management of Vines.—Vines now ſhoot vigorouſly, and they will produce, beſides bearing and other uſeful ſhoots, numbers that are altogether uſeleſs, which muſt now be all cleared away, and the ſooner the better. It is not every ſummer that is favourable to the ripening of grapes; but it is in every one's power to give them great aſſiſtance, by a right ordering of the vines at this early time; and where this work is executed in a timely and proper manner, the bunches of theſe fruit may be brought to be large and handſome, and much ſooner and better ripened than what is commonly done. To do this, the vines muſt now be perfectly well cleared from all ſorts of uſeleſs ſhoots of the year; and, at the ſame time, all the fruit-bearing, and other well placed uſeful ſhoots, ſhould be nailed up regularly, and cloſe to the wall; for there is a great deal of advantage attends this early dreſſing, both in affording an opportunity of performing the work with more expedition and regularity, and for the greater benefit of the trees and fruit; obſerving, that all the immediate bearing ſhoots, which now diſcover the advancing young bunches of fruit upon them, muſt be left; and ſuch other ſhoots as have ſtrength, and are very well ſituated for training in, for the purpoſe of bearing the next year, muſt alſo be left in places where they are apparently wanted, and can poſſibly be trained in. But all weak ſtraggling ſhoots, ſuch particularly as often riſe immediately from old wood, are uſeleſs, and muſt now be cleared away. After this, obſerve that all ſhoots that riſe in any part of the vines, muſt be conſtantly rubbed off according as they are produced; and by no means ſuffer thoſe ſmall ſhoots to remain, which commonly riſe from the ſides of the ſame ſummer's ſhoots that are now laid in; but let theſe be duly rubbed off as ſoon as they begin to advance. The early ſummer dreſſing of vines, in reſpect to pruning, may be effected with the finger and thumb, while the ſhoots are quite young and herbaceous; as the uſeleſs ſhoots may then, without a knife, be very expeditiouſly rubbed off cloſe to the mother wood.

Water Strawberry Plants. — The ſtrawberry plants will be in full bloſſom this month; therefore if the weather ſhould prove very dry, the beds ſhould be often watered to encourage the fruit to ſet. During the time theſe plants are in bloſſom, the beds ſhould be watered in dry weather about three times a week; and they ſhould have ſuch a watering at each time, as will reach to the roots of the plants. This is very needful work in dry weather, and it ſhould not be omitted, otherwiſe there will be but a very ſcanty crop of ſtrawberries, and theſe will be ſmall and not well reliſhed: this care of watering ſhould be continued alſo all the next month, provided the weather is dry.

Examine new-grafted Trees. — Examine the trees of all ſorts that were grafted this ſpring; when the graft and the ſtocks are well united, there is no farther occaſion for the clay. This is generally well effected by the middle or latter end of this month, at which time the clay ſhould be taken away; but let the bandages remain two or three weeks longer, or till the parts begin to ſwell; then take them off entirely.

Examine new-budded Trees. — Look alſo to new-budded trees; that is, let the trees which were budded laſt ſummer, be now often looked over, and take off all ſhoots that riſe from the ſtock, near the bud. This ſhould be conſtantly practiſed as often as any ſhoots appear; and let them be rubbed off quite cloſe; then the ſtocks having nothing to ſupply but the bud, it will certainly ſhoot more vigorouſly.

MAY. — *KITCHEN GARDEN.*

Care of Melon Plants in Frames. — Melon plants ſtill require particular care; thoſe which are under hand or bell-glaſſes, as well as thoſe in frames. The early plants in frames will now ſhew fruit plentifully, and ſome will be ſet and ſwelling; therefore in order to procure a ſufficient quantity of thoſe fruit for a full crop, the plants muſt, at this time, have all the aſſiſtance that is in the power of art to give them. One principal thing to be obſerved is, to preſerve a proper degree of heat in the beds, by occaſional linings of hot dung, while the fruit is about ſetting, and for ſome time after; for a kindly warmth is neceſſary to promote the ſwelling of the fruit after they are ſet; for it ſhould be obſerved, that although there be often very warm days in this month, yet there are often cold nights, which make it ſo neceſſary to preſerve a due heat in theſe beds; for if the weather ſhould prove cold, and at the ſame time there is but little warmth in the beds, the melons will not ſet nor ſwell kindly, but moſt of them will turn yellow and go off. The advantage of adding freſh lining to ſuch beds as are much decayed in their heat, will ſoon evidently appear in the growth of the plants and fruit. Air muſt be admitted to the plants, by raiſing the upper ends of the lights with props, gradually, one, two, or three inches, according as the power of the ſun and warmneſs of the day increaſe, and ſhut them down cloſe again about four or five in the evening, or ſooner, if the weather ſhould change cold or prove windy. About ſix or ſeven in the morning, let the mats be taken off; or when it is a warm ſunny morning, they may be uncovered as ſoon as the ſun reaches the glaſſes, for the plants ſhould not be kept too long in darkneſs, light being very eſſential to their growth. Shut down the lights immediately after watering; and, if the ſun ſhines, throw a mat over for half an hour, then take it off again. Obſerve, in watering theſe plants, to let as little as poſſible touch the fruit that are about ſetting. Where the plants advance very near the glaſſes, it will be neceſſary to raiſe the frame from about three to ſix inches; this is done by placing bricks, or ſquare pieces of wood, under each corner of the frame. According as the melons ſet, obſerve to place a piece of tile under each; for this will preſerve them from the damp of the earth of the bed.

Care of Melons and Cucumbers, under Bell and Hand Glaſſes. — When any of the melon or cucumber plants have filled the bell or hand glaſſes, the vines muſt then have liberty to run from under them: but they muſt not be truſted out before the latter end of the month, or beginning or middle of next. If therefore, about the laſt week in this month, or beginning of next, the plants have advanced conſiderably in runners to the extent of the glaſſes, they ſhould be trained out; provided however the ſeaſon is become warm, dry, and ſettled, not elſe: raiſing each glaſs upon three props, about two inches and a half high, and let the ends of the vines be trained out at regular diſtances, and peg them down; being careful to cover the ridges every night, and in all bad weather, with good mats. But when the vines of theſe plants are trained from under the hand glaſſes; it would be of great advantage to place oiled paper frames over ſome of the beds, previouſly removing the hand glaſſes; theſe frames remaining conſtantly night and day; and as they admit the light and heat of the ſun ſufficiently, they will prove moſt beneficial ſhelters. See *June*.

Cucumbers to pickle. — Sow cucumbers for pickling, &c. theſe are to be ſown in the natural ground; not however generally till the laſt week in this month. But if the ſeaſon be cold, or very wet, it would be proper to defer putting in the ſeed till the firſt week in June. Mark out the holes for the ſeed, exactly along the middle of each bed, allowing three feet and a half between hole and hole. Dig the places for the holes, breaking the earth well with the ſpade, and form them with the hand like a ſhallow baſon, about an inch and a half deep, and ten or twelve inches over; and ſow in the middle of each hole eight or ten ſeeds, covering them near half an inch deep with earth. After the ſeed is ſown, if the weather ſhould prove hot and dry, it will be proper to ſprinkle the holes with water; but this muſt be given moderately, juſt enough to moiſten the earth a little, for too much moiſture would rot the ſeed: but when the ſeed is germinated, and the young plants coming up, give water freely in dry warm weather. When the plants have been come up about a fortnight, they muſt be thinned; and leave no more than four, five, or ſix of the beſt plants in every hole. In ſowing picklers, it is the practice in cold wet ſeaſons, with many of the London gardeners, to ſow the ſeed on a ſlight hot-bed: and when the plants have been up about a week or ten days, to tranſplant them. It is adviſed to tranſplant theſe plants when quite young, in little cluſters together, therefore ſow the ſeed accordingly, that is, either with a thick blunt-ended dibble, or with your fingers contracted make holes about an inch wide, and half an inch, or near an inch deep, and about an inch and a half aſunder, dropping eight or ten ſeeds in each hole, this is called dotting them in; cover them near half an inch deep with earth. By thus ſowing the ſeed in patches, the plants will riſe in bunches; when the plants have been come up ſix, eight, or ten days, and ſhew the rough leaves in the centre, it is proper to plant them out, if the weather is ſettled; taking them up in cluſters as they grow, with the earth about their roots, and in that manner let them be planted in the places where they are to remain. This, in a bad ſeaſon, is a very good method, and worthy to be put in practice.

Sow late Celery for Winter and Spring ſupply. — Sow ſome celery ſeed about the middle of this month for a late crop, and follow the directions laid down in February. Prick it out in July, and follow the directions laid down in April, and finally tranſplant in September. (See September and November) and remember to earth up the celery ſown in February, and continue this neceſſary buſineſs every month.

Cutting Aſparagus, and care of the Beds. — Aſparagus will now be fit to cut for uſe. In cutting the buds or ſhoots of theſe plants, it ſhould be obſerved, that, when they are from about two or three to four or five, or at moſt ſix inches in height, they ſhould be gathered; but thoſe about three or four inches high are in prime order; when permitted to run much higher, the top of the bud opens, and the ſhoot does not eat ſo well as thoſe that are cut when the head is quite cloſe. When you cut them, be careful to thruſt your knife down cloſe by the ſide of the ſhoots you intend to cut, leſt you wound or deſtroy any young buds that are coming up and do not yet appear; cutting the ſhoots off ſlanting about three or four inches within the ground. See *April*. Let the beds of theſe plants be now carefully cleaned, for ſeed weeds will now riſe very thick on them.

Thin out Hamburgh Parſley, Scorzonera, and Salſafy, and alſo ſow for a Winter Crop. — The Hamburgh or large-rooted parſley, ſcorzonera, and ſalſafy, muſt now be carefully cleaned; and the plants ſhould be thinned, or hoed out, to proper diſtances, that their roots may have room to ſwell. Leave theſe plants about ſix or ſeven inches diſtance from one another. The ſeeds of ſcorzonera and ſalſafy ſhould now be ſown for the winter crop. Sow them in the firſt or ſecond week of this month. Theſe plants, when ſown early, are apt to run up for ſeed, before they are hardly fit for uſe. But thoſe that are ſown now will not run, and their roots will be in excellent order for the table by Michaelmas, and continue good till ſpring following.

Tranſplant Savoys and Cabbages, ſown in February. Tranſplant ſpring-ſowed cabbage and ſavoy plants for autumn and winter uſe. Theſe may be planted between rows of early cauliflowers, or between wide rows of garden beans, or French beans; that is, if there be no other ground at liberty. Plant them out, if poſſible, in moiſt weather, in rows two feet and a half aſunder, and about two feet diſtance in the lines; and as ſoon as they are planted, give each a little water.

Tie up the Leaves of Cabbages, that have ſtood the Winter. — The earlieſt cabbages will now be well advanced in growth, have formed tolerable full hearts, and begin to turn their inner leaves for cabbaging; they may be greatly aſſiſted and brought forward by tying their leaves together. Get ſome ſtrong baſs, or ſmall oſier twigs, and go over the plants row by row, and let ſuch of the forwardeſt, with fulleſt hearts, as have begun to turn their leaves pretty much inward, be tied: do not tie them too ſtrait, for that would occaſion the plants to rot. This will bring the plants forwarder for uſe ſooner by a week or fortnight than they would naturally be of themſelves; and they will be much whiter in the heart, and more tender to eat.

Protect Early Cauliflowers from Rain and Sun. — Look over early cauliflowers often, about the middle or latter end of the month; ſome of the plants will then begin to ſhew their flower heads in the center; and as ſoon as theſe appear, they ſhould be ſcreened from the ſun and wet, which would change the colour from a milk white to a yellow. Therefore, as ſoon as ever a flower appears, let ſome of the largeſt leaves be broke down over it. This will anſwer the double purpoſe of ſhading the head from the ſun, and defending it from wet; whereby the cauliflowers will be preſerved in their natural whiteneſs, and will be cloſe, firm, and beautiful. Theſe plants ſhould, in very dry weather, be often watered; for this will cauſe the heads to grow to a larger ſize. But previous to doing this, you muſt form the earth hollow like a baſon, round each plant, to contain the water when given to them.

Plant out Love Apples, for Soups, &c. — Theſe plants being trailers, and very luxuriant and rambling in their growth, muſt therefore be planted cloſe to a wall, pales, or eſpaliers; and when they begin to branch out, muſt be trained, and nailed to the walls or pales, in the manner of a wall tree, or may be trained to ſtrong ſtakes. Obſerve, they muſt be planted againſt a ſouth wall, or other ſouth fence; for if they were to be planted in the ſhade, the fruit would not ripen. The vacant ſpaces between wall-trees would ſuit them well.

Tranſplant Cauliflowers ſown in February. — Tranſplant, if not done laſt month, the young cauliflower plants raiſed this ſpring from ſeed. The plants are to be ſet in this compartment at two feet, or two feet and a half each way aſunder; and they muſt be watered as ſoon as they are planted. There may be ſown, if you chooſe it, on the ſame ground between the cauliflower plants, a thin crop of ſpinach.

Sow Cauliflower-ſeed for a Michaelmas Crop. — The plants that are raiſed from this ſowing will come into uſe in October, and will be in high perfection the greateſt part of November, and ſometimes longer. Theſe are what the London gardeners call the Michaelmas cauliflowers. Obſerve, the ſeed for this crop muſt not be ſowed till about the 24th of this month; at which time get ſome good ſeed of the laſt year's ſaving; ſow this moderately thick, and rake it in carefully, and ſprinkle the bed often in dry weather with water. When the plants have got two or three leaves an inch broad, they ſhould be pricked out into a nurſery-bed to attain ſtrength for final tranſplantation. See *June* and *July*.

Sow Endive, for an early Crop. — Sow endive for an early crop; principally ſome of the white, and a ſmall portion of the green. Likewiſe ſow ſome broad-leaved Batavia endive; this is the beſt ſort for ſtewing; it grows very large, and, if tied up, will cabbage well, and be very white, and eat alſo well in a ſallad: but this ſort is not hardy, for it ſoon rots in a wet autumn, and a moderate froſt will kill it. If required early, in conſtant ſucceſſion, it will be adviſeable to ſow ſome ſeed at two different times this month. But never depend on the ſowings of this month for a main crop, the plants being apt to run up ſoon to ſeed the ſame year;

however, where a few early plants are required, you may ſow a little ſeed about the beginning or middle of the month, and more towards the latter end; the plants of the firſt ſowing will not continue fit for uſe long; but the ſecond ſowing will not run ſo ſoon. But the ſeaſon for ſowing the principal autumn and winter crops, is the beginning or middle, and latter end of June, and in July. This ſeed ſhould be ſown in an open ſpot of rich earth; it muſt not be ſown thick, and take great care to rake it evenly into the ground. See *June, Auguſt,* and *September.*

Support Plants for Seed. — Support the ſtems or ſtalks of ſuch plants as were planted for feed. The onions and leeks, in particular, will now require this care; for the ſtalks of theſe plants will be run up to a good height: and if they are not ſecured in due time, the winds and heavy rains will break them down. Support likewiſe the ſtems of cabbages, ſavoys, and broccoli, which are for ſeed; having ſome ſtout ſtakes, let one or two be driven into the ground, cloſe to every plant, and the principal ſtems be tied ſecurely to them. Beſides, when the weeds are ſuffered to grow large among any ſmall crops, ſo as to mix and entangle with one another, and with the plants, it renders the work of hoeing or weeding them extremely tedious, and very troubleſome to perform.

Plant Radiſhes for Seed. — Tranſplant radiſhes for ſeed: this muſt be done when the roots are juſt in their prime: and the firſt and ſecond week in the month is the moſt proper time to do it: and if it is ſhowery weather, it will be a particular advantage. Chooſe for this purpoſe ſuch roots as are long, perfectly ſtraight, and with ſhort tops. Having alſo ſome regard to the colour of the root, that is, if it is the common red or ſhort-topped radiſh: thoſe that are of a clear pale red are in moſt eſteem, and particularly with the London gardeners, for market, as they generally eat more criſp and mild, than thoſe of a dark red colour; and when intended to ſave ſeed of the ſalmon radiſh, although theſe will be naturally of a pale red, yet to preſerve the ſorts it will be proper to plant the paleſt coloured roots. The principal reaſon why we direct radiſhes intended for ſeed to be tranſplanted is, that we can readily judge of the goodneſs of the root, take only what are of the right ſort, and reject ſuch as are not. Plant them three feet aſunder, they will ſhoot up ſtrong ſtalks, and ripen ſeed in September.

Deſtroying Weeds. — Let more than common care be now taken to deſtroy weeds among crops of every kind, and in every part throughout the ground. There is no work in the kitchen garden that requires more attention now than this: for weeds are at no time more detrimental to crops than the preſent. It ſhould therefore, be one of the principal works in this ground to deſtroy them before they grow large. For weeds, when permitted to grow large, not only exhauſt the goodneſs of the ground, and ruin the preſent crops, but are alſo a very diſagreeable ſight, and require more than double labour to clear the ground of them.

JUNE. — *FRUIT GARDEN.*

Method to fill vacant Parts of Wall-Trees with Branches. — At this ſeaſon it will be proper to obſerve, that where there are any vacant ſpaces in any kind of wall, or eſpalier-trees, it is now a moſt eligible time to prepare to furniſh them with the requiſite ſupply of wood in ſuch parts, the ſame year, by pinching or pruning ſhort ſome contiguous young ſhoots. For example, if two, three, or more branches may be wanted to fill the vacancy, and ſuppoſe there be only a young ſhoot produced in or near that place, it will, in ſuch caſe, be proper in the firſt or ſecond week of the month to ſhorten the ſaid ſhoot or ſhoots, to three, four, or five eyes, according to their ſtrength: and by this practice each ſhoot will ſend forth two or three, or perhaps four lateral ſhoots the ſame ſeaſon, to fill the vacancy. The above method of ſhortening the young ſhoots of the ſame ſeaſon may likewiſe be practiſed on young trees, to procure a ſupply of branches to form a head.

Planting Strawberries. — Where new plantations of ſtrawberries are wanted, it will, about the middle, or latter end of the month, be a proper time to provide ſome young plants for that purpoſe. Remember, however, to chooſe the young plants of the ſame year, which are formed at the joints of the runners, or ſtrings, that iſſue from the ſides of the old plants. In chooſing the plants, let them be taken from ſuch ſtrawberry beds as bear well, and produce large fruit. Chooſe a parcel of the ſtouteſt plants of the ſame ſummer's growth, as above hinted, taking them carefully up with the roots. Trim the roots a little, and cut off the ſtrings or runners from each plant; then let them be immediately planted. But it will not be ſo proper to plant them now into the beds or places where they are to remain; but rather plant them into a nurſery-bed, in a ſhady ſituation; a ſhady border will be a proper place: there put in the plants about four or five inches aſunder; and, as ſoon as planted, give a gentle watering to ſettle the earth to their roots. There let them remain till September, or October; by which time they will be ſtrong, and in fine order to tranſplant, and are then to be planted out for good. The above method of procuring ſtrawberry plants at this ſeaſon is not commonly practiſed; but it is much the beſt way, for the plants will be much ſtronger and finer by September, than any that can be procured at that time from the old beds, and will bear ſooner. Or for immediate bearers you may, any time in this month, plant out ſome of the young runner plants of the alpine, or prolific monthly ſtrawberry, they will bear fruit the ſame year: that is, they will bear in Auguſt, September, and October; and, in mild ſeaſons, this ſort of ſtrawberry will bear till near Chriſtmas, provided they are in a warm border.

JUNE. — *KITCHEN GARDEN.*

Care of Melons, in Frames. — The melon-plants, which are in frames, ſhould ſtill be carefully ſhaded in the middle of the day; that is, when the ſun ſhines vehemently. This ſhould now be particularly practiſed, where there is but ſlender depth of earth upon the beds, or where the plants are ſituated very near the glaſſes; for if they were in that caſe expoſed to the full noon ſun, it would be apt to ſcorch the leaves, and would alſo exhauſt the juices of the vine or runners, and that of the roots; whereby the young fruit, and even thoſe that are ſwelled to ſome tolerable ſize, would, for want of the proper nouriſhment, be greatly checked, and would thereby take an irregular growth, and become ſtunted and very ill-ſhaped. Therefore, let ſome thin mats, &c. be ſpread over the glaſſes every day, when the ſun ſhines fiercely; but this need not be done before eleven o'clock, or thereabouts; and the mats may be taken off again about two. In beds where there are twelve or fifteen inches thick of good loamy earth, the melon plants will require but moderate ſupplies of water, once in a week or fortnight, as you ſhall ſee occaſion; continue to cover the glaſſes every night with mats, till about the middle of the month.

Care of Bell-glaſs Melons. — The melon-plants which are growing under bell or hand-glaſſes, ſhould now have full liberty to run out. Let each glaſs be raiſed and ſupported upon three props, about two or three inches high, and lay the vines out carefully, and in a regular manner. Continue to cover them every night with mats, till about the middle, or towards the latter end of this month; and then, if warm ſettled weather, the covering may be entirely laid aſide, except the weather ſhould prove very wet: in which caſe, it would be proper to defend theſe plants, by a covering of thick mats, or canvas, ſupported upon hoop arches fixed acroſs the bed.

Method of Conſtructing Oiled Paper Frames for Melons, and Cucumbers. — Where it is intended to cover any of the hand-glaſs melon ridges with oiled paper frames, it ſhould be done in the firſt or ſecond week of this month. This kind of frame will be a great protection to the plants and young fruit, if cold and wet weather ſhould happen about the time of its ſetting; and it will alſo ſcreen the plants from the too great heat of the ſun. Theſe frames ſhould always be placed upon the ridges, as ſoon as theſe plants begin to advance from under the hand or bell-glaſſes; the glaſſes muſt be taken away when the frame is placed on the bed. Such perſons as are not provided with bell or hand-glaſſes, may, with the aſſiſtance of theſe frames only, raiſe good melons, provided the plants be firſt raiſed by ſowing the ſeed in a hot-bed, under a frame and glaſſes, in March, or April, as there directed, and afterwards planted out on new hot-ridges the beginning of May, and papered frames immediately placed over the ridges as ſoon as the plants are planted therein, and be covered with mats every night till the middle or latter end of this month. Theſe frames are made of thin ſlipes of wood, and are conſtructed in the manner and form of the ridge or roof of an houſe, or archways; they ſhould be made firm but light. Each frame ſhould be ten or twelve feet long, or thereabouts, and four feet and a half or five feet wide at bottom; narrowing gradually on both ſides to a ſharp ridge at top, or formed in a rounding arched manner; making the whole two feet and a half or a yard high; in forming it, a bottom frame ſhould be conſtructed with two inch and a half wide ſlips of deal, framing it the above length and width; and then have either ſtraight inch-wide rafters, or hoop arches carried from both ſides a foot aſunder, and upon theſe the paper is to be paſted, firſt drawing pack-thread both ways, for the better ſupport of the paper.

On one ſide of the frame there ſhould be two pannels, made to open on hinges; and each of theſe pannels muſt be eighteen inches wide, making them within two feet of each end of the frame. Theſe pannels are to be opened occaſionally, to examine the plants and fruit, and to do the neceſſary work about them; which is better than to take the frames off upon every occaſion. The frame being made according to the above dimenſions, get ſome paper and paſte upon it. The beſt ſort for this purpoſe is the large demy printing paper, or thick writing paper, ſuch as is ſold for eleven pence or twelve-pence a quire; and two quires of ſuch paper will cover at leaſt one of the above frames.

But, before the paper is paſted on, there ſhould be ſome ſmall twine, or packthread, drawn at equal diſtances, along the frame, and acroſs the ſlips of wood, drawing it firmly round them, and then draw ſome more contrary ways acroſs that; this will ſupport the paper, when the wind at any time happens to blow ſtrong againſt it. Then let the paper be neatly paſted upon the frame; and when it is perfectly dry, get ſome lintſeed oil, and a ſoft pliable bruſh ſuch as painters uſe; dip the bruſh in the oil, and bruſh the paper all over lightly with it. The oil will render the paper more tranſparent, and make it proof againſt rain: Theſe frames ſhould always be made, that is, papered, ſome time before they are uſed; for the oil ſhould be perfectly well dried in the paper before the frames are placed out upon the ridges.

Fill up the Alleys between the Melon and Cucumber Ridges. — The alleys, or ſpaces, between the hand glaſs melon ridges, ſhould be now filled up with warm dung and earth, if not done laſt month, in order that the roots of the plants may have full ſcope of ground to run in. Where theſe ridges are made all, or a great part above ground, the ſpaces or alleys between them not being above three or four feet wide, it is adviſeable to fill them up equal with the beds, dung below, and earth at top, the beginning of this month; and it would be of great advantage, if a quantity of new and old dung together was uſed, juſt to produce a moderate warmth; for this would throw a freſh heat into the beds, which would very much promote the ſetting and ſwelling of the young fruit. Let the dung be as high as the dung of the ridges; then lay the earth over that, raiſing the whole level with the ſurface of the ridges or beds.

Pickling Cucumbers. — The cucumber plants which were ſown the latter end of laſt month, in the natural ground, to produce picklers, &c. ſhould now be thinned. This ſhould always be done when the rough leaf begins to advance in the heart of the plants. In doing this work, obſerve to leave in each hole, at leaſt four of the ſtrongeſt plants, but never more than five or ſix, which will be ſufficient: let the reſt be drawn out with care, and clear away all the weeds. Then earth up the ſhanks of the remaining plants within a little of the ſeed leaves, preſſing them gently aſunder at regular diſtances from one another, and immediately give each hole a light watering to ſettle the earth; the plants after this will get ſtrength, and grow away ſurprizingly. Let them be often refreſhed with water in dry weather; for they will in a dry time need a little every other day.

Tranſplant the early Celery, which was ſown in February, into the Trenches. — Tranſplant celery into trenches to remain to blanch. That which was ſown early will be grown to a proper ſize for this purpoſe by the firſt or ſecond week of this month, when it ſhould be planted; and ſome of the ſecond ſowing ſhould be planted out towards the latter end of the month for a general crop. Chooſe for theſe plants a piece of rich ground in an open ſituation; then mark out the trenches by line, about a foot wide; and allow the ſpace of three feet between trench and trench, which will be ſufficient for the early plantation. Dig each trench neatly, about ſix or eight inches, or a moderate ſpade deep, laying the earth that comes out equally on each ſide, then dig the bottom level; or firſt, if thought neceſſary, if poor ground, lay the thickneſs of three inches of very rotten dung along in the bottom of each trench, and let the bottom be neatly dug, burying the dung equally, a moderate depth, then put in the plants. Plant them in one ſingle row, juſt along the middle of each trench, allowing the diſtance of five inches, or thereabout, between plant and plant in the row; as ſoon as they are planted give them ſome water, and repeat it occaſionally till they have taken root. Theſe plants will, in about a month or ſix weeks after they are planted out, require to be moderately earthed up; and this is done in order to render the ſtalks white and tender: the earthing then muſt be performed in dry days: the earth muſt be broken ſmall, and take care to lay it gently to both ſides of the plants, and not to earth them too high at firſt, leſt you bury the hearts; this earthing ſhould, after you begin, be repeated every week or fortnight, or thereabouts, till the plants are ready for uſe.

Tranſplant the Endive ſown in May for an early Crop. — Tranſplant endive for blanching; ſome of the firſt ſown plants of May will be ready for this by the middle, or towards the latter end of the month. Then put in the plants by line, about a foot aſunder every way, and let them have ſome water as ſoon as they are planted. But there ſhould not be many of theſe early ſown plants planted out; that is, not to deceive yourſelf in planting out enough for a main crop: for the plants, if they were ſown in May, will moſt of them be apt to run to ſeed before they arrive to any tolerable ſtate of maturity. Sow endive-ſeed for a principal crop, and to ſucceed thoſe which were ſown the former month. See *Auguſt.*

Sow Celery for Winter and Spring Supply.—Sow celery ſeed for a principal latter crop; this ſhould be done in the firſt or ſecond week of the month. Dig a bed of light rich earth, and lay the ſurface perfectly level; then ſow the ſeeds pretty thick, and rake them in lightly with a very even hand. In hot ſunny weather, ſhade the bed from the ſun every day, from ten till three o'clock, till the plants appear; otherwiſe, this ſeed being very ſmall, the full ſun would, in a manner, quite burn it up. Likewiſe, let the bed, in dry weather, be refreſhed every other evening with a light moderate watering. The plants from this ſowing will be fit to plant out into trenches, in July, Auguſt, and September, and to take up for the table from October till Chriſtmas, and for a ſpring ſupply.

Prick out Cauliflowers ſown in May. — The cauliflower plants which were ſown in May, for the Michaelmas crop, ſhould about the third week in this month, be pricked out in a nurſery bed of rich earth. Prepare for them a bed about forty inches broad, in an open ſituation; then put in the plants, three inches aſunder, or thereabout, and give them a little water to ſettle the earth well about their roots. It will be proper to ſhade them from the hot ſun till they have taken good root. The plants are to remain in this bed a month or five weeks, to get ſtrength, and then to be planted out for good in the places where they are to remain to produce their heads.

Care of Early Cauliflowers now arriving to Perfection.—Continue to look over the plantations of early cauliflowers now and then, in order to break down ſome of the large leaves over the young heads, according as they appear. Theſe plants, which are ſtill advancing in growth, or part coming into flower, ſhould, in very dry weather, be well watered, which will keep the plants in a growing ſtate, and produce very large flowers or heads.

Save Cauliflower Seed.—Mark ſome of the earlieſt plants when in full perfection, with the largeſt white, and cloſeſt heads, which muſt not be gathered, and the plants left in the ſame place; they will ſhoot up into ſeed-ſtalks in July and Auguſt, and ripen ſeed in September.

Aſparagus.— Aſparagus ſtill continuing in perfection; obſerve to cut or gather the buds, as directed laſt month. But let it be remembered, it is adviſeable to terminate the general cutting for the year ſoon after the twentieth or twenty-fourth of the month, otherwiſe it will weaken the roots; for as long as you continue to cut the buds, the roots continue ſending up new ſhoots, though every time ſmaller; and, if continued late in the ſeaſon, would greatly exhauſt themſelves; as the future produce next year, &c. would be diminiſhed in proportion. Before the aſparagus run up to ſtalks, you ſhould now clear the beds perfectly from weeds; for that work cannot be ſo readily done after the ſtalks have ſhot up to a great height.

Prick out Broccoli ſown in April. — Prick out from the ſeed-bed early in the month the young broccoli plants which were ſown in April. Let them remain in this bed about a month, or five or ſix weeks, and then plant them out for good.

JULY.—*FRUIT GARDEN.*

Summer Pruning and Nailing Wall-Trees. — In gardens where there are wall-trees that have not yet had their ſummer pruning and nailing, that very needful work ſhould now be done in the beginning of the month; otherwiſe, the fruit upon ſuch trees will not only be ſmall and ill grown, but will alſo be very ill taſted, in compariſon to the true flavour of theſe fruit. Beſides retarding the growth and debaſing the taſte of the fruit, it is alſo detrimental, in a very great degree, to wall and eſpalier trees, to neglect the ſummer ordering and nailing, entirely till this time; and in particular to apricots, peaches, and nectarines, and ſuch like trees as produce their fruit principally upon the one year old ſhoots. Beſides, it cauſes great perplexity to the pruner to break through and regulate ſuch a thicket, and confuſion of wood; requires treble the pains and labour, and cannot be executed with ſuch accuracy as when the work is commenced early in the ſummer. In vines, many ſmall ſhoots generally riſe, one at leaſt from every eye of the ſame ſummer's ſhoots which were laid in a month or two ago; and the ſame ſmall ſhoots muſt now, according as they are produced, be all as duly diſplaced. All other ſhoots, wherever placed, that have been lately produced, muſt alſo be rubbed off cloſe: and all ſuch ſhoots as ſhall riſe any time, this month, ſhould, according as they come out, be continually taken off. Where this is obſerved and duly practiſed, the bunches of grapes will be large and perfectly grown; and every bunch will alſo ripen more regular and ſooner by at leaſt three weeks, than where the vines are neglected and permitted to be over-run with uſeleſs ſhoots. See *May* and *January.*

Budding. — Budding may now be performed in apricots, peaches, and nectarines: plums, cherries and pears. That work may be done any time in this month, but the ſooner the principal budding is done the better. Let every ſort be budded upon its proper ſtock: apricots, peaches, nectarines, and plums, ſhould be budded upon plum-ſtocks; they generally make the ſtrongeſt and moſt laſting trees, when budded upon ſtocks raiſed from plum-ſtones, or ſtocks raiſed from the ſuckers of plum-trees: though all theſe ſorts will alſo grow upon ſtocks of one another, raiſed from the ſtones of the fruit; and alſo upon almond ſtocks raiſed the ſame way; but the plum-ſtock is always preferable for the general ſupply. Pears may be budded upon pear-ſtocks; and theſe muſt be raiſed by ſowing the kernels. Pears alſo ſucceed well, in particular for the wall, when budded upon quince-ſtocks to dwarf them. Cherries are to be budded principally upon cherry-ſtocks, which muſt be alſo raiſed by ſowing the ſtones. Such cherries, plums, or pears, as were budded laſt ſummer, or grafted in the ſpring and miſcarried, may now be budded with any of the ſame kinds of fruit; for theſe trees will ſucceed either by grafting or budding. Budding generally ſucceeds beſt when performed in cloudy weather, or in a morning or an evening after three or four o'clock; for the great power of the mid-day ſun is apt to dry the cuttings ſo much, that the buds would not readily part from the wood. However, where there are large quantities to be budded, it muſt be performed at all opportunities. In performing this work, it muſt be obſerved, that where the trees are to be raiſed for walls and eſpaliers, the budding muſt be performed low in the ſtock; that is, the height of five or ſix inches from the ground, and at five or ſix feet for ſtandards. Budding may alſo be performed now upon trees that bear fruit. What is meant by this, is, where there are wall or eſpalier trees, that produce fruit not of the approved kinds, ſuch trees may now be budded with the ſorts deſired; and the budding is to be performed upon ſtrong ſhoots of the ſame ſummer's growth. Several buds may be put into every ſuch tree; by which means the wall or eſpalier will be ſoon covered with the deſired kinds, and in two or three years after budding they will begin to bear.

JULY.—*KITCHEN GARDEN.*

Plant Peas and Beans for a late Crop in September and October. Peas and beans may ſtill be ſowed the three firſt days in this month, it muſt not be later but the ſooner the better. Though thoſe peas and beans which are planted at this ſeaſon, do not always ſucceed in bearing abundantly, it will, however, where there is ground at liberty, be worth the trial, to put in a few of each, at two or three different times in this month; and if the ſeaſon ſhould prove ſomewhat moiſt, there will be a great chance of reaping a tolerable crop from them in September; at which time they will be a great rariety. The beſt beans to plant now, are the ſmall kinds; none better than the white bloſſom, ſmall Spaniſh, long pods, mumford, mazagan, and the like kinds; I have gathered plentifully from theſe ſorts at Michaelmas. But the large kinds of peas, ſuch as marrowfats, &c. may ſtill be ſown; and it will be alſo proper to ſow a few of the beſt kinds of hotſpur and dwarf peas. Obſerve, that if the weather and ground be very dry, it will be proper to ſoak the peas and beans in water for a few hours. Let the water be taken from a pond or river, and let the ſeed lie therein eight or ten hours; then ſow or plant them. Let theſe late crops be ſowed and planted in the moiſteſt part of the ground, where convenient, but not in a ſhady place, for in ſuch a ſituation the plants would draw up, and come to nothing; and remember to allow them ſufficient room between the rows, for much depends upon that at this time of ſowing. Prepare ſuch pieces of ground as are vacant, in order to receive ſuch ſeeds and plants as are proper to ſupply the table with neceſſary productions in autumn and winter.

Sow Broccoli Seed, for a late Spring Supply. — Now ſow alſo ſome broccoli-ſeed to come in for a late ſpring crop. This is to be the laſt ſowing, and ſhould be done ſome time before the tenth of the month. This ſeed ſhould be ſown in a rich ſpot, where the ſun has not much power. The plants raiſed from this ſowing will be ready to plant out for good in the middle or towards the latter end of Auguſt, and beginning of September, and will produce their heads in April, and in the beginning of May.

Plant Kidney beans, for a late Crop. — Plant a late crop of kidney-beans. Either the dwarf or running kinds may ſtill be planted, or ſome of both; but moſt of the dwarfs for any main crops. But the ſeed muſt be put into the ground the firſt week in this month, particularly that deſigned for a full crop; more may be planted about the middle and latter end of the month, of the dwarf kinds, to continue the ſucceſſion of beans in gathering till Michaelmas or longer; as they will, in mild autumns, continue till the middle or end of October. But in planting theſe beans, it will now be proper to obſerve the following precaution. That is, if the weather be at this time very hot, and the ground alſo very dry, it will, in that caſe, be adviſeable, before the beans are planted, either to water the drills, or lay the beans to ſoak in river or pond water. Let them be laid in the water in a morning, and continue there about five or ſix hours, and then being immediately planted. Moſt of the running ſorts are exceeding profitable for the ſervice of a family, for they are ſurprizing great bearers; but, in particular, the ſcarlet flowering bean; and there is a variety of this, that differs from it only in colour, which both in the ſeed and flowers, is white; but is not to be diſtinguiſhed from the ſcarlet, neither in the manner of growth nor mode of bearing; and both the varieties are very proper for this plantation: the large white Dutch running kinds are alſo very proper to plant now. The advantage of planting theſe running kinds is very great; for thoſe that are now planted, will, after they begin, continue bearing till the cold weather deſtroys the plants. But it ſhould be obſerved that where there are not the convenience of ſticks or poles for theſe plants to climb up upon, they will not ſucceed; and where that is the caſe, it will be beſt to plant none but the dwarf kinds. For the early crop, ſee *April.*

Tranſplant Cauliflowers ſown in May. — The cauliflower plants which were ſown in May, for the autumn crop, muſt now be planted out where they are to remain. This plantation will begin to produce their heads in the beginning or middle of October; and will continue, ſometimes, coming in gradually, till the middle or end of November, or till near Chriſtmas, if an open mild ſeaſon.

Sow Carrots for Autumn Uſe. — In the firſt or ſecond week in this month, you may ſow ſome carrot-ſeed, to raiſe ſome young carrots for the table in autumn. The carrots raiſed from this ſowing will come into uſe after Michaelmas, and will be very fine in October and November, &c. Chooſe light ground, which dig a proper depth, and directly while freſh turned up, let the ſeed be ſowed moderately thin, and rake it in evenly. When the plants are come up an inch or two high, let them be cleared and thinned to ſix or eight inches diſtance.

Sow Turnips for Autumn and Winter's Supply. — The plants raiſed from this ſowing will be in excellent order from about Michaelmas till Chriſtmas. It will be a great advantage if there falls ſome rain, to take the opportunity of ſuch times to ſow the feed. Great care ſhould be taken not to ſow it too thick: ſow it as regularly as poſſible, and take the ſame care in raking it into the ground.

Sow the black Turnip-rooted Radiſh for Winter's Supply.—Now is the very beſt time in the whole year, to ſow the large black turnip-rooted radiſh. There are two ſorts, one black, and the other white, and are generally known by the name of the black or white Spaniſh radiſh. The black ſort is in moſt eſteem, grows as large as ordinary turnips, and very hardy to ſtand the winter; they are by many people much admired for autumn and winter, to ſlice in ſallads, or eat alone, raw; the moſt proper time to ſow the principal winter crop, is between the tenth and twenty-fourth; they ſhould be ſowed in an open ſpace of freſh digged ground, broad caſt, and trod down, and raked in regularly. When the plants have been come up ſome time, they muſt be hoed out to about ſix or eight inches diſtance; they will then have proper room to ſwell, and will be ready to draw for the table about Michaelmas, and will continue good all winter. Sow alſo ſome ſmall Italian turnip-radiſh for autumn.

Gather Seeds. — Gather ſeeds of all ſorts according as they ripen. Let this be done always in perfect dry weather; cutting or pulling up the ſtems with the ſeeds thereon, and let them be ſpread immediately in a dry place where the air can freely come. There let them lie to harden the ſeed, obſerving to turn them now and then; and when they have laid a fortnight, or three weeks, the ſeed ſhould then be beaten out, and well cleaned from the huſks and rubbiſh, and put up in boxes or bags, and continue the ſucceeding months.

Tranſplant Leeks, and Onions ſown in February. — Chooſe the ſtrongeſt plants, and trim the roots, and cut off the tops of their leaves; then plant them, obſerving to put ſix rows in each bed, and ſet the plants the diſtance of ſix inches from one another in the rows.

Gather Herbs for Drying. — Gather mint and balm, pennyroyal, ſweet marjoram, as alſo carduus, and all ſuch kinds of herbs as are now in flower, in order to dry, to ſerve the family in winter. Theſe kinds of herbs ſhould always be cut for the purpoſe of drying, when they are in the higheſt perfection, which is when the plants are nearly of full growth, and juſt coming into flower. Let them be cut, in dry weather, and ſpread, or hung up in a dry airy place, out of the reach of the ſun; and there let them dry gently; for they ſhould be always dried in the ſhade. Likewiſe gather herbs to diſtil. Many of the proper kinds will now be arrived to full growth and advancing into flower; and that is the proper time to cut all ſuch herbs as are intended for the purpoſe of diſtilling. Alſo gather ſome chamomile flowers, and the flowers of marigolds and lavender, to lay up ſome for the future ſervice of the family. Let them be gathered in a dry day, and ſpread to dry in a ſhady place; then put them up in paper bags till wanted.

AUGUST.—*FRUIT GARDEN.*

Fig Trees. — Take care of the fig trees; the figs will now be full grown, and will begin to ripen, and therefore require a due ſhare of ſun to promote their ripening, and to give them their true flavour. All the ſtrong ſhoots muſt therefore be now laid in cloſe to the wall; but take care to uſe the knife on theſe trees but very little at this time. Cut off no ſhoots but ſuch as grow directly on the front of the branches: lay in all the fair growing ſide ſhoots; for theſe young ſhoots that are now laid in, are to bear the fruit to be expected next year; and therefore, as theſe trees produce their fruit upon none but the year-old ſhoots, be careful to leave enough at this time; for what is not wanted to lay in at the general ſeaſon of pruning, can at that time be eaſily cut away. But, whatever you do, be ſure not to ſhorten any of the ſhoots, but lay in every one at full length; for the ſhoots of theſe trees muſt never be ſhortened, becauſe they are the only bearing wood for next year, and as they bear principally towards their upper ends, ſhortening would deſtroy the beſt fruitful parts thereof, and throw them into a redundancy of uſeleſs wood the following ſummer. Obſerve to lay them in regularly, not acroſs one another, and then let them be well ſecured, for the wind and rain have great power over theſe trees on account of their broad leaves.

Budded-Trees. — Go over the ſtocks or trees which were budded in July, and let all the bandages be looſened. This ſhould always be done in about three weeks, but never exceed a month, after the budding is performed; otherwiſe, as the bud will ſwell, the ſap will be ſtopped in its regular courſe, and the parts about the bud will be pinched, and will ſwell irregularly. Likewiſe examine that part of the ſtock below the bud, and when there are any ſhoots ſent forth in that place, let them be taken off cloſe.

Defend Wall Fruit from Inſects, Birds, &c. — Waſps and flies are particularly to be guarded againſt, for theſe inſects will devour the moſt delicate fruit at a ſurpriſing rate, and, if not prevented, make great havock. The only method to prevent this, is to continue to place baits in different parts of the trees to catch them; that is, let a quantity of large phials be filled with ſugared, or honey water, and hang three or four in each of the principal trees; this will greatly protect the fruit: for the ſweetneſs of the water will entice the inſects to neglect it, and they will continually hover about the mouth of the phials; numbers will daily creep in to drink, and when once they enter not one in an hundred can get out again; beſides the bottles of ſweetened water, let alſo ſome ſmall bags made of thin crape or gauze be put over ſome of the fineſt and ripeſt bunches of grapes. Theſe bags ſhould be made juſt ſo large as to contain one bunch of fruit: this will effectually keep off the inſects, and alſo the birds; the latter will devour theſe fruit at a vaſt rate, if they can come at them, eſpecially the ſparrows. But the birds you may keep from the fruit by fixing nets before the vines, or hanging up ſcare-crows of feathers, or diſcharging a gun or piſtol: but the moſt certain method to preſerve

ſerve ſome of your fineſt bunches of fruit from all devourers, is to bag them as before directed. Or, for want of crape-bags, &c. may uſe thoſe of white paper, but theſe do not ſucceed ſo well, for the ſun is then too much excluded from the fruit; and in wet weather, the paper being wetted, it adheres to the bunches and rots them; whereas the ſun and air have free acceſs through the crape, and when wet they will very ſoon become dry again; and if wet weather continue, no inconvenience attends the fruit by means of the bags.

AUGUST.—*KITCHEN GARDEN.*

Sow Spinach, for Winter and Spring Supply.—This muſt be done ſome time in the firſt or ſecond week in the month. But in poor ground, and cold ſituations the ſeed ſhould be ſown in the firſt week; but in rich warm ground it ſhould not be ſown till the ſecond week in the month, for if ſowed much ſooner in rich ground, the plants are apt to grow too rank before winter, and apt to fly up to ſeed early in the ſpring. Chooſe a piece of ground that lies tolerably dry in winter, and immediately ſow the ſeed, and tread it down evenly, and then rake it into the ground. Obſerve, it is the prickly ſeeded kind that is to be ſown now, for this ſort will beſt endure the cold and wet in winter. When the plants are come up, and got leaves an inch broad, or thereabouts, they muſt then be thinned, and cleared from weeds; thin the plants regularly, leaving them the diſtance of three or four inches, or thereabouts, from one another; they will then have proper room to ſpread, and gather ſtrength, to be able to endure the cold. Beſides, when ſpinach is allowed to ſpread itſelf regularly, the plants will produce very large and thick leaves; and every ſuch leaf is worth three that is produced from ſuch plants as crowd one another. Obſerve, you ſhould weed the plants every month both Summer and Winter.

Sow Cabbage Seed for next Spring, and Summer Supply.—Sow early cabbage ſeed, to produce plants for the ſervice of next ſummer. Alſo ſow the large autumn kinds to ſucceed the early crops, and for autumn ſupply, &c. The proper early ſorts to ſow now, are the early dwarf, early and large ſugar loaf, the early Batterſea, and Yorkſhire kinds, &c. But this early ſeed muſt not be ſown until ſome time between the ſixth and the twelfth of the month; nor muſt it be ſown later; there being an advantage in ſowing it juſt at that time; for was the ſeed to be ſown ſooner, many of the plants would be apt to run to ſeed in March; and was it to be ſown later in the month, the plants would not get proper ſtrength before winter.

Sow Onions for a Winter and Spring Supply.—This being the moſt eligible ſeaſon to ſow the general crop of winter and ſpring ſervice, and for early heading ſummer onion; it muſt be done in the firſt, but at fartheſt the ſecond week in the month; ſow the ſeed tolerably thick, but as equal as can be; then tread it in, and rake the ground evenly, that the ſeed may be equally covered, and the plants riſe regularly in every part of the beds. The plants from this ſowing will ſupply the table in the early part of winter and all the ſpring, for ſallads or other uſes, and continue till April and May; and if you let ſome of them ſtand till June, they will bulb and grow to a tolerable ſize, but will ſoon after run to ſeed. Sow alſo ſome Welſh onions; this is done in caſe the others ſhould be deſtroyed by the froſt; for the Welſh onions will ſurvive almoſt the ſevereſt winter; notwithſtanding their blades will ſometimes die down to the ground in November or December, the roots remain ſound, and new leaves will ſprout up again in about ſix weeks or two months after the others are decayed. But it is adviſeable alſo, to ſow a portion of each ſort about the middle, or towards the latter end of the month, for late ſupply in the ſpring, as they will not run ſo ſoon as the others.

Sow Radiſh Seed for Autumn Supply.—Radiſh ſeed may ſtill be ſown twice this month to raiſe ſome plants for autumn ſervice. If you ſow this ſeed in the beginning of the month, the plants will be ready about the beginning or middle of September; and that ſown about the middle, or towards the latter end, will be fit to draw towards Michaelmas, and will continue tolerably good all October. The proper ſorts of radiſh ſeed to ſow, at this time, for autumn crops, are the ſalmon, or ſcarlet kinds; and the ſhort-top radiſh. Sow alſo ſome of the ſmall white Italian turnip-rooted radiſh to come in next month, when they will make a pretty variety at table, and eat very agreeable in ſallads or alone. Alſo ſow a crop of black Spaniſh turnip-radiſh for autumn and winter.

Sow Cauliflower Seed for the early or General Crops.—Cauliflower ſeed ſhould be ſown towards the latter end of this month, to raiſe ſome plants, to produce the early and general crop next ſummer. The proper time to ſow the ſeed is ſome time between the eighteenth and twenty-fourth of the month; and it muſt not be ſown ſooner than that time, otherwiſe the plants will be apt to button (as it is called) or flower, in winter, or early in the ſpring, in their infant ſtate: which flowers never exceed the ſize of an ordinary button, and thereby you are diſappointed of having an early crop, at the due ſeaſon; or if ſowed late, the plants will not acquire a proper growth to reſiſt the winter's froſt; therefore mark the above time; but the London gardeners, who raiſe prodigious quantities for public ſupply, generally ſow their main crop on a particular day, (the 21ſt of this month,) having from long experience proved that to be the moſt eligible period of ſowing this crop of cauliflowers, for next ſummer's general ſupply. But in order to have a more certain crop and regular ſupply of cauliflowers, it will be proper to ſow ſome ſeed at two different times this month. The firſt and main ſowing muſt be at the time before mentioned; and the general rule is to allow the diſtance of a week, between the firſt and ſecond ſowing.

The firſt ſown plants are principally for the earlieſt and firſt general crop, and a quantity of which ſhould be planted out for good, in the latter end of October, under bell or hand glaſſes, or a parcel may be planted under a ſouth wall, and there remain, without any other ſhelter during the winter. They will ſometimes ſtand it tolerably well; but, if you chooſe it, you may alſo at that time plant a parcel of the firſt ſown plants in a bed or border, and arch it over with hoops, in order to be occaſionally ſheltered with mats till tranſplanting ſome time next ſpring in March. Sow the ſeed, and rake it in with particular care; and with the rake, teeth downward, in its proper poſition, draw the earth evenly over the ſeed: or in another method of ſowing, the bed when digged, being juſt raked ſmooth, ſow the ſeed, and ſift over it about a quarter of an inch of light earth. In dry weather let the bed be from time to time moderately watered. When the plants are come up, continue, in dry weather, to water the bed moderately, at leaſt every two days. Then, about the twentieth, or ſome time between that and the twenty-fifth of next month, the plants ſhould be pricked out from the ſeed bed. See *September* and *October*.

Management of Artichoke Plants.—Examine now the artichoke plants, both of the old plantations, and thoſe planted laſt March, or April. Many of theſe plants will now be in fruit; and, beſides the principal or top fruit, there will raiſe many ſmall heads or ſuckers from the ſides of the ſtems; but in order to encourage the principal head to grow to a large ſize, moſt of theſe ſmall ſide ſhoots ſhould be diſplaced. This practice is neceſſary, if you prefer one large handſome head to three or four ſmall ones; but when you practice this, the ſuckers or ſide heads ſhould always be taken off, before they exceed the ſize of an egg; and theſe are in ſome families dreſſed and eaten. Theſe, the gardeners about London, call ſuckers: they gather them as above, and tie them in bunches, and carry them to market, where they have a ready call for them, in that of Covent-garden and Spitalfields, &c.

Sow Lettuce Seed for Autumn, Winter, and Spring Supply.—Sow lettuce ſeed this month for uſe this autumn, and the following winter and ſpring; the firſt ſowing ſhould be in the firſt week; the other at the end of the month. The principal ſorts for ſowing now are the green and white cos lettuce, Cilicia, brown-dutch, common, white, and hardy green cabbage lettuce; but you may alſo ſow ſome of any of the other kinds. The firſt ſowing is to be performed ſome time before the tenth of the month, and is to raiſe plants for ſupplying the table in October, November, and December, the ſecond ſowing muſt be done ſome time between the eighteenth and twenty-fourth of the month; and the plants raiſed from this ſowing are ſome to be planted out in September, for winter ſupply: and others, ſuch as Cilicia, brown-dutch, common, white, and hardy green cabbage lettuce, to remain where ſowed, and thinned as wanted in winter and ſpring; and a good quantity of the cos, and other lettuces be planted out in September and October, upon warm borders in order to ſtand the winter, to ſupply the table next March, April and May. See *September* and *October*.

Sow Endive, for a late Spring Crop.—Sow ſome green curled endive the beginning of this month, to plant out the middle and end of September, and in October for a late ſpring crop. The beſt endive to ſow now is the green curled ſort; this ſort is not only the beſt for uſe, but the hardieſt, for it will endure wet and cold in winter better than any other kind. But you may likewiſe ſow, as a variety for a ſallad, ſome of the white curled ſort. See *May* and *June*.

SEPTEMBER.—*FRUIT GARDEN.*

Tranſplant Strawberries.—Now is a proper time to plant ſtrawberries; and if moiſt weather, it may be done any time in the month: but if the weather be very dry and hot, it will be proper not to begin that work till the middle, or towards the latter end of the month. The ſtrong young runner plants of the ſame year, taken from beds that bear well, are the proper ſets for planting; ſuch as adviſed next month and in June: and if any were then (June) planted out in nurſery-beds, as there directed, they will be now in fine order for this plantation. Theſe plants ſhould be allowed good ground; let it be well dunged and neatly digged, and lay it out in beds four feet broad, allowing alleys between the beds from eighteen or twenty inches, to two feet wide, for the convenience of going in to weed, water, and gather the fruit. The plants are to be ſet in rows lengthway the beds; the rows fifteen or eighteen inches aſunder, and the plants to be ſet the ſame diſtance from one another in the rows.

Or they may be planted in borders along the front and back of eſpalier-trees or under walls, hedges, &c. or ſome may be planted by way of an edging to borders, or where convenient: the wood ſtrawberries will ſucceed both in the ſhade under buſhes, trees, &c. and in a free expoſure, but the other ſorts ſhould generally be allowed an open ſunny expoſition. It will be moſt proper to do that work in moiſt weather, if poſſible. The proper ſorts of ſtrawberries to plant are: The ſcarlet ſtrawberry. The hautboy.

The large Chili ſtrawberry. The white and red wood-ſtrawberries. The pine-apple ſtrawberry, having a greeniſh fruit. The Alpine, everlaſting, or prolific ſtrawberry.

This laſt ſort is remarkable for its fruitfulneſs; for the plants continue to produce fruit from June to November, and if ſheltered with a common frame and glaſſes, will, if open weather, continue bearing till Chriſtmas. But the fruit of this ſort is in the greateſt perfection in July, Auguſt, and beginning of September.

Guther early Apples and Pears.—Now begin to gather apples and pears for keeping, according as they are fit; many of the autumn ſorts will be ready to take down towards the middle or latter end of this month. This work muſt always be done in a perfectly dry day; and be ſure to let the fruit be alſo quite dry before you begin to pull them; and all the fruit which are for keeping ſhould hang their full time on the the trees, but eſpecially the late autumnal and winter pears and apples. See *October*.

About the latter end of this month, many of the winter fruits will be fit to gather; but if the weather is fine, let them hang on the trees till the beginning of October. When the apples or pears have hung their full time on the trees, they will eaſily quit the wood on being handled; and when they begin to drop off apace, that is a certain ſign of their maturity, and that they may be gathered. See *October*.

SEPTEMBER.—*KITCHEN GARDEN.*

A Complete Practical Method of rearing Muſhrooms.—This is now the ſeaſon to begin to prepare the dung for making muſhroom-beds. Theſe beds ſhould be made of the beſt warm horſe ſtable dung, and about the beginning, or any time this month, it will be proper to provide a neceſſary quantity, ready for that purpoſe; before you work the dung up in a bed, it ſhould be toſſed up together in a heap till the firſt great heat is over; this is generally effected in a fortnight or three weeks time, or thereabouts, it will then be in right order, and you may proceed to make the bed. But before you make the bed it is proper to provide a ſufficient quantity of good muſhroom ſpawn: this is a material article; and a proper quantity muſt be procured to plant into the bed to produce the muſhrooms, for this ſpawn contains the plants in embryo. This is frequently found in the dung of old cucumber or melon, or other decayed dung of hot beds; it is alſo often to be met with in dung hills, which have lain ſix or eight months or more; ſpawn is alſo to be found in paſture fields, and ſhould be ſearched for in thoſe places where you ſee muſhrooms riſe naturally; but I generally prefer the ſpawn found in dung, either in old hot beds or in old dung hills. I have often found excellent ſpawn in the farmer's dung hills; ſuch as we commonly ſee piled up in large heaps in the lanes, or on commons near their fields; and you will generally find it moſt of all in thoſe dung heaps which conſiſt chiefly of horſe ſtable dung, obſerving to ſearch in ſuch as appear to have laid for ſeveral months. Spawn is commonly found in ſearching as above, in lumps of dry rotten dung; it is a white fibrous ſubſtance, running and ſpreading itſelf in the ſaid lumps of dry rotten dung, appearing of a white ſtringy or filamentoſe nature, and if of the true ſort, has exactly the ſmell of a muſhroom. Let theſe lumps be taken up carefully, dung and ſpawn together, obſerving to preſerve the pieces as entire as poſſible, laying them at the ſame time in a wheel-barrow or baſket with the ſame care; when you have gathered enough for your purpoſe, let the lumps be laid in a dry place, and covered with ſome dry litter till the bed is ready. But if the pieces of ſpawn are wet, or very damp, you may lay them thinly on a mat in a dry ſhady place, where they may dry leiſurely; then cover them as above. I have been obliged often to buy my ſpawn of the market gardeners in the neighbourhood of London; but particularly thoſe called the Neat-houſe gardeners near Chelſea, alſo about Lambeth and places adjacent; where many of the gardeners labourers go about at this ſeaſon and collect great quantities for ſale. It may, if cloſely packed up in hampers, be ſafely conveyed to a great diſtance. I have more than once ſent it above an hundred and fifty miles. It is ſold from about five to eight or ten ſhillings per buſhel.

When you have obtained the ſpawn, you may then begin to make the bed as ſoon as the dung is in a right condition for that purpoſe. Chooſe a dry ſpot either in the melon-ground, to make the bed on, or on any other dry ſheltered ſituation; and the bed may be made either wholly upon the ſurface of the ground, or in a ſhallow trench only ſix inches deep, the width and length of the bed, and the excavated earth of the trench will ſerve to earth it. Mark out on the ground the width and length of the bed, according to the quantity you intend to raiſe; it is to be made ridgeways, like the roof of an houſe, about four feet high. Bring in the dung, and lay the bottom of the bed to the full extent: and, as you advance in height, draw both ſides in gradually from the bottom, till you bring it, as it were, to a ſharp edge at the top. As you proceed in making the bed, obſerve to ſhake and mix the dung well together, but do not tread it, but beat it down firmly with the fork, and permit the whole to ſettle gradually of itſelf. Thus let the bed be carried on till you have raiſed it to the height of, at leaſt, three feet and a half, or four feet high, finiſhing the whole in the form of a ridge of a houſe, as directed. Having made the bed, you muſt let it remain for at leaſt a fortnight, or three weeks, or a month, according to its ſubſtance and extent, before you put in the ſpawn, or till the heat is become quite moderate; for if the ſpawn was to be put in while the heat is ſtrong, it would be entirely deſtroyed; therefore have two or three long ſticks thruſt down into the dung, to pull up occaſionally to try the heat; which ſhould be quite mild, and reduced to a very low warmth, before you venter the ſpawn in: for this is very delicate; impatient both of too much heat and copious moiſture.

Remember, after the bed is made, if there ſhould happen to fall much rain before it is ready for the ſpawn, to cover the whole a good thickneſs at the top with long dry litter, for much wet would ſpoil the bed. When the bed is in a due condition, let the ſpawn be brought out in a dry day, and plant it in rows lengthways of the bed, obſerviug to begin the firſt row within about ſix inches of the bottom. Plant the pieces of ſpawn in the dung, obſerving to put them juſt within the ſurface of the bed, and let them be put in about five or ſix inches aſunder; when you have finiſhed one row, begin another ſix or eight inches from the firſt, and ſo proceed till you have planted the whole. When this is done, let the ſurface of the bed be made quite ſmooth, by beating the dung gently with the back of your ſpade. Then let every part of the bed be covered with ſome rich dry earth about an inch and a half thick; let this alſo be made quite ſmooth by uſing the ſpade as above. Then let the whole be covered with ſome clean and dry ſtraw, or dry long ſtable litter, a foot thick at leaſt, to keep out the wet and cold; obſerving, however, if you have any doubt, of the bed recovering a vigorous heat again ſoon after being ſpawned and cloſely carthed over, which confines the heat and hot ſteam; you may cover it only but a quarter or half the thickneſs at firſt, or not at all for a few days or a week, or fortnight, if a very ſubſtantial bed, and the weather is dry; but if rain falls, defend it above with the ſtraw, or dry long horſe-ſtable litter; for if the bed is ſuffered either to have too much heat or wet, all is loſt, ſo delicate is the ſpawn; and requires therefore the greateſt precautions in the firſt ſetting.

When heavy rains fall, examine the above covering; and if you at any time find that the wet has penetrated through to the bed, let the wet ſtraw be removed, and lay ſome freſh on next the ſurface. In time of ſevere froſt, or ſnowy weather, the depth of covering ſhould be augmented with more dry ſtraw, and over this ſome mats or canvas cloth. Or, after the bed has been ſpawned and covered ſome conſiderable time, and the muſhrooms do not ſeem to come freely, or that the warmth of the bed appears ſpent, you may remove the covering, and apply the next bed a quantity of warm, dry, horſe-ſtable litter, near a foot thick, and other dry litter over that, and this will promote a freſh moderate heat in the bed, and prove very beneficial.

But theſe beds, in the ſummer ſeaſon, may ſometimes have the covering of litter taken off during the time of a moderate warm ſhower, and in very hot weather may now and then have little ſprinklings of water. Theſe beds, if properly made, and taken care of as above, will begin to produce plenty of good muſhrooms in five or ſix weeks, or thereabouts; and will continue ſometimes bearing for ſeveral months. The ſpawn, when it begins to run, ſpreads itſelf very faſt every way, and the plants will riſe over the bed. But ſometimes a muſhroom bed will not begin to yield any plants till two, three or four months after it is made; but when that happens, you ſhould not deſpair, for ſuch a bed, after it begins, often produces abundance of fine muſhrooms, and continues to do ſo a long time. You muſt remember, when a muſhroom bed has done producing, and you pull it to pieces, to ſave all the freſh ſpawn to plant in new beds; for the ſpawn will keep good for ſeveral months, provided you keep it in a dry warm place, and cover it with dry litter. I have ſometimes planted muſhroom ſpawns on the late made cucumber ridges; that is, thoſe made in April and May, and in a month or two after, introduced the pieces along the top edges of the bed into the earth, where it has ſucceeded and produced a great number of muſhrooms in September and October; obſerve, when you expect them to appear, to cover the places with litter.

Plant out Lettuces, ſown early in Auguſt for Autumn and Winter Supply.—The crop for this autumn and beginning of winter ſervice, ſhould be planted out the beginning and middle of this month, in any bed, or border, in rows ten or twelve inches aſunder; but thoſe of the late Auguſt ſowings, intended to ſtand the winter for ſpring ſupply, are to be planted out in October.

Plant out Cauliflowers, into Nurſery-beds, which were ſown in Auguſt.—The cauliflower plants which were ſown in Auguſt will require to be planted out into a nurſery-bed about the middle or twentieth of this month. Mind to draw out ſome of the beſt plants from the ſeed-bed, rejecting ſuch whoſe ſtems are crooked and black. Plant them in rows about three or four inches aſunder, and allow near the ſame diſtance between plant and plant in the row; obſerving not to plant them ſo deep as to bury their hearts, for that would deſtroy them. If there ſhould happen to fall heavy rains, it will at ſuch time be proper to put on the lights, to defend the plants therefrom; for too much moiſture would prove very prejudicial to theſe young plants, and would occaſion their ſhanks to turn black and rot.

Neceſſary Care of Michaelmas Cauliflowers, ſown in May.—Some of the cauliflowers which were planted out in July, for the Michaelmas

mas crop, will begin to ſhew their heads about the end of this month, or beginning of next. If the weather in this month proves dry, form the earth like a baſon round each plant, and pour water therein; this will encourage them to grow freely, and produce large heads in October and November; for if they are ſtinted now for want of moiſture, their heads will be ſmall at their proper ſeaſon.

Prick out Cabbage Plants, ſown laſt Auguſt for an Early Crop next Summer.—The cabbage plants which were ſown the firſt or ſecond week in Auguſt for an early crop next ſummer, ſhould be pricked into nurſery-beds. Some of the forwardeſt about the beginning, and the reſt in the middle or latter end of this month. Let the principal ſupply of the early cabbage plants remain in the nurſery-beds in a warm ſituation, till February, or March, before you plant them out for good; for it ſometimes happens in ſevere winters, that many of the plants which are planted out early into a more open expoſure, are killed by the froſt. See *Auguſt* and *February.*

Tranſplant Celery into the Trenches which was ſown in June for the Winter and Spring Supply. — Plant out more celery the beginning of this month for a ſucceſſional winter crop, and about the middle or latter end of the month plant out for a late winter crop, and for ſpring ſupply. Trim the roots and tops of the celery, and plant one row in each trench. Let the plants be ſet about four or five inches aſunder in the row, and water them directly. Obſerve never to omit earthing them up every month till it is gathered. See *December.*

Plant out Endive ſown laſt Auguſt for a Winter Crop. — Plant out endive the beginning of this month, for a general winter crop; let theſe be planted in a dry ſpot in a warm ſituation, allowing them a foot diſtance each way. About the middle, or towards the latter end of this month, you ſhould plant out ſome endive on a warm border under a ſouth wall, to remain till December and after Chriſtmas before you begin to blanch it. This, if it ſurvives the froſt, will be acceptable for ſallads, and other uſes, in January, February, and March. See *April* and *May.*

Chervil and Corn Sallad. — Sow chervil and corn ſallad the beginning of this month, if not done in Auguſt, for winter and early ſpring uſe; the former for ſoups, and both of them alſo for ſallads. See *Auguſt.*

Gather ripe Seeds. — Gather ſeeds in dry weather, of ſuch plants as now ripen, ſuch as lettuce, leeks, onions, cauliflowers, &c. which you muſt well attend to in theſe kinds particularly, according as they acquire maturity, and before attacked by the autumnal rains or mildew.

OCTOBER. — *FRUIT GARDEN.*

Gather Winter Pears and Apples. — Winter pears and apples ſhould in general be gathered this month. Some will be fit to take down the beginning of the month, others will not be ready before the middle, or towards the latter end. To know when the fruits have had their full growth, you ſhould try ſeveral of them in different parts of the tree, by turning them gently upward; if they quit the tree eaſily it is time to gather them. But none of the more delicate eating pears ſhould be permitted to hang longer on the trees than the middle of this month, eſpecially if the nights are inclinable to froſt: for if they are once touched with the froſt, it will occaſion many of them to rot before they are fit for the table, even if ever ſo good care is afterwards taken of them. Obſerve, that for all the principal keeping fruits, a dry day muſt be choſen for this work, and alſo let the trees and fruit be quite dry before you begin to gather; about eleven or twelve o'clock is the beſt time in the day to begin, and may be continued till three or four in the afternoon; obſerving likewiſe, that the capital fruits deſigned for long keeping ſhould all be carefully pulled one by one, and put into a baſket, taking care to lay them gently, that they may not bruiſe one another. According as the fruit are gathered, let them be carried into the fruitery, or any other dry place, and lay them in heaps, each ſort by themſelves. Thus let them lie together about a fortnight to ſweat; this will make them keep better, and alſo render their flavour much finer, than if they were laid up for good as ſoon as they are gathered. When they have lain that time, let all the choice keeping fruit be then carefully wiped one by one with cloths, and lay them up where they are to remain. Some of the fineſt eating pears and apples, you may pack up in baſkets or boxes; obſerving to put ſome clean wheat ſtraw at bottom, and alſo round the ſides of the baſkets or boxes, and, when they are filled, lay ſome ſtraw at top, and then cover the whole with dry ſtraw, a conſiderable thickneſs, to exclude the damps and free air: for this is of conſiderable advantage in promoting their ſound keeping. The more inferior or common kinds, for general ſupply, may be laid on the ſhelves and floor of the fruitery; firſt laying ſome clean ſtraw, then lay the fruit upon this, obſerving, if there is plenty of room, to let them be laid only two or three layers thick, otherwiſe you may lay them in ſeveral layers one upon another; covering the whole with dry clean ſtraw, a foot thick at leaſt, to exclude the damp air, froſt, &c. whereby the fruit will keep much better than if they remained open, or but thinly covered; as the damps and air, when fully admitted, haſten the decay of the fruit.

OCTOBER. — *KITCHEN GARDEN.*

Plant Beans for early Summer Supply. — The latter end of this month, you may plant ſome beans, for an early crop the ſucceeding ſummer. Thoſe which are planted now, if they ſurvive the the winter's froſt, &c. will come in for uſe the end of May or beginning of June. The Mazagan bean is the beſt to plant at this ſeaſon, for they will come earlier than any other, and are excellent bearers, though but of humble growth; and they will ſtand the winter better than the larger ſorts. A warm border under a ſouth wall, or other ſouth fence, is the beſt ſituation to plant theſe beans in at this ſeaſon. In planting early beans, it often proves very ſucceſsful, firſt to ſow the beans pretty thick in a bed of rich earth; and when they come up an inch or two in height, tranſplant them into the border. The method is, this: dig a bed about three or four feet broad of good earth in a warm corner; this done, ſcatter in the beans about an inch aſunder, and immediately cover them with the earth. In the ſpring take them carefully up out of the ſeed-bed, with their full ſpread of roots, and as much earth as will hang about them; pull away the old beans at the bottom, and trim the end of the perpendicular root; aud then plant them in rows three or four feet aſunder, obſerving to cloſe the earth well about every plant; they will ſoon take root and grow freely.

One reaſon for this practice is, that beans which are tranſplanted will come in ſooner by a week or ten days, than thoſe which are not; though the ſeed of both are put into the ground the ſame day. Another thing is, that when the beans are thus firſt ſown in a ſmall bed, and ſevere froſts afterwards ſet in any time before the plants are ready to be tranſplanted; in that caſe the ſeed, or plants, by being all together within a ſmall compaſs, can be readily protected by placing a frame, or ſome other covering over them; and by that means be preſerved; when thoſe in the open ground are ſometimes killed, or greatly damaged by the froſt.

Sow Peas for an early Summer Supply. — They may be ſowed in the middle or latter end of the month, and the produce will come in at May and June, provided they eſcape the froſt; but, however, if they are ſown any time in the month, it will not make a great difference; and indeed thoſe ſown in the latter end of the month will have the better chance to ſucceed. The earlieſt hotſpur are the proper ſort of peas to ſow at this time. Chooſe ſuch ſeed as are new, plump, and ſound. There are ſeveral ſorts of the hotſpurs; ſuch as the Golden, the Charlton, the Reading, the Maſter, and Nichols's; but the Charlton, Golden, and a variety thereof, called Nichols's early pea, are thoſe which we now generally recommend to ſow for the beſt early crop. A warm ſouth border, under a wall or other fence, is the proper place to ſow them in. Scatter the peas therein pretty thick, but as regular as can be, and cover them immediately about an inch and a half deep with earth.

Tranſplant Lettuces ſown the beginning and end of Auguſt. — Lettuces for the winter ſervice of the early Auguſt ſowing; in the beginning or middle of the month ſhould be planted out in beds of rich light earth, in a ſheltered ſituation, ſix or eight inches aſunder: they will ſupply the table before and after Chriſtmas. The cos and other lettuces which were ſown at the end of Auguſt muſt be planted in frames or under hand-glaſſes, to ſtand the winter for ſpring uſe, and an early ſummer crop ſhould now be tranſplanted into the places where they are to remain all winter; this may be done about the middle or latter end of this month; or as ſoon as the plants are fit.

Chooſe a light rich ſpot for theſe plants in a warm ſituation, and where it lies well to the ſun. Plant the lettuces about three inches diſtant each way; cloſe the earth extremely well about each, and take care that they are not planted too deep. Then put on a frame, and cover them with the lights in froſty or very wet and cold weather; by which means theſe may be ſaved, and will be ready to plant out in the ſpring, as a ſure ſubſtitute, in caſe thoſe which were planted in the open borders are killed; and if both ſucceed, they will ſupply the table in ſucceſſional order. You may plant ſome of theſe lettuces under bell or hand-glaſſes, where cauliflowers are planted; placing them round the outſide of the cauliflowers, next the ſides of the glaſſes, and in the ſpring muſt be tranſplanted into the open ground; or if not accommodated with frames and glaſſes, or hand-glaſſes, &c. ſufficiently for this purpoſe, you may plant them in a bed in a warm ſituation, and then place ſome hoops acroſs the bed, and cover them with mats occaſionally, in cold nights, or froſty and rainy weather.

Tranſplant Cauliflower Plants from the Nurſery Bed of September to ſtand the Winter. — In the laſt week in this month tranſplant finally ſome of the beſt cauliflower plants into a warm quarter of rich ground, under hand glaſſes, in rows four feet aſunder, where they are to remain to produce their heads early next ſummer, and if they all ſurvive the winter, then in the ſpring thin them, leaving only one or two of the ſtouteſt plants in a place. See *March.*

Let ſome good rotten dung be ſpread over the place, and then let the ground be dug one ſpade deep, and well broken, taking care to bury the dung regularly. The glaſſes are to be kept conſtantly and cloſe down over the plants, till they have taken good root, which will be effected in about a week or ten days; then raiſe them on props, ſuch as brick-bats, or pieces of wood or ſtone, about three inches thick; and with theſe raiſe the glaſſes. In this manner the glaſſes are to remain night and day, except in froſty weather, when they muſt be let down quite cloſe; but if the months of November and December prove mild and dry, and the plants are much on the growing order, it will be proper to ſet the glaſſes off in fine dry days; obſerve to attend duly to this caution all the cold months. But if you are not provided ſufficiently with hand or bell glaſſes, or frames, you may plant ſome cauliflower plants out for good on a warm border, where they will ſometimes ſurvive the winter, and produce good heads. Or, for want of frames or any ſort of garden glaſſes, we often preſerve cauliflower plants through the winter in a bed of common earth, covered occaſionally with garden mats; the bed being in a warm ſituation, and arched over with hoops, and covered with mats in bad weather; ſuch as in time of hard rains, froſty or ſnowy weather: prick them out three or four inches aſunder, and plant out finally in the ſpring.

Winter dreſſing of Aſparagus Beds.—Any time in this month cut down the aſparagus ſtalks, and dreſs the beds. Let the ſtalks or haum be cut down cloſe to the ſurface of the beds; carry them immediately off the ground; then with a ſharp hoe, cut up all the weeds, and draw them off the beds into the alleys, then ſpread a little earth over the beds as you advance in your digging; the alleys ſhould be all of an equal depth, and the ſurface of the beds be left even and regular. But as old aſparagus beds will need an augment of dung once in two or three years, and that when deſigned to aſſiſt them with it, this is the time; but the manure or dung muſt be applied before the alleys are digged or the beds landed up. The dung for that purpoſe muſt be very rotten, and none is more proper than the dung of old cucumber or melon beds. When the aſparagus beds have thus had their winter dreſſing, there may be planted in each alley a row of coleworts, or cabbage plants; ſet the plants ſix or eight inches diſtant in the row. In this ſituation ſuch plants will, even in ſevere winters, ſometimes ſurvive the froſt; when thoſe which are planted in an open or level ſpot are deſtroyed. Or there may be planted in each valley a row of early garden beans.

Force Aſparagus for Winter Uſe.—Where forced aſparagus is required for uſe in winter, you may now begin to make hot beds for raiſing the firſt crop, for gathering in November and December; and for the method, ſee ***February***. If a conſtant ſucceſſion is required all winter and ſpring, a new hot-bed, planted with freſh plants, muſt be made every three or four weeks, from the beginning or middle of October, to the end of February or March; which will furniſh a conſtant ſupply of aſparagus from November till the arrival of the natural crops in the open ground, in April or May.

NOVEMBER.—*FRUIT GARDEN.*

Preparations for Plantations of Fruit-Trees.—If you intend to make new plantations of fruit trees, either for the wall or for eſpaliers, the borders ſhould be trenched two ſpades deep: but previouſly, if the ſoil is poor, or very light, and wants augmentation, add a ſupply of freſh ſtrong earth or compoſt, a good loamy earth, if it can be obtained, and rotten dung, working the whole together; but if only a few trees are wanted at different places, this work need not be performed but on ſuch places where the trees are to be planted, in a ſpace of from three or four to five or ſix feet width for each tree. If an orchard is to be planted, and the ſoil is but indifferent, it will be of advantage to add ſome very rotten dung, and freſh loam, or any good earth or compoſt the moſt eaſily obtained, in each hole where the trees are to ſtand; working the earth, loam and dung well together.

General Directions for Planting and Tranſplanting.—Obſerve, that the beginning of this month is the moſt eligible ſeaſon for planting and tranſplanting moſt ſorts of fruit-trees. In procuring them for planting, it is of conſiderable importance to have them taken up with their full ſpread of roots, all as entire as poſſible. In planting any kind of fruit-trees, take care always to let a circular hole be opened for each tree, a ſpade deep, and wide enough to let the roots ſpread freely and equally every way, and let the bottom of the holes be always well looſened. Likewiſe obſerve to let the roots of the trees be always pruned where needful; that is, cut off only any broken parts, and trim the ends of very long ſtraggling roots in general, for this makes them more freely produce new fibres. Likewiſe prune any irregular and croſs-placed ſhoots and branches of the head, and reduce within bounds any very long ſtragglers and very crouded wood, leaving the eligible branches in regular order. The next caution is, never to plant a tree too deep; never let the upper part of the roots be more than from three or four to five or ſix inches below the common ſurface of the ground. And in planting the tree, take good care to place it upright in the hole, and let the earth be well broken, and throw it in equally about all the roots, and at the ſame time ſhaking the tree gently, to cauſe the earth to fall in cloſe among the roots and fibres: when the hole is filled up, let the ſurface of the earth be gently trodden round the tree.

Plant Wall and Eſpalier Fruit-Trees.—Plant fruit trees, where required, in open weather, of any ſorts intended, both for walls, eſpaliers, and ſtandards; for wall trees, the ſorts are apricots, peaches, nectarines, plums, cherries, pears, vines, figs; for eſpaliers, apples, pears, plums, quinces, cherries; and for ſtandards, the principal ſorts are apples, pears, plums, cherries; with ſmaller portions of quinces, medlars, mulberries, filberts, ſervices, &c. Let the wall and eſpalier trees be planted fifteen feet aſunder, at leaſt, but if eighteen or twenty it will prove of conſiderable advantage, by admitting of a larger ſcope for the horizontal extenſion of the branches; it is often the caſe in gardens, where the trees have been planted too cloſe, that the trees meet and confuſe one another; though ſometimes they have not been planted above ſix or ſeven years. This is a great error, and ſhould be thought of when you are about to plant the trees. The diſtance which ſhould be allowed to peaches, nectarines, and apricots, is at leaſt fifteen or ſixteen feet from tree to tree; though eighteen or twenty will not be too much, yet the former diſtance will do very well. Plums and cherries ſhould be allowed the ſame room to run, though plums will require rather more room than cherries. By having theſe trees in eſpaliers, and againſt walls, their fruit is greatly improved in ſize, beauty and flavour; though apples are rarely indulged with a wall, but all the others are planted as wall and eſpalier-trees. Where the above trees are to be planted againſt walls or eſpaliers, we muſt repeat the caution, to allow them proper room; for this has been often forgot in making new plantations; and we very often ſee them planted ſo cloſe together, as would induce one to think, that the perſon who planted them never entertained a thought of their growing any larger; for by the time the trees begin to bear tolerably, they have met, incumbered, and ſtarved one another.

Plant Standard Fruit-trees.—Standard apples, and other fruit-trees of all ſorts, may alſo be planted any time this month, in mild weather. Where a plantation of ſtandard trees is to be made, either in the garden, or for an orchard, the trees ſhould be ſet at the diſtance of from twenty-five to thirty or forty feet every way from one another; but fifty or ſixty feet is more adviſeable, if for a continued full plantation in orchards; though ſtandards of ſmall or moderate growth may be planted at half that diſtance.

Plant Mulberry-trees, Medlars, and Quinces.—Mulberry, medlar, and quince-trees, may now be ſafely tranſplanted.

The mulberry-trees are moſt commonly planted, and trained for ſtandards; a few trees of them is ſufficient for the ſervice of a family or for variety; but to have earlier and larger fruit, you may alſo plant ſome for walls and eſpaliers. There are two ſorts, the black and the white fruited, but the black is the ſort to cultivate for general ſupply. Medlars may either be planted for ſtandards, or for eſpaliers; but by the latter, the fruit is generally much larger. Quinces ſucceed very well in ſtandards, but they are alſo ſometimes planted in eſpaliers, to form a variety among other fruit-trees trained in that order.

Plant Raſpberries.—This is a good ſeaſon to plant raſpberries, where a new plantation is wanted. Obſerve, it is the young ſhoots or ſuckers which ariſe every ſummer from the old roots that are the proper plants for the propagation of them, and for a freſh plantation. Theſe ſhrubs ſhould be planted in an open ſituation, and where the ground is good; and if you dig in ſome very rotten dung, it will be an advantage to the plants. In chooſing the plants for this plantation, obſerve to take ſuch as are well furniſhed with roots, for that is a principal article in raſpberry plants; and if there be one, two, or more buds formed on the root for next ſummer ſhoots, ſuch plants are particularly to be choſen. Having procured the plants, ſhorten the ſhoots a little, and leave only one ſtrong ſhoot on each root; let the ends of the roots alſo be trimmed: then put in the plants in rows four or five feet diſtant, and let them be planted a yard diſtant from one another in the row.

Plant Filbert-trees.—Now is a good time to plant filbert-trees and it is alſo a proper time to plant thoſe of the hazle-nut, and others of that kind, where ſuch plants are wanted. All theſe trees will thrive in almoſt any ſituation where it is not too wet in winter: they are principally raiſed by ſuckers from the root, or by layers of the young branches, to continue the deſirable varieties permanent in their kind; or by grafting in the ſpring: they being apt to vary when raiſed from the nuts. The trees ſhould be planted in rows, allowing twelve or fifteen feet between plant and plant in the row, and the rows ſhould be not leſs than twenty feet diſtant, and may train them to a ſingle ſtem of three, four, five, or ſix feet, and permitted to branch out above with full heads, according to their natural order of growth.

Plant Walnut-trees and Cheſnuts.—Now plant walnut-trees, and it is alſo a good ſeaſon to plant cheſnuts. Theſe trees are more fit to be planted in parks, orchards, or other open places, than in gardens, eſpecially in any conſiderable quantity: ſet theſe trees at leaſt thirty or forty feet diſtant from one another. Walnuts, in particular, are profitable to plant in large premiſes: their fruit is always very ſaleable in the markets, &c.

Plant Gooſeberry and Currant Trees.—Plant gooſeberry and currant trees where wanted. This ſhould be done about the middle of this month. Where it is intended to plant theſe ſhrubs in a full plantation by themſelves, mind to allow them proper room. Let them be planted in rows eight or ten feet diſtant, and allow at leaſt ſix feet between plant and plant in the row. At this diſtance you have room to dig and hoe between the trees, and alſo to prune them, and gather the fruit; and at this diſtance the berries will grow large, and will ripen freely; and there will alſo be room to plant or ſow many ſorts of kitchen plants between them. But if you intend to plant theſe ſhrubs in ſingle rows round the quarters of the kitchen-garden (as is commonly practiſed) you ſhould plant them full ſeven feet diſtant from each other. Alſo, if they are to be planted to divide the kitchen-ground into wide compartments of thirty or forty feet width and more, you ſhould ſet them about eight or ten feet diſtance in the row.

Propagate Gooſebetries and Currant Trees. — Plants cuttings and ſuckers of gooſberries and currants: this is an expeditious and plenteous method of propagating theſe ſhrubs. The proper cuttings for planting muſt be ſhoots of the laſt ſummer's production. Let them be taken from healthy trees, and ſuch as are remarkable, according to their kinds, for bearing the fineſt fruit: having procured ſuch cuttings, let each be ſhortened from about ten to twelve, or fifteen to eighteen inches long, according to its ſtrength, and plant them in a ſhady border. Let them be planted in rows croſsways the border, allowing ten or twelve inches between row and row, and put every cutting one third or near half way into the earth. Theſe ſhrubs may alſo be propagated by ſuckers from the root; which may now be taken up with roots, and planted; the ſtrongeſt at once where they are to remain, and the reſt in nurſery rows, for a year or two, &c. But ſome object to ſuckers, contending that they never produce ſuch large fruit as thoſe raiſed by cuttings, and are apt to run very much to wood; there is however no very material difference; and ſuckers being ready rooted, ſometimes of two or three years advance in growth, it is the moſt expeditious method. However, good cuttings may be preferred, and treat them as above; they will be well rooted in one year, and in the third will bear fruit.

Protecting Roots from Froſt and ſupporting new-planted Trees. — If the weather ſhould now prove ſevere, it will be proper to protect the roots of new-planted fruit-trees from being hurt by the froſt, by laying mulch, or long litter, on the ſurface of the ground, particularly the choiceſt of the ſtone-fruit kinds. Support all new planted ſtandard trees with ſtakes, and let a hay-band be put round the ſtem of the tree, at the place where it is to be faſtened to the ſtake, to prevent the bark from being galled.

NOVEMBER. — *KITCHEN GARDEN.*

Small Sallad, for Winter's Supply. — Sow the different ſorts of ſmall ſallading every ten or twelve days, that the table may be duly ſupplied with them. The ſorts are creſſes, muſtard, radiſh, rape, and lettuce. Where it was not done laſt month, and a ſupply of theſe ſmall herbs are required to be forwarded as ſoon as poſſible, it is eligible to make a ſlender hot-bed at this ſeaſon for raiſing them. The ſeed may either be ſown in drills, or all over the ſurface, and covered not more than a quarter of an inch deep with earth; or theſe ſeeds, at this ſeaſon, ſhould be but juſt covered. See *March.*

Tie up Endive, to Blanch. — Take the advantage of a dry day, to tie up ſome endive to whiten them. Chooſe for this purpoſe ſome of the beſt full-grown plants; and when their leaves are perfectly dry, let them be gathered up regularly in your hand, and tied together with a ſtring of baſs, or ſmall oſier twig. But if the weather is inclinable to be froſty or very wet, let the following method be practiſed to whiten ſome endive; lay them in a dry airy place for a day or two, to drain off the wet from between their leaves, and lay ſome earth in any dry open ſhed; raiſing the earth in a high ridge, and ſo lay the endive therein; obſerving in time of hard froſt to cover it with ſtraw. By the above method, you may whiten endive in any of the winter months, provided you take care to lay in a ſufficient quantity at the approach of ſevere weather. You may alſo practiſe the following method: in a ſouth border, or other warm dry ſituation in the full ſun, dig ſome of the ground in broad high ridges, making the ſides ſteep for the wet to run off: and into the ſides of this may depoſit the endive. For this purpoſe, let ſome endive plants be tied up as above directed, and inſert them into the ſide of the ridge of earth horizontally, almoſt to the top of their leaves. Thus the endive in this ridge of earth will blanch tolerably well, without much hazard of its rotting by rain. If the ridge is made high and ſteep, wet cannot lodge. But theſe plants, in ſuch ridges, ſhould be ſheltered in ſevere froſts by a covering of ſome dry long litter.

Earth up Artichokes. — About the middle or towards the latter end of this month, it will be time to cut down the leaves of artichokes, and earth up the plants to protect them from ſevere froſts. Let the trenches be dug out a good ſpade deep, and lay the earth as you dig it out ridge-ways, in a gradual rounding manner, over the rows of plants, obſerving to cover the crowns of them at leaſt ſix inches thick, leaving only the central leaves or heart of the plants uncovered, and drawing the earth cloſe about them; but at the approach of hard froſts let them be alſo covered with long litter; likewiſe in ſevere weather fill the trenches with very long dry litter, to prevent the froſt entering that way to the roots, &c.

Gather and Preſerve Carrots, Parſnips, Beet, &c. — The beginning of this month you ſhould take up carrots and parſnips, or other kitchen roots, in order to lay them in ſand, to preſerve them for winter uſe. If thoſe roots were to be permitted to remain in the ground, they would canker and rot, particularly the carrots; beſides, if ſevere froſt ſhould ſet in, the ground will be frozen ſo hard that it would be difficult to take the roots up at the time they are wanted. It is therefore proper to take up all the main crops of carrots, and a portion of the parſnips; the reſt may remain in the ground, as theſe are not ſo liable to ſpoil as the carrots. Then lay a bed of dry ſand on the floor about two or three inches thick; place the roots upon the ſand cloſe together, with the crowns outwards. Cover the roots with ſand two inches thick, then lay ſome more roots on that, and then more ſand, and ſo proceed with a layer of ſand and another of roots, till you have laid them all, and lay ſome ſtraw over the whole. Likewiſe dig up ſome red beet roots, to preſerve in the ſame manner; alſo ſalſafy, ſcorzonera, horſe-radiſh turnips, black turnip radiſh, &c. laying them in ſand as the carrots and parſnips.

Potatoes. — Where potatoes ſtill remain in the ground, let them now be taken up as ſoon as poſſible, before ſevere froſt begins; theſe roots cannot bear much froſt, for ſuch as are affected by it, immediately turn very watery, and then are not fit to eat. They ſhould be digged up with a flat three tyned fork, there being proper potatoe-forks for the purpoſe, made with flat tynes, blunted, roundiſh at the ends; in proceeding to dig up the potatoes, previouſly cut down the haulm or ſtalks of the plants near the ground, the remaining part of the ſtalks will ſerve as a direction in pitching the fork; then in digging up the potatoes, turn them clean up to the top, and collect them into baſkets, &c. Let theſe roots, when taken up, be well cleaned, and laid up in a dry apartment; and when the weather is ſevere, let them be covered with ſome dry ſtraw, and let this be laid almoſt a foot thick over them. Theſe roots, after being houſed, ſhould be from time to time looked over, and all ſuch as have any tendency to rotteneſs ſhould be taken out; for ſuch would infect thoſe that are ſound, and the infection would ſoon ſpread. See *March.*

DECEMBER. — *FRUIT GARDEN.*

Management of Fruit-tree Borders. — Where any of the fruit-tree borders are poor, or of bad ſoil, or much exhauſted, and want manuring, or to be revived with an augment of freſh earth, this is now a very good time to do that work. For that purpoſe, get from a common or elſewhere, a quantity of good freſh loamy earth, if it can be had, (top ſpit), or in want of this, other ſubſtantial good ſoil, and ſome of the beſt thoroughly rotten dung, mixing both well together, Let this be laid upon the border, dug in, and well worked with the earth of the border. The ſooner this is done the better, for this dreſſing will be of great ſervice to the trees in general, as will be ſeen in a ſummer or two after, but particularly ſuch trees as are in a declining ſtate. The freſh earth, and the good rotten dung, will encourage the trees ſurpriſingly, ſo as to produce large fruit, and they will be fair and well taſted. Or borders of ordinary good ſoil may be continued in a fertile ſtate by application of dung only, once in two or three years. In open weather, dig and prepare ſuch borders, or other places as are to be planted with fruit-trees; for this being a leiſure time, that work can be done in a proper manner. In doing this work let thoſe rules be obſerved which we gave in the preceding month. If any of the wall trees appear of a weak or ſickly ſtate, open the earth about the extreme roots, but not to diſturb them generally, and then apply a compoſt of freſh loamy ſoil, or other good earth, and rotten dung, immediately next to the principal roots, and towards their extreme parts, it will greatly enliven the growth of the tree the following year.

Examine the Fruit in the Fruitery. — Examine the fruit in the fruitery now pretty often; let them be looked over with good attention once or twice every week: and let all ſuch as are rotten, or beginning to rot, be removed; for if theſe were permitted to lie, they would ſoon taint all the ſound fruit near them. Continue conſtantly a good covering of clean ſtraw, at leaſt a foot thick, over the fruit; and ſecure the windows of the fruit-room from the admiſſion of wet and froſt.

DECEMBER. — *KITCHEN GARDEN.*

Earth up Celery. — Take advantage of the firſt dry and mild day to earth up the celery that requires it; and ſee that the plants are firſt perfectly dry. Break the earth ſmall, and let it be laid up to the plants, with care not to break their leaves, or bury the hearts of the plants, for that would rot them. Obſerve, if poſſible, to earth up the plants within four or five inches of their tops, to guard them from the froſt, and to blanch them a good length. If ſevere froſty weather ſets in, it will be proper to cover ſome of your beſt celery plants for preſent uſe, with ſome long litter, or ſuch as peas ſtraw, fern, or the like.

Muſhrooms. — Now take good care of the muſhroom beds, to keep the froſt and wet from them. To do this, let a good covering of clean dry ſtraw be kept conſtantly over every bed, not leſs than a foot in thickneſs. After heavy rains or ſnow, let the beds be examined, and if you find the covering next the bed wet, let the wet ſtraw be directly removed, and ſome dry be laid in its place. For the general management of theſe beds, ſee *September.*

Manure and Trench Kitchen-ground. — Now take advantage of dry days and froſty weather, and bring in rotten dung from old hot beds, or from dung-hills, and lay it upon ſuch vacant pieces of kitchen ground as want manure. Likewiſe now dig or trench up all ſuch pieces of ground as are vacant; and, in order that the ground may receive the true advantage of fallow, let every piece, as you dig or trench it, be laid up in narrow ridges. The method of ridging up the ground in winter ſhould be practiſed in every ſoil and ſituation, it being of great advantage: this will improve the ground more than many could imagine; for by its being laid up in rough ridges, the froſt, ſun and air, can then have more free acceſs; all of which contribute greatly to the enriching and mellowing the ground; and the ſooner this is done the better. Let the ridges be digged generally two full ſpades broad, and one or two deep, and lay them up rough, and as high and ſharp as they will ſtand. By digging the vacant pieces of ground in the winter ſeaſon, it is not only an advantage to the ſoil, but it alſo looks neat, and will greatly forward

ward the buſineſs in the ſpring, when there is always much other work in hand.

Culture of Pines in the Hot Houſe. — Theſe plants are propagated by planting the crowns or ſuckers: theſe, after having been laid to dry in a warm place four or five days, are to be ſet in pots of five or ſix inches over at the top, filled with good freſh light earth, mixed with a little rotten dung; this mixture muſt be often turned, for eight or twelve months, to make it mix the more perfectly. The moſt proper compoſt mould for the pine plant, ſays Mr. Speechly, is prepared by paring off the turf of a paſture, where the ſoil is a ſtrong rich loam, and of a reddiſh colour, about two inches thick; and laying it with the graſs ſide downwards, and one courſe thick in the pens of ſheep-paſtures, where it may continue two, three, or more months, being enriched by their urine and dung, and reduced by the treading of their feet. When it has lain in the pens till the quantity of ſheep's dung conſtitutes about one third part, it may be laid in a heap for at leaſt ſix months, being often turned in that time: three wheel barrows of this ſoil, one barrow of vegetable mould from decayed oak-leaves, and half a barrow of coarſe ſand, make a compoſt mould for crowns, ſuckers, and young plants. Three wheel barrows of the above ſwarth, two barrows of vegetable mould, one of coarſe ſand, and one fourth of a barrow of ſoot, make a compoſt mould for fruiting plants. The plants, when ſet, muſt have a little water, to ſettle the earth about their roots; and the pot then plunged into a well-tempered bed of tanner's bark.

In the ſummer ſeaſon they ſhould be gently watered about twice in a week; and once a week over their leaves, in order to waſh the filth from them, and to promote the growth of the plants. Some perſons frequently ſhift their plants from pot to pot; but it is not adviſeable to remove them oftener than twice in a ſeaſon; firſt about the end of April, and again in the beginning of Auguſt. At each of theſe times the bark-bed ſhould be ſtirred, and new bark added; and the plants, when they are plunged into it, ſhould be gently watered over their leaves. Here they may remain till the beginning of November; and in the winter ſeaſon they ſhould not be watered more than once a week. Thoſe plants which ſhew their fruit ſhould never be removed; becauſe ſhifting them at this period will ſtint their growth, and retard their ripening. In winter the heat of the ſtove is regulated by a thermometer, which ſhould never be kept to a greater warmth than five or ſix diviſions above ananas, nor ſuffered to be more than as many diviſions below it. In winter they will require watering only once a week. When the plants are placed into the tan for the winter ſeaſon, which ſhould be done about the beginning of October, the tan-bed ſhould be renewed, adding two-thirds of new tan to one third of the old, which will maintain a proper degree of warmth till February, when it ſhould be ſtirred again, and a load or two of new tan added, ſo as to raiſe the bed as much as it ſunk ſince the autumn. In April it will be proper to ſtir up the tan again; and by adding freſh tan, to renew the warmth of the bed, and forward the fruit. At this time it will be proper to ſhift the young plants, which are deſigned to produce fruit the following year; and the tan-bed into which theſe are plunged, muſt be renewed, in order to forward their growth, that they may have ſtrength enough by autumn to produce good fruit.

Thoſe plants, which ſhew their fruit early in February, will ripen about June; but the ſeaſon in which the fruit is in greateſt perfection is from the beginning of May, to the end of September. The method of judging when the fruit is ripe is by the ſmell and from obſervation; nor ſhould it remain ſo long before it is cut as to become ſoft to the touch, for it will become flat and dead; and it ſhould be cut early in the morning, laid in a cool but dry place, preſerving the ſtalk and crown upon it, and eaten the ſame day in which it is cut. That ſort with green fruit, if ſuffered to ripen well, is of an olive-colour; but the ſugar-loaf ſort is perferable, and is eaſily diſtinguiſhed from all the others by the purple ſtripes on the inſide of its leaves. The fruit, when ripe, is of a paler colour than the others. This ſort was brought from Braſil to Jamaica. The next in goodneſs to this is the Montſerrat *pine*.

One of the principal difficulties attending the culture of the *pine-apple* has been to deſtroy the inſects which infeſt it. Mr. Speechley, in a late treatiſe on this ſubject, has enumerated three ſpecies, viz. the brown turtle inſect, or *coccus heſperidum* of Linnæus; the white ſcaly inſect; and the white mealy crimſon-tinged inſect. The methods that have been formerly in uſe for extirpating them have been to ſhift the plants into freſh pots, at the ſame time cleanſing their leaves, and roots, which is uſually denominated a dreſſing. Decoctions made from tobacco, wormwood, walnut leaves, henbane, and other herbs of a bitter and poiſonous quality, have alſo been generally uſed on this occaſion, to which ſome have added ſnuff, ſulphur, and pepper; but none of theſe are in their nature ſufficiently penetrating.

He recommends the following receipt: take one pound of quickſilver; put it into a glazed veſſel, with one gallon of boiling water; let it ſtand till it becomes cold, and pour off the water for uſe. Repeat this on the ſame quickſilver, till a ſufficient number of gallons is provided; then to every gallon of this mercurial water add ſix ounces of ſoft green ſoap, diſſolved in a portion of it; let the mixture be milk-warm when it is uſed; then tie the leaves of the large ſized plants together; take them out of the pots, and diveſt them of their leaves, and dip them wholly in the mixture for three minutes, and ſet them out in the open air to dry, with their roots downwards; in a few hours repeat the operation a ſecond time, having added one table-ſpoonful of ſweet oil to every gallon of the mixture; then ſet them to dry with their tops downwards, and afterwards remove them to the hot houſe. The moſt eligible ſeaſons are March and September. The ſame author has alſo deſcribed a method of raiſing pines without the uſe of tanner's bark, or, at moſt, with only a covering of tan two inches thick, viz. by oak-leaves, collected in the fall of the year, laid in heaps ſix or ſeven feet thick to couch, well trodden, and occaſionally moiſtened, for five or ſix weeks, which, he ſays, are ſuperior to bark for this uſe. See Dr. Hunter's Edition of Evelin's Sylva, 1776. A ſimilar idea of uſing the decayed leaves of trees in the hot-houſe was before ſuggeſted by Mr. Clark of Chiſwick, and applied to the culture of melons. It appears that leaves under proper management, i. e. after fermentation, &c. are a moſt valuable manure; mixed with dung they make the beſt hot-beds, which preſerve their heat much longer than thoſe which are made entirely with dung. Beſides, when reduced to black vegetable mould, and mixed with compoſt of earth, they are ſuperior to every other for flowers, as well as for all plants that grow in pots. Of late, ſome very conſiderable improvements have been made in the culture of pines. The leaves of the oak have been ſubſtituted for the more expenſive bark; and by treating the pines with them, they are found to thrive as well, and to produce as good fruit, as in the other method; and of the proper way of managing theſe leaves for the rearing of exotic plants, an account is given under the article OAK *Leaves*. But the moſt conſiderable improvement is that mentioned in the 67th volume of the Philoſophical Tranſactions, where a method is ſhown by William Baſtard, Eſq; of Devonſhire, of raiſing theſe fruits in water. The plant contained in a pot of earth is placed in a pan, which is always kept full of water, and which ſtands on a ſhelf near the higheſt, and conſequently the moſt heated, part of the back wall of the hot houſe, ſo that the *pine* plants ſtand as near as poſſible to the glaſs, without abſolutely touching it. The fruit raiſed in this manner is ſaid to be always much larger as well as better flavoured, than when it is ripened in a bark-bed. Mr. Baſtard obſerves, that, as a perſon was moving a large pine-plant from the hot bed in his houſe, which was juſt ſhowing fruit, by ſome accident he broke off the plant juſt above the earth in which it grew, and there was no root whatever left to it: by way of experiment he took the plant, and fixed it upright in a pan of water (without earth) on the ſhelf; it ſoon threw out roots, and bore a pine apple that weighed more than two pounds.

The firſt Article in this Treatiſe which deſcribes the conſtituent parts of the ſcenes of nature; and the ſecond which illuſtrates thoſe properties in the objects of nature that ſhould determine the choice and management of them in Gardening; are extracted from a very valuable Work, and abridged to a fourth of its original compaſs, by ſelecting the moſt beautiful and eſſential paſſages.

Though theſe Articles occupy two ſheets in this work, it is preſumed not one of the ſubſcribers would wiſh they had been comprized in leſs, as they abound with ſuch beautiful ideas, pictureſque diſplays, and judicious remarks.

With reſpect to the other parts of this Treatiſe, which contain the Flower, Fruit, and Kitchen Gardens, I hold myſelf indebted in ſome inſtances to other works which have treated on theſe ſubjects in a general point of view; and cannot but in juſtice acknowledge, they poſſeſs great merit, and exhibit evident traits of practical and experimental knowledge.

The only objection that can be made to them is their tedious prolixity and uſeleſs repetition; therefore, where I have had occaſion to conſult them, I have pruned them of their excreſcencies, and lopped off their ſuperfluities; by which means I have been able, in this limited ſpace, to comprize all the eſſential principles of gardening.

In my directions for the management of the Kitchen Garden, I have particularly attended to the early and late crops, and have been infinitely more copious on them than I have been on the general crops; becauſe the former require much more care and attention, being in a great meaſure dependent upon art; while the latter need but little direction; being forwarded by the ſpontaneous efforts of nature. Beſides, the produce of the early and late crops is more acceptable to private families, as affording a ſupply of articles which are rare and not to be purchaſed without conſiderable expence; while that of the general crops may be cultivated with little direction or trouble, or purchaſed at a trifling charge. And though the early and late crops do not yield ſo abundantly as the general, their ſcarcity and value amply compenſate for their deficiency.

I have not entered into the general buſineſs of the hot-houſe, but have confined my directions to the culture of the Pine; being the moſt rare and delicate of its productions; and as it is an article which comes within the concern of but few, I have omitted it, as it would lead too far beyond the œconomy of this publication.

Thoſe Noblemen and Gentlemen who wiſh to be furniſhed with any of the Articles requiſite for putting into execution the different practices here recommended, may be ſupplied from my Nurſery; where all orders will be duly attended to.

HOXTON FIELD NURSERY. JOHN RENTON.

GARGARISM, Gargle, in medicine, a liquid form of remedy, for diſorders in the mouth, gums, throat, &c. Gargariſms are compoſed of honey, ſalt, ſyrups, ſpirits, vinegar, waters, and decoctions; and produce their effects by cleanſing, lubricating, &c. the parts.

GARLAND, an ornament for the head, made in manner of a crown or chaplet. Garlands denote ornaments of flowers, fruits, and leaves, intermixed; anciently much uſed at the gates of temples, where feaſts or ſolemn rejoicings were held; or at any other places where marks of public joy and gaiety were deſired; as at triumphal arches, tournaments, &c. Garlands or feſtoons were alſo put on the heads of victims, in the ancient heathen ſacrifices.

GARLICK, in botany. See Allium.

GARNET, in natural hiſtory. See Granate.

GARNISHING is generally uſed for the furniture, aſſemblage, or ſortment, neceſſary for the uſing or adorning any thing. The word is French, formed of the verb *garnir, to furniſh*, or *fit out*. The garniſhing of a diſh conſiſts of certain things which accompany it, either as a part and ingredient thereof; in which ſenſe pickles, muſhrooms, oyſters, &c. are garniſhing: or as a circumſtance, or ornament; as when leaves, flowers, roots, &c. are laid about a ſervice to amuſe the eye.

GARRISON, in the art of war, a body of forces diſpoſed in a fortreſs, to defend it againſt the enemy, or to keep the inhabitants in ſubjection, or even to be ſubſiſted during the winter ſeaſon. Garriſon, and winter quarters, are ſometimes uſed indifferently for the ſame thing; and ſometimes they denote different things. In the latter caſe, a garriſon is a place wherein forces are maintained to ſecure it, and where they keep regular guards; as, a frontier town, a citadel, caſtle, tower, &c.

GARTER, a ligature to keep up the ſtockings, it is alſo particularly uſed for the badge or cognizance of a noble order of knights, hence denominated the

Order of the Garter, a military order, next in dignity after the nobility, inſtituted by king Edward III. in 1344, under the title of the *ſovereign* and *knights companions of the moſt noble order of the garter*. For a particular deſcription of the order of Bath, the order of the Thiſtle, and the order of St. Patrick, with their jewels and appendages, ſee Knighthood.

Garter *principal King at Arms*. This office was inſtituted by Henry V. *Garter* and *principal king at arms*, are two diſtinct offices united in one perſon; *Garter*'s employment is to attend the ſervice of the order of the *garter*; for which he is allowed a mantle and badge, a houſe in Windſor-caſtle, and penſions both from the ſovereign and knights, and laſtly, fees. He alſo carries the rod and ſceptre at every feaſt of St. George, when the Sovereign is preſent, and notifies the election of ſuch as are new choſen; attends the ſolemnity of their inſtallations, and takes care of placing their arms over their ſeats; and carries the *garter* to foreign kings and princes, for which ſervice it has been uſual to join him in commiſſion with ſome peer, or other perſon of diſtinction. *Garter*'s oath relates only to ſervices being performed within the order, and is taken in chapter before the ſovereign and knights. His oath, as king at arms, is taken before the earl marſhal.

Garter is alſo a term in heraldry, ſignifying the moiety, or half of a bend.

GAS, in chymiſtry, is a name given to the volatile inviſible parts which eſcape from certain bodies, and which cannot be retained and collected, at leaſt without great difficulty and mixture of other ſubſtances. The word is applied by Van Helmont to ſignify thoſe elaſtic fluids which are inviſible, and not condenſable by cold; ſeveral of which he has deſcribed: ſuch are the *gas ventoſum*, or atmoſpherical air; *gas ſylveſtre*, or the fluid expelled during fermentations and effervescences, called by later authors, fixed, factitious, and fixable air; *gas pingue*, or the fluid extricated from inflammable ſubſtances during their analyſis by heat; *gas flammeum*, or the fluid produced in the deflagration of nitre. For a particular definition of theſe ſeveral kinds of air, ſee the Syſtem of Aerology.

GASCONADE, a boaſt or vaunt of ſomething very improbable. The term has its riſe from the Gaſcoons, or people of Gaſcony, in France, who, it ſeems, have been diſtinguiſhed for bragging and rhodomontado.

GASTEROSTEUS, the stickle-back, in ichthyology, a genus of fiſhes belonging to the order of thoracici. There are three rays in the membrane of the gills; the body is carinated: and there are ſome diſtinct prickles before the back-fin. There are 11 ſpecies diſtinguiſhed by the number of prickles on the back. In the fens of Lincolnſhire, and ſome rivers that proceed from them they are found in prodigious quantities. At Spalding there are once in ſeven or eight years, amazing ſhoals that appear in the Welland, and come up the river in form of a vaſt column. They are ſuppoſed to be the multitudes that have been waſhed out of the fens by the floods of ſeveral years, and collected in ſome deep hole, till, overcharged with numbers, they are periodically obliged to attempt a change of place. The quantity is ſo great, that they are uſed to manure the land. A notion may be had of this vaſt ſhoal, by being informed, that a man being employed by the farmer to take them, has got for a conſiderable time four ſhillings a-day by ſelling them for a halfpenny per buſhel. This ſpecies ſeldom reaches the length of two inches; it hath three ſharp ſpines on the back, that can be raiſed or depreſſed at pleaſure. The colour of the back and ſides is an olive-green; the belly white; but in ſome the lower jaws and belly are of a bright crimſon.

GASTRIC, Gastricus, in anatomy, is applied to divers veins, on account of their proceeding from the ſtomach or ventricle, which the Greeks call γαςηρ. The *gaſtricus major*, or greater *gaſtric* vein, is inſerted into the ſplenic vein; and the *minor*, or leſſer *gaſtric* into the trunk of the vena porta.

Gastric *Juice*, a name given by ſome authors to the proper juice of the ſtomach. This is a thin pellucid ſpumous, and ſaltiſh liquor, which continually diſtils from the glandulous kernels of the ſtomach, for the diſſolution, mixture, and dilution of our food, and is of great ſervice in digeſtion.

GASTROCNEMIUS, from γαςηρ, and κνημη the *leg*, in anatomy, a name common to two muſcles, conſtituting the ſura, or calf of the leg; the one called *externus*, and the other *internus*. For theirorigin, inſertion, and uſe, ſee Syſtem of Anatomy, Sect. XIII. For their repreſentation, ſee Plate III, *fig*. 2, Letters *k* and *l*.

GAVEL, or Gabel, in law, ſignifies tribute, toll, cuſtom, yearly rent, payment, or revenue, of which there where anciently ſeveral kinds; *gavel-corn, gavel-malt, out-gavel, gavel-fodder*, &c.

GAUGING, the art or act of meaſuring the capacities or contents of all kinds of veſſels, and determining the quantity of fluids, or other matters, contained therein. See Mensuration.

GAWSE, or Gawze, in commerce, a very thin, ſlight, tranſparent kind of ſtuff, woven ſometimes of ſilk, and ſometimes only of thread.

GAZELLA, Gazelle, or Antelope, is a ſpecies of the *capra*, or *goat*, in the Linnæan ſyſtem; others have made it a diſtinct genus, with annulated, or twiſted horns, eight broad cutting teeth in the lower jaw, and body and limbs of a light elegant form. Thus, they make it an intermediate genus between the *goat* and *deer*, agreeing with the firſt in the texture of their horns, which have a core in them, and they never caſt them, and with the laſt in the elegance of their form and great ſwiftneſs. The agility and ſpeed of this animal are ſurpriſing, ſo that the chace of it is a favourite diverſion in the eaſtern nations. Some ſpecies of the antelope form herds of two or three thouſand, while others keep in ſmall troops of five or ſix. There are ſeveral ſpecies and varieties of this animal, which, excepting two or three, inhabit the hotteſt part of the globe. Their proper climates ſeem to be thoſe of Aſia and Africa, where they are very numerous.

GAZETTE, a news-paper, or printed account of the tranſactions of divers countries.

GEHENNA, Γεεννα, a ſcripture term, which has given ſome pain to the critics. It occurs in St. Matthew v. 22. 29. 30. x. 28. xviii. 9. xxiii. 15. 33. Mark ix. 43. 45. 47. Luke xii. 5. James iii. 6. The authors of the Louvain and Geneva verſions retain the word *gehenna*, as it ſtands in the Greek; the Engliſh tranſlators render it by *hell* and *hell-fire*; and the like do the tranſlators of Mons, and father Bohours. The word is formed from the Hebrew *gehinnon*, i. e. valley of Hinnom. In that valley, which was near Jeruſalem, there was a place named *Tophet*, where ſome Jews ſacrificed their children to Moloch, by making them paſs through the fire. King Joſias, to render this place for ever abominable, made a cloaca or common-ſewer thereof, where all the filth and carcaſes in the city were caſt. The Jews obſerve farther, that there was a continual fire kept up there, to burn and conſume thoſe carcaſes; for which reaſon, as they had no proper term in their language to ſignify *hell*, they made uſe of that of *gehenna*, or *gehinnon*, to denote the fire unextinguiſhable.

GELATINOUS, among the phyſicians, is applied to any thing approaching the glutinous conſiſtence of a Jelly.

GELDING, the operation of caſtrating, and particularly horſes. The manner of gelding is thus: the beaſt being caſt on ſome ſoft place, the operator takes the teſticles between his fore and great finger; ſlits the cod, and preſſes out the ſtones; then taking a pair of nippers made very ſmooth, either of ſteel, box, or brazil, he claps the ſtrings of the ſtones between them, very near to where the ſtones are ſet on, and preſſes them ſo hard, that there may be no flux of the blood, and then ſears away the ſtone with a thin cauterizing iron, made red hot. This done, he takes a hard plaſter, made of wax, reſin and waſhed turpentine, melted together, and melts it on the head of the ſtrings with the hot iron, and afterwards ſeers the ſtrings, and melts more of the ſalve, till there is a good thickneſs of the ſalve laid on the ſtrings. This being done to the ſtones, the nippers are looſened, and the like is done to the other; and the two ſlits of the cod, are then filled with white ſalt, and the outſide of the cod anointed with hog's greaſe; and thus they let him riſe, and keep him in a warm ſtable, without tying him up. If he ſwells much in his cod or ſheath, they chaſe him up and down, and make him trot an hour in the day, and he ſoon recovers. See Castration and Eunuch.

GEM, in natural hiſtory, a common name for all precious ſtones; of which there are two claſſes, the pellucid, and ſemipellucid. The bodies compoſing the claſs of pellucid gems are bright, elegant, and beautiful foſſils, naturally and eſſentially compound, ever found in ſmall detached maſſes, extremely hard, pellucid, and of great luſtre; compoſed of a very firm and pure matter, without any admixture of earthy ſubſtance; giving fire with ſteel, not fermenting with acid menſtruums, and very difficultly calcinable in the fire. Of this claſs there are two genera; the chroſtaſima, and the chroaſtaces. See CHROSTASIMA and CHROASTACES.

The bodies compoſing the claſs of ſemipellucid gems, are ſtones naturally and eſſentially compound, not inflammable nor ſoluble in water, found in detached maſſes, and compoſed of cryſtalline mater, debaſed by earth: however, they are but ſlightly debaſed, and are of great beauty and brightneſs, of a moderate degree of tranſparency, and are uſually found in ſmall maſſes. Of this claſs there are two orders: the firſt of which conſiſts of the ſemipellucid gems, of but two variegations, and frequently of one plain ſimple colour; though ſometimes veined: this order contains four genera, viz. the ſardæ, the chalcedonies, the hydrophanæ, and the pramnion. See the articles SARDÆ, HYDROPHANÆ, and PRAMNION.

The ſecond order of ſemipellucid gems, conſiſting of thoſe remarkable for their veins, zones, and variegations, contains alſo four genera, viz. the achatæ, the onyches, the ſardonyches, and the camæa. See the articles ACHATÆ, ONYCHES, SARDONYCHES, and CAMÆA.

The knowledge of gems depends principally on obſerving their hardneſs and colour. Their hardneſs is commonly allowed to ſtand in the following order: the diamond the hardeſt of all: then the ruby, ſapphire, jacinth, emerald, amethyſt, garnet, carneol, chalcedony, onyx, jaſper, agate, porphyry, and marble. This difference, however, is not regular and conſtant, but frequently varies. Good cryſtals may be allowed to ſucceed the onyx; but the whole family of metallic glaſſy fluors ſeem to be ſtill ſofter. In point of colour, the diamond is valued for its tranſparency, the ruby for its purple, the ſapphire for its blue, the emerald for its green, the jacynth for its orange, the amethyſt carneol for its carnation, the onyx for its tawny, the jaſper, agate, and porphyry for their vermillion, green, and variegated colours, and the garnete for its tranſparent blood red.

All theſe gems are ſometimes found coloured and ſpotted, and ſometimes quite limpid and colourleſs. In this caſe the diamond-cutter or poliſher knows how to diſtinguiſh their different ſpecies by their different degrees of hardneſs upon the mill. For the cutting or poliſhing of gems, the fine powder of the fragments of thoſe that are next in degree of hardneſs is always required to grind away the ſofter; but as none of them are harder than the diamond, this can only be poliſhed by its own powder.

Imitation or Counterfeiting of GEMS *in Glaſs.*—The art of imitating gems in glaſs, is too conſiderable to be paſſed without notice: ſome of the leading compoſitions therein, we ſhall briefly mention upon the authority of Neri. Theſe gems are made of paſtes; and are no way inferior to the native ſtones, when carefully made and well poliſhed, in brightneſs or tranſparence, but want their hardneſs. The general rules to be obſerved in making the paſtes are theſe: 1. That all the veſſels in which they are made be firmly luted, and the lute left to dry before they are put into the fire. 2. That ſuch veſſels be choſen for the work, as will bear the fire well. 3. That the powders be prepared on a porphyry ſtone; not in a metal mortar, which would communicate a tinge to them. 4. That the juſt proportion in the quantity of the ſeveral ingredients be nicely obſerved. 5. That the materials be all well mixed; and if not ſufficiently baked the firſt time, to be committed to the fire again, without breaking the pot: for if this be not obſerved, they will be full of bliſters and air-bladders. 6. That a ſmall vacuity be always left at the top of the pot, to give room to the ſwelling of the ingredients.

To make paſte of extreme hardneſs, and capable of all the colours of the gems, with great luſtre and beauty: Take of prepared cryſtal, ten pounds; ſalt of polverine, ſix pounds; ſulphur of lead, two pounds; mix all theſe well together into a fine powder; make the whole with common water into a hard paſte; and make this paſte into ſmall cakes of about three ounces weight each, with a hole made in their middle; dry them in the ſun, and afterwards calcine them in the ſtraiteſt part of a potter's furnace. After this, powder them, and levigate them to a perfect fineneſs on a porphyry ſtone, and ſet this powder in pots in a glaſs furnace to purify for three days: then caſt the whole into water, and afterwards return it into the furnace, where let it ſtand 15 days, in which time all foulneſs and bliſters will diſappear, and the paſte will greatly reſemble the natural jewels. To give this the colour of the emerald, add to it braſs thrice calcined; for a ſea green, braſs ſimply calcined to a redneſs; for a ſapphire, add zaffer, with mangane[s]e and for a topaz, manganeſe and tartar. All the gems are thus imitated in this, by the ſame way of working as the making of coloured glaſſes; and this is ſo hard, that they very much approach the natural gems. The colour of all the counterfeit gems made of the ſeveral paſtes, may be made deeper or lighter, according to the work for which the ſtones are deſigned; and it is a neceſſary general rule, that ſmall ſtones for rings, &c. require a deeper colour, and large ones a paler. Beſides the colours made from manganeſe, verdigreaſe, and zaffer, which are the ingredients commonly uſed, there are other very fine ones which care and ſkill may prepare. Very fine red may be made from gold, and one not much inferior to that from iron; a very fine green from braſs or copper; a ſky-colour from ſilver, and a much finer one from the granates of Bohemia.

GEMELLES, in heraldry, a bearing of bars by pairs, or in couples, in a coat of arms. He beareth gules, on a chevron argent, three bars *gemelles* ſable, by the name of Throgmorton.

GEMELLUS, in anatomy, a muſcle of the arm, called alſo Biceps extenſor cubiti. For its origin, inſertion, and uſe, ſee ſyſtem of ANATOMY, Sect. XIV. For repreſentation, ſee Plate III. *fig.* 1. Letter *b*.

GEMINI, in aſtronomy, the *twins*; a conſtellation, or ſign of the zodiac, the third in order, repreſenting Caſtor and Pollux: and it is marked thus, ♊. See ſyſtem of ASTRONOMY, Sect. IX.

GEMINI, in anatomy, two muſcles of the thigh, called alſo gemelli, for their origin, inſertion, and uſe, ſee ſyſtem of ANATOMY, Part III. Sect. XIII. for their repreſentation, ſee Plate III. *fig.* 2, Letters *k* and *n*.

GEMMA, or BUD, in botany; a compendium or epitome of a plant ſeated upon the ſtem and branches, and covered with ſcales, in order to defend the tender rudiments incloſed from cold and other external injuries, till, their parts being unfolded, they acquire ſtrength, and render any further protection unneceſſary. Buds, together with bulbs, which are a ſpecies of buds generally ſeated upon or near the root, conſtitute that part of the herb called by Linnæus *hybernacula*; that is, the winter-quarters of the future vegetable; a very proper appellation, as it is during that ſevere ſeaſon that the tender rudiments are protected in the manner juſt mentioned. Plants, conſidered in analogy to animals, may properly enough be reckoned both viviparous and oviparous. Seeds are the vegetable eggs; buds, living fœtuſes, or infant-plants, which renew the ſpecies as certainly as the ſeed. From the obvious uſes of the buds, we may collect the reaſon why the ſupreme author of nature has granted this ſort of protection to moſt of the trees that are natives of cold climates; and, on the other hand, denied it to ſuch as, enjoying a warm benign atmoſphere, have not the tender parts of their embryo-ſhoots expoſed to injuries and depredations from the ſeverities of the weather. As each bud contains the rudiments of a plant, and would, if ſeparated from its parent vegetable, become every way ſimilar to it; Linnæus, to ſhew the wonderful fertility of nature, has made a calculation, by which it appears, that, in a trunk ſcarce exceeding a ſpan in breadth, ten thouſand buds (that is, herbs) may be produced. What an infinite number then of plants might be raiſed from a very large tree.

GENDARMES, or GENS D'ARMES, in the French armies, a denomination given to a ſelect body of horſe, on account of their ſucceeding the ancient Gendarmes, who were thus called from their being completely clothed in armour; (ſee *Scots* GENDARMES *infra.*) Theſe troops are commanded by captain-lieutenants, the king and the princes of the blood being their captains; the king's troop, beſides a captain-lieutenant, has two ſub-lieutenants, three enſigns, and three guidons.

Grand GENDARMES, at preſent are a troop compoſed of 250 gentlemen; the king himſelf is their captain, and one of the firſt peers their captain-lieutenant, who has under him two lieutenants, three enſigns, three guidons, and other officers.

Small GENDARMERY, are, the Scots Gendarmes, the queen's, the dauphin's, the gendarmes of Anjou, Burgundy, the Engliſh and Flemiſh gendarmes, having each a captain-lieutenant, ſub-lieutenant, enſign, guidon, and quarter-maſter.

Scots GENDARMES, were originally inſtituted by Charles VII. of France, about the middle of the 5th century, and formed a part of his guard; in which ſtation alſo they acted under other princes. It was their prerogative to take precedence of all the companies of the gendarmerie of France; and, on particular occaſions, they even preceded the two companies of the king's mouſquetaires. The ſons of the Scottiſh monarchs were the uſual captains of this company; and, after Mary's acceſſion to the throne, its command belonged to them as a right. It was thence that James VI. made a claim of it for his ſon prince Henry. This honour, and its emoluments, were alſo enjoyed by Charles I. and the next in command to this prince was Louis Stuart duke of Lennox. George Gordon, Marquis of Huntley, ſucceeded the duke of Lennox in the year 1624, and took the title of captain or commander in chief when Charles I. mounted the Engliſh throne. It is not certain whether Charles II. was ever captain of this company; but it was conferred on his brother the duke of York, who was captain of the Scots gendarmes till the year 1667, when he reſigned his commiſſion into the hands of the French king. Since that time, no native of Great Britain has enjoyed this command.

GENDER, among grammarians, a diviſion of nouns, or names, to diſtinguiſh the two ſexes. This was the original intention of gender; but, afterwards, other words, which had no proper relation either to the one ſex or the other, had genders aſſigned them, rather out of caprice than reaſon; which is at length eſtabliſhed by cuſtom. Hence genders vary according to the languages, or even according to the words introduced from one language into another. Thus, *arbor*, in Latin, is feminine; but *arbre*, in French, is maſculine; and *dens*, in Latin, is maſculine; but *dent*, in French, is feminine. The oriental languages frequently neglect the uſe of genders; and the Perſian language has none at all; which is no diſadvantage, the diſtinction of genders being in great meaſure uſeleſs.

The Latins, Greeks, &c. generally content themſelves, to expreſs the different genders by different terminations, as *bonus equus*, "a good horſe;" *bona equa*, "a good mare," &c. But in Engliſh, we frequently go further, and expreſs the difference of ſex by different words; as boar, ſow; boy, girl; buck, doe; bull, cow; cock, hen; dog, bitch; &c.—We have only about 24 feminines, diſtinguiſhed from the males, by the variation of the termination of the male into *eſs*: of which number are abbot, abbeſs; count, counteſs; actor, actreſs; heir, heireſs; prince, princeſs; &c. which is all that our language knows of any thing like genders. The eaſtern languages, as well as the vulgar languages of the weſt, have only two genders; the maſculine and feminine. The Greek and Latin have likewiſe the neuter, common, and the doubtful gender; and beſide theſe, they have the epicene, or promiſcuous, which under one ſingle gender and termination includes both the kinds.

The Engliſh language with ſingular propriety, following nature alone, applies the diſtinction of maſculine and feminine only to the names of animals; all the reſt are neuter; except when by a poetical or rhetorical fiction, things inanimate and qualities are exhibited as perſons, and conſequently become either male or female. And this gives the Engliſh an advantage above moſt other languages in the poetical and rhetorical ſtyle; for when nouns naturally neuter are converted into maſculine or feminine, the perſonification is more diſtinctly and forcibly marked. Lowth's Grammar, p. 44. ed. 1772.

Gender, in geometry. *Geometrical Lines* are diſtinguiſhed into *genders*, or *genera*, claſſes, or orders, according to the number of the dimenſions of the equation that expreſſes the relation between their ordinates, and the abſciſſes. See Syſtem of GEOMETRY.

GENEALOGY, a ſeries or ſucceſſion of anceſtors, or progenitors; or, a ſummary account of the relations and kindred of a perſon or family, both in the direct and collateral lines. The word is Greek, *γενεαλογια*, which is formed of *γενος*, *genus*, *proſapia*, *race*, and *lineage*; and λογος, *ſermo*, *diſcourſe*.

GENERAL, ſomething that comprehends all, or extends to a whole genus, or kind. All the ſciences have ſome *general* principles, or *axioms*. A *general* court; *general* councils are particularly called *oecumenical*.

General *Officers*, in an army, are thoſe who do not only command over a ſingle company, or regiment, but whoſe office and authority extend over a body of ſeveral regiments of horſe and foot. Such are *Brigadier-generals*, *Lieutenant-generals*, *Major-generals*, *generals* of the horſe, of the foot. See *General*, below. See alſo *Paymaſter-general*, *Commiſſary-general*, *Muſter-maſter-general*, &c. and *Pay*. We have alſo officers in law, in the revenues, &c. diſtinguiſhed by the appellation of *general*: as, *Attorney-general*, *Solicitor-general*, &c. *Receiver-general*, *Comptroller-general*, &c.

General *Terms*, among logicians, thoſe which are made the ſigns of general ideas. See ABSTRACTION, and IDEA. All things that exiſt, Mr. Locke obſerves, being particulars, it might be expected that words ſhould be ſo too in their ſignification: but we find it quite contrary; for moſt of the words that make all languages are generally terms. This is the effect of reaſon and neceſſity. For, firſt, it is impoſſible that every particular thing ſhould have a diſtinct name; becauſe it is impoſſible to have diſtinct ideas of every particular thing; to retain its name, with its peculiar appropriation to that idea.

Secondly, it would be uſeleſs, unleſs all could be ſuppoſed to have the ſame ideas in their minds. For names, applied to particular things, whereof I alone have the ideas in their minds. For names, applied to particular things, whereof I alone have the ideas in my hand, could not be ſignificant or intelligible to another who is not acquainted with all thoſe particular things which have fallen under my notice. Thirdly, it would be of no great uſe for the improvement of knowledge; which, though founded in particular things, enlarges itſelf by general views; to which things, reduced into ſorts under general names, are properly ſubſervient. In things where we have occaſion to conſider and diſcourſe of individuals and particulars, we uſe proper names: as in perſons, countries, cities, rivers, mountains, &c. Thus we ſee, that jockeys have particular names for their horſes, becauſe they often have occaſion to maintain this or that particular horſe when he is out of ſight.

Afterwards obſerving that a great number of things reſemble each other in ſhape, and other qualities, we frame a general idea that takes in only the qualities in which thoſe many particulars agree; and to this idea we give the name *man*, for example; in which there is nothing new; that which is peculiar to each individual being left out, and only that which is common to all retained. And thus we come to have a general idea and a general name. By the ſame method the mind proceeds to more general notions and names; as thoſe of animal, ſubſtance, being, thing, and ſuch univerſal terms as ſtand for any ideas whatſoever. As to the ſignification of general words, it is evident they do not barely ſignify one particular thing; neither do they ſignify a plurality; but they ſignify a genus, kind, or ſort of things. See the articles ABSTRACTION and GENUS.

General *of an Army*, is the chief commanding officer; whoſe buſineſs is to regulate the march and encampment of the army; to chooſe the moſt advantageous ground in the day of battle, to diſpoſe the army, to poſt the artillery, and to ſend his orders, wherever there is occaſion, by his aids-de-camp. At a ſiege, he is to cauſe the place to be inveſted, to regulate the approaches and attacks, to viſit the works, and to ſend out detachments for ſecuring the convoy, and for foraging. See GENERALISSMO.

The natural qualities of a *general* ſhould be a martial genius, a ſolid judgment, a healthy robuſt conſtitution, intrepidity and ſelf-poſſeſſion on critical occaſions, goodneſs of heart, liberality, and birth: he ſhould alſo be of a mean age, neither too young, becauſe he would want prudence and experience, nor too old, becauſe he would want vivacity and activity. He ſhould be ſteady and uniform in his conduct, affable in his diſpoſition, and yet inflexible in maintaining the diſcipline of his army. His acquired qualities ſhould be ſecreſy, juſtice, ſobriety, temperance, knowledge of the art of war both from theory and practice, the art of commanding and of ſpeaking with preciſion; great attention in preſerving the lives and ſupplying the wants of the ſoldiers, and a conſtant ſtudy of the characters of the officers of his army, ſo that he may be capable of employing them according to their reſpective talents. His conduct appears in eſtabliſhing his magazines in the moſt convenient places; in examining the country, that he may not engage his troops too far, while he is ignorant of the means of bringing them off; in procuring ſubſiſtence for them; and in ſelecting the moſt advantageous poſts for fighting, retreating, or ſhunning a battle. His experience inſpires his army with confidence; his quality by creating reſpect, augments his authority; his liberality enables him to procure intelligence of the ſtrength and deſigns of the enemy, and thus to take the moſt ſucceſsful meaſures. In a word, a *general* ought to be fond of glory, to have an averſion to flattery, to render himſelf beloved, and to keep a ſtrict diſcipline and ſubordination.

General *of the Artillery*. See ORDNANCE. *General of Horſe*, is an officer next under the chief *general*, who has an abſolute command of the horſe of an army, above the *lieutenant-generals*. *General of Foot*, is an officer under the chief *general*, who has an abſolute command of the foot of the army. *Adjutant General*, is an officer who attends the *general*, aſſiſts in council, and carries the *general*'s orders to the army. He diſtributes the daily orders to the majors of brigade. He is likewiſe charged with the general detail of the duty of the army. The majors of brigade ſend every morning to the adjutant-*general* an exact return, by battalion and company, of the men of their brigade. In a day of battle, the adjutant *general* ſees the infantry drawn up, after which he places himſelf by the *general*, to receive any orders which may regard the corps of which he has the detail. In a ſiege, he orders the number of workmen required, and ſigns the warrants of their payment. He receives the guards of the trenches at their rendezvous, and examines their condition; he gives and ſigns all orders for parties; he has an orderly ſerjeant from each brigade of infantry in the line, to carry ſuch orders as he may have occaſion to ſend from the *general*.

General is alſo uſed, in the military art, for a particular march, or beat of drum; being the firſt which gives notice, commonly in the morning early, for the infantry to be in readineſs to march.

GENERALISSIMO, called alſo *Captain General*, and ſimply *General*, is an officer, who commands all the military powers of a nation; who gives orders to all the other general officers; and receives no orders himſelf but from the king. Monſ. Balzac obſerves that the cardinal de Richelieu firſt coined this word, of his own abſolute authority, upon his going to command the French army in Italy.

GENERATE, in muſic, is uſed to ſignify the operation of that mechanical power in nature, which every ſound has in producing one or more different ſounds. Thus any given ſound, however ſimple, produces along with itſelf, its octave, and two other ſounds extremely ſharp, viz. its twelfth above, that is to ſay, the octave of its fifth; and the other the ſeventeenth above, or, in other words, the double octave of its third major. Whether we ſuppoſe this procreation of ſounds to reſult from an aptitude in the texture and magnitude of certain particles in the air, for conveying to our ears vibrations that bear thoſe proportions one to another, as being determined at once by the partial and total oſcillations of any muſical ſtring; or from whatever œconomy of nature we chooſe to trace it; the power of one ſound thus to produce another, when in action, is ſaid to *generate*. The ſame word is applied by Signior Tartini and his followers, to any two ſounds which, ſimultaneouſly heard, produce a third.

GENERATION, in phyſics, denotes the act of procreating, or producing a thing which before was not: or, the total change or converſion of a body into a new one, which retains no ſenſible part, or mark of its former ſtate. Thus, fire is ſaid to be *generated*, when we perceive it to be where before was only wood, or other fuel; or when the wood is ſo changed as to retain no ſenſible character of wood; thus, alſo, a chick is ſaid to be *generated*, when we perceive the chick, where before was only an egg; or when the egg is changed into the form of a chick. In *generation*, there is not properly any production of new parts, but only a new modification or manner of exiſtence of the old ones; by this, *generation* is diſtinguiſhed from *creation*. The Peripatetics explain *generation* by a change or paſſage from a privation, or want of a ſubſtantial form, to the having of ſuch a form. The moderns allow of no other change in *generation*, than what is local: according to them, it is only a tranſpoſition, or new arrangement of parts; and thus the ſame matter ſhall ſucceſſively undergo an infinity of *generations*.

A grain of wheat, e. gr. is committed to the ground: this, imbibing the humidity of the ſoil becomes turgid, and dilates to ſuch a degree, that it becomes a plant; and, by a continual acceſſion of matter, ripens by degrees into an ear; and at length into new ſeed. This ſeed ground in the mill appears in form of flour; which mixed up with water, makes a paſte; whereof with the addition, of yeaſt, fire, &c. bread is *generated*; and this bread broken with the teeth, digeſted in the ſtomach, and conveyed through the canals of the body, becomes fleſh. Now, in all this ſeries of *generations*, the only thing effected is a local motion of the parts of the matter, and their ſettling again in a different order; ſo that, in reality, wherever there is a new arrangement or compoſition of elements, there is a new *generation*; and therefore *generation* is finally reducible to motion.

GENERATION is more immediately underſtood of the production of animal and vegetable bodies from ſeed, or the coition of others of different ſexes, but of the ſame genus, or kind. Some modern naturaliſts maintain, after Monſ. Perrault, that there is not properly any new *generation*; that God created all things at firſt; and that what we call *generations*, are only augmentations and expanſions of the minute parts of the bodies of ſeeds; ſo that the whole ſpecies, to be afterwards produced, were really all formed in the firſt, and encloſed therein; to be brought forth and diſcloſed to view in a certain time, and according to a certain order and œconomy. The manner wherein the ſeed of the male animal acts on that of the female, in order to impregnate, and render it prolific, has long been enquired after, and remains ſtill a myſtery. The ancients diſtinguiſhed two kinds of *generation: regular*, called *univocal*; and *anomalous*, called alſo *equivocal*, or *ſpontaneous*. The firſt is that effected by parent animals of the ſame kind; as that of men, birds, beaſts, &c. The ſecond was ſuppoſed effected by corruption, the ſun, &c. as that of inſects, frogs, &c. But this latter kind is now generally and deſervedly exploded.

There are two principal theories, or methods of accounting for the *generation* of animals: the one ſuppoſes the embryo, or fœtus, to be originally in the ſeed of the male; the other, in the ovum, or egg of the female. The *firſt* ſuppoſes the animalcules found in the male ſeed, to be the firſt rudiments of the fœtus; and that the female only furniſhes a proper nidus, and nutriment, to bring them forwards. The *ſecond* ſuppoſes the firſt rudiments of the animal to be in the ova; and that the male ſeed only ſerves to warm, cheriſh, and ripen the ova, till they fall out of the ovary into the womb. Dr. Harvey was of opinion, that all females are furniſhed with eggs; and that *generation* is effected wholly by means of the womb; which conceives the fœtus by a kind of contagion communicated to it by the ſeminal fluid of the male, much in the ſame manner as the loadſtone communicates magnetiſm to iron. This contagion, he ſuppoſes, acts not only on the uterus, but is communicated to the whole body of the female, which is altogether prolific; though the uterus, he acknowledges, is the only part that is capable of conceiving the fœtus, juſt as the brain is alone capable of forming ideas and notions. This ingenious phyſician and naturaliſt maintains, that the prolific fluid of the mail, neither does nor can enter into the womb of the female; but Verheyen has ſince actually found great quantity of the male ſeed in the matrix of a cow, diſſected ſixteen hours after copulation: and the celebrated Ruyſch, having diſſected a woman who was ſurpriſed in adultery and aſſaſſinated on the ſpot, found a great quantity of the ſeminal liquor of the male, not only in the cavity of the womb, but alſo in the *tubæ uteri*. Other miſtakes into which Dr. Harvey has fallen through the imperfection of the microſcope in his time, notwithſtanding his accuracy and diligence in obſerving, have been ſince detected by Malpighi, Leewenhoeck, and others. The *firſt* ſyſtem is well illuſtrated by Dr. Geo. Garden. That author, upon comparing the obſervations and diſcoveries of Harvey, Malpighi, De Graaf, and Leewenhoeck together, concludes it moſt probable, "That all animals are ex animalculo: that theſe animalcules are originally in ſemine marium, and not in that of the female; but that they can never come forward, nor be formed into animals, without the ova in the female."

The *firſt* of theſe points he argues from the three following obſervations. 1. That ſomething has often been obſerved by Malpighi, in the cicatricula of an egg before the incubation, like the rudiments of an animal, in form of a tadpole.

2. From the ſudden appearance and diſplaying of all the parts after incubation, it ſeems probable, that they are not then actually formed out of a fluid; but that the ſtamina of them have been formerly there exiſtent, and are now expanded. The firſt part of the chick, which is diſcovered with the naked eye, is the punctum ſaliens, and that not till three days and nights of incubation are paſt; on the fifth day the rudiments of the head and body appear. This made Dr. Harvey conclude, that the blood had a being before any other part of the body, and that from it all the organs of the fœtus were both formed and nouriſhed: but by Malpighi's obſervations it appears, that the parts are then only ſo far extended, as to be made viſible to the naked eye; and that they were actually exiſtent before, and diſcernable by glaſſes. After a farther incubation of thirty hours, we ſee the head, the eyes, and the carina, with the vertebræ] diſtinct, and alſo the heart. After forty hours, its repulſe is viſible, and all the other parts more diſtinct, which cannot be diſcerned by the naked eye before the beginning of the fifth day: from whence it ſeems very probable, that even the ſo early diſcovery of thoſe parts of the fœtus by the microſcope, is not the diſcerning of parts newly formed, but only parts more dilated and extended by receiving of nutriment from the coliquamentum; ſo that they ſeem all to have been actually exiſtent before the incubation of the hen. And what Swammerdam has diſcovered in the tranſmutation of inſects, gives no ſmall light to this; ſince he makes it appear, that in thoſe large erucas which feed upon cabbage, if they be taken about the time they retire to be transformed into aurelias, and plunged often in warm water, to make a rupture of the outer ſkin; you will diſcern, through the tranſparency of their ſecond membrane, all the parts of the butterfly, the trunk, wings, feelers, &c. folded up: but that, after the eruca is changed into an aurelia, none of thoſe parts can be diſcerned; but ſo much drenched with moiſture, though they be there actually formed. 3. From the analogy between plants and animals. All vegetables, we ſee, do proceed ex plantula; the ſeeds of vegetables being no other but little plants of the ſame kind, folded up in coats and membranes: whence we may infer, that ſo curiouſly an organized creature as an animal is not the ſudden product of a fluid, or coliquamentum, but does much rather proceed from an animalcule of the ſame kind, and has all its little members folded up according to their ſeveral joints and plicatures, which are afterwards enlarged and diſtended, as we ſee in plants.

The ſecond point, which our late diſcoveries have made probable, is that theſe animalcules are originally in the ſeed of the male and not in the female. For, 1. There are obſerved innumerable animalcula in ſemine maſculino, of all animals. Hartſoeker and Leewenhoeck have made this ſo evident, that there ſeems no room to doubt of it. 2. We obſerve the rudiments of a fœtus in eggs which have been fecundated by the male; though no ſuch thing is viſible in thoſe not yet fecundated. Malpighi, in his obſervations, makes it very probable, that theſe rudiments proceed originally from the male, and not from the female. 3. The reſemblance between the rudiments of the fœtus in ova, both before and after incubation, with the animalcule, makes it very probable that they are one and the ſame. The ſame ſhape and figure, which Mr. Leewenhoeck gives us of the animalcule, Malpighi gives of the rudiments of the fœtus, both before and after incubation; and even the fœtuſes of vivaparous animals appear ſo at firſt to the naked eye; whence Dr. Harvey acknowledges, that all animals, even the moſt perfect, are formed of a worm. 4. This gives a rational account of many fœtuſes at one birth; and how, at leaſt, a whole cluſter of eggs in a hen are fecundated by one coition of the male. 5. This gives a new light, as it were, to the firſt prophecy concerning the Meſſiah, that, "the ſeed of the woman ſhall bruiſe the head of the ſerpent," all the reſt of mankind being thus moſt properly and truly the ſeed of the man.

6. The analogy already mentioned, which we may rationally ſuppoſe between the manner of propagation of plants and animals, likewiſe makes this probable. Every herb and tree bears its ſeed after its proper kind; which ſeed is nothing elſe but a little plant of that kind; which being thrown into the earth, as into its uterus, ſpreads forth its roots and receives thence its nouriſhment, but has its form within itſelf; and we may rationally conjecture ſome ſuch analogy in the propagation of animals. The third thing which our diſcoveries make probable is, that animals cannot be formed of theſe animalcula without the ova in feminis, which are neceſſary for ſupplying them with proper nutriment; and this is evinced from the following conſiderations.

1. It appears that an animalcule cannot come forward, if it does not fall into a proper nidus: this we ſee in the cicatriculæ in eggs: and though a million of them ſhould fall into one egg, none of them would come forward, but what were in the centre of the cicatricula; and perhaps the nidus, neceſſary for their formation, is ſo proportioned to their bulk, that it can hardly contain more than one animalcule; which may be the reaſon why there are ſo few monſters. This, we ſee, is abſolutely neceſſary in the oviparous kinds; and the only difference that lies between them and the viviparous, ſeems to be this, that in the latter the ova are properly nothing but the cicatricula, with its colliquamentum, ſo that the fœtus muſt ſpread forth its roots in the uterus, to receive its nouriſhment; but the egg in oviparous animals may be properly termed an uterus, in relation to the fœtus; as it contains not only the cicatricula, with its amnion and colliquamentum; which is the immediate nouriſhment of the fœtus, but alſo the materials which are to be converted into that colliquamentum; ſo that the fœtus ſpreads forth its roots no farther than in the white and yolk of the egg, from whence it derives all its nouriſhment. Now, that an animalcule cannot come forward without ſome ſuch proper nidus, will not be denied; for if there were nothing needful but their being thrown into the uterus, we do not ſee why many hundreds of them ſhould not come forward at once; at leaſt while ſcattered in ſo large a field.

2. That this cicatricula is not originally in utero, ſeems evident

dent from the frequent conceptions which have been found extra uterum: ſuch as the child which continued twenty-ſix years in the woman of Thouloufe's belly; and the little fœtus found in the abdomen of Mad. de St. Mere, together with the teſticle torn and full of clotted blood; ſuch alſo ſeem to be the fœtus in the abdomen of the woman of Copenhagen, mentioned in the Nouv. de la Rep. des Lett. for Sept. 1685. all the members of which were eaſily to be felt through the ſkin of the belly, and which ſhe had carried in her belly for four years; the ſeven years gravidation related by Dr. Cole; and many other the like inſtances. Now, granting once the neceſſity of a proper nidus for the formation of an animalcule into an animal, theſe obſervations make it probable, that the teſtes are the ovaria appropriated for this uſe; for though the animalcules coming thither in ſuch caſes, may ſeem to be extraordinary, and that uſually the impregnation is in utero; yet it may be collected from hence, that the cicatriculæ or ova to be impregnated are in the teſtibus femineis; for if they were not ſo, the accidental coming of animalcules thither could not make them come forward more than in any other part of the body; ſince they cannot be formed and nouriſhed without a proper nidus.

3. It is acknowledged, that the fœtus in utero, for ſome conſiderable time after conception, has no connexion with the womb; that it ſits wholly looſe in it, and is no other than a little round egg, with the fœtus in the midſt; which ſends forth its umbilical veſſels by degrees, and at laſt lays hold of the uterus. Now from hence it ſeems evident, that the cicatricula, which is the fountain of the animalcule's nouriſhment, does not ſpout from the uterus, but has its origin elſewhere; and falls in thither as into a fit ſoil, from whence it may draw nutriment for the growth of the fœtus: elſe it cannot be eaſily imagined how it ſhould not have an immediate connection with the uterus, from the time of conception. It is indeed difficult to conceive, how theſe eggs ſhould be impregnated per ſemen maris, both becauſe there is no connexion between the Fallopian tubes, and the ovary for its tranſmiſſion; and becauſe Dr. Harvey could never diſcover any thing of it in utero: but as to the laſt, Mr. Leewenhoeck has cleared that difficulty by the diſcovery of innumerable animals in the tubæ, or cornua uteri, and thoſe living a conſiderable time after coition. And as to the former, we may either ſuppoſe, that there is ſuch an inflation of the tubæ, at the time of coition, as makes them embrace the ovaries; and ſuch an approach of the uterus and its cornua, as that it may eaſily tranſmit the ſeed into the ovary: or elſe, that the ova are impregnated by the animalcules after they deſcend into the uterus, and not in the ovary. The former ſeems probable for this reaſon, that at leaſt a whole cluſter of eggs in a hen will be fecundated by one tread of the cock: now this fecundation ſeems to be in the vitellary and not in the uterus, as the eggs paſs along from day to day: for it can hardly be ſuppoſed, that the animalcules ſhould ſubſiſt ſo long, being ſcattered looſely in the uterus, as to wait there for many days, for the fecundation of the eggs as they paſs along. The latter conjecture has this to ſtrengthen it; that the animalcules are found to live a conſiderable time in the uterus; and that if they ſhould impregnate the ova in the ovary itſelf, the fœtus would increaſe ſo faſt, that the ova could not paſs through the tubæ uteri; but would either burſt the ovary, or fall down into the abdomen, from the orifices of the tuba; and from hence probably proceed thoſe extraordinary conceptions in the abdomen, out of the uterus. Thus much is urged for the ſyſtem *ab animalculo*. See Foetus.

The retainers to the ſyſtem of *generation ab ovo* contend, that the rudiments of the fœtus are laid in the ovary, and that the female furniſhes the whole matter of the body; which they chiefly ſupport from the conformation in rabbets, ſheep, cows, &c. where the vagina of the womb is ſo long, and ſinuous, that it is ſcarce poſſible the male ſeed ſhould ever arrive within the body of the uterus; eſpecially in cows, whoſe vagina are filled with a thick, viſcid ichor, and the inner orifice of the womb is exactly cloſed; beſides that the thickneſs of the membranes of the ova ſhould ſeem impenetrable to ſo craſs a matter as the male ſeed. And, that if animalcula be found in the male ſeed, which, however, will admit of ſome diſpute (that inteſtine motion and agitation of the groſſer particles thereof, which gave riſe to the opinion, being accountable for, from the common laws of warm fluids); yet are the ſame obſerved in vinegar, pepper-water, &c. Add, that it is highly improbable, that thoſe animalcules ſhould contain the rudiments of a future body; ſince their large numbers would produce too plentiful an offspring; inſomuch that it would be neceſſary for 9999 parts of them to be in vain, and periſh: which is contrary to the œconomy of nature in other things. Analogy is likewiſe urged in favour of this ſyſtem: thus all plants are maintained to ariſe from eggs; ſeeds being no other than eggs under another denomination. All oviparous animals do unexceptionally ariſe from eggs, which the females caſt forth; and it is highly probable, that the viviparous only differ from the oviparous, in that the females lay and hatch their eggs within themſelves. Againſt this hypotheſis it is urged, that what are uſually called *ova* or *eggs*, in women, are no other than little cells, or bladders, full of a certain liquor; and how can a drop of liquor paſs for an egg? Add, that theſe imaginary eggs have no proper membrane belonging to them, nor any covering but that of the cell; which ſeems ſo inſeparable therefrom, that, when they are diſcharged, it is hard to conceive how they ſhould take it with them. And beſide, how ſhould they make themſelves a paſſage through the common membrane wherewith the ovary is inveſted which is of ſo cloſe a texture that it muſt ſeem abſolutely impenetrable by a round body of ſo ſoft a conſiſtence as one of theſe veſicles? Laſtly, veſiculæ, in all reſpects perfectly like ova, have been found in other parts of the body, where it is apparent they could not ſerve for any purpoſes of *generation*. Mem. de l'Acad. Royal. de Scien. an. 1708, 1709.

To this it is anſwered, that ova or veſiculæ have been actually found in diſſections, detached and ſeparated from the ovary, and the ruptures in the membrane of the ovary, through which they had paſſed, remaining ſtill viſible. M. Littre even obſerved ſome of theſe ſeparated ova ſpread with blood-veſſels, like thoſe in the yolks of birds eggs. Nay, more; the ſame author is poſitive, that he ſaw an embryo in one of the ova not yet ſeparated; and could diſcern its head, mouth, noſe, trunk and funiculis umbilicalis, whereby it adhered to the membranes of the ovary. See Generation *of Man*.

Sir John Floyer ſtarts a difficulty, which ſeems to preſs equally againſt each ſyſtem, taken ſingly: it is fetched from monſters. In a mule for inſtance, which is the production of a venereal copula between an aſs and a mare, the bulk of the body partakes of the form of the dam, and the feet, tail, and ears, of that of the ſire. Hence it is argued, that the rudiments of the greater part of the fœtus are laid in the ovum; and that the impregnation either conveys or changes the extremities. If the male ſupplied the animalcula, the fœtus ſhould always be of the ſame ſpecies as the male: if the female ſupply it, it ſhould be of her kind; whereas monſters are of both. Three other ſyſtems of *generation*, which indeed ſo much reſemble one another, that they may be reduced to one, have been lately formed from the experiments and obſervations of Monſ. de Buffon, Monſ. de Maupertuis, and Mr. Needham.

Monſ. de Buffon has endeavoured to prove that the ova in women and quadrupeds are chimeras, and that the ſpermatic animalcule cannot be the *fœtus*. He could never find any ova which had detached themſelves from the ovary, and paſſed through the Fallopian tube into the matrix. But he diſcovered a glandular body on the female teſticle, which anatomiſts had miſtaken for one of theſe; which glandular body, at certain times, ſwelled, opened and diſcharged a liquor full of the ſame animalcules, which Leewenhoeck, took for living creatures in the ſemen of males. And Monſ. de Buffon adds, that he found bodies perfectly ſimilar to theſe, not only in the ſemina of very different animals, but in the infuſions of plants, of grains, and in the juices of fiſh-meats, dreſſed and prepared by the fire ſo as to leave no creature living in them. From whence this ingenious gentleman concludes, that theſe pretended animalcules are not future animals of the ſpecies of the father; he does not even allow them to be true animals, but ſays they are ſomething of an intermediate nature between brute matter and animals; parts organized and animated, the aſſemblage of which forms the fœtus, ſee Lettres de Monſ. de Maupertuis, let. 17.

But the chief difficulty conſiſts in conceiving how the fœtus is formed from theſe elements. Monſ. de Buffon thinks that every part, both of animals and vegetables, contains an infinite number of organic molecules; but that they are much more numerous in the ſeminal liquors of both ſexes, and in the ſeeds of plants, than in other parts. Theſe organic parts ſerve for the nutrition and growth of animals and plants; and the ſurplus of theſe parts, when the other purpoſes to which they are adapted and anſwered, being reunited in proper interior moulds, correſponding to the ſize and ſhape of the animal or vegetable to be produced, forms ſuch animals or vegetables. And thus the unity and diverſity of the ſeveral ſpecies are preſerved and continued. When the quantity of this organic matter is ſmall, as in man and moſt large animals, *generation* only takes place at a certain age of maturity, and even then the number of animals is but ſmall. In other animals, as in fiſhes, and moſt birds, abounding with theſe organic parts the caſe is juſt the reverſe. With regard to the *generation* of mankind, he ſuppoſes that the ſuperfluous organic parts are collected together into the ſeminal veſſels of the male and the teſticles of the female, which are the reſervoirs deſtined to receive them: and in theſe reſervoirs, they form a prolific liquor in each ſex, which has been previouſly extracted from every part of the body. Theſe ſeminal liquors, compoſed of parts alike active and perfectly analogous to one another, in form and motion, are mixed in the womb, and contribute, by uniting with each other, to the formation of the fœtus, which is either male or female, as the ſeed of the man or woman abounds moſt with organic molecules; and the infant reſembles either the father or mother, according to their different combinations of theſe molecules. The organic parts of theſe liquors, being equally active, fix and counterbalance each other; ſo that the molecules of each parent are determined to form ſimilar parts to thoſe of the individual that furniſhed them, as the head, arms, &c. The molecules proceeding from the genital part fix themſelves firſt: and the other molecules arrange themſelves ſucceſſively round theſe in the ſame order which they before occupied in the parent. When a great quantity of the ſeminal liquors of both ſexes is received into the womb, there are formed different ſpheres of attraction, in different parts of theſe liquors; the conſequence of which is that ſeveral fœtuſes are formed at the ſame time. For a fuller account of Monſ. de Buffon's ſyſtem, we muſt refer to his Hiſtoire Naturelle, printed at Paris, 1752, where the ſubject of the *generation* of animals takes up the greateſt part of the third volume.

Monſ. de Maupertuis's ſyſtem in his Venus Phyſique, has a near reſemblance to that of Monſ. de Buffon, and tends equally to overturn the firſt ſyſtem of *generation*, called os animalculo, eſpouſed by Dr. George Gulen, the ſecond Syſtem of *generation*, called *ab avo*, which have prevailed among modern phyſiologiſts. He aſcribes the formation of the fœtus to the mixture of the male and female ſeed, by means of the affinity and mutual attraction of the correſponding parts that compoſe them. And to confirm his own and Monſ. de Buffon's opinion, he adds an accouut of a ſexdigitary family, as he calls it, at Berlin, many of which had a ſupernumerary finger or toe, and ſometimes both. He ſays that this ſexdigitiſm, or quality of having ſupernumerary fingers or toes, has been tranſmitted equally by the father and by the mother; that it was loſt by alliances with thoſe who had but the common number of fingers. He adds, that he does not believe that any one will aſcribe the continuation of ſexdigitiſm in a family, to chance; theſe ſupernumerary parts might have been accidental varieties at firſt, but if they be once eſtabliſhed by a ſufficient number of *generations*, where both ſexes have had them, they then become a foundation for a diſtinct ſpecies; and perhaps all the different ſpecies, diſcernable in animals of the ſame kind, have been multiplied in this way. What we may obſerve in other animals gives ground for theſe ſuſpicions.

Mr. Turbervill Needham, in his Summary of Obſervations on the *Generation*, Compoſition, and Decompoſition of animal and vegetable Subſtances, having offered ſeveral objections againſt the ſyſtems of *generation* by eggs and by animalcules, recites a multitude of experiments, from which he concludes, that there are no pre-exiſtent germs formed for the production of animals and vegetables; but that matter, in ſome degree organized in its minute aſſemblages, gives birth to them, and that the gradation between animal and vegetable life is much more familiar and eaſy than it had before appeared to be. He ſuppoſes, in conformity to the doctrine of Monſ. de Buffon, that there are in matter certain organical parts, diſpoſed for the formation of animal and vegetable ſubſtances; that theſe, by coalition, conſtitute the *prima ſtamina* of all animal and vegetable bodies, which are ſimple, uniform, and common to all, and conſequently to be found in a certain quantity in every portion of food, aliment, or nutritive juice; and from thence to be digeſted, and when the ſubject becomes adult, to be ſecreted and ſtrained, for the formation of the ſeed of every plant and animal; and in this fluid or ſubſtance to be afterwards found in great abundance.

Into theſe organical principles, Mr. Needham reſolves that claſs of beings which has been denominated microſcopic animals. He tells us, that ſeeds macerated in water firſt diſunite into ſmall particles, motionleſs, and ſeemingly inert: but that theſe particles by degrees afterwards arrive at a power of motion, and ſeem alive, though in reality they are not ſo. The author deduces the ſame obſervations from experiments on the juices of animals, mutton gravy, and the like; and affirms, from the whole, that no axiom was ever more true than that of the ancients, *corruptio unius eſt generatio alterius*, that is the corruption, one is the generation of another, though they draw it from falſe principles, and ſo eſtabliſhed it as to render *generation* equivocal. He then proceeds to the examination of the male ſemen of animals; and affirms, that thoſe animalcules appearing like tadpoles, which others have obſerved in this ſemen, are produced ſubſequently to the evacuation of this fluid, and have their origin from principles contained in this matter, either by evolution of organical parts, as Buffon ſuppoſes, or, as Mr. Needham thinks, from a real vegetation, and a change from the vegetable to the animal life, he ſays that the ſemen, immediately evacuated, and viewed by the microſcope, appears an homogeneous fluid; that, after a few moments, it begins to liqueſy; then to ſhoot out into long filaments and ramifications on every ſide; which afterwards open and divide into moving globules, trailing after them ſomething like long tails; theſe tails are in reality no parts of the animals, but long ſtrings or filaments of the viſcid ſeminal ſubſtance, which gradually becomes ſhorter and ſhorter, till at laſt the globules get rid of them, and ſwim equally in the fluid. This vegetative power, in parts of the ſemen, of ſhooting into filaments, Mr. Needham found to reſide in all ſubſtances, animal and vegetable, and in every part of thoſe ſubſtances, as far as the ſmalleſt microſcopical point; and to this he attributes all that is called animal life in the fluids, produced from vegetables, or the infuſions of them; and from hence he concludes with M. Buffon, that there is a real productive force in nature. He adds, that there is a vegetative force in every microſcopical point of matter, and in every viſible filament of which the whole animal or vegetable texture conſiſts; and he alſo conjectures, that this force extends much farther; becauſe in all his obſervations, the whole ſubſtance, after a certain ſeparation of ſalts and volatile parts, divided into filaments and vegetated into numberleſs zoophytes, which yielded all the ſeveral ſpecies of common microſcopic animals; and theſe animals alſo, after a certain time ſubſided to the bottom, became motionleſs, reſolved again into a gelatinous filamentous ſubſtance, and gave zoophytes and animals of a leſſer ſpecies. The caſe is the ſame, he ſays, with regard to the ſpermatic animalcules as well as the others, and, therefore, he reduces them all to the ſame claſs of beings. From theſe facts, he infers, that every animal or vegetable ſubſtance advances as faſt as it can in its reſolution to return to one common principle, the ſource of all, or a kind of univerſal ſemen, from which its atoms may return again and aſcend to a new life.

Mr. Needham alſo obſerves, that the animalcules in the ſemen of animals, and in the infuſions and juices of animal and vegetable ſubſtances, are not of the nature of any other beings, or to be ranked with them: that they conſtitute a claſs apart from all others, the characteriſtic of which is, that they are neither generated nor ſubſiſt by nutriment, as other plants, and animals do, nor generate in the ordinary way. Of this claſs, he apprehends, is that ſpecies of POLYPE, called the bell animal (See ANIMALCULES) owing its formation to the decompoſition of ſome water plants, but approaching towards the nature of other animals, as, when once generated, it eats, and even generates as other animals do.

Mr. Needham's ſyſtem may be ſummed up in a few words: he ſuppoſes all ſemen of any kind to be an exalted portion of animal or vegetable matter, ſecreted from the aliment of every generating ſubject, when it is adult, and no farther demand is made for its increaſe of growth; this is endued with a proportionable vegetating force; and is various in various circumſtances, and heterogeneous in different ſubjects, but uniform in its productions, when it falls into a proper matrix, where it finds matter to aſſimilate of a proper quality, and in a quantity ſufficient to form that ſpecific being: whilſt in other circumſtances, it will, if it extravaſates, by the ſame vegetating force, produce the ſeveral phænomena which he has aſcribed to it. Phil. Tranſ. vol. xlv. p. 615, &c.

GENERATION *of Man*. As it is in the human ſubjects that the gradual proceſs of *generation* has been principally inquired into, and the ſtructure and office of the organs ſubſervient thereto, chiefly examined: what the lateſt naturaliſts and anatomiſts have ſettled with regard to it, is reſerved for this head. The parts of *generation*, then, are different in the different ſexes. Thoſe proper to the male, are the penis, the teſticles, the veſiculæ ſeminales, the vaſa deferentia, the paraſtatæ and the vaſa præparentia; which ſee deſcribed each under its proper article, PENIS, TESTICLE, &c. The parts of *generation* proper to the female are the PUDENDUM, the CLITORIS, NYMPHÆ, HYMEN, UTERUS, FALLOPIAN TUBES, and OVARIES OF TESTES, which we have fully deſcribed in our Syſtem of ANATOMY.

The proceſs of *generation*, ſo far as the male contributes to it, is as follows. The penis being erected by an affuſion of blood, as ſhewn under erection; the glands, at the ſame time tumefied; and the nervous papillæ in the glands much rubbed, and highly excited, in coitu: an ejaculatory contraction follows, by which the ſeed is preſſed out of the ſeminal veſicles, and expelled with ſome conſiderable force. The proceſs of *generation* on the one part of the female is thus: the clitoris being erected, after the like manner as the penis in man; and the neighbouring parts all diſtended with blood; they more adequately embrace the penis in coitu: and, by the intumeſcence, preſs out a liquor from the glands about the neck of the womb, to facilitate the paſſage of the penis. At the ſame time, the fibres of the womb, contracting, open its mouth (which at other times is extremely cloſe) for the reception of the finer part of the ſeed.

Thus the ſeed, pregnant with animalcules, is conveyed, with ſome impetus, into the uterus: where being retained by the convulſive reſtriction of the inner membrane thereof, and farther heated and agitated therein, it is prepared to impregnate the ovum.

During the act of coition, the Fallopian tubes growing ſtiff, embrace the ovaries with their ſtrong muſculous edges like fingers, and compreſs them, till their mouths being dilated and expanded by this membrane, force the egg now ripened, into their cavities, and gradually drive it forwards, by their virmicular motion, till at laſt they protrude into the cavity of the womb to meet the ſeed, ſome of the animalcules whereof, entering the dilated pores of the glandulous membrane of the egg, are there retained, nouriſhed, grow to its navel, and ſuffocate the reſt of the leſs lively animalcula. And thus is conception performed. Others rather ſuppoſe the ſeed conveyed from the uterus, through the Fallopian tubes, to the ova; and thus take the impregnation to be firſt performed in the ovaries, or even in the tubæ themſelves, the ova and the ſeed meeting by the way. Others, conſidering the cloſeneſs of the mouth of the womb, and the thickneſs of the membranes of the ovaries, judge it impoſſible for the ſeed to paſs that way; and therefore ſuppoſe it is taken up by the veins which open into the cavity of the vagina, or even the womb; where circulating, it ferments with the maſs of blood; and hence all the ſymptoms which appear in conception. At length it enters and impregnates the egg by the ſmall twigs of arteries which are upon its membranes. This fermentation ſwelling the membranes of the tubæ, they open their cavity, and make room for the ova to paſs into the womb. The egg impregnated, and cloſe ſhut up in the womb, ſwims in the humours thereof; which, growing more and more ſubtil, enter the parent pores found on one ſide the ovum, and ſoon diſtend, fill, and augment it: and there being ſtill farther attenuated, nouriſh the embryo; thicken and expand the membranes of the ovum, eſpecially in that part by which it grew to the ovary; and thus form the rudiments of a placenta. The ſame cauſes ſtill continuing, and the pores both of the placenta and the membranes being enlarged; the egg begins to fill the cavity of the womb: and at length its ſtem or calyx grows to the concave ſurface thereof: and thus is the navel ſtring, or funiculus, formed. See FOETUS and *Funiculus* UMBILICALIS.

This ſyſtem is founded on the ſuppoſition of animalcula in the male ſeed. They who ſet them aſide as unconcerned in generation, account for it thus: the ſeed containing volatile, oily, and ſaline parts, as appears from its fœtid ſmell, oleaginous ſubſtance, &c. being lodged in the womb, and there farther digeſted and exalted, grows yet more volatile, fetid, pungent, and ſtimulating; and thus, adding to the heat occaſioned by coition villicates the nervous fibres of that part, and occaſions a fermentation, and gentle inflammation; and by that means an extraordinary flux of humours to that and the adjacent parts. By this means the tubæ becomes rigid, and fit to graſp the ovaries, which are always heated by the effluvia of the ſemen and the warmth of the parts ſurrounding. Upon this there is a greater flux into the ovaries; till at length, the ova, ſome of them at leaſt, by ſuch greater ſupply of nouriſhment, increaſe in bulk; and as thoſe graſped by the edges of the tubæ will be kept warmeſt, and the greateſt flux be made thereto, they will ſooneſt be ripened, fall off, and be received by the tubæ, and conveyed to the womb; where growing after the manner of the ſeeds of plants, the placenta at length takes hold of, and adheres to, the uterus; from which time the embryo begins to be nouriſhed after a different manner. See GESTATION, NUTRITION and CIRCULATION.

Whoever reads this ſhort ſketch of the different theories of generation that have hitherto been invented, will probably require no other arguments to convince him, that phyſicians and philoſophers are ſtill ignorant of the nature of this myſterious operation they were in the days of Noah. Concerning the formation and nutrition of the fœtus after the female has conceived, there have alſo been great diſputes; but as this ſubject is more eaſily inveſtigated, and in ſome meaſure falls under the notice of our ſenſes, there is much leſs uncertainty concerning theſe matters than generation, or the manner in which the embryo is originally formed. The following particulars are confirmed by the greateſt number of obſervations.

About the ſeventh day, the eye may diſcover the firſt lineaments of the fœtus; but theſe lineaments are as yet very imperfect. Two little veſicles appear in an almoſt tranſparent jelly, the largeſt of which is deſtined to become the head of the fœtus, and the other ſmaller one is reſerved for the trunk. But at this period no extremities are to be ſeen; the umbilical chord appears only as a very minute thread, and the placenta does not as yet abſorb the red particles of the blood. At the end of fifteen days, not only the head but the features of the face begin to be developed. The noſe appears like a ſmall prominent line; and we are able to diſtinguiſh another line under it, which is deſtined for the ſeparation of the lips. Two black points appear in the place of eyes, and two minute holes mark the ears. At the ſides of the trunk both above and below, we ſee four minute protuberances, which are the rudiments of the arms and legs. At the end of three weeks the body of the fœtus is ſomewhat augmented, and both the hands and feet are to be diſtinguiſhed. The upper extremities are found to increaſe faſter than the lower ones, and the ſeparation of the fingers is accompliſhed ſooner than that of the toes. Towards the end of the firſt month, the fœtus is about an inch long, and the human form may be deciſively aſcertained: all the parts of the face may be diſtinguiſhed; the ſhape of the body is clearly marked out, the haunches and the abdomen are elevated, the fingers and toes are ſeparated from each other, and the inteſtines appear like minute threads. After ſix weeks the fœtus is grown much longer, and the human figure appears to be more perfect, but the head is ſtill larger in proportion than the other parts of the body.

At the end of the ſecond month, the fœtus meaſures two inches and a quarter; at the end of the third month, three inches and a quarter; at the end of the fourth month, three inches and a half; and about the fourth or fifth month, uſually about five inches; and from that time to the end of the ninth month, it gradually increaſes to about the length of twelve inches, ſometimes more, and ſometimes not quite ſo much. The fœtus during all this time aſſumes an oval figure, which correſponds with the ſhape of the uterus. Its chin is found reclining on its breaſt, with its knees drawn up towards its chin; and its arms folded over them. But it ſeems likely that the poſture of ſome of theſe parts is varied in the latter months of pregnancy, ſo as to cauſe thoſe painful twitches which its mother uſually feels from time to time. In natural caſes, its head is probably placed towards the os tincæ from the time of conception to that of its birth; though formerly it was conſidered as being placed towards the fundus uteri, till about the eighth or ninth month, when the head, by becoming ſpecifically heavier than the other parts of the body, was ſuppoſed to be turned downwards. The capacity of the uterus increaſes in proportion to the growth of the fœtus, but without becoming thinner in its ſubſtance, as might naturally be expected. The nouriſhment of the fœtus, during all this time, ſeems to be derived from the placenta, which appears to be originally formed by that part of the ovum which is next the fundus uteri. The remaining unconnected part of the ovum, and likewiſe the ſurface of the placenta, are covered by a membrane called *chorion*, within which is another pellucid membrane called *amnios*. Beſides theſe two membranes, Dr. Hunter has diſcovered a third, which is the exterior one, being ſuppoſed to be a lamella from the inner ſurface of the uterus. In the latter months of pregnancy it becomes gradually thinner and more connected with the chorion. He has named it *membrana caduca*. In ſome quadrupeds, the urine appears to be conveyed from the bladder through a canal called *urachus*, to the *allantois*; which is a reſervoir, reſembling a long and blind gut, ſituated between the chorion and amnios. The human fœtus ſeems to have no ſuch reſervoir, though ſome writers have ſuppoſed that it does exiſt. From the top of the bladder, a few longitudinal fibres are extended to the umbilical chord; and the fibres have been conſidered as the urachus, though without having ever been found pervious.

The two former include a watery fluid, which is the *liquor amnii*, in which the fœtus floats till the time of its birth. The *liquor amnii* coagulates like the lymph. It has been ſuppoſed to paſs into the œſophagus, and to afford nouriſhment to the fœtus; but this does not ſeem probable. Children have come into the world without an œſophagus, or any communication between the ſtomach and the mouth; but there has been no well atteſted inſtance of a child's having been born without a placenta; and it does not ſeem likely that any of the fluid can be abſorbed through the pores of the ſkin, the ſkin in the fœtus being every where covered with a great quantity of mucus. In the firſt months of pregnancy, the involucra bear a large proportion to their contents, but this proportion is afterwards reverſed as the fœtus increaſes in bulk. The placenta, which is the medium through which the blood is conveyed from the mother to the fœtus, and the manner in which this conveyance takes place, deſerve to be clearly deſcribed, as being a ſubject not generally underſtood. Without ſuch an explanation it might perhaps be readily ſuppoſed, that the arteries of the uterus paſs into the ſubſtance of the placenta; and that the blood, after being conveyed through the umbilical arteries to the fœtus, is returned back by the umbilical vein to the placenta, and from thence to the uterus. Such an idea, however, would be a very erroneous one, and we ſhall point out the true manner in which this proceſs is conducted.

The *placenta* is a broad, flat, and ſpongy ſubſtance, like a cake, cloſely adhering to the inner ſurface of the womb, uſually near the fundus, and appearing to be made up by the ramifications of the umbilical arteries and vein. The arteries of the uterus diſcharge their contents into the ſpongy cells of this cake; and the veins of the placenta, abſorbing the blood from theſe cells in the ſame manner as they abſorb it in the copora cavernoſa penis, at length forms the *umbilical vein*, which paſſes on to the liver, and from thence to the heart of the fœtus, by the vena cava. Its circulation however, through the heart is not conducted in the fœtus as it i in the adult: in the latter, the blood is carried from the right au ricle of the heart through the pulmonary artery, and is returned to the left auricle by the pulmonary vein; but a dilatation of the lungs is eſſential to the paſſage of the blood through the pulmonary artery, and this dilatation cannot take place till after the child is born and has reſpired. This deficiency, however, is ſupplied in the fœtus by an immediate communication between the right and left auricle of the heart, through an oval opening in the ſeptum, which divides the two auricles, called *foramen ovale*. The blood is returned again from the fœtus, through two arteries called the *umbilical arteries*, which ſometimes ariſe from the iliacs, and ſometimes from the aorta deſcendens. Theſe two veſſels taking a winding courſe with the vein, form with that, and the membranes by which they are ſurrounded, what is called the *umbilical chord*. Theſe arteries, after ramifying through the ſubſtance of the placenta, open and diſcharge their blood into its cells, from whence it is abſorbed by the veins of the uterus; ſo that a conſtant depoſition and abſorption are carried on, and the fœtus is found to have a circulation independent of its mother.

GENERATION *of Fiſhes*. See Syſtem of ICHTHYOLOGY.

GENERATION *of Plants*. See Syſtem of BOTANY, Sect. VI.

GENERATION *of Inſects*. See Syſtem of ENTOMOLOGY, Part I.

GENERATION *of Parts*. See Syſtem of ANATOMY; for the male organs, Part III. Sect. II. for the female, Part V. Sect. I. for a repreſentation Plate X.

GENERATION is alſo uſed, though ſomewhat improperly, for GENEALOGY, or the ſeries of children iſſued from the ſame ſtock. Thus, the goſpel of St. Matthew commences with *the book of the generation of Jeſus Chriſt*, &c. The latter, and more accurate tranſlators, inſtead of *generation* uſe the word *geneaology*.

GENERATION is alſo uſed to ſignify a people, race, or nation, eſpecially in the literal tranſlations of the ſcripture, where the word generally occurs wherever the Latin has *generatio*, and the Greek γενεα, γενεσις.

Thus, "A wicked and preverſe *generation* ſeeketh a ſign," &c. "One *generation* paſſes away, and another cometh," &c.

Generation is alſo uſed in the ſenſe of an age, or the ordinary period of a man's life. Thus we ſay, to the third and fourth *generation*. In this ſenſe, hiſtorians uſually reckon a *generation* the the ſpace of thirty-three years, or thereabouts. See Age.

GENERICAL *Name*, in natural hiſtory, the word uſed to ſignify all the ſpecies of natural bodies, which agree in certain eſſential and peculiar characters, and therefore all of the ſame family or kind; ſo that the word uſed as the *generical* name equally expreſſes every one of them, and ſome other words expreſſive of the peculiar qualities or figures of each are added, in order to denote them ſingly, and make up what is called a ſpecific name. Thus the word *roſe*, or roſe, is the *generical* name of the whole ſeries of flowers of that kind, which are diſtinguiſhed by the ſpecific names of the red roſe, the white roſe, the apple roſe, &c. The ignorance of former ages, in the true principles of natural hiſtory, has occaſioned the bodies, which are the objects of it, to be arranged into very unnatural ſeries under the name of *genera*; and theſe have been called by names as improper as the characters they were diſtinguiſhed by. Linnæus has done a great deal in exploding the bad *generical* names in Botany.

GENESIS, the firſt book of the Old Teſtament, containing the hiſtory of the creation, and the lives of the firſt patriarchs. The book of *Geneſis* ſtands at the head of the Pentateuch. Its author is held to be Moſes: it contains the relation of 2369 years, viz. from the beginning of the world to the death of Joſeph. This book, beſides the hiſtory of the creation, contains an account of the original innocence and fall of man; the propagation of mankind; the riſe of religion; the general defection and corruption of the world; the deluge; the reſtoration of the world; the diviſion and peopling of the earth; and the hiſtory of the firſt patriarchs to the death of Joſeph. It was eaſy for Moſes to be ſatisfied of the truth of what he delivers in this book, becauſe it came down to him through a few hands: for from Adam to Noah, there was one man, viz. Methuſelah, who lived ſo long as to ſee them both: in like manner Shem converſed with Noah and Abraham; Iſaac with Abraham and Joſeph, from whom the records of this book might eaſily be conveyed to Moſes by Amram, who was contemporary with Joſeph.

GENEVA, or Gin, a popular name for a compound water, which is, or ought to be, procured from the berries of the juniper-tree, diſtilled with brandy or malt-ſpirits. The word is formed from *genevre*, the French name of the Juniper-berry. The beſt *geneva* we now have, is made from an ordinary ſpirit, diſtilled a ſecond time with an addition of ſome juniper berries; but the original liquor of this kind was prepared in a very different manner. It was a cuſtom in the diſtilling of ſpirits from wort, or other fermented liquors, to add in the working ſome aromatic ingredient, ſuch as ginger, cortex Winteranus, or grains of paradiſe, to take off the bad flavour, and to give a pungent taſte to the ſpirit. Among other things uſed with this intent, ſome tried the juniper berries, and finding that they gave not only an agreeable flavour, but very valuable virtues alſo to the ſpirit, they brought it to a general cuſtom, and the liquor ſold under this name. The method of adding the berries was to the malt in the grinding: a proper proportion was allowed, and the whole was reduced to meal together, and worked in the common way. The ſpirit thus obtained was flavoured *ab origine*, with the berries, and exceeded all that could be made by any other method. Our common diſtillers leave out the juniper berries entirely from the liquor they now make and ſell under that name. Our chymiſts have let them into the ſecret, that the oil of juniper berries, and that of turpentine, are very much alike in flavour, though not in price: and the common method of making what is called *geneva* in London, is with common malt ſpirit, and a proper quantity of oil of turpentine diſtilled together. Shaw's Eſſay on diſtill. p. 7.

GENIAL, Genialis, an epithet applied by the ancients to certain deities, whom they ſuppoſed to preſide over generation.

GENICULI, in botany, the joints or knots which appear in the ſhoots of plants; whence botaniſts call thoſe marked therewith *geniculate plants*.

GENIO-HYOIDÆUS, in anatomy, a muſcle of the *os hyoides*. For the origin, inſertion, and uſe of theſe muſcles, ſee the Syſtem of Anatomy, Sect. XI.

GENITAL, Genitalis, in anatomy, ſomething that relates to generation. Genital parts denote the parts, in both ſexes, employed in generation. See Generation.

GENETIVE, in grammar, the ſecond caſe of the declenſion of nouns. The relation of one thing conſidered as belonging in ſome manner to another, has occaſioned a peculiar termination of nouns, called the *genetive caſe*; but, in the vulgar tongues, they make uſe of a ſign to expreſs the relation of this caſe. In Engliſh they prefix the particle *of*, in French *de* or *du*, &c.: Though in ſtrictneſs there are no caſes in either of theſe languages; inaſmuch as they do not expreſs the different relations of things by different terminations, but by additional prepoſitions, which is otherwiſe in the Latin.

GENIUS, in mythology, a good or evil ſpirit, or demon, whom the ancients ſuppoſed to ſet over each perſon, to direct his birth, accompany him in life, and be his guard until death.

Genius is more frequently uſed for the force or faculty of the ſoul conſidered as it thinks or judges. Thus, we ſay, a happy *genius*, a ſuperior *genius*, an elevated *genius*, a narrow confined *genius*, &c. In like ſenſe we alſo ſay, a work of *genius*, a want of *genius*, &c.

Genius is alſo uſed in a more reſtrained ſenſe, for a natural talent, or diſpoſition to one thing more than another. In which ſenſe we ſay a *genius* for verſe, for the ſciences, &c. Art and induſtry add much to natural endowments, but cannot ſupply them where they are wanting. Every thing depends on genius. A painter often pleaſes without obſerving rules; whilſt another diſpleaſes though he obſerves them, becauſe he has not the happineſs of being born with a genius for painting. Nature has thought fit to make a diſtribution of her talents among men, in order to render them neceſſary to one another; the wants of men being the very firſt link of ſociety: ſhe has therefore pitched upon particular perſons, to give them aptitude to perform rightly ſome things which ſhe has rendered impoſſible to others; and the latter have a greater facility granted them for other things, which facility has been refuſed to the former. Nature, indeed, has made an unequal diſtribution of her bleſſings among her children; yet ſhe has diſinherited none; and a man diveſted of all kinds of abilities, is as great a phenomenon as an univerſal genius.

GENTILE, Gentilis, a pagan, or perſon who adores falſe gods. The Hebrews applied the name גוים, *gentes*, *nations*, to all the people of the earth who were not Iſraelites or Hebrews. Some will have it that the *gentiles* were thus called in contradiſtinction to the Jews, becauſe the latter had a poſitive law to obſerve in matters of religion, whereas the *gentiles* had only the natural law; hence they are called *gentiles*.

GENTLEMAN, a perſon of good family, or deſcended of a family which has long borne arms, the grant of which adds gentility to a man's family. In our ſtatutes, *gentilis homo* was adjudged a good addition for a *gentleman*, 27 Edw. III. The addition of knight is very ancient: but that of eſquire, or *gentleman*, was rare before 1 Hen. V. We read that J. Kingſton was made a *gentleman* by king Richard II. As it may juſtly be aſked, what conſtitutes a *gentleman* with us? the reply is eaſy; being a *gentleman*, is being entitled to bear arms. And Mr. Camden obſerves, that the diſtinction of a *gentleman* of coat armour, or an upſtart, and a *gentleman* of blood, is the bearing of arms from the grandfather; and that he who bears arms from his grandfather, is to all intents and purpoſes a *gentleman* of blood; for which cauſe it is requiſite by the ſtatutes of the Bath that every knight before his admiſſion, proves himſelf to be ſo qualified; which done it carries with it, if his merit be equal, a paſſport alſo to the order of the Garter. Notitia Anglicana, p. 24. See alſo Doddridge's Honour's Pedigree, p. 147. Smith, De Republ. Ang. & Forteſcue, fol. 82.

Guillim, in his chapter of *gentlemen*, ſays, that they have their beginning either of blood, as being born of worſhipful parents; or that they have done ſomething, either in peace or war, whereby they deſerve to bear arms, and be accounted *gentlemen*. He farther ſays, chap. xxiv. if a *gentleman* be bound apprentice to a merchant or other trader, he hath not thereby loſt his gentility; and he deſires it may be remembered, for the honour of trade, that king Henry VIII. thought it no diſhonour to him, when he quitted his queen, to take his wife Anne, the daughter of Thomas Bullen, ſometime mayor of London. To which may be added the thought, that the firſt William, who founded our royal race, was the grandſon of a tanner.

GENUS, Gender, in botany, denotes a ſyſtem, or aſſemblage, of ſeveral plants, agreeing in ſome one or more common characters in reſpect of the ſtructure of certain parts; whereby they are diſtinguiſhed from all other plants. The diſtribution of plants into *genera*, and ſpecies, is abſolutely neceſſary to eaſe the memory, and prevent its being oppreſſed, and overburdened with an infinity of different names. The knowledge of a *genus* comprehends, in a kind of miniature, that of all the plants belonging thereto; each being denominated from ſome circumſtance, common to the whole kind, to ſave the embarraſſment of ſo many particular names. See Syſtem of Botany, Sect. V.

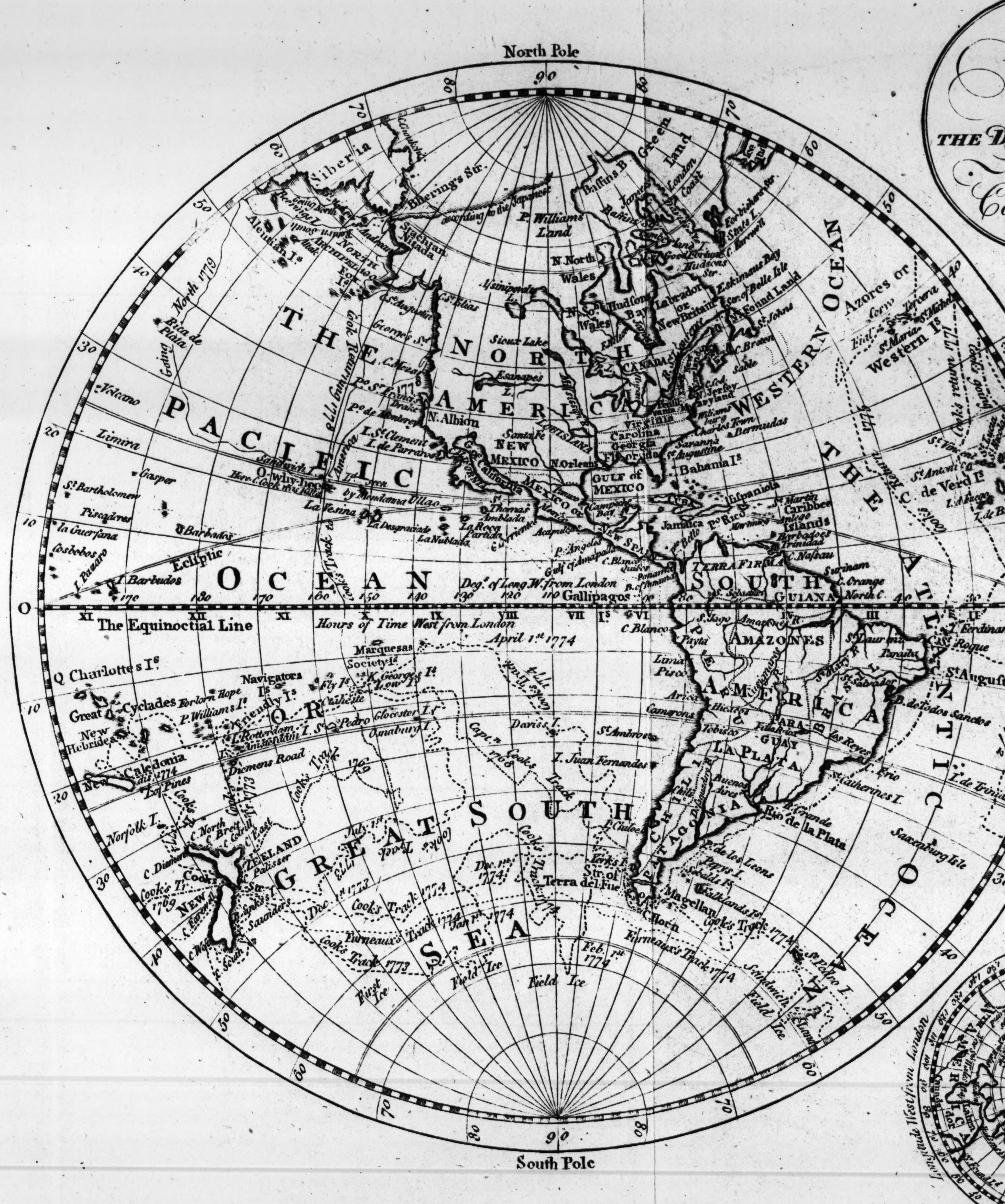
Genus is alſo uſed for a character, or manner applicable to every thing of a certain nature or condition. In which ſenſe it ſerves to make capital diviſions in divers ſciences; as muſic, rhetoric, botany, anatomy, and natural hiſtory.

GEOCENTRIC, in aſtronomy, is applied to a plannet or its orbit, to denote it concentric, with the earth, or, as having the earth for its centre, or the ſame centre with the earth.

GEOGRAPHY, formed of γη, *terra*, *earth*; and γραφω, *ſcribo*, *I write*, *I deſcribe*; the doctrine oa knowledge of the earth, both as in itſelf, and as to its affections; or a deſcription of the terreſtrial globe, and, particularly, of the known habitable part thereof, with all its parts. *Geography* may be conſidered as a branch of mathematics, becauſe it conſiders the earth, and its affections, as depending on quantity; and, conſequently, as meaſurable: viz. its figure, place, magnitude, motion, celeſtial appearances, &c. with the ſeveral circles imagined on its ſurface.

The following Syſtem of Geography *is the production of* Mr. Marquois, *Parliament Street, Weſtminſter*.

BRITISH 18 MR 63 MUSEUM


North Pole
South Pole
THE NORTH AMERICA
THE PACIFIC OCEAN
OR GREAT SOUTH SEA
THE WESTERN OCEAN
THE ATLANTIC OCEAN
SOUTH AMERICA
Siberia
Blerings Str.
P. Williams Land
N. North Wales
N. South Wales
Hudsons Bay
Labrador or New Britain
Baffins B.
Green Land
Eskimaux Bay
New Found Land
Canada
Sioux Lake
N. Albion
Virginia
Carolina
Georgia
Florida
Louisiana
New Mexico
N. Orleans
Gulf of Mexico
Mexico
California
Bahama Is.
Bermudas
Azores or Western Is.
C. de Verd Is.
Hispaniola
Jamaica
Caribbee Islands
Barbadoes
Trinidad
Terra Firma
Guiana
Surinam
Amazones
Peru
Brazil
Lima
La Plata
Paraguay
Chili
Patagonia
Buenos Ayres
Rio de la Plata
Terra del Fuego
Str. of Magellan
C. Horn
Falklands Is.
Gallipagos
Juan Fernandes
Marquesas
Society Is.
Otaheite
Friendly Is.
Navigators Is.
New Hebrides
New Caledonia
Norfolk I.
New Zeeland
Q. Charlotte's Is.
Great Cyclades
Sandwich Is.
Owhyhee
Ecliptic
The Equinoctial Line
Hours of Time West from London
Degs. of Long. W. from London
Cook's Track 1774
Furneaux's Track 1773
Field Ice
Sandwich Land
Georgia
April 1st 1774
Going North 1779
Cook's Return 1779
0
10
20
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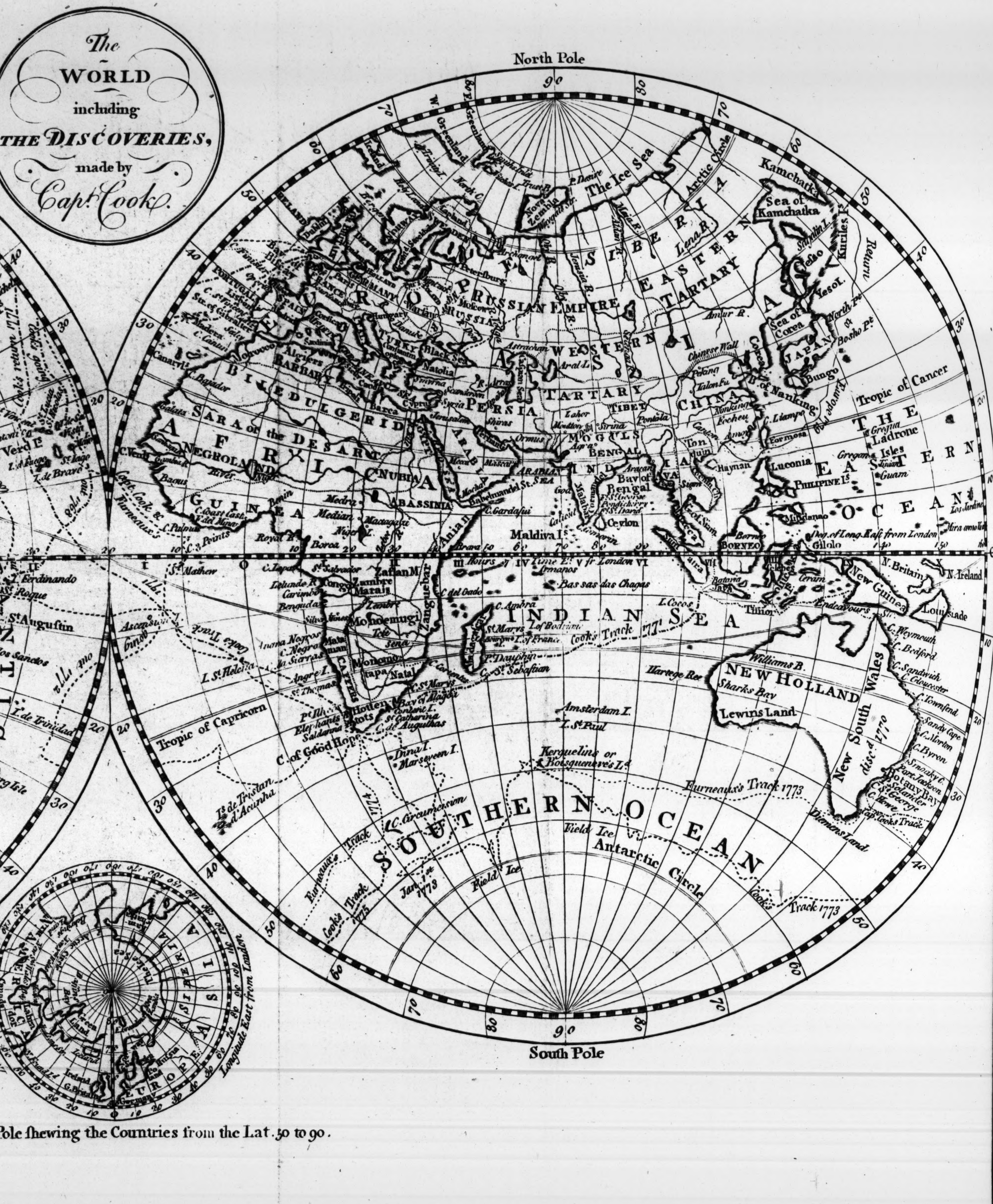
40
50
60
70
80
90

The North Pole shewi


The WORLD including THE DISCOVERIES, made by Capt. Cook.
North Pole
South Pole
The Ice Sea
Arctic Circle
Kamchatka
Sea of Kamchatka
SIBERIA
EASTERN TARTARY
WESTERN TARTARY
RUSSIAN EMPIRE
Petersburg
Moscow
Black Sea
Natolia
PERSIA
ARABIA
TIBET
CHINA
Chinese Wall
Nanking
Canton
JAPAN
Sea of Corea
Kuriles
Tropic of Cancer
Ladrone Isles
THE EASTERN OCEAN
PHILIPINE Is.
Luconia
Formosa
MOGULS
BENGAL
Bay of Bengal
Ceylon
Maldiva Is.
BORNEO
Gilolo
New Guinea
N. Britain
N. Ireland
Louisiade
Timor
Endeavours Str.
AFRICA
BARBARY
BILEDULGERID
SARA or the DESART
NEGROLAND
GUINEA
NUBIA
ABASSINIA
Zanguebar
C. Gardafui
Monoemugi
CAFFRES
Natal
Madagascar
Tropic of Capricorn
C. of Good Hope
C. des Aguilhas
I. St. Helena
INDIAN SEA
Cooks Track 1771
NEW HOLLAND
New South Wales disc. 1770
Botany Bay
Diemens Land
Amsterdam I.
I. St. Paul
Kerguelins or Bosquenevs Is.
Furneaux's Track 1773
SOUTHERN OCEAN
Antarctic Circle
Field Ice
Cooks Track 1773
Degr. of Long. East from London
Verd Is.
Ferdinando Noronha
St. Augustin
Ascension
L. de Trinidad
Longitude East from London
EUROPE
ASIA

Pole ſhewing the Countries from the Lat. 50 to 90.

Los Jardines
N. Ireland
Louisiade
C. Townsend
Sandy Cape
Byron

SYSTEM OF GEOGRAPHY.

HISTORY.

THE Chaldeans and Egyptians, who were diſtinguiſhed by their ſkill in geometry and aſtronomy, were the firſt perſons that paid any particular attention to *geography*; and it is ſaid that the firſt map was made by order of Seſoſtris I. who conquered Egypt. Hiſtorians relate, that the Roman ſenate, about a hundred years before Chriſt, ſent geographers into divers parts to make an accurate ſurvey and menſuration of the whole globe; but they ſcarce ſaw the twentieth part of it.

Before them, Neco king of Egypt, ordered the Phœnicians to make a ſurvey of the whole coaſt of Africa; which they accompliſhed in three years: Darius procured the Ethiopic ſea, and the mouth of the Indus, to be ſurveyed. Thales of Miletus, Anaximander his diſciple, who is ſaid to have conſtructed the firſt ſphere; Democritus, Euxodus, &c. who made uſe of maps common in Greece; Ariſtagoras of Miletus, who preſented to Cleomenes, king of Sparta, a table of braſs, on which he had deſcribed the known earth, with its ſeas and rivers; and other Greeks, availing themſelves of the aſſiſtance derived from the Chaldeans and Egyptians, proſecuted the ſtudy and enlarged the extent of this ſcience. It appears that in the time of Socrates, geographical maps were uſed at Athens, for this philoſopher humbled the pride and boaſt of Alcibiades, by deſiring him to point out his territories in Attica in a map: and Pliny relates, that Alexander, in his expedition into Aſia, took two geographers, Diognetus and Bæton, to meaſure and deſcribe the roads; and that from their itineraries, the writers of the following ages took many particulars.

Pytheas the famous geographer of Marſeilles flouriſhed in the time of Alexander; and Ariſtotle ſeems to have been no leſs converſant with *Geography* than philoſophy: after Alexander, Selucus, Nicanor, Theophraſtus, the diſciple of Ariſtotle, Eratoſthenes, who publiſhed three books of geographical commentaries, and corrected a chart of Anaximander, Hipparchus, who corrected the obſervations of Eratoſthenes, and thus furniſhed occaſion for a diſpute which greatly contributed to the improvement of *geography*. *Geography* was tranſmitted, with the other arts, from Greece to Rome: Polybius, under a commiſſion from Scipio Æmelianus, reconnoitred the coaſts of Africa, Spain, and France, and meaſured the diſtances of all thoſe places which Hannibal had viſited in his march over the Pyrennes and Alps. Varro's works contain many geographical remarks: Zenodoxus, Theodorus and Polycletus were employed under the conſulſhip of Julius Cæſar and Mark Anthony in ſurveying and meaſuring the globe. The commentaries of Cæſar are well known. Auguſtus was a diſtinguiſhed patron and promoter of this ſcience; under whom Strabo publiſhed his *geography*. And the taſte for the ſtudy and advancement of *geography* was greatly encouraged under Tiberius, Claudius, Veſpaſian, Domitian, and Adrian. Iſidore of Charax, who lived to the commencement of the firſt century of the Chriſtian æra; Pomponius Mela, who publiſhed a book intitled De Situ Orbis; Metius Pompoſianus, who, having depicted the earth on a parchment, fell a ſacrifice to the jealouſy of Domitian, the emperor ſuſpecting that he aimed at the empire; Pliny the naturaliſt, who has deſcribed the countries known in his time in the third, fourth, fifth, and ſixth books of his Natural Hiſtory; Marinus the Tyrian, who corrected and enlarged the diſcoveries of preceding geographers; and the emperor Antoninus, deſerve particular mention.

This abſtract of the hiſtory of ancient geographers, notwithſtanding whoſe ſucceſſive labours *geography* was ſtill in a very imperfect ſtate, brings us to a period, about the 150th year of the Chriſtian æra, in which Ptolemy of Alexandria contributed greatly to the improvement of this ſcience, by a more ample and accurate deſcription of the terreſtial globe than any had yet given of it. He availed himſelf of numerous obſervations and ancient charts; he corrected the miſtakes and ſupplied many defects of others; and by reducing the diſtances of places on the earth to degrees and minutes, after the manner of Poſidonius, making uſe of the degrees of longitude and latitude, and ſettling the ſituation of places by aſtronomical obſervations, he reduced *geography* into a regular ſyſtem, and laid a foundation for thoſe farther diſcoveries and improvements, which naturally reſulted from the progreſſive, and at preſent advanced ſtate of geometry, aſtronomy, navigation, and commerce. Many valuable geographical works appeared under Diocleſian, Conſtantius, and Maximian, &c. Under the emperor Theodoſius the provincial and itinerary chart or table, ſince known under the name of Peutinger, was digeſted and formed: and the laſt work, that ought to be claſſed with thoſe of the ancients, was the Notitia Imperii, attributed to Ethicus, who lived between the years 400 and 450 of the Chriſtian æra. The ages of barbariſm ſucceeded the fall of the Roman empire; and the arts and ſciences were obliged to ſeek refuge and protection from the Arabians and Orientaliſts in Aſia; the principal of whom, diſtinguiſhed by their attention to *geography*, were Almamom, caliph of Babylon, and Abulfeda, a Syrian prince. After the revival of learning in Europe, and particularly during the two laſt centuries, *geography* has derived very conſiderable acceſſions from travels, voyages, and a variety of nautical and aſtronomical obſervations. For a fuller account of the hiſtory of ancient *geography*, ſee the preface to Bertius's edition of Ptolemy's Theatrum Geographiæ Veteris, Fol. The ſcience, however muſt needs have been exceedingly defective; as a great part of the globe was then unknown: particularly all America, the northern parts of Europe and Aſia, with the Terra Auſtralis, and Magellanica; and as they were ignorant of the earth's being capable of being ſailed round, and of the torrid zone's being habitable, &c.

The principal writings on this ſcience, among the ancients are, Ptolemy's eight books: the moderns, Johannes De Sacroboſco De Sphæra, with Clavius's comment: Ricciolus's Geographia and Hydrographia Reformata: Weigelius's Speculum Terræ; De Chales's Geography; and above all, Varenius's Geographia generalis, with Jurin's additions, to which may be added, Leibnecht's Elementa Geographiæ generalis; Sturmius's Compendium Geographicum: Wolfius's Geographia, in his Elementa Matheſeos, and Bankes's Geography, with the lateſt diſcoveries.

GEOGRAPHICAL DIVISIONS OF THE EARTH.

In *geography* the different places of the globe are treated of under four grand diviſions, viz. Europe, Aſia, Africa, and America, and theſe are ſubdivided into kingdoms, ſtates, provinces, &c.

EUROPE contains Denmark, Eaſt and Weſt Greenland, Iceland, Norway, Denmark Proper, Lapland, Sweden, Muſcovy or the Ruſſian Empire, Scotland, and the Hebrides, Orkney, England, Wales, Ireland, Iſle of Man, Iſles of Wight, Jerſey, Guernſey, &c. France, United Netherlands, or Holland, Auſtrian and French Netherlands, Germany, Pruſſia, Bohemia, Hungary, Tranſylvania, Sclavonia, and Croatia, Poland and Lithuania, Switzerland, Spain, Portugal, Italy, part of Turkey, Ancient Greece, Turkiſh Iſlands, &c.

ASIA contains part of Turkey, Tartary, China, India, Perſia, Arabia, Indian and Oriental Iſlands, &c. &c.

AFRICA contains Egypt, and the States of Barbary; with all that part of the Globe, from the tropic of Cancer to the Cape of Good Hope, and ſeveral Iſlands.

AMERICA contains New Britain, Canada, Nova Scotia, United States of America, New England, New York, New Jerſey, Penſylvania, Mary-land, Virginia, North and South Carolina, Georgia, Weſt Indies, Jamaica, Eaſt and Weſt Florida, New Mexico, Califormia, Old Mexico, Terra Ferma, Peru, Chil Paraguay, Cuba, Hiſpaniola, Brazil, Cayenne, the Iſlands of Martinico, and Guadaloupe, Surinam, the Iſlands of St. Euſtatia, and St. Thomas's, Terra Incognita, &c. &c.

NATURAL DIVISIONS OF THE EARTH.

The conſtituent parts of the earth are two, the *land* and *water*. The parts of the land are continents, iſlands, peninſulas, iſthmuſes, promontories, capes, coaſts, mountains, &c. The land is divided into two great continents (beſides the iſlands), viz. the *eaſtern* and *weſtern* continent. The eaſtern is ſubdivided into three parts, viz. Europe, on the north-weſt; Aſia, on the north-eaſt; and Africa (which is joined to Aſia by the iſthmus of Suez, 60 miles over), on the ſouth. The weſtern continent conſiſts of North and South America, joined by the iſthmus of Darien, 60 or 70 miles broad. A *continent* is a large portion of land, containing ſeveral countries or kingdoms, without any entire ſeparation of its parts by water, as Europe. An *iſland* is a ſmaller part of land, quite ſurrounded by water, as Great Britain. A *peninſula* is a tract of land every where ſurrounded by water, except at one narrow neck, by which it joins the neighbouring continent; as the Morea in Greece: and that neck of land which ſo joins it, is called an *iſthmus*: as the iſthmus of Suez which joins Africa to Aſia, and the iſthmus of Darien which joins North and South America. A *promontory* is a hill, or point of land, ſtretching itſelf into the Sea, the end of which is called a *cape*; as the Cape of Good Hope. A *coaſt* or *ſhore* is that part of a country which borders on the ſea-ſide. Mountains, vallies, woods, deſarts, plains, &c. need no deſcription. The moſt remarkable are taken notice of, and deſcribed in the ſyſtem. The parts of the water are oceans, ſeas, lakes, ſtraits, gulfs, bays, or creeks, rivers, &c. The waters are divided into three extenſive oceans (beſides leſſer ſeas, which are only branches of theſe), viz. the *Atlantic*, the *Pacific*, and the *Indian* Ocean. The Atlantic, or Weſtern Ocean, divides the eaſtern and weſtern continents, and is 3000 miles wide. The Pacific divides America from Aſia, and is 10,000 miles over. The Indian Ocean lies between the Eaſt Indies and Africa, being 3000 miles wide.

The *ocean* is a great and ſpacious collection of water, without any entire ſeparation of its parts by land; as the Atlantic Ocean. The *ſea* is a ſmaller collection of water, which communicates with the ocean, confined by the land; as the Mediterranean and the Red Sea. A *lake* is a large collection of water, entirely ſurrounded by land; as the lake of Geneva, and the lakes in Canada. A *ſtrait* is a narrow part of the ſea, reſtrained or lying between two ſhores, and opening a paſſage out of one ſea into another; as the ſtrait of Gibraltar, or that of Magellan. This is ſometimes called a *ſound*; as the ſtrait into the Baltic. A *gulf* is a part of the ſea running up into the land, and ſurrounded by it, except at the paſſage whereby it is communicated with the ſea or ocean. If a gulf be very large, it is called an inland ſea; as the Mediterranean; if it do not go far into the land, it is called a *bay*, as the Bay of Biſcay; if it be very ſmall, a *creek*, *haven*, *ſtation*, or *road* for ſhips, as Milford Haven. Rivers, canals, brooks, &c. need no deſcription: for theſe leſſer diviſions of water, like thoſe of land, are to be met with in moſt countries, and every one has a clear idea of what is meant by them.

GEOGRAPHY.

TABLE exhibiting the ſuperficial content of the whole globe in ſquare miles, ſixty to a degree, and alſo of the ſeas and unknown parts, the habitable earth, the four quarters or continents; and the great empires and principal iſlands, placed as they are ſubordinate to one another in magnitude.

	Square Miles.	Iſlands.	Squ. Miles	Iſlands.	Sq. Ml.
The Globe	199,512,595	Hiſpaniola	36000	Skye	900
Seas&unknown par.	160,522,026	Newfoundland	35000	Lewis	880
The Habitable worl	38,990,569	Ceylon	27730	Funen	768
Europe	4,456,065	Ireland	27457	Yvica	625
Aſia	10,768,823	Formoſa	17000	Minorca	520
Africa	9,654,807	Anian	11300	Rhodes	480
America	14,110,874	Gilolo	10400	Cephalonia	420
Perſian Empire under Darius	1,650,000	Sicily	9400	Amboya	400
Rom. Empire in its utmoſt height.	1,610,000	Timor	7800	Orkney Pomona	324
Ruſſian	4,161,685	Sardinia	6600	Scio	300
Chineſe	1,749,000	Cyprus	6300	Martinico	260
Great Mogul	1,116,000	Jamaica	6000	Lemnos	220
Turkiſh	950,057	Flores	6000	Corfu	194
Preſent Perſian	800,000	Ceram	5400	Providence	168
ISLANDS.		Breton	4000	Man	160
Borneo	228,000	Socrata	3600	Bornholm	160
Madagaſcar	168,000	Candia	3220	Wight	150
Sumatra	120,000	Porto Rico	3200	Malta	150
Japan	118,000	Corſica	2520	Barbadoes	140
Great Britain	72,926	Zealand	1935	Zant	120
Celebes	68,400	Majorca	1400	Antigua	100
Manilla	58,500	St. Jago	1400	St. Chriſtopher's	80
Iceland	46,000	Negropont	1300	St. Helena	80
Terra del Fuego	42,075	Teneriff	1272	Guernſey	50
Mindinao	39,200	Gothland	1000	Jerſey	43
Cuba	38,400	Madeira	950	Bermudas	40
Java	38,250	St. Michael	920	Rhode	36

To theſe iſlands may be added the following, which have lately been diſcovered, or more fully explored. The exact dimenſions of them are not aſcertained; but they may be arranged in the following order, according to their magnitude, beginning at the largeſt, which is ſuppoſed to be nearly equal in ſize to the whole continent of Europe:

New Holland, New Caledonia, Friendly Iſlands,
New Guinea, New Hebrides, Marqueſas,
New Zealand, Otaheite, Eaſter or Davis's Iſland.

DIVISION I. EUROPE.

Europe, though the leaſt extenſive quarter of the globe, is in many reſpects that which moſt deſerves our attention. Geography diſcovers to us two circumſtances with regard to Europe, which perhaps have had a conſiderable tendency in giving it the ſuperiority over the reſt of the world. Firſt, the happy temperature of its climate, no part of it lying within the torrid zone; and ſecondly, the great variety of its ſurface. The immenſe number of mountains, rivers, ſeas, &c. which divide the different countries of Europe from one another, is likewiſe extremely commodious for its inhabitants. Theſe natural boundaries check the progreſs of conqueſt or deſpotiſm, which has always been ſo rapid in the extenſive plains of Africa and the Eaſt: the ſeas and rivers facilitate the intercourſe and commerce between different nations; and even the barren rocks and mountains are more favourable for exciting human induſtry and invention, than the natural unſolicited luxuriancy of more fertile ſoils. There is no part of Europe ſo diverſified in its ſurface, ſo interrupted by natural boundaries or diviſions, as Greece: and we know that it was there the human mind began to know and to avail itſelf of its ſtrength, and that many of the arts, ſubſervient to utility, or pleaſure, were there invented, or at leaſt greatly improved. What Greece is with regard to Europe, Europe is with regard to the reſt of the globe. We do not however ſpeak of Greece as it is at preſent, under the domination of Turks and unnatural tyranny of Barbarians, but of ancient Greece which was diſtinguiſhed above all the reſt of Europe for the equity of its laws, and the freedom of its political conſtitution; moſt of the European governments are now monarchical, but we may diſcover, on due examination, that there are a thouſand little ſprings, which check the force, and ſoften the rigour of monarchy in Europe, that do not exiſt any where elſe, and the ſpirit of liberty is gaining ground daily. In proportion to the number and force of theſe checks, the monarchies of Europe, ſuch as Ruſſia, France, Spain, and Denmark, differ from one another. Beſides *monarchies*, in which one man bears the chief ſway, there are in Europe, *ariſtocracies* or governments of the nobles, and *democracies* or governments of the people. Venice is an example of the former; Holland, and ſome ſtates of Italy and Switzerland, afford examples of the latter. There are, likewiſe, mixed governments, which cannot be aſſigned to any one claſs. Great Britain, which partakes of all the three, is the moſt ſingular inſtance of this kind we are acquained with. The other mixed governments of Europe are compoſed only of two of the ſimple forms, ſuch as Poland, ſeveral ſtates of Italy, &c. The Chriſtian religion is eſtabliſhed throughout every part of Europe, except Turkey; but from the various capacities of the human mind, and the different lights in which ſpeculative opinions are apt to appear when viewed by perſons of different educations and paſſions, that religion is divided into a number of different ſects, but which may be comprehended under three general denominations; 1ſt, The Greek church; 2d, Popery; and 3d, Proteſtantiſm; which laſt is again divided into Lutheraniſm and Calviniſm, ſo called from Luther and Calvin, the two diſtinguiſhed reformers of the 16th century, and of theſe there are alſo various ſects. The languages of Europe are derived from the ſix following; the Greek, Latin, Teutonic or old German, the Celtic, Sclavonic, and Gothic.

GRAND DIVISIONS OF EUROPE.

This grand diviſion of the earth is ſituated between the 10th degree weſt, and the 65th degree eaſt longitude from London; and between the 36th and 72d degree of north latitude. It is bounded on the north, by the Frozen Ocean; on the eaſt, by Aſia; on the ſouth, by the Mediterranean Sea, which divides it from Africa; and on the weſt, by the Atlantic Ocean, which ſeparates it from America; being 3000 miles long, from Cape St. Vincent in the weſt to the mouth of the river Oby in the north-eaſt; and 2500 broad from north to ſouth, from the north Cape in Norway to Cape Cayha or Metapar in the Morea, the moſt ſouthern promontory in Europe. It contains the following kingdoms and ſtates.

	Kingdoms	Len.	Bth.	Chief City	diſt bearing from Lond.	Dif of time from Lond	Religions.
					Miles. * * *	H. M. * * *	
ritiſh Empire	England	380	300	London			Calv. Luth.&c.
	Scotland	300	350	Edinburgh	400 N.	0 12 aft	Calvaniſts, &c.
	Ireland	285	160	Dublin	270 N.W	0 26 aft	Calv.& Papiſts.
	Norway	1000	300	Bergen	540 N.	0 24 bef	Lutherans
	Denmark	240	180	Copenhagen	500 N.E.	0 50 bef	Lutherans
	Sweden	800	500	Stockholm	750 N.E	1 10 bef	Lutherans
	Ruſſia	1500	1100	Peterſburgh	1140 N.E.	2 4 bef	Greek Church
	Poland	700	680	Warſaw	760 E.	1 24 bef	Pap. Luth.& Ca
	K of Pr. dom	609	350	Berlin	540 E.	0 59 bef	Luth. & Calv.
	Germany	600	500	Vienna	600 E.	1 5 bef	Pap. Luth.& Ca
	Bohemia	300	250	Prague	600 E.	1 4 bef	Papiſts
Netherlands	Holland	150	100	Amſterdam	180 E.	0 18 bef	Calvaniſts
	Flanders	200	200	Bruſſels	180 S. E.	0 16 bef	Papiſts
	France	600	500	Paris	200 S. E.	0 9 bef	Papiſts
	Spain	700	500	Madrid	800 S.	0 17 aft	Papiſts
	Portugal	300	100	Liſbon	850 S.W	0 38 aft	Papiſts
	Switzerland	260	100	Bern, Coire, &c.	420 S.E.	0 28 bef	Calv. & Papiſts
Italy	Several ſm. ſtates	*Piedm. Montſerat, Milan, Parma, Modena, Mantua, Venice, Genoa, Tuſcany* *Turin, Caſal, Milan, Parma, Modena, Mantua, Venice, Genoa, Florence &c.*					
	Popedom	240	120	Rome	820 S E	0 50 bef	Papiſts
	Naples	280	120	Naples	870 S E	1 0 bef	Papiſts
	Hungary	300	200	Buda	780 S E	1 17 bef	Pap. & Proteſt.
Turkey in Europe.	Danubian Provinces	600	420	Conſtantinople	1320 S E	1 58 bef	Mahometans & Greek Church
	Lit. Tartary	380	240	Precop	1500 E	1 24 bef	
	Greece	400	240	Athens	1360 S E	1 37 bef	

This includes the Crim Tartary now ceded to Ruſſia, for particulars of which ſee RUSSIA

N. B. In the above Table and what follows, N. ſtands for North, S. for South, E. for Eaſt, and W. for Weſt.

Excluſive of the Britiſh iſles, before mentioned, Europe contains the following principal Iſlands:

Iſlands.		Chief Towns	Subject to
In the Northern Ocean.	Iceland	Skalholt	Denmark
Baltic Sea	Zealand, Funen, Alſon, Falſter, Langland, Laland, Femeren, Mona, Bornholm,	—	Denmark
	Gothland, Aland, Rugen, —	—	Sweden
	Oſel, Dagho, — —	—	Ruſſia
	Uſedom, Wollin, — —	—	Pruſſia
Mediterranean Sea	Ivica, — —	Ivica,	Spain
	Majorca, — —	Majorca	Ditto
	Minorca, — —	PortMahon	Ditto
	Corſica, — —	Baſtia	France
	Sardina, — —	Cagliari	K. of Sard
	Sicily, — —	Palermo	K. of 2 Sic
Adriatic, or Gulf of Venice.	Luſiena, Corfu, Cephalonia, Zant, Leucadia, —	—	Venice
Archipelago, and Levant Seas.	Candia, Rhodes, Negropont, Lemnos, Tenedos, Scyros, Mytelene, Scio, Samos, Patmos, Paros, Cerigo, Santorim, part of ancient & mod. Greece, &c.	—	Turkey

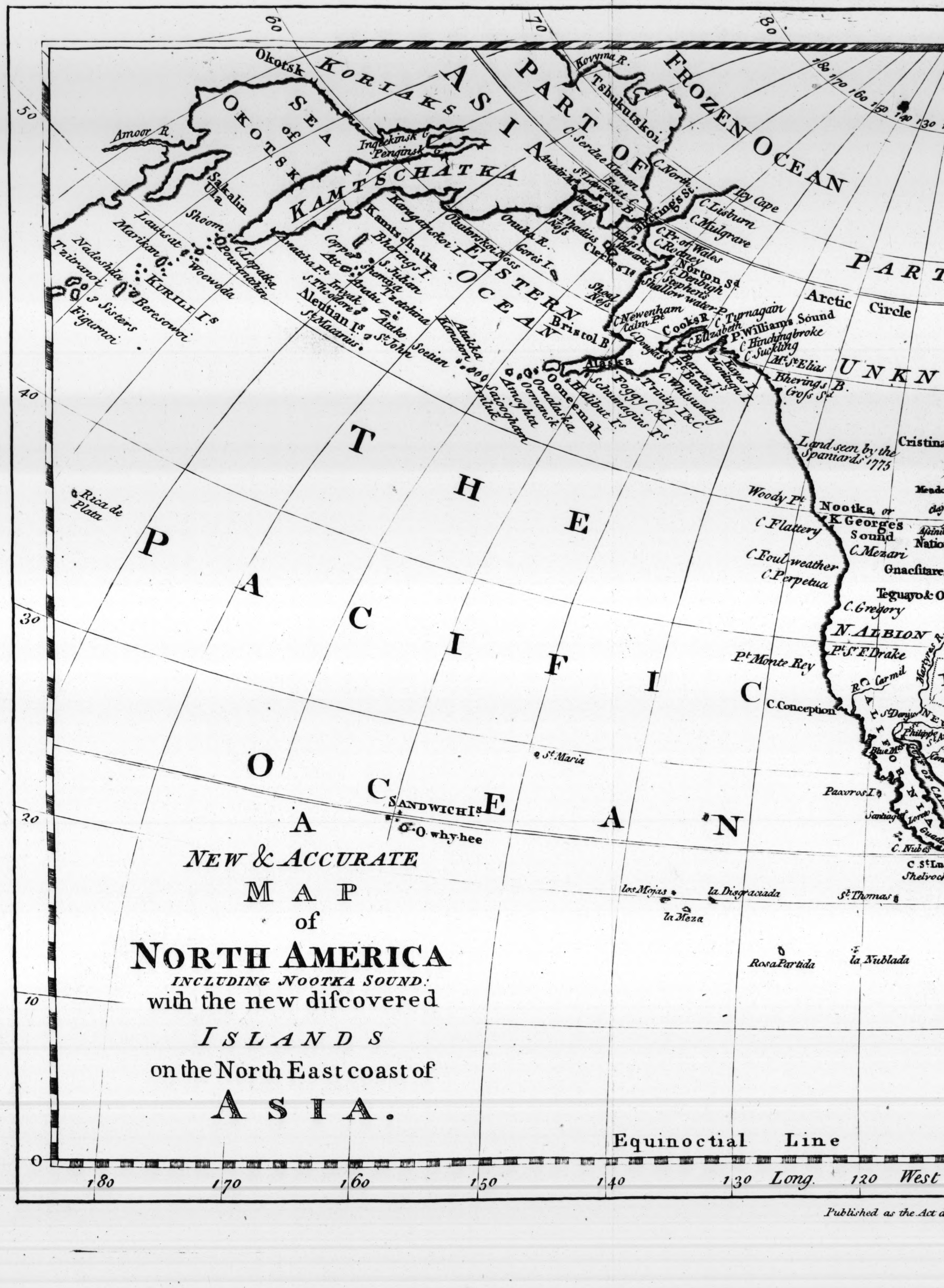
DENMARK.

The dominions of the Daniſh Majeſty are divided into four parts: 1ſt, Eaſt and Weſt Greenland, Iceland, and the iſlands in the Atlantic Ocean; 2d, Norway; 3d, Denmark Proper; and 4th, his German territories.

The dimenſions of theſe countries are as under.

Denmark.		Square Miles.	Length	Breadth	Chief Cities.
Denmark Proper.	North Jutland.	9600	155	98	Wyburg.
	South Jutland, or Sleſwick.	2115	70	63	Sleſwick.
Iſlands at the entrauce of the Baltic Sea.	Zeland,	1935	60	60	COPENHAGEN, N. Lat. 55—41 E. Lon. 12—5
	Funen,	768	38	32	Odenſee.
	Falſter and Langland,	220	27	12	Nikoping. Naxkaw.
	Femeren,	50	13	8	Borge.
	Alſen,	54	15	6	Sonderborge.
	Mona,	39	14	5	Stege.
	Bornholm,	160	20	12	Roſtcomby.
In the N. Seas,	Iceland Iſland.	46000	435	185	Skalholt.
	Norway,	71400	750	170	Bergen.
Daniſh	Lapland,	28400	285	172	Wardhuys.
Weſtphalia,	Oldenburg,	1260	62	32	Oldenburg.
Lower Saxony,	Stormar, Daniſh Hoſtein	1000	52	32	Gluckſtadt.
	Total	163,041			

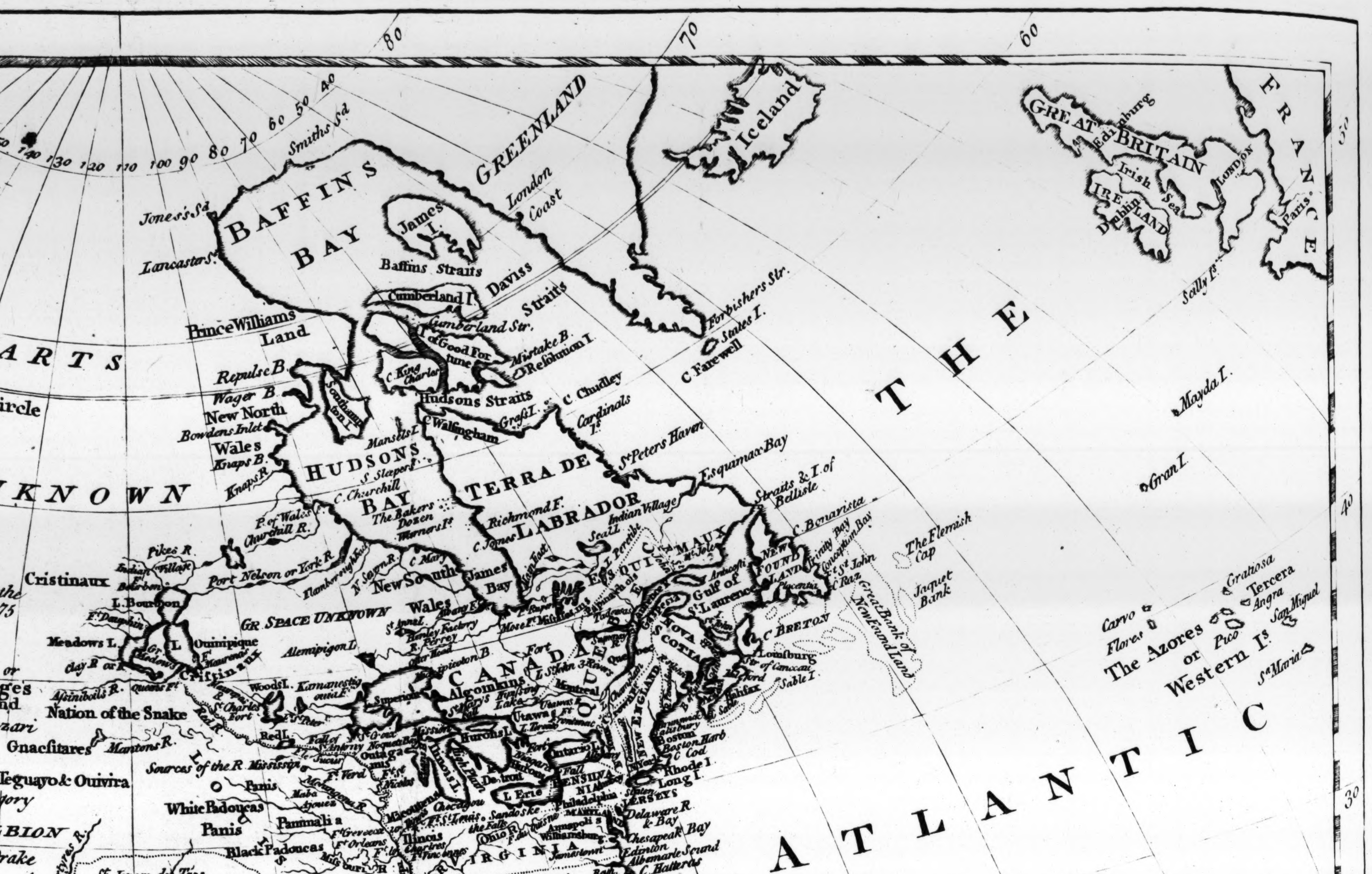
BRITISH
18 MR 63
MUSEUM



A
NEW & ACCURATE
MAP
of
NORTH AMERICA
INCLUDING NOOTKA SOUND:
with the new diſcovered
ISLANDS
on the North East coast of
ASIA.

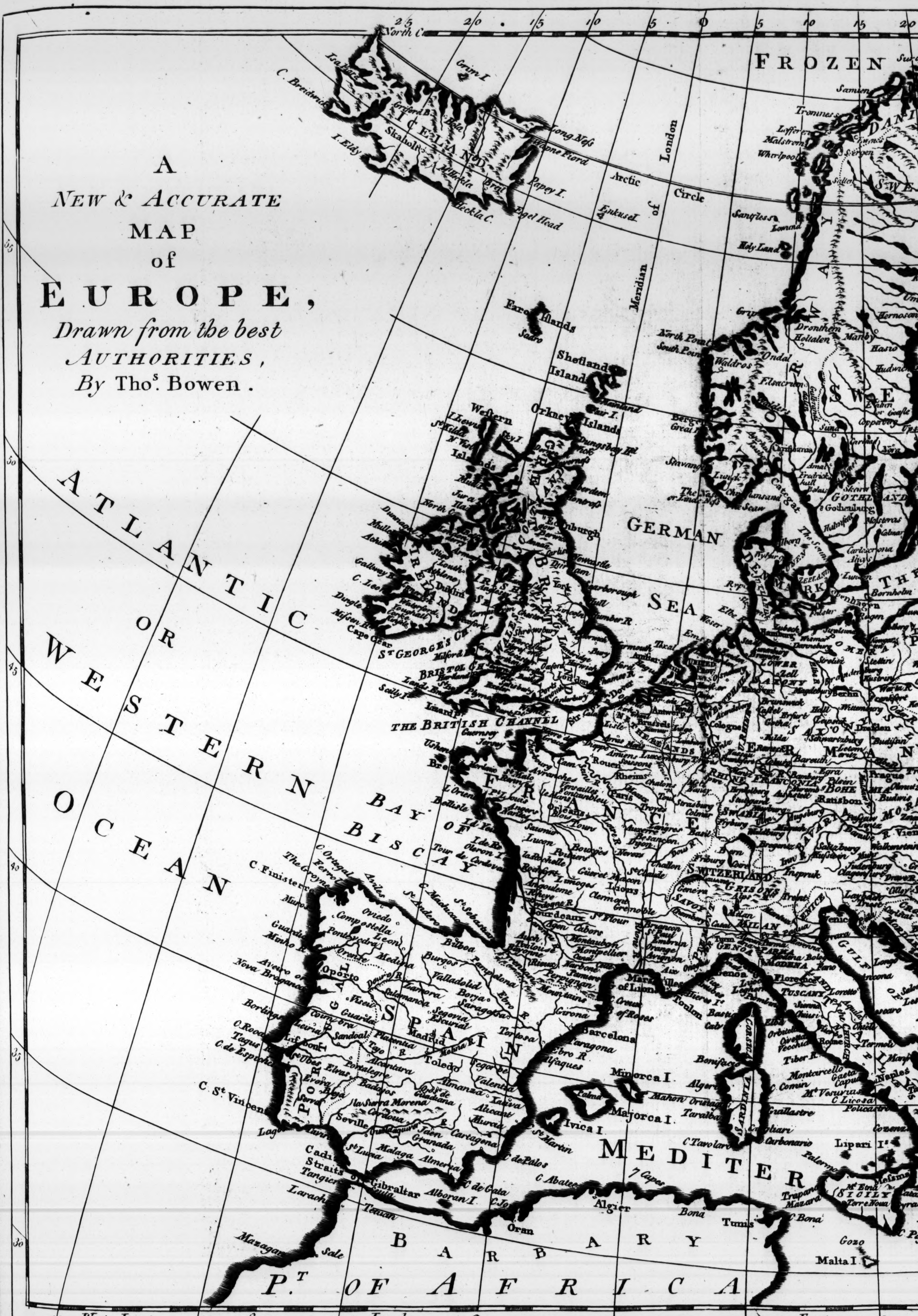
PART OF ASIA
FROZEN OCEAN
KORIAKS
SEA of OKOTSK
KAMTSCHATKA
EASTERN OCEAN
THE PACIFIC OCEAN
Okotsk
Amoor R.
Sakalin
Ula
Shoom
Inquekinsk
Penginsk
Kovyma R.
Tshukutskoi
C. Serdze Kamen
East C.
St. Lawrence B.
C. North
Bherings St.
Icy Cape
C. Lisburn
C. Mulgrave
C. Pr. of Wales
C. Rodney
Norton Sd.
C. Denbigh
Stephens
Shallow water
Clerkes I.
St. Thadius
Shoal Ness
C. Newenham
Calm Pt.
Bristol B.
Cooks R.
C. Elizabeth
C. Turnagain
P. Williams Sound
C. Hinchingbroke
C. Suckling
Mt. St. Elias
Bherings B.
Cross Sd.
Kaye I.
Montagu
Barren Is.
P. Banks
C. Whitsunday
Trinity I. & C.
Foggy C. & I.
Schumagins Is.
Halibut Is.
C. Douglas
Alaska
Oonemak
Oonalaska
Oomanak
Amoghta
Saitoghan
Amluk
Atakka
Kanaton
Soetien
Atako
St. John
Aleutian Is.
St. Macarius
St. Theodore
Copper I.
Att
Shemiya
Bheings I.
S. Julian
Tschitka
Kamtschatka
Karaganskoi I.
Olutorskoi Noss
Anadir
Oruska R.
Gore's I.
Avatcha Pt.
C. Lopatka
Pourumchin
Kurili Is.
Woewoda
Laurcat
Marikan
Nadeschda
Beresowoi
Tzirtanoi
3 Sisters
Figurnoi
Rica de Plata
Arctic Circle
PART
UNKN
Land seen by the Spaniards 1775
Cristina
Woody Pt.
Nootka, or K. Georges Sound
C. Flattery
C. Mezari
C. Foul-weather
C. Perpetua
Gnacsitare
Teguayo
C. Gregory
N. ALBION
Pt. Sr. F. Drake
Pt. Monte Rey
R. Carmil
C. Conception
St. Maria
Sandwich Is.
O-why-hee
Paxoros I.
Santiago
C. Nubes
C. St. Lucas
Shelvocks
Los Mojas
la Disgraciada
la Meza
St. Thomas
Rosa Partida
la Nublada
Equinoctial Line
Long.
West
50
40
30
20
10
0
60
70
80
180
170
160
150
140
130
120

Published as the Act



80
70
60
GREENLAND
Iceland
GREAT BRITAIN
Edinburg
Irish Sea
IRELAND
Dublin
London
FRANCE
Paris
Scilly Is.
BAFFINS BAY
Smiths Sd
Jones's Sd
Lancaster Sd
James I.
London Coast
Baffins Straits
Daviss Straits
Cumberland I.
Cumberland Str.
Prince Williams Land
Forbishers Str.
States I.
C. Farewell
Mayda I.
Repulse B.
Wager B.
New North Wales
Bowdens Inlet
Knaps B.
Hudsons Straits
C. Chudley
Cardinals Is.
HUDSONS BAY
C. Churchill
The Bakers Dozen
St. Peters Haven
Esquimaux Bay
TERRA DE LABRADOR
Richmond F.
Indian Village
Straits & I. of Bellisle
C. Bonavista
NEW FOUND LAND
Trinity Bay
Conception Bay
St. John
C. Raz
The Flemish Cap
Great Bank of Newfoundland
Jaquet Bank
Gran I.
Gratiosa
Tercera
Angra
San Miguel
Carvo
Flores
Pico
St. Maria
The Azores or Western Is.
THE ATLANTIC OCEAN
Cristinaux
Pikes R.
Port Nelson or York R.
New South Wales
James Bay
ESQUIMAUX
Gulf of St. Laurence
C. BRETON
Lousburg
Sable I.
NOVA SCOTIA
Halifax
L. Bourbon
Meadows L.
Ouinipique
Cristinaux
GR. SPACE UNKNOWN
Alemipigon L.
CANADA
Algonkins
Quebec
Montreal
Nation of the Snake
Gnacsitares
Teguayo & Ouivira
Sources of the R. Missisippi
Panis
White Padoucas
Black Padoucas
Padoucas
Panimaha
Kansez
Hurons L.
Detroit
Ontario L.
L. Erie
NEW ENGLAND
Boston
C. Cod
Rhode I.
Long I.
NEW YORK
JERSEYS
PENSILVANIA
Philadelphia
MARYLAND
Delaware R.
VIRGINIA
Chesapeak Bay
Albemarle Sound
C. Hatteras
NORTH CAROLINA
C. Fear
Brunswick
SOUTH CAROLINA
Charlestown
GEORGIA
Savanna
St. Augustine
EAST FLORIDA
WEST FLORIDA
Mobile
Pensacola
New Orleans
Missisippi
The Bermuda or Summer Is.
Tropic of Cancer
NEW MEXICO
Sta. Fe
St. Jerom de Taos
St. Diego
Apacheria
NEW NAVARRE
NEW BISCAY
Parral
Culiacan
C. St. Lucar
Shelvocks I.
C. Corrientes
Xalisco
Guadalaxara
Mexico
Tlascala
Acapulco
Guaxaca
Pasion I.
St. Bernard B.
Bravo or R. del Norte
GULF OF MEXICO
Bay of Campeche
Campeche
Merida
Havanna
C. St. Antonio
CUBA
Isle de Pinos
Caymanes
Jamaica
St. Domingo
Porto Rico
LUCAYOS or BAHAMA IS.
Bahama
St. Salvador
Samana
WINDWARD or CARIBBEE IS.
St. Thomas
Virgin Is.
St. Martins
St. Bartholomew
Barbuda
Antigua
St. Eustatia
St. Kitts
Nevis
Guadalupe
Desirade
Marigalante
Dominico
Martinico
St. Lucia
St. Vincent
Barbados
Grenada
Tobago
Trinidad
LEEWARD ISLES
Curacoa
Buenayre
Aruba
Orchilla
Aves
Margarita
CARIBBEAN SEA
B. of Honduras
Honduras
St. Catalina
St. Andres
Nicaragua
Leon
G. of Fonseca
Pta. Remedios
Guevettan
C. Blanco
Costa Rica
Veragua
Panama
Portobello
Carthagena
Darien
Samba
Quicaro
C. Corrientes
Gallapagos Is.
Gallego I.
C. St. Francisco
R. de la Hacha
Maracaybo
Cumana
Mouths of the Orinoco
Truxillo
Apure R.
Pamplona
St. Thome de Guyana
PART OF SOUTH AMERICA
Popayan
Paraguay R.
Parathans
Cayenne I. & T.
St. Louis
North Cape
West 110 from 100 London 90 80 70 60 50 40

d as the Act directs by C. Cooke No. 17 Paternoster Row



A
New & Accurate
MAP
of
EUROPE,
Drawn from the best
Authorities,
By Thos. Bowen.

FROZEN
ICELAND
Arctic Circle
Meridian of London
Faro Islands
Shetland Islands
Orkney Islands
Western Islands
GERMAN SEA
ATLANTIC OR WESTERN OCEAN
St. GEORGE'S CH.
BRISTOL CH.
THE BRITISH CHANNEL
IRELAND
BRITAIN
DENMARK
SWEDEN
NORWAY
FRANCE
BAY OF BISCAY
SPAIN
PORTUGAL
SWITZERLAND
SAXONY
MEDITER
BARBARY
Pt. OF AFRICA
SICILY
SARDINIA
CORSICA
Majorca I.
Minorca I.
Ivica I.
Malta I.
Gozo
Lipari Is.
Straits of Gibraltar
Algier
Tunis
Oran
Tangier
Larache
Mazagan
Sale
Tetuan
Cadiz
Seville
Granada
Malaga
Madrid
Toledo
Lisbon
Oporto
Barcelona
Marseilles
Toulon
Genoa
Rome
Naples
Paris
Orleans
Lyons
Bourdeaux
Rouen
Brest
London
Edinburgh
Dublin
York
Amsterdam
Antwerp
Brussels
Cologne
Hamburg
Lubeck
Berlin
Dresden
Prague
Ratisbon
Vienna
Copenhagen
Bergen
Dronthen
Gothenburg
Bornholm
Gulf of Venice
C. Finisterre
C. St. Vincent
C. de Gata
C. de Palos
Frozen Sea
North C.
25 20 15 10 5 0 5 10 15 20
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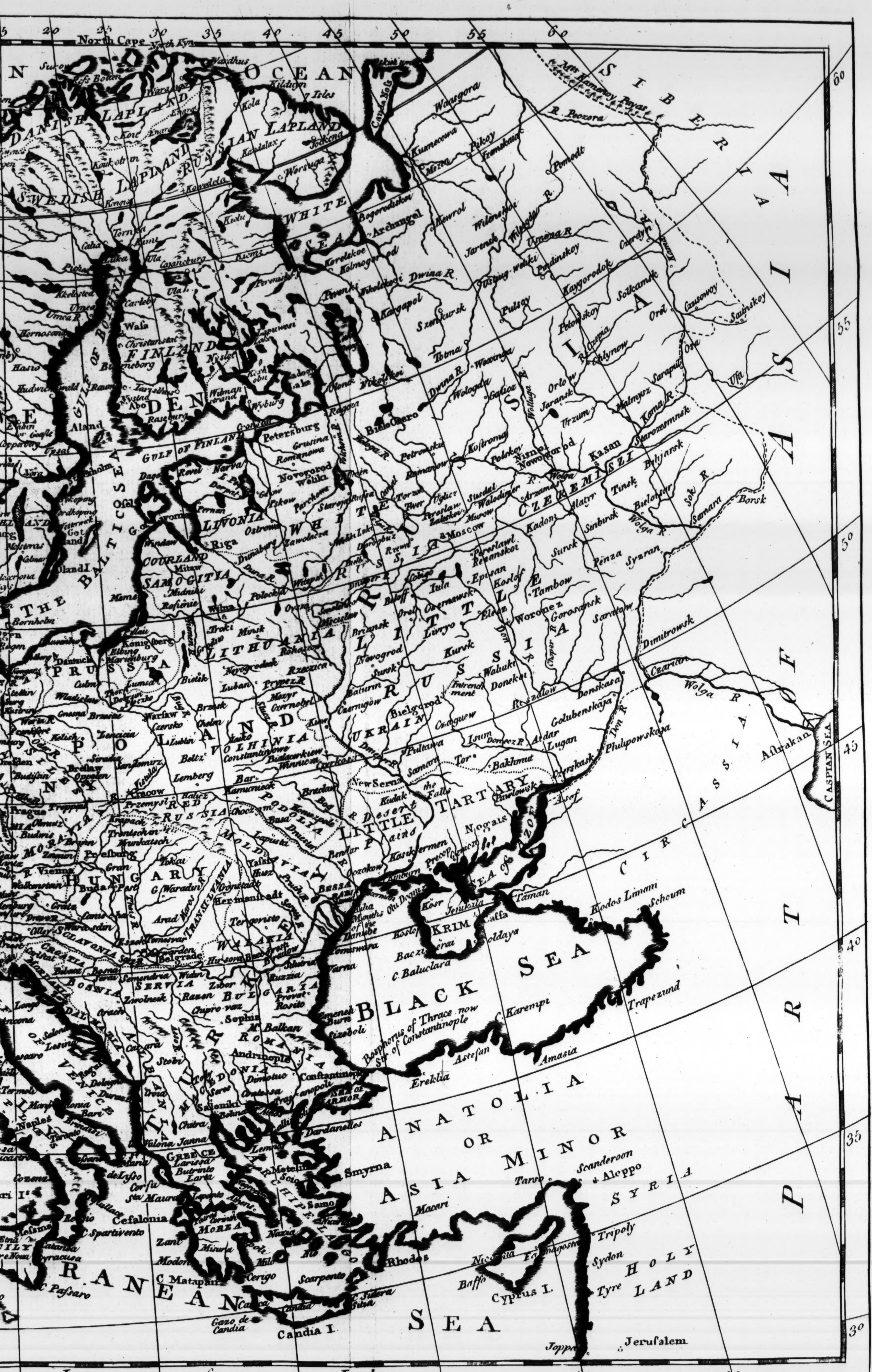
North Cape
OCEAN
DANISH LAPLAND
SWEDISH LAPLAND
RUSSIAN LAPLAND
WHITE SEA
Archangel
Kola
Wardhus
7 Isles
Candanos
SIBERIA
R. Peczora
Woxagora
Kumecowa
Pustozer
Wilenskoi
Jarensk
Ustiug welik
Dwina R.
Kargapol
Solikamsk
Kaygorodok
FINLAND
GULF OF BOTHNIA
Abo
Aland
Wasa
Kexholm
Wiburg
GULF OF FINLAND
Petersburg
Novogorod
Narva
Revel
LIVONIA
Riga
COURLAND
SAMOGITIA
Mitaw
Memel
THE BALTIC SEA
Stockholm
Upsal
Gotland
Oland I.
Bornholm
PRUSSIA
Königsberg
Dantzick
Elbing
Marienburg
Thorn
LITHUANIA
Wilna
Grodno
Minsk
Smolensko
Moscow
Twer
Kostroma
Jaroslaw
Wologda
Kasan
Nisi Novogorod
Wolga R.
CZEREMISZI
Simbirsk
Samara
Saratow
Penza
Tambow
Woronez
Tula
Kaluga
Orel
Kursk
Bielgorod
LITTLE RUSSIA
RUSSIA
WHITE RUSSIA
UKRAIN
Czernigow
Kiow
Pultawa
Dnieper R.
Don R.
Donkoi
Czaritzin
Astrakan
CASPIAN SEA
CIRCASSIA
Asof
SEA of ZABACHE
LITTLE TARTARY
Nogais
Crim
Kaffa
Oczakow
Bender
Precop
POLAND
Warsaw
Cracow
Lemberg
Lublin
VOLHINIA
PODOLIA
Kaminiec
RED RUSSIA
MOLDAVIA
Jassy
BESSARABIA
TRANSILVANIA
Hermanstadt
WALACHIA
Bucharest
HUNGARY
Buda
Pest
Presburg
Vienna
Temeswar
Belgrade
SCLAVONIA
CROATIA
BOSNIA
SERVIA
BULGARIA
Sophia
Adrianople
Constantinople
ROMANIA
MACEDONIA
Saloniki
TURKEY
ALBANIA
GREECE
MOREA
Athens
Cefalonia
Zant
C. Matapan
Cerigo
Candia I.
Rhodes
Smyrna
Dardanelles
ANATOLIA OR ASIA MINOR
BLACK SEA
Bosphorus of Thrace now Str. of Constantinople
Trapezund
Sinope
Amasia
Erekli
Tarsus
Scanderoon
Aleppo
SYRIA
Tripoly
Sydon
Tyre
HOLY LAND
Jerusalem
Joppa
Cyprus I.
Nicosia
Famagusta
Baffa
SEA
MEDITERRANEAN
Naples
Sicily
Syracusa
C. Passaro
C. Spartivento
PARTS OF ASIA
Long. from London
15
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60

GEOGRAPHY.

AST AND WEST GREENLAND, ICELAND, AND THE ISLANDS IN THE ATLANTIC OCEAN.

EAST GREENLAND — Or as others call it, New Green- and or the country of Spitzbergen, lie between 9 and 20 deg. E. ong. 76 and 81 deg. N. lat. according to captain Phipps's obſer- ations in his Voyage 1773. It was diſcovered by Sir Hugh Villoughby in 1553; and is ſuppoſed to be a continuation of Old Greenland. It obtained the name of Spitzbergen from the height nd raggedneſs of its rocks. There is a whale-fiſhery, chiefly pro- ecuted by the Dutch and ſome Britiſh veſſels, on its coaſts. It ikewiſe contains two harbours; one called South Haven, and the ther Maurice Bay; but the inland parts are uninhabited.

WEST GREENLAND — Lies between the meridian of Lon- on, and 50 deg. W. long. and between 60 and 76 deg. N. lat. The taking of whales in the ſeas of Greenland, among the fields f ice that have been increaſing for ages, is one of the greateſt cu- oſities in nature. Theſe fields, or pieces of ice, are frequently nore than a mile in length, and upwards of a 100 feet in thick- eſs; and when they are put in motion by a ſtorm, nothing can e more terrible; the Dutch had thirteen ſhips cruſhed to pieces y them in one ſeaſon.

ICELAND — Receives its name from the great maſſes of ice hat are ſeen near it: lies between 63 and 67 deg. N. lat. and be- ween 11 and 27 deg. W. long. It extends four hundred miles n length, and an hundred and ſixty in breadth, containing about 6000 ſquare miles. In April, 1783, the inhabitants of Iceland bſerved ſomething riſen and flaming in the ſea, to the ſouth of Grinbourgh, at eight miles diſtant from the rocks des Oiſeaux, which afterwards was found to be a new iſland. The fact is au- hentic, but its dimenſions and ſituation are not yet well aſcertained. n this Iſland are many volcanoes; the principal, is that called Heckla ſituated in the ſouthern part about four miles from the ſea- oaſt. Its eruptions were particularly dreadful in 1693, when hey occaſioned terrible devaſtations, the aſhes being thrown all ound the iſland to the diſtance of 180 Engliſh miles. But amongſt ll the curioſities in Iceland, nothing is more worthy of attention han the hot ſpouting water-ſprings with which this iſland abounds. n ſeveral of theſe hot ſprings, the inhabitants who live near them oil their victuals, only by placing a pot of cold water, into which he fleſh is put, to a certain depth within the ſpring.

NORWAY. — The natural ſignification of Norway is the *Nor- hernway.* It is bounded on the South by the entrance into the Baltic alled the Scaggerac, or Categate; on the Weſt and North by the orthern ocean; and on the Eaſt it is divided from Sweden by long ridge of mountains, called at different parts by different arts by different names; as Fillefield, Dofrefield, Runfield, and Dourfield. The reader may conſult the table of dimenſions in Denmark for its extent; but it is a country ſo little known to the eſt of Europe, that it is difficult to fix its dimenſions with preci- ion. This is one of the moſt mountainous countries in the world; for it contains a chain of unequal mountains running rom ſouth to north: to paſs that of Hardanger, a man muſt tra- el about ſeventy Engliſh miles; and to paſs others, upwards of ifty. Dofrefield is counted the higheſt mountain perhaps in Eu- ope. Norway contains quarries of excellent marble as well as nany other kinds of ſtones; and the magnet is found in the iron nines. As are cryſtals, granates, amethyſts, agate, thunder ſtones nd eagle-ſtones. There are alſo gold, ſilver, lead, copper, and iron-mines in this country.

DENMARK PROPER, OR JUTLAND, exclusive of the ISLANDS in the BALTIC.

	Miles.		Degrees.
Length	240	lies between	54 and 58 North latitude.
Breadth	114		8 and 11 Eaſt Longitude.

It is divided on the North from Norway by the Scaggerac ſea, nd from Sweden on the Eaſt by the Sound; on the South by Ger- many and the Baltic; and the German ſea divides it from Great Britain on the Weſt. Denmark Proper is divided into two parts: he peninſula of Jutland anciently called *Cimeria Cherſoneſus*, and he iſlands at the entrance of the Baltic, mentioned in the table. t is remarkable, that though all theſe together conſtitute the king- dom of Denmark, yet not any one of them is ſeparately called by hat name. Copenhagen, the metropolis, is in the iſland of Zea- and. In all the northern provinces of Denmark the winters are very ſevere, ſo that the inhabitants often paſs arms of the ſea in ſledges upon the ice; and during the winter all their harbours are frozen up. Copenhagen, ſituated on the fine iſland of Zealand, was ori- inally a ſettlement of ſailors, and firſt founded by ſome wandering fiſhermen in the twelfth century, but is now the metropolis, Co- penhagen has an harbour, formed by a large canal flowing through the city, which admits indeed but only one ſhip to enter at a time, but is capable of containing 500.

HIS DANISH MAJESTY's GERMAN DOMINIONS.

HOLSTEIN, a duchy of Lower Saxony, about 100 miles long nd 50 broad, and a fruitful country, was formerly divided be- ween the empreſs of Ruſſia (termed Ducal Holſtein), the king of Denmark, and the imperial cities of Hamburgh and Lubeck; but on the 16th of November, 1773, the Ducal Holſtein, with all the ights, prerogatives, and territorial ſovereignty, was formerly tranſ- erred to the king of Denmark, by virtue of a treaty between both courts. The famous city of Hamburgh lies, in a geographical ſenſe, in Holſtein; but is an imperial, free, and Hanſeatic city, lying on the verge of that part of Holſtein, called Stormar. It has the ſovereignty of a ſmall diſtrict round it, of about 10 miles circuit; and is one of the moſt flouriſhing commercial towns in Europe. Lubec, an imperial city, with a good harbour, and once the capital of the Hans Towns, and ſtill a rich and populous place, is alſo in this duchy.

LAPLAND.—The northern ſituation of Lapland, and the diviſion of its property, require, before I proceed farther, that I ſhould treat of it under a diſtinct head, and in the ſame method that I obſerve in other countries. The whole country of Lapland extends, ſo far as it is known, from the North Cape in 71° 30′ N. lat. to the White Sea, under the arctic circle. Part of Lapland belongs to the Danes, and is included in the government of Wardhuys; part to the Swedes, which is by far the moſt valuable; and ſome parts in the eaſt, to the Muſcovites or Ruſſians.

That belonging to the Swedes comprehends all the country from the Baltic, to the mountains that ſeparate Norway from Sweden. The Muſcovite part lies towards the Eaſt, between the lake Enarak and the White Sea. The Daniſh Laplanders can be ſaid to be under no regular government. The Swediſh Lapland, therefore, is the object chiefly conſidered by authors in deſcribing this country. It has been generally thought, that the Laplanders are the deſcendants of Finlanders driven out of their own country, and that they take their name from *Lappes*, which ſignifies exiles. Silver and gold mines, as well as thoſe of iron, copper, and lead, have been diſcovered and worked in Lapland to great advantage; beautiful cryſtals are found here, as are ſome Amethiſts and topazes; alſo various ſorts of Mineral ſtones, ſurprizingly poliſhed by the hand of nature; valuable pearls have likewiſe been ſometimes found in theſe rivers, but never in the ſeas.

	Miles. ——	SWEDEN.	—— Degrees.
Length	800	lies between	56 and 69 North latitude.
Breadth	500		10 and 30 Eaſt longitude.

This country is bounded by the Baltic Sea, the Sound, and the Categate, or Scaggerac, on the South; by the impaſſable mountains of Norway, on the Weſt; by Daniſh or Norwegian Lapland, on the North; and by Muſcovy on the Eaſt. It is divided into ſeven provinces: 1. Sweden Proper. 2. Gothland. 3. Livonia. 4. Ingria. (Theſe two laſt provinces belong now, however, to the Ruſſians, having been conquered by Peter the Great, and ceded by poſterior treaties.) 5. Finland. 6. Swediſh Lapland. And 7. The Swediſh iſlands. Great abatements muſt be made for the lakes and unimproved parts of Sweden; which are ſo extenſive, that the habitable part is confined to narrow bounds. The following are the dimenſions given us of this kingdom.

Sweden.	Square Miles	Sum total.	Length.	Breadth,	Capital Cities.
	76,835	228,715			
Sweden Proper —	47,900		342	194	STOCKHOLM. N. Lat. 59—30. E. Long. 19—15.
Gothland — —	25,975		253	160	Calmar.
Schonen — —	2,960	76,835	77	56	Lunden.
Lapland and W. Bothnia —	76,000		420	340	Torne. Uma.
Swediſh Finland, and Eaſt Bothnia	73,000		395	225	Abo. Dajenburgh.
Gothland I.	1000		80	23	Wiſby.
Oeland I.	560	150,560	84	9	Barkholm.
Upper Saxony Pomerania, P.	960		47	24	Stralſund.
Upper Saxony Rugen I.	360	1,320	24	21	Bergen.

Of Sweden Proper, the following are the ſubdiviſions: *Uplandia, Sudermania, Weſtmania, Nericia, Geſtricia, Helſingia, Dalicarlia, Medelpedia, Angermania, Jemptia.*

Of Gothland, the following are the ſubdiviſions: *Eaſt Gothland, Weſt Gothland, Smaland, Wermeland, Dalia, Schonen, Bleking, Halland.*

Of Swediſh Lapland, the following are the ſubdiviſions: *Thorn Lapmark, Kimi Lapmark, Lula Lapmark, Pithia Lapmark, Uma Lapmark.*

The principal places in Weſt Bothnia are Umea, Pitea, and Tornea.

Of Finland, the following are the ſubdiviſions: *Eaſt Bothnia, Cajania, Savoloxia, Nyland, Travaſtia, Finland Proper.*

The Swediſh iſles are *Gothland, Oeland, Aland,* and *Rugen.*

The face of Sweden is pretty ſimilar to thoſe of its neighbouring countries; only it has the advantage of navigable rivers. Sweden produces cryſtals, amethyſts, topazes, porphyry, lapis-lazuli, agate, cornelian, marble, and other foſſils. The chief wealth of Sweden, however, ariſes from her mines of ſilver, copper, lead, and iron. The laſt mentioned metal employs no fewer than 450 forges, hammering-mills, and ſmelting-houſes. A kind of a gold mine has likewiſe been diſcovered in Sweden, but ſo inconſiderable, that from the year 1741 to 1747, it produced only 2,398 gold ducats, each valued at 9s. 4d. ſterling. Their ſeas are the Baltic, and the gulfs of Bothnia and Finland, which are arms of the Baltic; and on the weſt of Sweden are the Categate ſea, and the Sound, a ſtrait about four miles over which divides Sweden from Denmark.

Theſe ſeas have no tides, and are frozen up uſually four months in the year; nor are they ſo ſalt as the ocean, never mixing with it, becauſe a current ſets always out of the Baltic ſea into the ocean. Stockholm is a ſtaple-town, and the capital of the kingdom; it ſtands about 760 miles north-eaſt from London, upon ſix contiguous iſlands, and built upon piles. The caſtle, accommodates the royal court, and the national courts and colleges. The harbour is ſpacious and convenient, though difficult of acceſs, and this city is furniſhed with all the exterior marks of magnificence, and erections for manufactures and commerce that are common to other great European cities.

MUSCOVY, OR THE RUSSIAN EMPIRE IN EUROPE AND ASIA.

Situation and Extent of the Ruſſian Empire in EUROPE.

Miles		Degrees.
Length 1500	lies between	23 and 65 Eaſt longitude.
Breadth 1100		47 and 72 North latitude.

According to the moſt authentic accounts of this mighty empire, it conſiſts of fifteen (Mr. Voltaire ſays ſixteen) provinces or governments; beſides part of Carelia, Eſthonia, Ingria, Livonia, and part of Finland, which were conquered from Sweden; the Crimea, or Crim Tartary, anciently the Taurica Cherſoneſus, a peninſula in the Euxine ſea, ſubject to the Turks formerly, but added in the year 1783 to the Ruſſian empire, with the iſle of Taman, and part of Cuban; alſo the duchy of Courland in Poland, of which the empreſs of Ruſſia has now the entire diſpoſal.

The following Table will give ſome idea of the Ruſſian empire, properly ſo called, or Ruſſia in Europe, with its acquiſitions from Sweden in the preſent century. And alſo of the Ruſſian empire in its moſt extenſive ſenſe; for we muſt alſo include all the acquiſitions in Tartary, now known by the name of Siberia: the whole comprehending the northern parts of Europe and Aſia, ſtretching from the Baltic and Sweden on the Weſt, to Kantſchatka and the Eaſtern Ocean; and on the North, from the Frozen Ocean to the forty-ſeventh degree of latitude, where it is bounded by Poland, Little Tartary, Turkey, Georgia, the Euxine and Caſpian Seas, Great Tartary, Chineſe Tartary, and other unknown regions in Aſia. The country now compriſed under the name of Ruſſia or the Ruſſias, is of an extent nearly equal to all the reſt of Europe, and greater than the Roman empire in the zenith of his power, or the empire of Darius ſubdued by Alexander, or both put together.

	Ruſſian empire In Europe.	Square Miles.	Length.	Breadth.	Chief Cities.
Greek Church	Ruſ. or Muſc	784,650	1160	1050	Moſcow.
	Belgorod,	72,900	375	285	Waronetz.
	Don Coſſacs,	57,000	400	280	Panchina.
	Uk. Coſſacs,	45,000	330	205	Kiow.
	Lapland,	72,000	405	270	Kola.
Conquered from Sweden ſince 1700.	Ruſ. Finland,	41,310	320	180	Wyburg.
	Livonia,	21,525	218	145	Riga.
	Ingria,	9,100	175	90	PETERSBURGH { N Lat. 60 e. l. 30 25
Seized from the Turks in 1783,	Crim Tart.	8,200	160	15	Kaffa.
	Ruſſian Emp. in Aſia.				
Chriſtians and Idolaters.	Muſco. Tartary & Siberia,	2,000,000	3150	1500	Tobolſky.
	Kalm. Tart.	850,000	2100	750	Aſtrachan.
	Total	4,161,685			

Ruſſia has been alſo ſubdivided into thirty-one Provinces, viz.

Northern Provinces.—1. *Lapland*; 2. *Samoida*; 3. *Ballamorenſkey*, 4. *Meſeen*; 5. *Dwina*; 6. *Syrianes*; 7. *Permia*; 8. *Rubeninſki*; 9. *Belæſeda.*

Middle Provinces.—10. *Rezan*; *or Pereſlaf*; 11. *Belozero*; 12. *Wologda*, 13. *Jeraſlaf*, 14. *Tweer*, 15. *Moſcow*, 16. *Belgorod.*

Eaſtern Provinces.—17. *Bulgar*; 18. *Kaſan*; 19. *Tſcheremiſſi*; 20. *Little Novogrod*; 21. *Don Coſſacs.*

Weſtern Provinces.—22. *Great Novogrod*; 23. *Ruſſian Finland*, 24. *Kexholm*; 25. *Kaleria*; 26. *Ingria.*

Southern Provinces.—27. *Livonia*; 28. *Smolenſko*; 29. *Zernigof*; 30. *Secfſk*; 31. *Ukraine, or country of the Old Coſſacs.*

Mr. Fooke, chaplain to the Britiſh factory at Peterſburgh, who publiſhed an account of Ruſſia, has enumerated the following nations as comprehended in this great empire.

Mongouls, Kalmucs, Tartars, Samoides, Oſtiacs, Burattians, Jakutans, Tunguſians, Voguls, Laplanders, Finns, Lettonians, Eſthonians, Lieffs, Ingrians, Tſcheremiſſes, Tſcouwaſches, Mordvines, Votiaks, Terptyaireis, Tartars of Kaſan and Orenburg, Tartars of Tobolſk, Tartars of Tomſk, Nogayan Tartars, Tartars of the Ob, Tſchoulym Tartars, Katſchintz Tartars, Teleutes, Abinzes, Biryouſſes, Kurilians, Kiſtim and Toulibert Tartars, Vergo Tomſkoi Tartars, Sayun Tartars, Touralinzes, Bougharians, Baſchkirians, Meſtſceraiks, Barabinzes, Kirkguiſians, Beltirians, Yakoutes, Kamtſchadales; and various others: but ſome of which muſt be conſidered rather as diſtinct tribes than as diſtinct nations. As to the names of Ruſſia and Muſcovy, by which this empire is arbitrarily called, they probably are owing to the ancient inhabitants, the Ruſſi, or Boruſſi, and the river Moſca, upon which the ancient capital Moſcow was built.

Ruſſia is in general a flat, level country, except towards the north, where lie the Zimnopoias mountains, thought to be the famous Montes Riphæi of the ancients, now called the Girdle of the Earth. On the weſtern ſide of the Dnieper comes in part of the Carpathian mountains, and between the Black Sea and the Caſpian, mount Caucaſus borders a range of vaſt plains extending on the ſea of Oral. And here we may obſerve, that from Peterſburgh to Pekin, we hardly meet with a mountain on the road through Independent Tartary; and from Peterſburgh to the north part of France, by the road of Dantzic, Hamburgh, and Amſterdam, we ſcarcely can perceive the ſmalleſt hill.

The moſt conſiderable rivers are the Wolga, or Volga, running eaſt and ſouth, which, after traverſing the greateſt part of Muſcovy, and winding a courſe of 3000 Engliſh miles, diſcharges itſelf into the Caſpian ſea; it is not only reckoned the largeſt, but one of the moſt fertile rivers. By means of this extenſive river, the city of Moſcow preſerves a communication, not only with all the ſouthern parts of Ruſſia, but even with Perſia, Georgia, Tartary, and other countries bordering on the Caſpian ſea. The Don, or Tanais, which divides the moſt eaſtern part of Ruſſia from Aſia; and in its courſe towards the eaſt, comes ſo near the Wolga, that the late czar had undertaken to have a communication between them by means of a canal: this grand project, however, was defeated by the irruptions of the Tartars. This river, excluſive of its turnings and windings, diſcharges itſelf into the Palus Mæctis, or ſea of Aſoph, about four hundred miles from its riſe. The Boriſthenes, or Dnieper, which is likewiſe one of the largeſt rivers in Europe, runs through Lithuania, the country of the Zaporog Coſſacs, and that of the Nagaiſch Tartars, and falls into the Euxine, or Black Sea, at Kinburn, near Oczakow; it has thirteen cataracts within a ſmall diſtance.

Peterſburgh, the Emporium of Ruſſia and capital of the province of Ingria, lies at the junction of the Neva with the lake Ladoga, in latitude 60, on both ſides the river Neva between that lake and the bottom of the Finland gulph; it extends about ſix miles every way; and contains every ſtructure for magnificence, the improvement of the arts, revenue, navigation, war, commerce, and the like, that are to be found in the moſt celebrated cities in Europe. The city of Moſcow was formerly the glory of this great empire, and it ſtill continues conſiderable enough to figure among the capitals of Europe. It ſtands on the river from whence it takes its name, in lat. 55-45, and about 1414 miles north-eaſt of London; and though its ſtreets are not regular, it preſents a very pictureſque appearance; for it contains ſuch a number of gardens, groves, lawns, and ſtreams, that it ſeems rather to be a cultivated country than a city.

SCOTLAND AND ITS ADJACENT ISLES.

Before we proceed to the deſcription of this kingdom, we ſhall give ſome account of the iſlands of Shetland, Orkney, and the Hebrides, or Weſtern iſles.

The iſlands of Shetland lie north-eaſt of the Orcades, or Orkney-iſlands, between 60 and 61 degrees of north latitude, and make part of the ſhire of Orkney. The Orcades lie north of Dungſby-head, between 59 and 60 degrees of north latitude; divided from the continent by a tempeſtuous ſtrait called Pentland Frith, 24 miles long and 12 broad. The Hebrides, or Weſtern iſles, are very numerous, and ſome of them large; ſituated between 55 and 59 degrees of north latitude.

The largeſt of the Shetland iſlands, which are forty-ſix in number (though many of them are uninhabited), is Mainland, which is 60 miles in length, and 20 in breadth. Its principal town is Larwick. Skalloway is another town, where the remains of a caſtle are ſtill to be ſeen, and it is the ſeat of a preſbytery. The largeſt of the Orkney iſlands, which are about thirty in number (though ſeveral of them are unpeopled), is called Pomona. Its length is 33 miles, and its breadth, in ſome places, nine. It contains four excellent harbours. The Iſle of Mull, in the Hebrides, is twenty-four miles long, and, in ſome places, almoſt as broad. The other principal weſtern iſland are, Lewis, or Harries, (for they both form but one iſland), which belongs to the ſhire of Roſs, and is 100 miles in length, and 13 or 14 in breadth; its chief town is Stornway. Sky, belonging to the ſhire of Inverneſs, is 40 miles long, and, in ſome places, 30 broad; fruitful and well peopled. Bute, is about ten miles long, and three or four broad. The iſles of Ila and Jura, are part of Argyleſhire, and contain together about 370 ſquare miles. North Uiſt contains an excellent harbour, called Lochmoddy, famous for herring-fiſhing.

Miles. ——	SCOTLAND.	—— Degrees.
Length 300	lies between	54 and 59 North latitude.
Breadth 100		1 and 6 Weſt longitude.

It is termed by the Italians, Scotia; by the Spaniards, Eſcotia: by the French, Eſcoſſe; and Scotland by the Scots, Germans, and Engliſh. Scotland, which contains an aræa of 27,794 ſquare miles, is bounded on the South by England; and on the north, eaſt, and weſt, by the Deucaledonian, German, and Iriſh ſeas, or, more properly, the Atlantic ocean. Scotland is divided into the countries ſouth of the Frith of Forth, the capital of which, and of all the kingdom, is Edinburgh; and thoſe to the north of the ſame river, where the chief town is Aberdeen. This was the ancient national diviſion; but ſome modern writers, with leſs geographical accuracy, have divided it into Highlands and Lowlands, on account of the different habits, manners, and cuſtoms of the inhabitants of each. Eighteen countries, or ſhires, are allotted to the ſouthern diviſion, and 15 to the northern; and thoſe countries are ſubdivided into ſheriffdoms, ſtewarties, and bailiwicks, according to the ancient tenures and privileges of the landholders.

Shires.	Sheriffdoms and other ſubdiviſions.	Chief Towns.
1. Edinburgh	Mid Lothian —	Edinburgh, W. lon. 3. N. lat. 56. Muſſelburgh, Leith, and Dalkeith.
2. Haddington	Eaſt Lothian —	Dunbar, Haddington, and North Berwick.
3. Merſe, anciently Berwick †	The Merches, and Lauderdale —	Dunſe, and Lauder.
4. Roxborough	Tiviotdale, Lidſdale, Eſkdale, and Euſdale,	Jedburgh, Kelſo, and Melros.
5. Selkirk	Ettrick Foreſt —	Selkirk.
6. Peebles	Tweedale —	Peebles.
7. Lanerk	Clydeſdale —	Glaſgow, W. lon. 4-5. N. lat. 55-52. Hamilton, Lanerk, and Rutherglen.
8. Dumfries	Nithſdale, Annandale	Dumfries, Annan.
9. Wigtown	Galloway, Weſt part	Wigtown, Stranraer, and Whitehorn.
10. Kircudbright	Galloway, Eaſt part	Kircudbright
11. Air	Kyle, Carrick, and Cunningham —	Air, Kilmarnock, Irwin, Maybole, Stewarton and Saltcots.
12. Dumbarton	Lenox — —	Dumbarton.
13. Bute 14. Caithneſs	Bute, Arran and Caithneſs — —	Rothſay. — — Wick, N. lat. 58-40. and Thurſo.
15. Renfrew	Renfrew —	Renfrew, Paiſley, Greenock, and Port-Glaſgow.
16. Stirling	Stirling —	Stirling and Falkirk.
17. Linlithgow	Weſt Lothian —	Linlithgow, Burroughſtonneſs, & Queen's-ferry.
18. Argyle	Argyle, Cowal, Knap-Dale, Kintire, Lorn, part of Weſtern Iſles, Iſla, Jura, Mull, Wiſt, Terif, Col, Liſmore	Inverary, Dunſtaffnage, Killonmer, & Campbeltown
19. Perth	Perth, Athol, Gowry, Broadalbin, Monteith, Strathern, Stormont, Glenſhield, Raynork	Perth, Scone, Dumblane, Blair, & Dunkeld.
20. Kincardin	Merns — —	Bervie, Stonhive, and Kincardin.
21. Aberdeen	Mar, Buchan, Garioch, and Strathbogie	Old Aberdeen, New Aberdeen, Fraſerſburgh, Peterhead, Kintore, and Strathbogie
22. Inverneſs	Aird, Strathglaſs, Sky, Harris, Badenoch, Lochaber, Glenmoriſon	Inverneſs, Inverlochy, Fort Auguſtus, Boileau
23. Nairne 24. Cromartie	Weſtern part of Murray and Cromartie	Nairne, Cromartie.
25. Fife	Fife — —	St. Andrews, Cowper, Falkland, Kirkaldy, Innerkythen, Ely, Dumfermline, Dyſart, Anſtruther, and Aberdour
26. Forfar	Forfar, Angus —	Montroſe, Forfar, Dundee, Arbroth, & Brechin.
27. Bamff	Bamff, Strathdovern, Boyne Euzy, Balveny, Strathawin,	Bamff and Cullen
28. Sutherland	Strathnaver and Sutherland. —	Strathy and Dornoch.
29. Clacmannan 30. Kinroſs	Fife part — —	Culroſs, Clacmannan, Alloa, and Kinroſs
31. Roſs	Eaſter & Weſter Roſs Iſles of Lewis Lochbroom, Lochcarren, Ardmeanach, Ferrintoſh, Strathpeffer, and Ferrindonald.	Taine, Dingwall, Fortroſe, Roſamarkie, & New Kelſo.
32. Elgin	—Murray & Strathſpey—	Elgin and Forres.
33. Orkney	Iſles of Orkney and Shetland. —	Kirkwall W. lon. 3. N. lat. 79. 45. and Skalloway, N. lat. 61.

In all thirty-three ſhires, which chooſe thirty repreſentatives to ſit in the parliament of Great Britain; Bute and Caithneſs chooſing alternately, as do Nairne and Cromartie, and Clacmannan and Kinroſs.

The royal boroughs which chuſe repreſentatives, are

Edinburgh — — —	1	Innerkythen, Dumfermlin, Queensferry, Culroſs, and Stirling — —	1
Kirkwall, Wick, Dornoch, Dingwall, Tayne	1	Glaſgow, Renfrew, Rutherglen, Dumbarton —	1
Fortroſe, Inverneſs, Narine Forres — —	1	Haddington, Dunbar, North Berwick, Lauder, Jedburgh	1
Elgin, Cullen, Bamff, Inverary, and Kintore	1	Selkirk, Peeble, Linlithgow, and Lanerk — —	1
Aberdeen, Bervie, Montroſe, Aberbrothe, and Brechin	1	Dumfries, Sanquehar, Annan, Lochmaban, & Kircudbright	1
Forfar, Perth, Dundee, Cowper, and St. Andrews	1	Wigtown, New Galloway, Stranrare, and Whitehorn	1
Crail, Kilrenny, Anſtruther Eaſt & Weſt, & Pittenweem	1	Air, Irwin, Rothſay, Campbeltown, and Inverary	1
Dyſert, Kirkaldy, Kinghorne, and Burnt Iſland —	1		

The principal mountains in Scotland, are the Grampian hills, which run from eaſt to weſt, from near Aberdeen to Cowal in Argyleſhire, almoſt the whole breadth of the kingdom. Another chain of mountains, called Pentland hills, runs through Lothian and join thoſe of Tweedle. A third, called Lammer Muir, riſe near the eaſtern coaſt, and runs weſtward through the Merſe. Beſides thoſe continued chains among which we may reckon the Cheviot or Tiviot Hills, on the borders of England, Scotland contains many detached mountains, which, from their conical figure, ſometimes goes by the Celtic word *Laws*. Many of them are ſtupendouſly high, and of beautiful forms.

The largeſt river in Scotland is the Forth, which riſes in Montieth near Callendar, and paſſing by Sterling, after a number of beautiful meanders, diſcharges itſelf near Edinburgh into that arm of the German ſea to which it gives the name of Frith of Forth. Second to the Forth is the Tay, which iſſues out of Loch Tay, in Broadalbin, and running ſouth-eaſt, paſſes the town of Perth, and falls into the ſea at Dundee. The Spey, which is called the moſt rapid river in Scotland, iſſues from a lake of the ſame name in Badenoch, and running from ſouth-weſt to north-eaſt, falls into the ſea near Elgin; as do the rivers Dee and Don, which run from weſt to eaſt, and diſembogue themſelves at Aberdeen. The Tweed riſes on the borders of Lanerkſhire, and, after many beautiful ſerpentine turnings, diſcharges itſelf into the ſea at Berwick, where it ſerves as a boundary between Scotland and England, on the eaſtern ſide. The Clyde is a large river on the weſt of Scotland, has its riſe in Annandale, runs north-weſt through the valley of that name, and, after paſſing by Lanerk, Hamilton, the city of Glaſgow, Renfrew, Dunbarton, and Greenock, falls into the Frith of Clyde, oppoſite to the iſle of Bute. Beſides thoſe capital rivers, Scotland contains many of an inferior ſort, well provided with ſalmon, trout, and other fiſhes, which equally enrich and beautify the country.

Edinburgh the capital of Scotland, was built for the benefit of protection from the caſtle, and a more inconvenient ſituation for a capital can ſcarcely be conceived. In former times the town was ſurrounded by water, excepting towards the eaſt; ſo that when the French landed in Scotland, during the regency of Mary of Guiſe, they gave it the name of Liſlebourgh. Leith, which is properly the harbour of Edinburgh, is about two miles diſtant. Glaſgow, in the ſhire of Lanerk, ſituated on a gentle declivity ſloping towards the river Clyde, 44 miles weſt of Edinburgh, is, for population, commerce, and riches, the ſecond city of Scotland, and, conſidering its ſize, the firſt in Great Britain, and perhaps in Europe, as to elegance, regularity, and the beautiful materials of its buildings. Aberdeen bids fair to be the third town in Scotland for improvement and population. It is the capital of a ſhire, to which it gives its name, and contains two towns, New and Old Aberdeen. The former is the ſhire town, and evidently built for the purpoſe of commerce. It is a large well built city, and has a good quay, or tide-harbour.

Miles.		ENGLAND.	Degrees.
Length	380	lies betweeen	50 and 56 North latitude.
Breadth	300		2 Eaſt and 6-20 Weſt longitude.

It is bounded on the North, by that part of the Iſland called Scotland; on the Eaſt, by the German ocean; on the Weſt, by St. George's Channel; and on the South by the Engliſh Channel, which parts it from France, and contains 49,450 ſquare miles. The ſituation, by the ſea waſhing it on three ſides, renders England liable to a great uncertainty of weather, ſo that the inhabitants on part of the ſea-coaſts are often viſited by agues and fevers. On the other hand, it prevents the extremes of heat and cold, to which other places, lying in the ſame degree of latitude, are ſubject; and it is, on that account, friendly to the longivity of the inhabitants in general, eſpecially thoſe who live on a dry ſoil. To this ſituation likewiſe we are to aſcribe that perpetual verdure for which England is remarkable, occaſioned by refreſhing ſhowers, and the warm vapours of the ſea.

Antiquaries are divided with regard to the etymology of the word *England*. In the time of the Romans the whole iſland went by the name of *Britannia*. The word *Brit*, according to Mr. Camden,

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† Berwick, on the North ſide of the Tweed, belonging formerly to Scotland, and gave name to a county in that kingdom; but it is now formed into a town and county of itſelf, in a political ſenſe diſtinct from England and Scotland, having its own privileges.

den, ſignified painted or ſtained; the ancient inhabitants being famous for painting their bodies; other antiquaries, however, do not agree in this etymology. The weſtern tract of England, which is almoſt ſeparated from the reſt by the rivers Severn and Dee, is called Wales, or the *land of ſtrangers*, becauſe inhabited by the Belgic Gauls, who were driven thither by the Romans, and were ſtrangers to the old natives. When the Romans provinciated England they divided it into,

1. Britannia Prima, which contained the ſouthern parts of the kingdom. 2. Britannia Secunda, containing the weſtern parts, comprehending Wales. And, 3. Maxima Cæſarienſis, which reached from the Trent as far northward as the wall of Severus, between Newcaſtle and Carliſle, and ſometimes as far as that of Adrian in Scotland, between the Forth and Clyde. When the Saxons invaded England about the year 450, and when they were eſtabliſhed in the year 582, their chief leaders appropriated to themſelves, after the manner of the other northern conquerors, the countries which each had been the moſt inſtrumental in conquering; and the whole formed an heptarchy, or political republic, conſiſting of ſeven kingdoms. But in time of war, a chief was choſen out of the ſeven kings; for which reaſon I call it a political republic, its conſtitution greatly reſembling that of ancient Greece.

Kingdoms erected by the Saxons, ſtyled the Saxon Heptarchy.

Kingdoms.	Counties.	Chief Towns.
1. Kent, founded by Hengiſt in 475, and ended in 823.	Kent —	Canterbury.
2. Sou. Saxons founded by Ella in 491, and ended in 600.	Suſſex —	Chicheſter,
	Surry —	Southwark.
3. Eaſt Angles, founded by Uffarin 575, and ended in 793.	Norfolk —	Norwich
	Suffolk —	Bury St. Edmonds,
	Cambridge —	Cambridge,
	With the Iſle of Ely	Ely.
4. We. Saxons, founded by Cerdic 512, and ended in 1060.	Cornwall —	Launceſton
	Devon —	Exeter
	Dorſet —	Dorcheſter
	Somerſet —	Bath
	Wilts —	Saliſbury
	Hants —	Wincheſter
	Berks —	Abingdon.
5. Northumberland, founded by Ida in 574, and ended in 792.	Lancaſter —	Lancaſter
	York —	York
	Durham —	Durham
	Cumberland —	Carliſle
	Weſtmoreland —	Appleby
	Northumberland, and Scotland to the Frith of Edinburgh	Newcaſtle.
6. Eaſt Saxons, founded by Erchewin in 527, and ended in 746.	Eſſex —	London.
	Middleſex, and part of Hertford —	
7. Mercia, founded by Cridda in 582, and ended in 874.	Other part of Hertf.	Hertford
	Glouceſter —	Glouceſter
	Hereford —	Hereford
	Worceſter —	Worceſter
	Warwick —	Warwick
	Leiceſter —	Leiceſter
	Rutland —	Oakham
	Northampton	Northampton
	Lincoln —	Lincoln
	Huntingdon —	Huntingdon
	Bedford —	Bedford
	Buckingham —	Ayleſbury
	Oxford —	Oxford
	Stafford —	Stafford
	Derby —	Derby
	Salop —	Shrewſbury
	Nottingham —	Nottingham
	Cheſter —	Cheſter.

Beſides the 52 counties into which England and Wales are divided, there are counties corporate, conſiſting of certain diſtricts, to which the liberties and juriſdictions peculiar to a county have been granted by royal charter. Thus the city of London is a county diſtinct from Middleſex; the cities of York, Cheſter, Briſtol, Exeter, Norwich, Worceſter, and the towns of Kingſton upon Hull, and Newcaſtle upon Tyne, are counties of themſelves, diſtinct from thoſe in which they lie. The ſame may be ſaid of Berwick upon Tweed, which lies in Scotland, and hath within its juriſdiction, a ſmall territory of two miles on the north ſide of the river. Though England is full of delightful riſing grounds, and the moſt enchanting ſlopes, yet it contains few mountains. The moſt noted are the Peak in Derbyſhire, the Endle in Lancaſhire, the Wolds in Yorkſhire, the Cheviot-hills on the borders of Scotland, the Chiltern in Bucks, Malvern in Worceſterſhire, Corſwold in Glouceſterſhire, the Wrekin in Shropſhire: with thoſe of Plinlimmon and Snowdon in Wales.

The rivers in England add greatly to its beauty, as well as its opulence. The Thames, the nobleſt perhaps in the world, riſes on the confines of Glouceſterſhire, a little S. W. of Cirenceſter, and after receiving the many tributary ſtreams of other rivers, it paſſes to Oxford, then by Abingdon, Wallingford, Reading, Marlow, and Windſor. From thence to Kingſton, where formerly it met the tide, which, ſince the building of Weſtminſter-bridge, is ſaid to flow no higher than Richmond; from whence it flows to London, and after dividing the counties of Kent and Eſſex, it widens in its progreſs, till it falls into the ſea at the Nore, from whence it is navigable for large ſhips to London bridge. The river Medway, which riſes near Tunbridge, falls into the Thames at Sheerneſs, and is navigable for the largeſt ſhips as far as Chatham. The Severn, reckoned the ſecond river for importance in England, and the firſt for rapidity, riſes at Plinlimmon-hill in North Wales; becomes navigable at Welſh-pool; runs eaſt to Shrewſbury; then turning ſouth, viſits Bridgenorth, Worceſter, and Tewkſbury, where it receives the Upper Avon; after having paſſed Glouceſter, it takes a ſouth-weſt direction: is near its mouth increaſed by the Wye and Uſtre, and diſcharges itſelf into the Briſtol Channel, near King-road; and there lie the great ſhips which cannot get up to Briſtol. The Trent riſes in the Moorlands of Staffordſhire, and running ſouth-eaſt by Newcaſtle-under-Line, divides that county into two parts; then turning north-eaſt on the confines of Derbyſhire, viſits Nottingham, running the whole length of that county to Lincolnſhire, and being joined by the Ouſe, and ſeveral other rivers towards the mouth, obtains the name of the Humber, falling into the ſea ſouth-eaſt of Hull.

The other principal rivers in England, are the Ouſe which falls into the Humber, after receiving the water of many other rivers. Another Ouſe riſes in Bucks, and falls into the ſea near Lynn in Norfolk. The Tyne runs from weſt to eaſt through Northumberland, and falls into the German ſea at Tinmouth, below Newcaſtle. The Tees run from weſt to eaſt, dividing Durham from Yorkſhire, and falls into the German ſea below Stockton. The Tweed runs from weſt to eaſt on the borders of Scotland, and falls into the German ſea at Berwick. The Eden runs from ſouth to north through Weſtmoreland and Cumberland, and paſſing by Carliſle, falls into Solway Frith below that city. The Lower Avon runs weſt through Wiltſhire to Bath, and then dividing Somerſetſhire from Glouceſterſhire, runs to Briſtol, falling into the mouth of the Severn below that city. The Derwent, which runs from eaſt to weſt through Cumberland, and paſſing by Cockermouth, falls into the Iriſh ſea a little below. The Ribble, which runs from eaſt to weſt through Lancaſhire, and paſſing by Preſton, diſcharges itſelf into the Iriſh ſea. The Merſey, which runs from the ſouth-eaſt to the north-weſt through Cheſhire, and then dividing Cheſhire from Lancaſhire, paſſes by Liverpool, and falls into the Iriſh ſea a little below that town; and the Dee riſes in Wales, and divides Flintſhire from Cheſhire, falling into the Iriſh channel below Cheſter.

LONDON—The Metropolis of the Britiſh Empire, ſituated in 51°31′ north latitude, 400 miles ſouth of Edinburgh, and 270 ſouth-eaſt of Dublin; 180 miles weſt of Amſterdam, 210 north-weſt of Paris, 500 ſouth-weſt of Copenhagen, 600 miles north-weſt of Vienna, 790 ſouth-weſt of Stockholm, 800 north-eaſt of Madrid, 820 north-weſt of Rome, 850 north-eaſt of Liſbon, 1360 north-weſt of Conſtantinople, 1414 ſouth-weſt of Moſcow. It appears to have been founded between the reigns of Julius Cæſar and Nero, but by whom is uncertain; for we are told by Tacitus, that it was a place of great trade in Nero's time, and ſoon after became the capital of the iſland. It was firſt walled about with hewn ſtones, and Britiſh bricks, by Conſtantine the Great, and the walls formed an oblong ſquare, in compaſs about three miles, with ſeven principal gates. London, in its large ſenſe, including Weſtminſter, Southwark, and part of Middleſex, is a city of a very ſurpriſing extent, of prodigious wealth, and of the moſt extenſive trade. This city, when conſidered with all its advantages, is now what ancient Rome once was; the ſeat of liberty, the encourager of arts, and the admiration of the whole world. London is the centre of trade; it has an intimate connection with all the countries in the kingdom; it is the grand mart of the nation, to which all parts ſend their commodities, from whence they are again ſent back into every town of the nation, and to every part of the world. It is ſituated on the banks of the Thames, a river which though not the largeſt, is the richeſt and moſt commodious for commerce of any in the world. The irregular form of this city makes it difficult to aſcertain its extent. However, its length from eaſt to weſt, is generally allowed to be above ſeven miles, from Hyde-park corner to Poplar, and its breadth in ſome places three, in others two; and in others again not much above half a mile. Hence the circumference of the whole is almoſt 18 miles; or according to a modern meaſurement, the extent of continued buildings, is 35 miles two furlongs and 39 roods. It is much eaſier to form an idea of the large extent of a city ſo irregularly built, by the number of its inhabitants.

N. B. The Meridian of London, is in this ſyſtem made the firſt Meridian, and of courſe has no Longitude; and the Longitudes of the ſeveral places here deſcribed are all computed from the Meridian of London. Briſtol is reckoned the ſecond city in the Britiſh dominions for trade, wealth, and the number of inhabitants. It ſtands upon the north and ſouth ſides of the river Avon, and the two parts of the city are connected by a ſtone bridge.

Part of this city is in Glouceſterſhire, and part in Somerſetſhire. York is a city of great antiquity, pleaſantly ſituated on the river Ouſe; it is very populous, and ſurrounded with a good wall, through which are four gates, and five poſterns. It is the capital of Yorkſhire, 198 miles diſtant from London. The city of Exeter was for ſome time the ſeat of the Weſt-Saxon kings; and the walls, which at this time encloſe it, were built by king Athelſtan, who encompaſſed it alſo with a ditch. It is one of the firſt cities in England, as well on account of its buildings and wealth as its extent and the number of its inhabitants. It has ſix gates, and, including its ſuburbs, is more than two miles in circumference. It is the capital city of Devonſhire, ſituate on the River Ex, 170 miles diſtant from London, in Latitude 50' 44' N. and Longitude 3°: 34½' W. being 10 miles North of the Britiſh Channel. The city of Glouceſter ſtands on a pleaſant hill, with houſes on every deſcent, and is a clean, well-built town, with the Severn on one ſide, a branch of which brings ſhips up to it. It is 104 miles diſtant from London. Litchfield ſtands in a valley, three miles ſouth of the Trent, and is divided by a ſtream which runs into that river. It is 119 miles diſtant from London. Cheſter is a large, populace, and wealthy city, with a noble bridge, that has a gate at each end, and twelve arches over the Dee, which falls into the ſea. The walls were firſt erected by Edelfleda, a Mercian lady, in the year 908, and join on the ſouth ſide of the city to the caſtle, from whence there is a pleaſant walk round the city upon the walls, except where it is intercepted by ſome of the towers over the gates: and from whence there is a proſpect of Flintſhire, and the mountains of Wales. It is the capital of Cheſhire, 182 miles diſtant from London. Warwick is the county town of Warwickſhire, and appears to have been of eminence even in the time of the Romans. It ſtands upon a rock of free-ſtone, on the banks of the Avon; and a way is cut to it through the rocks from each of the four cardinal points. The town is populous, and the ſtreets are ſpacious and regular, and all meet in the centre of the town. It is 105 miles N. W. from London. The city of Coventry is large and populous, it has a handſome town-houſe, and twelve noble gates. The City, with the Territories about it, is a county of itſelf; it is 91 miles diſtant from London.

Saliſbury is a large, neat, and well-built city, ſituated in a valley, and watered by the Upper Avon on the Weſt and ſouth, and by the Bourne on the eaſt. The ſtreets are generally ſpacious, and built at right angles. It is 80 miles diſtant from London. The city of Bath took its name from ſome natural hot baths, for the medicinal waters of which this place has been long celebrated, and much frequented. It is ſituate on the River Avon, in Somerſetſhire, 108 miles diſtant from London. Nottingham, the county of Nottinghamſhire, is pleaſantly ſituated on the aſcent of a rock, overlooking the river Trent, which runs parallel with it about a mile to the ſouth, and has been made navigable. It is one of the neateſt places in England, and has a conſiderable trade. It is 122 miles North of London. No nation in the world can ſhew ſuch dock-yards, and all conveniences for the conſtruction and repairs of the royal navy, as Portſmouth, (the moſt regular fortification in England), Plymouth (by far the beſt dock-yard), Chatham, Woolwich, and Deptford. Every town in England is noted for ſome particular production or manufacture, to which its building and appearance are generally fitted; and though England contains many excellent and commodious ſea-ports, yet all of them have an immediate connection with London, which is the common centre of national commerce.

WALES. — As the principality of Wales is peculiar in language and manners, though in a political ſenſe forming a part of England; we have therefore treated it in a ſeparate point of view.

	Miles.		Degrees.
Length	130	lies between	51 and 54 North latitude.
Breadth	96		2-41 and 4-56 Weſt longitude.

Area in ſquare miles 7011.—Wales was formerly of greater extent than it is at preſent, being bounded only by the Severn and the Dee; but after the Saxons had made themſelves maſters of all the plain country, the Welch, or ancient Britons, were ſhut up within more narrow bounds, and obliged gradually to retreat weſtward. It does not however appear, that the Saxons ever made any farther conqueſts in their country than Monmouthſhire and Herefordſhire, which are now reckoned part of England. Wales towards the north is mountainous, but contains rich vallies. This country is well ſupplied with wholeſome ſprings; and its chief rivers are the Clywd, the Wheeler, the Dee, the Severn, the Elwy, and the Alen, which furniſh Flintſhire with great quantities of fiſh.

Wales contains no cities or towns that are remarkable either for populouſneſs or magnificence. At a ſmall village called Newton, in Glamorganſhire, is a remarkable ſpring nigh the ſea, which ebbs and flows contrary to the ſea. In Flintſhire is a famous well, known by the name of St. Winifred's Well, at which, it is ſaid, miraculous cures have been performed. The ſpring boils with vaſt impetuoſity out of a rock, and is formed into a beautiful polygonal wall, covered with a rich arch ſupported by pillars, and the roof is moſt exquiſitely carved in ſtone. The ſpring is ſuppoſed to be one of the fineſt in the Britiſh dominions; and by two different trials and calculations lately made, is found to fling out about twenty-one tons of water in a minute. It never freezes, or ſcarcely varies in the quantity of water in droughts or after the greateſt rains. The ſmall town adjoining to the well, is known by the name of Holywell. Carnarvonſhire is the high mountains of Penmanmawr.

IRELAND. — The iſland of Ireland is ſituated on the weſt ſide of England, between 6 and 10 degrees weſt longitude, and between 51 and 55 degrees 20 minutes north latitude. The extent or ſuperficial content of this kingdom, is, from the neareſt computation and ſurvey, found to be in length 285 miles from Fairhead north, to Miſſenhead ſouth; and from the eaſt part of Down, to the weſt part of Mayo, its greateſt breadth 160 miles, and to contain 11,067,712 Iriſh plantation acres, which make 17,927,864 acres of Engliſh ſtatute meaſure, and is held to bear proportion to England and Wales as 18 to 30. Mr. Templeman, who makes the length 275, and the breadth 150 miles, gives it an ærea of 27,457 ſquare miles. From the eaſt part of Wexford to St. David's in Wales, it is reckoned 45 miles, but the paſſage between Donaghadee and Portpatrick in Scotland is little more than 20 miles, and the paſſage from Holyhead in North Wales about 52 miles.

More conjectures as to the Latin (Hibernia) the Iriſh (Erin) as well as the Engliſh name of this iſland have been formed than the ſubject deſerves. It probable takes its riſe from a Phœnician or Gallic term, ſignifying the fartheſt habitation weſtward. It is extraordinary, that even modern authors are not agreed as to the diviſions of Ireland; ſome dividing it into five circuits, and ſome into four provinces, thoſe of Leinſter, Ulſter, Connaught, and Munſter. I ſhall follow the laſt diviſion, as being the moſt common, and likewiſe the moſt ancient.

PROVINCE OF LESTER, 12 COUNTIES.

Counties. —	*Chief Towns.*	*Counties.* —	*Chief Towns.*
Dublin	Dublin	Weſt Meath	Mullingar
Louth	Drogheda	King's County	Phillipſtown
Wicklow	Wicklow	Queen's County	Maryborough
Wexford	Wexford	Kilkenny	Kilkenny
Longford	Longford	Kildare	Naas and Athy
Eaſt Meath	Trim	Carlow	Carlow

PROVINCE OF ULSTER, 9 COUNTIES.

Counties. —	*Chief Towns.*	*Counties.* —	*Chief Towns.*
Down	Down Patrick	Londonderry	Derry
Armagh	Armagh	Tyrone	Omagh
Monaghan	Monaghan	Fermanagh	Enniſkillen
Cavan	Cavan	Donegall	Lifford
Antrim	Carrickfergus		

PROVINCE OF CONNAUGHT, 5 COUNTIES.

Counties. —	*Chief Towns.*	*Counties* —	*Chief Towns.*
Leintrim	Carrick on Shannon	Sligo	Sligo
Roſcommon	Roſcommon	Galway	Galway
Mayo	Ballinrode & Caſtlebar		

PROVINCE OF MUNSTER, 6 COUNTIES.

Counties.—	*Chief Towns.*	*Counties.* —	*Chief Towns.*
Clare	Ennis	Limerick	Limerick
Cork	Cork	Tipperary	Clonmel
Kerry	Tralee	Waterford	Waterford.

The ſoil is rocky, but extremely fertile, when properly cultivated. The bogs of Ireland are very extenſive: that of Allen extends 80 miles, and is computed to contain 300,000 acres. There are others alſo which are very extenſive, and ſmaller ones ſcattered over the whole kingdom. The numerous rivers, enchanting lakes, ſpacious bays, commodious havens, harbours, and creeks, with which Ireland abounds, greatly enrich and beautify this country The Shannon iſſues from Lough Allen, in the county of Leitrim, ſerves as a boundary between Connaught and the three other provinces, and after a courſe of 150 miles, forming in its progreſs many beautiful lakes, it falls into the Atlantic Ocean, between Kerry-point and Loop-head, where it is nine miles broad. The Ban falls into the ocean near Colerain; the Boyne falls into St. George's channel at Drogheda, as does the Liffey at the bay of Dublin, and is only remarkable for watering that capital where it forms a ſpacious harbour. The Barrow, the Nore, and the Suir, water the ſouth part of the kingdom, and, after uniting their ſtreams below Roſs, they fall into the channel at Waterford haven. Dublin, the capital of Ireland, is in magnitude and the number of inhabitants, the ſecond city in the Britiſh dominions. It is ſituated 270 miles north-weſt of London, and near ſixty miles weſt from Holyhead in North Wales, the uſual ſtation of the paſſage-veſſels between Great Britain and Ireland. Dublin ſtands about ſeven miles from the ſea, at the bottom of a large and ſpacious bay, to which it gives name, upon the river Liffey, which divides it almoſt into two equal parts, and is banked in through the whole length of the city, on both ſides, which form ſpacious and noble quays, where veſſels below the bridge load and unload before the merchants doors and warehouſes.

The river Liffey, though navigable for ſea veſſels as far as the cuſtom-houſe, or centre of the city, is but ſmall, when compared with the Thames of London. Cork is deſervedly reckoned the ſecond city in Ireland, in magnitude, riches, and commerce. It lies 129 miles ſouth-weſt of Dublin. Its haven is deep, and well ſheltered from all winds; but ſmall veſſels only can come up to the city, which ſtands about ſeven miles up the river Lee. Waterford, is a city of conſiderable extent, trade, and opulence, and has one of the fineſt quays in Europe, beſides a cathedral, cuſtom-houſe, and other ſpacious buildings. Belfaſt is a large ſea-port and trading town at the mouth of the Lagen water, where it falls into Carrickfergus bay. Downpatrick has a flouriſhing linen manufacture. Carrickfergus (or Knockfergus) the capital town of the province, has a good harbour and caſtle, but little commerce. Derry (or Londonderry, as it is moſt uſually called) ſtands in Lough-Foyl, is a ſtrong little city, having linen manufactures, with ſome commerce and ſhipping. All this extreme north part of Ireland is ſituated ſo near to Scotland, that they are in ſight of each others coaſts. Donegall, the county town of the ſame name (otherwiſe called the county of Tyrconnel), is a place of ſome trade; as is likewiſe Enniſkilling.

ISLE OF MAN. — The Mona mentioned by Tacitus was the iſle of Angleſea, not this iſland. Some think it takes its name from the Saxon word *Mang* (or among), becauſe lying in St. George's Channel, it is almoſt at an equal diſtance from the kingdoms of England, Scotland, and Ireland; but Mona ſeems to have been a generical name with the ancients for any detached iſland. Its length from north to ſouth is rather more than thirty miles, its breadth from eight to fifteen; and the latitude of the middle of the iſland is fifty-four degrees ſixteen minutes north. It is ſaid, that on a clear day the three Britannic kingdoms may be ſeen from this iſland. The air here is wholeſome, and the climate, only making allowance for the ſituation, pretty much the ſame as that in the north of England, from which it does not differ much in other reſpects. The hilly parts are barren, and the champaign fruitful in wheat, barley, oats, rye, flax, hemp, roots, and pulſe. The ridge of mountains, which, as it were, divides the iſland, both protects and fertilizes the vallies, where there is good paſturage. The Iſle of Man contains ſeventeen pariſhes, and four towns on the ſea coaſts. Caſtle town is the metropolis of the iſland, and the ſeat of its goverment; Peele, which of late years begins to flouriſh; Douglas has the beſt market and beſt trade in the iſland, and is the richeſt and moſt populous town, on account of its excellent harbour, and its fine mole, extending into the ſea; Ramſey has likewiſe a conſiderable commerce, on account of its ſpacious bay, in which ſhips may ride ſafe from all winds excepting the north-eaſt.

ISLE OF WIGHT. — This iſland is ſituated oppoſite the coaſt of Hampſhire, from which it is ſeparated by a channel, varying in breadth from two to ſeven miles: it is conſidered as part of the county of Southampton, and is within the dioceſe of Wincheſter. Its greateſt length, extending from eaſt to weſt, meaſures nearly twenty-three miles; its breadth from north to ſouth above thirteen. The air is in general healthy, particularly the ſouthern parts; the ſoil is various, but ſo great is its fertility, it was many years ago computed, that more wheat was grown here in one year, than could be conſumed by the inhabitants in eight: and it is ſuppoſed that its preſent produce, under the great improvements of agriculture, and the additional quantity of land lately brought into tillage, has more than kept pace with the increaſe of population. A range of hills, which affords fine paſture for ſheep, extends from eaſt to weſt, through the middle of the iſland. The interior parts of the iſland, as well as its extremities, afford a great number of beautiful and picturеſque proſpects, not only in the paſtoral, but alſo in the great and romantic ſtyle. The iſland is divided into thirty pariſhes; the town of Newport ſtands nearly in the centre of the iſland, of which it may be conſidered as the capital. The river Medina empties itſelf into the channel at Cowes harbour, diſtant about five miles, and being navigable up to the quay, renders it commodious for trade.

SCILLY ISLES, anciently the SILURES, — Are a cluſter of dangerous rocks, to the number of 140, lying about 30 miles from the Land's End in Cornwall, of which county they were reckoned a part. By their ſituation between the Engliſh channel and St. George's channel, they have been the deſtruction of many ſhips and lives. Some of the iſlands are well inhabited, and have large and ſecure harbours.

In the Engliſh channel are four iſlands ſubject to England: theſe are Jerſey, Guernſey, Alderney, and Sark; which, though they lie much nearer to the coaſt of Normandy than to that of England, are within the dioceſe of Wincheſter. They lie in a cluſter in Mount Saint Michael's bay, between Cape la Hogue in Normandy and Cape Frebelle in Britanny. The computed diſtance between Jerſey and Sark is four leagues; between that and Guernſey, ſeven leagues; and between the ſame and Alderney, nine leagues.

JERSEY, anciently CÆSAREA, — Was known to the Romans; and lies fartheſt within the bay, in 49 degrees 7 minutes north lat. and in the 2d degree 26 minutes weſt longitude, 18 miles weſt of Normandy, and 84 miles ſouth of Portland. The north ſide is inacceſſible through lofty cliffs, the ſouth is almoſt level with the water; the higher land, in its midland part, is well planned, and abounds with orchards, and the vallies are fruitful and well cultivated. The iſland is not above twelve miles in length; but the air is ſo ſalubrious, that, in Camden's time, it was ſaid there was here no buſineſs for a phyſician.

GUERNSEY — Is thirteen miles and a half from ſouth-weſt to north-eaſt, and twelve and a half where broadeſt, eaſt and weſt; has only ten pariſhes, to which there are but eight miniſters, four of the pariſhes being united, and Alderney and Sark, which are appendages of Guernſey, having one a-piece. Though this is a much finer iſland than that of Jerſey, yet it is far leſs valuable; becauſe it is not ſo well cultivated, nor is it ſo populous. Want of firing is the greateſt inconveniency that both iſlands labour under. The only harbour here is at St. Peter le Port, which is guarded by two forts; one called the Old Caſtle, and the other Caſtle Cornet. Guernſey is likewiſe part of the ancient Norman patrimony.

ALDERNEY — Is about eight miles in compaſs, and is by much the neareſt of all theſe iſlands to Normandy, from which it is ſeparated by a narrow ſtrait, called the Race of Alderney, which is a dangerous paſſage in ſtormy weather, when the currents meet; otherwiſe it is ſafe, and has depth of water for the largeſt ſhips.

SARK — Is a ſmall iſland depending upon Guernſey; the inhabitants are long lived, and enjoy from nature all the conveniencies of life. The religion of all the four iſlands is that of the church of England.

FRANCE.

Miles. —— FRANCE. —— Degrees.
Length 600 } lies between { 5 Weſt and 8 Eaſt longitude.
Breadth 500 } lies between { 42 and 51 North latitude.

It is bounded by the Engliſh channel and the Netherlands, on the North; by Germany, Switzerland, and Italy, Eaſt; by the Mediterranean and the Pyrenean mountains, which divide it from Spain, South; and by the bay of Biſcay, Weſt.

This Kingdom is divided, and the Dimenſions of the ſeveral Parts are diſtinctly ſpecified in the following TABLE:

France	Countries Names.	Square Miles.	Length.	Breadth.	Chief Cities.
Papiſts	Orleannois	22,950	230	180	Orleans
	Guienne	12,800	216	122	Bourdeaux
	Gaſcoigne	8,800	125	90	Aux, or Augh
	Languedoc	13,175	200	115	Thoulouſe
	Lyonnois	12,500	175	130	Lyons
	Champagne	10,000	140	110	Rheims
	Bretagne	9,100	170	105	Rennes
	Normandy	8,200	155	85	Rouen
	Provence	6,800	95	92	Aix
	Burgundy	6,700	150	86	Dijon
	Dauphine	5,820	107	90	Grenoble
	Iſle of France	5,200	100	85	PARIS { N. Lat. 48-57 E. Lon. 2-25
	Franche Compte	4,000	100	60	Beſançon
	Picardy	3,650	120	87	Amiens
	Rouſſillon	1,400	50	44	Perpignan
Netherlands	Artois	990	63	32	Arras
	Hainault	800	57	22	Valenciennes
	Flanders	760	58	22	Liſle
	Luxemburg	292	48	13	Thionville
Germany	Lorrain	2,500	—	—	Metz
	Alſace	2,250	95	30	Straſburgh
	Total	138,687			

To theſe is to be added the iſland of Corſica; but the city of Avignon with the Venaiſſin, was in 1774 ceded to the Pope.

France took its name from the Francs, or *Freemen*, a German nation, reſtleſs and enterpriſing, who conquered the Gauls, the ancient inhabitants; and the Roman force not being able to repreſs them, they were permitted to ſettle in the country by treaty. By its ſituation, it is the moſt compact kingdom perhaps in the world, and well fitted for every purpoſe both of power and commerce: and ſince the beginning of the 15th century, the inhabitants have availed themſelves of many of their natural advantages. France is happy in an excellent ſoil, which produces corn, wine, oil, and almoſt every luxury of life. Some of their fruits have a higher flavour than thoſe of England; but neither the paſturage nor tillage are comparable to ours. The chief mountains in France, or its borders, are the Alps, which divide France from Italy: the Pyrenees, which divide France from Spain: Vauge, which divide Lorrain from Burgundy and Alſace; Mount Jura, which divides Franche Compté from Switzerland: the Cevenes, in the province of Languedoc; and Mount Dor in the province of Auvergne. The principal rivers in France are the Loire, the Rhone, the Garonne, and the Seine. The Loire takes its courſe north and north-weſt, being, with all its windings, from its ſource to the ſea, computed to run about 500 miles. The Rhone flows on the ſouth-weſt to Lyons, and then runs on due ſouth till it falls into the Mediterranean. The Garonne riſes in the Pyrenean mountains, takes its courſe, firſt north eaſt, and has a communication with the Mediterranean by means of a canal, the work of Lewis XIV. The Seine, ſoon after its riſe, runs to the north-weſt, viſiting Troyes, Paris, and Rouen, in its way, and falls into the Engliſh channel at Havre. To theſe we may add the Soane, which falls into the Rhone at Lyons; the Charente, which riſes near Havre de Grace, and diſcharges itſelf into the Bay of Biſcay at Rochfort. The Rhine, which riſes in Switzerland, is the eaſtern boundary between France and Germany, and receives the Moſelle and the Sarte in its paſſage. The Somme, which runs north-weſt through Picardy, and falls into the Engliſh channel below Abbeville. The Var, which riſes in the Alps, and runs ſouth, dividing France from Italy, and falling into the Mediterranean, weſt of Nice. The Adour runs from eaſt to weſt, through Gaſcoigne, and falls into the Bay of Biſcay, below Bayonne. Few lakes are found in this country. There is one at the top of a hill near Alegre, which the vulgar report to be bottomleſs, and one at La Beſſe, in which if you throw a ſtone, it cauſes a noiſe like thunder.

Cities and towns are very numerous in France; of which we ſhall mention only Paris, Liſle, and their principal ſea ports, Breſt, and Toulon. Liſle, in French Flanders, is thought to be the moſt regular and ſtrongeſt fortification in Europe, and was the maſter-piece of the famous Vauban. Moving ſouthward, we come to the Iſle of France; the capital of which, and of the whole kingdom, is Paris. This city has been ſo often deſcribed, it may appear ſuperfluous to mention it more particularly, were it not that the vanity of the French has given it a preference, which it by no means deſerves, to all the capitals in the world, in every reſpect. The city of Paris is ſaid to be fifteen miles in circumference. The ſtreets are very narrow, and the houſes very high, many of them ſeven ſtories. The houſes are built of ſtone, and are generally mean, even to wretchedneſs, owing partly to their containing a different family on every floor. The river Seine, which runs through the centre of the city, is not half ſo large as the Thames at London; it is too far diſtant from the ſea for the purpoſes of navigation, and is not furniſhed, as the Thames, with veſſels or boats of any ſort; over it are many ſtone and wooden bridges, which have nothing to recommend them.

The environs of Paris are very pleaſant, and contain a number of fine ſeats, ſmall towns, and villages; ſome of them, being ſcattered on the edges of lofty mountains riſing from the Seine, are remarkably delightful. The palace of Verſailles, ſtands twelve miles from Paris, and is magnificent and expenſive beyond conception, and adorned with all that art can furniſh. Breſt is a ſmall, but very ſtrong town; upon the Engliſh channel, with a moſt ſpacious and fine fortified road and harbour, the beſt and ſafeſt in all the kingdom: yet its entrance is difficult, by reaſon of many rocks lying under water. Lewis XIV. rendered Toulon, from a pitiful village, a ſea-port of great importance. He fortified both the town and harbour, for the reception and protection of the navy royal. Its old and its new harbour lie contiguous; and by means of a canal, ſhips paſs from the one to the other, both of them having an outlet into the ſpacious outer harbour.

NETHERLANDS. — The ſeventeen provinces, which are known by the name of the Netherlands, were formerly part of Gallia Belgica, and afterwards of the circle of Belgium or Burgundy, in the German empire. They obtained the general name of Netherlands, Pais-Bas, or Low-Countries, from their ſituation in reſpect of Germany.

Miles.		Degrees.
Length 360	lie between	49 and 54 North lat.
Breadth 260		2 and 7 Eaſt lon.

They are bounded by the German ſea on the North; by Germany, Eaſt; by Lorrain and France, South; and by the Britiſh Channel, Weſt. We ſhall, for the ſake of perſpicuity, and to avoid repetition, treat of the ſeventeen provinces under two great diviſions: firſt, the *Northern* which contains the ſeven United Provinces, uſually known by the name of HOLLAND: ſecondly, the *Southern*, containing the Auſtrian and French Netherlands. The United Provinces are, properly ſpeaking, eight, viz. Holland, Overyſſel, Zealand, Frieſland, Utretcht, Groningen, Gelderland, and Zutphen; but the two latter forming only one ſovereignty, they generally go by the name of the Seven United Provinces.

Length 150 Breadth nearly the ſame.	lie between	51 and 54 North lat. 2 and 7 Eaſt lon.

The following is the moſt ſatisfactory account we meet with of their geographical diviſion, including the Texel, and other iſlands.

	Countries Names. United Provinces.	Square Miles.	Length.	Breadth.	Chief Cities.
Calviniſts.	Overyſſel	1,900	66	50	Deventer
	Holland	1,800	84	52	AMSTERDAM
	Gelderland	986	50	40	Nimeguen
	Frieſland	810	44	34	Leuwarden
	Zutphen	644	37	33	Zutphen
	Groningen	540	45	37	Groningen
	Utrecht	450	41	22	Utrecht
	Zealand	303	29	24	Middleburg
	Texel and other iſlands	113			
		7,546			

Theſe provinces lie oppoſite to England, at the diſtance of 90 miles, upon the eaſt ſide of the Engliſh channel, and are only a narrow ſlip of low ſwampy land, lying between the mouths of ſeveral great rivers, and what the induſtry of the inhabitants have gained from the ſea by means of dykes, which they have raiſed and ſtill ſupport with incredible labour and expence. The air of the United Provinces is therefore foggy and groſs, until it is purified by the froſt in winter, when the eaſt wind uſually ſets in for about four months, and their harbours are frozen up. The rivers are an important conſideration to the United Provinces; the chief of which are the Rhine, one of the largeſt and fineſt rivers in Europe; the Maeſe, the Scheld, and the Vecht. There are many ſmall rivers that join theſe, and a prodigious number of canals; but there are few good harbours in the United Provinces; the beſt, are thoſe of Rotterdam, Helvoetſluys, and Fluſhing; that of Amſterdam, though one of the largeſt in Europe, has a bar at the entrance of it, over which large veſſels cannot paſs without being lightened. Amſterdam, which is built upon piles of wood, is thought to be, (next to London), the moſt commercial city in the world. Its conveniency for commerce, and the grandeur of its public works, are almoſt beyond deſcription. In this, and all other cities of the United Provinces, the beauty of the canals, and walks under trees planted on their borders, are admirable; but above all, we are ſtruck with the neatneſs and cleanlineſs that is every where obſerved within doors. This city, however, labours under two great diſadvantages: bad air, and the want of freſh wholeſome water, which obliges the inhabitants to preſerve the rain water, in reſervoirs. Rotterdam is the next to Amſterdam for commerce and wealth. The Hague, though but a village, is the ſeat of government in the United Provinces, and is celebrated for the magnificence and beauty of its buildings, the reſort of foreign ambaſſadors and ſtrangers of all diſtinction who live in it, the abundance and cheapneſs of its proviſions, and the politeneſs of its inhabitants: it is no place of trade, but it has been for many years noted as an emporium of pleaſure and politics. Leyden and Utrecht are fine cities, as well as famous for their univerſities. Saardam, though a wealthy trading place, is mentioned here as the workſhop where Peter the Great of Muſcovy, in perſon, ſerved his apprenticeſhip to ſhip-building, and laboured as a common handicraft. The upper part of Gelderland is ſubject to Pruſſia, and the capital city of Gelder.

AUSTRIAN AND FRENCH NETHERLANDS.

Miles.		Degrees.
Length 200	lie between	49 and 52 North latitude.
Breadth 200		2 and 7 Eaſt longitude.

PICARDY— Is bounded by the United Provinces on the North; by Germany, Eaſt; by Lorrain, Champaign, and Picardy, in France, South; and by another part of Picardy, and the Engliſh sea, Weſt. As this country belongs to three different powers, the Auſtrians, French, and Dutch, we ſhall be more particular in diſtinguiſhing the provinces and towns belonging to each ſtate.

I. PROVINCE OF BRABANT.

Subdiviſions.	Chief Towns.	Sq. M.
1. Dutch Brabant.	Boiſleduc, Breda, Bergen op-Zoom, N. Grave, N. E. Lillo, Steenbergen, N. W.	1374
2. Auſtrian Brabant.	Bruſſels, E. lon. 4 deg. 6. min. N. lat. 50-50. Louvain, Vilvorden, Landen, in the middle.	1892

II. PROVINCE OF ANTWERP. —And, III. PROVINCE OF MALINES — Are independent of Brabant, though ſurrounded by it, and ſubject to the houſe of Auſtria.

IV. PROVINCE OF LIMBURG, S. E.

Chief Towns	Limburg, E. lon. 6-5. N. lat. 50-37. ſubject to Auſtria. —	312
	Maeſtricht, Dalem, Fauquemont, or Valburgh, ſubject to the Dutch. —	300

V. PROVINCE OF LUXEMBURG.

Auſtrian Luxemburg.	Luxemburg, E. lon. 6-8. N. lat. 49-45.	2408
French Luxemburg —	Thionville Montmedy S. E.	292

VI. *Province of* NAMUR, *in the Middle, ſubject to* Auſtria.

Chief Towns	Namur, on the Sambre and Maeſe, E. lon. 4-50. N. lat. 50-30. Charleroy on the Sambre	425

VII. PROVINCE OF HAINAULT.

Auſtrian Hainault	Mons, E. lon. 3-33. N. lat. 50-30. Aeth, Enguien, in the middle —	640
French Hainault	Valenciennes, Bouchain, Conde, Landrechy, S. W. — —	800

VIII. PROVINCE OF CAMBRESIS.

Subject to France	Cambray E. of Arras, E. lon. 3-15. N. lat. 50-15. Crevecour, S. of Cambray	150

IX. PROVINCE OF ARTOIS.

Subject to France	Arras, S. W. on the Scarpe, E. lon. 2-15. N. lat. 50-20. St. Omer, E. of Boulogne, Aire, S. of St. Omer, S. Venant, E. of Aire Bethune, S. E. of Aire, Terouen, S. of St. Omer	990

X. PROVINCE OF FLANDERS.

Dutch Flanders.	Sluys, Axel, Hulſt, Sas van Ghent, N.	280
Auſtrian Flanders	Ghent on the Scheld, E. Lon. 3-36. N. lat. 51. Bruges, Oſtend, Newport, N. W. near the ſea. Oudenard on the Scheld; Courtray, Dixmud, on the Lis Ypres, N. of Liſle; Tourney on the Scheld; Menis on the Lis.	1905
French Flanders	Liſle, W. of Tournay; Dunkirk, on the coaſt E of Calais; Douay, W. of Arras; Mardike, W. of Dunkirk; St. Amand, N. of Valenciennes; Gravelin, E. of Calais —	760

The air of Brabant, and upon the coaſt of Flanders, is bad; that in the interior parts is more healthful, and the ſeaſons more ſettled, both in winter and ſummer, than they are in England. The ſoil and its produce are rich, eſpecially in corn and fruits. They have abundance of paſture; and Flanders itſelf has been reckoned the granary of France and Germany. The chief rivers are the Maeſe, Sambre, Demer, Dyle, Nethe, Geer, Saune, Ruppel, Scheld, Lis, Scarpe, Deule, and Deneer.

The walls of Ghent, formerly the capital of Flanders, and celebrated for its linen and woollen manufactures, contain the circuit of ten miles; but now unoccupied, and great part of it in a manner void. Bruges, formerly ſo noted for its trade and manufactures, and fine canals, is now dwindled to an inconſiderable place. Oſtend is a tolerably convenient harbour for traders; Ypres, is only a ſtrong garriſon town. The ſame may be ſaid of Charlcroy and Namur. Louvain, the capital of the Auſtrian Brabant, inſtead of its flouriſhing manufactures and places of trade, now only contains handſome gardens, walks, and harbours. Bruſſels retains ſomewhat of its ancient manufactures; and being the reſidence of the governor or viceroy of the Auſtrian Netherlands, it is a populous, lively place. Antwerp, once the emporium of the European continent, is now conſiderably reduced.

Miles.	—— GERMANY. ——	Degrees.	Sq. Miles.
Length 600 Breadth 520	lies between	5 and 19 Eaſt long. 45 and 55 North lat.	181,631.

The empire of Germany, properly ſo called, is bounded by the German Ocean, Denmark, and the Baltic, on the North; by Poland and Hungary, including Bohemia, on the Eaſt; by Switzerland and the Alps, which divide it from Italy, on the South; and by the dominions of France and the Low Countries, on the Weſt, from which it is ſeparated by the Rhine, Moſelle, and the Maeſe. Germany is divided into nine Grand Diſtricts, of which three are in the North, three in the middle, and three in the South.

The northern circles, — *Upper Saxony, Lower Saxony, Weſtphalia.*
The circles in the middle, — *Upper Rhine, Lower Rhine, Franconia.*
The ſouthern circles, — *Auſtria, Bavaria, Swabia.*

I. UPPER SAXONY CIRCLE.

Diviſions	Subdiviſions.		Chief Towns.	Sq.M.
Pomerania, in the North.	Pruſ. Pomerania, NE		Stettin, E.l.14 50N.l.53-30	4820
	Swed. Pom. N. W.		Stralſund	2991
Brandenburgh, in the middle, ſub. to its own elector, the K. of Pruſſia	Altmark, weſt		Stendel	10910
	Middlemark		Berlin, Potſdam	
	Newmark, eaſt		Francf. Cuſtrin	
Saxony, Proper, in the ſouth, ſub. to its own elector.	Duchy of Sax. N.		Wirtenberg	7500
	Luſatia marq. eaſt		Bautzen, Gorlitz,	
	Miſnia, marq. ſou.		Dreſ. E.long.13-36 N. lat. 51. Meiſſen	
Thuringia, langr. weſt.	——		Erfurt —	3620
The duchies of —	Saxe Meinungen	Subject to their own dukes	Meinungen	
	Saxe Zeitz		Zeitz	
	Saxe Altenb. S.E.		Altenburg	240
	Saxe Weimar, W		Weimar	
	Saxe Gotha, W.		Gotha	1500
	Saxe Eiſn. S.W.		Eiſnach	
	Saxe Saalfeldt		Saalfeldt	
The counties of —	Schwartſ W	Subject to their reſpective counts.	Schwartſburg	96
	Belchin N.		Belchingen	
	Mansfel. N		Mansfelt	
The duchies of —	Hall, mid. ſub. to Pr.		Hall	
	Saxe Naumburg, ſubject to its own duke		Naumburg	210
The counties of —	Stolberg, north weſt		Stolberg	
	Hohenſtein, weſt		Northhauſen	
Principality of —	Anhalt, north —		Deſſau, Zerbſt Bernberg Kothen	966
Biſhoprick of —	Saxe Hall, weſt		Hall	
	Voigtland, ſouth, ſub. to the elector of Saxony		Plawen	696
Duchy of —	Merſburg, mid. ſub. to the elect. of Sax.		Merſburg —	336

II. LOWER SAXONY CIRCLE.

Diviſions.	Subdiviſions.		Chief Towns.	Sq.M.
Holſtein D. north of the Elbe.	Holſtein Proper N.	Partly ſub. to Denm. and partly to the D. of Holſtein Gottorp	Kiel, ſub. to Holſtein Gottorp.	1850
	Ditmarſh, weſt		Meldorp, ſub to Denm	
	Stormaria, ſouth		Glucſtat, ſub to Denm	
	Hamburg, a ſovereign ſtate		Hamburg, E. l. 10-35. N.l.54. an imperial city.	
	Wagerland, eaſt		Lubec, an imperial city.	
Lauenburg Duchy, north of the Elbe, ſubject to Hanover	——		Lauenburg	450
Subject to the duke of Brunſwick Wolfenbuttle	D. Brunſwic Proper	middle	Brun. E. l. 10-30 N. lat. 52-30	860
	D. Wolfenbuttle		Wolfenbuttle	
	C. Rheinſtein, ſouth		Rheinſtein	
	C. Blackenburg		Blackenburg	
Subject to the elector of Hanover. K. of Gr. Britain	D. Calenburg		Hanover	8024
	D. Grubenhagen		Grubenhagen	
	Gottingen		Gottingen	
Luneburg D. ſub. to Hanover	D. of Luneburg Proper		Luneburg	
	D. Zell		Zell, E. long. 10. N. lat. 52-52.	
Bremen D. and Verden D. ſuk to Hanover, north —			Bremen, E. lon. 9. N. lat. 53-30. an imperial city.	2040
			Verden ——	693
Mecklenburg D.	D. Schwerin, north, ſubject to its duke		Schwerin E. lon 11-30. N. lat. 54	4400
	D. Guſtrow, north, ſubject to its duke		Guſtrow.	
Hilderſheim biſhoprick, in the middle, ſubject to its biſhop	——		Hilderſheim, an imperial city.	1302
Magdeburg duchy, ſouth-eaſt, ſubject to the king of Pruſſia	——		Magdeburg	1535
Halberſtadt duchy, ſubject to Pruſſia, ſouth-eaſt			Halberſtadt	450

III. WESTPHALIA CIRCLE.

Diviſions.	Subdiviſions.		Chief Towns.	Sq.M.
North Diviſion.	Embden, C. or Eaſt Frieſ. ſub. to the king of Pruſſia		Embden, an imperial city	720
	Oldenburg. C.	ſubj. to the K. of Den.	Oldenburg	
	Delmenhurſt		Delmenhurſt	
	Hoye	ſubject to Hanover	Hoye	624
	Diepholt		Diepholt	220
Weſtern Diviſion.	Munſter B. ſub. to its biſhop		Munſter,	3600
	Paderborn B. ſub. to its biſh.		Paderborn	800
	Oſnaburg B. ſub. to its biſhop		Oſnaburg	870
	Lippe C. ſubject to its count		Lippe, Pyrmont	400
	Minden D.	ſub. to Pru.	Minden	595
	Ravenſberg C.		Ravenſberg	525
	Weſtphalia D. ſubj. to the elector of Cologn		Arenſburg	1444
	Tecklenb. C.	ſubj. to their reſpective counts.	Tecklenburg	840
	Ritberg C.		Ritberg	120
	Schawenb. C.		Schawenburg	
Middle Diviſion.	Cleves D. ſubj. to the king of Pruſſia		Cleves E. lon. 5-36. N. lat. 51-40.	630
	Berg. D.	ſub. to the elector of Palatine.	Duſſeldorf	
	Juliers D.		Juliers, Aix	1300
	Mark C. ſubject to Pruſſia		Hain	980
	Leige B. ſub. to its own biſh.		Leige	1942
	Benth. C. ſubj. to Hanover		Bentheim	418
	Steinfort C. ſub. to its count		Steinfort	114

IV. UPPER RHINE CIRCLE.

Heſſe	Heſſe Caſſel, landg. N.		Caſſel	3500
	Heſſe Marpurgh, landg. N.		Marpurgh	
	Heſſe Darmſtadt, landg.		Darmdſtadt	396

Each of the above diviſions are ſubject to their reſpective landgraves.

	Heſſe Homberg		Homberg	
	Heſſe Rhinefeldt		Rhinefeldt	180
	Wonfield		Wonfield	
Counties in the Wetteraw ſouth.	Naſſau Dillenburgh	Each county ſubject to its own count of the houſe of Naſſau.	Dillenburg	1200
	Naſſau Diets		Diets	
	Naſſau Hadamar		Hadamar	
	Naſſau Kerberg		Kerberg	
	Naſſau Siegen		Siegen	
	Naſſau Idſtein		Idſtein	
	Naſſau Weilburg		Weilburg	
	Naſſau Wiſbaden		Wiſbaden	
	Naſſau Bielſteid		Bielſteid	
	Naſſau Otweiler		Otweiler	
	Naſſau Uſingen		Uſingen	
Territory of Frankfort, a ſovereign ſtate			Frankfort on the Maine, an imperial city	120
County of Erpach, ſub. to its own count			Erpach, eaſt	230
Biſhoprick of Spire, a ſovereign ſtate			Spire on the Rhine, an imperial city	245
Duchy of Zwebruggen, or Deuxponts, ſub. to the Duke of Deuxp.			Deuxponts in the Palat	700
County of Catzenelbogen, ſub. to H. Caſſel			Catzenelbogen on the Lohn	
Counties of	Waldec, ſub. to its own count		Waldec	368
	Solms, ſub. to its own count		Solms	
	Hanau, ſub. to Heſſe Caſſel		Hanau	324
	Iſenburg, ſub. to its own C.		Iſenburg, Sayn,	
	Sayn, Wied, Witgenſtein,		Wied, Witgenſtein,	
	Hatzfield, Weſterburg		Hatfield, Weſterburg	
Abbey of Fulda, ſubject to its abbot			Fulda	621
Hirſchfeld, — ſubject to Heſſe Caſſel	—		Hirſchfeld	

V. LOWER RHINE CIRCLE.

Diviſions.			Chief Towns.	Sq. M.
Palatinate of the Rhine, on both ſides that river, ſub. to the Elector Palatine.			Heidelburg on the Necker, Philipſburg, Manhelm, and Frankendal on the Rhine.	2618
Archbiſhopricks and Electorates of	Cologn	Sub. to their reſpective electors	Cologne, on the Rhine Bonn, on the Rhine	1964
	Mentz		Mentz, on the Rhine Aſchaffe. on the Maine	1405
	Triers		Triers, on the Moſelle	1765
Biſhoprick of Worms, a ſovereign ſtate	——		Worms on the Rhine, an imperial city.	154
Duchy of Simmeren, ſub. to its own duke			Simmeren.	
Counties of	Rhinegraveſtein		Rhinegraveſtein	
	Meurs, ſubject to Pruſſia		Meurs	
	Veldents, ſub. to the Elect. Palatine		Veldents	
	Spanheim		Creutznach	
	Leyningen		Leyningen	

6. FRANCONIA CIRCLE.

Biſhopricks of	Wurtſburg, W.	Subject to their reſp. biſhops.	Wurtſburg	1645
	Bamberg, N.		Bamberg	1700
	Aichſtat, S.		Aichſtat	513
Marquiſates of	Cullenbach, north eaſt	Sub. to their reſpective margraves.	Cullenbach	900
	Anſpach, S.		Anſpach	1000

Subdiviſions.	Chief Towns.	Sq.M
Principality of Henneberg, N. ——	Henneberg	
Duchy of Coburg, N. ſubject to its duke	Coburg	406
Duchy of Hilburghauſen, ſubject to its duke	Hilburghauſen	
Burgravate of Nuremburg, S. E. an independent ſtate — —	Nuremburg an imperial city.	640
Territory of the great-maſter of the Teutonic order, Mergentheim, S. W.	Mergentheim	56
Counties of Reineck, W.	Reineck	
Bareith, E. ſub. to its own mar.	Bareith	188
Papenheim, S. ſub. to its own C	Papenheim	
Wertheim, W.	Wertheim	
Caſſel, middle	Caſſel	120
Schwartzburg, ſubject to its own count	Schwartzburg middle	96
Holach, S. W.	Holach	220

VII. AUSTRIA CIRCLE.

The whole circle belongs to the Emperor, as head of the Houſe of Auſtria.

Archduchy of Auſtria Proper	Vienna, E. lon. 16-20. N. lat. 48-20. Lints, Ens, weſt.	7160
Duchies of Stiria and Cilley, C.	Gratz, Cilley, S. E.	5000
Carinthia	Glagenfurt, Lavem, S.E.	3000
Carniola	Laubach, Zerknits, Trieſte, St. Veits, SE.	4570
Goritia	Gorits, S. E.	
County of Tyrol — Inſpruck	S. W. on the confines of Italy and Switzerland.	3900
Biſhopricks of Brixen — Brixen		1300
Trent — Trent		210

VIII. BAVARIA CIRCLE.

Duchy of Bavaria Proper on the Danube Palatinate of Bavaria.	Subject to the elector palatine as ſucceſſor to the late elector of Bavaria.	Munich, E. lon. 11-32. N lat. 48-5. Landſhut, Ingoldſtat, NW. Donawert [Ratiſ. N. an imperial city Amberg [Sultzbach.] N. of the Danube	8500
Freſſingen, ſubject to its biſhop	Freſſingen	—	240
Biſhoprick of Paſſau, ſubject to its own biſhop, Paſſau, E. on the Danube			240
Duchy of Neuberg, ſubject to the Elector Palatine	Neuberg, W. on the Danube		450
Archbiſhoprick of Saltſburgh, ſubject to its own archbiſhop	Saltzburg S. E. Hallen		2540

IX. SWABIA CIRCLE.

Duchy of Wurtemberg, Subject to the Duke of Wurtemberg Stutgard.		Stutgard, E. lon. 9 lat. 48-40. Tubingen Haibron.	on or near the Neckar.	3564
Marquiſates of Baden Baden	ſub. to their own reſpective marg.	Baden	On or near the Rhine.	258
Baden Durlach		Baden-Durlach		490
Biſhoprick of Augſburg, ſubject to its own biſhop —		Augſburg, an imperial city, Hochſtet, Blenheim, on or near the Danube.		765
Territory of Ulm, a ſovereign ſtate —		Ulm, on the Danube, an imperial city.		280
Biſhoprick of Conſtance, ſub. to its own biſhop under the houſe of Auſtria.		Conſtance on the lake of Conſtance		60
Principalities of Mindelheim	Sub. to their reſpective princes	Mindelh. S. of Augſ		216
Furſtenberg		Furſtenberg, S.		788
Hohenzollern		Hohenzollern, S.		150
Counties of Oeting		Oeting, Eaſt		580
Konigſeck		Konigſeck, ſouth-eaſt		
Hohenrichburg		Gemund, north		379
Baronies of Waldburg		Waldburg, ſouth-eaſt		
Limpurg		Limpurg, north.		120
Abbies of Kempten		Kempten, on the Iller		
Buchaw		Buchaw, S. of the Danube		
Lindaw		Lindaw, on the lake of Conſtance, imperial cities		
Imperial cities, or ſovereign ſtates	—	Nordlingen, N. of the Danube. Memmingen, eaſt. Rotweil, on the Neckar, and others.		
Subject to the houſe of Auſtria. Black Foreſt, N. W. Rhinefield C.		Rhinefield & Lauffenb.		480
Marquiſate of Burgaw.		Burgaw, eaſt	—	650
Territory of Briſgaw on the Rhine		Friburg and Briſac		380

The Germans went by various names, ſuch as Allemanni, Teutones; which laſt is ſaid to have been their moſt ancient deſignation: and the Germans themſelves call their country Teutchland. The chief mountains of Germany are the Alps, which divide it from Italy, and thoſe which ſeparate Saxony, Bavaria, and Moravia, from Bohemia. Berlin, which is accounted the capital of his Pruſſian majeſty's dominions, lies on the river Spree, and, beſides a royal palace, has many other ſuperb palaces; it contains fourteen Lutheran, and eleven Calviniſt churches. We can ſay little more of Dreſden, the elector of Saxony's capital, than hath been already ſaid of all fine cities, that its fortifications, palaces, public buildings, churches, and charitable foundations, and, above all, its ſuburbs, are magnificent beyond all expreſſion; that it is beautifully ſituated on both ſides the Elbe; and that it is the ſchool of Germany for ſtatuary, painting, enamelling, and carving. The city of Leipſic in Upper Saxony, is 46 miles diſtant from Dreſden, and is ſituated in a pleaſant and fertile plain on the Pleiſſe. The city of Hanover, the capital of that electorate, ſtands on the river Leine, and is a neat, thriving, and agreeable city. The biſhoprick of Oſnaburg, lies between the rivers Weſer and Ems. The chief city, Oſnaburg, has been long famous all over Europe for the manufacture known by the name of the duchy, and for the beſt Weſtphalia hams. Breſlau, the capital of Sileſia, is a fine city lying on the river Oder. Frankfort is ſituated in a healthful, fertile, and delightful country along the Maine, by which it is divided into two parts, diſtinguiſhed by the names of Frankfort and Saxenhauſen. The former of theſe, being the largeſt, is divided into twelve wards, and the latter into two. Vienna is the capital of the circle of Auſtria, and, being the reſidence of the emperor, is ſuppoſed to be the capital of Germany. It is a noble and ſtrong city, and the princes of the houſe of Auſtria have omitted nothing that could contribute to its grandeur and riches.

KINGDOM OF PRUSSIA, FORMERLY DUCAL PRUSSIA.

This country is bounded to the North by part of Samogitia; to the South, by Poland Proper and Maſovia; to the Eaſt, by part of Lithuania; and to the Weſt, by Poliſh Pruſſia and the Baltic. Its greateſt length is about 160 miles, and breadth about 112. The name of Pruſſia is probably derived from the Boruſſi, the ancient inhabitants of the country. The air, upon the whole, is wholeſome, and the ſoil fruitful. As Pruſſia, ſince the beginning of the preſent century, has become a moſt reſpectable power upon the continent of Europe, we ſhall ſtate the whole of his Pruſſian majeſty's territories, which lie ſcattered in other diviſions of Germany; Poland, Switzerland, and the northern kingdoms, with their names; all which are in the following Table:

Proteſtants.	Countries Names.	Square Miles.	Length.	Breadth.	Chief Cities.	
Poland.	Ducal Pruſſia	9,950	160	112	KONINGSBERG	54-44N la. 21-35E lo.
	Royal Pruſſia	6,400	118	104	Elbing	
Up. Saxony	Brandenburg	10,910	215	110	Berlin	
	Pomerania	4,820	150	63	Camin	
	Sw. Pomerania	2,991	90	48	Stetin	
Lo. Saxony	Magdeburg	1,535	63	50	Magdeburg	
	Halberſtadt	450	42	17	Halberſtadt	
Bohemia	Glatz	550	38	23	Glatz	
	Sileſia	10,000	196	92	Breſlaw	
	Minden	595	42	26	Minden	
Weſtphalia	Ravenſberg	525	38	34	Ravenſburg	
	Lingen	120	15	11	Lingen	
	Cleves	630	43	21	Cleves	
	Meurs	35	10	6	Meurs	
	Mark	980	52	43	Ham	
	Eaſt Frieſland	690	46	32	Embden	
	Lippe	25	8	4	Lipſtadt	
	Gulich	528	44	24	Gulich	
	Tecklenburg	36	12	6	Tecklenburg	
Netherlands.	Gelders	360	34	23	Gelders	
Switzerland.	Neufchatel	320	32	20	Neufchattel	
	Total —	51,281				

Beſides a great part of Sileſia, which the late king of Pruſſia, under various pretences, wreſted from Auſtria; availing himſelf alſo of the internal troubles in Poland, he has, by virtue of no other right than that which a powerful army confers on every tyrant, ſeized upon Thorn, with the countries on the Viſtula, and the Neiſter, and other territories contiguous to his own dominions cloſe to the walls of Dantzic.

The kingdom of Pruſſian is divided into the German and Lithuanian departments; the former of which contains 280 pariſhes, and the latter 105. Koningſberg, the capital of the whole kingdom, ſeated on the river Pregel, over which it has ſeven bridges, is about 84 miles from Dantzic. According to Dr. Buſching, the city is ſeven miles in circumference.

Miles. — KINGDOM *of* BOHEMIA. — Degrees.

Length 478 Breadth 322	lies between	48 and 52 north latitude. 12 and 19 eaſt longitude.

Bounded by Saxony and Brandenburg, on the North; by Poland and Hungary, on the Eaſt; by Auſtria and Bavaria on the South; and by the palatinate of Bavaria, on the Weſt; formerly comprehending, 1. Bohemia Proper; 2.a Sileſi; and, 3. Moravia.

Diviſions.	Chief Towns.	Miles.	Sq.M.
1. Bohemia Proper, W. moſtly ſubject to the Houſe of Auſtria.	Prague, E. lon. 14-20. N. lat. 50. Konningſgratz, E. Glatz, E. ſubject to the king of Pruſſia. Egra, W.	Length 162 Breadth 142	12060
2. Sileſia, Eaſt, moſtly ſubject to the king of Pruſſia.	Breſlaw, E. long. 17. N. lat. 51-15. Glogaw, N. Croſſen, N. Jagendorf, S. Tropaw, & Treſchen, S. both ſubj. to the houſe of Auſtria.	Length 196 Breadth 92	10250
3. Moravia, S. entirely ſubj. to the houſe of Auſtria.	Olmuntz, E. lon. 16-45. N. lat. 49-40. Brin, middle. Igla, S. W.	Length 120 Breadth 88	5124

Prague, the capital of Bohemia, is one of the fineſt and moſt magnificent cities in Europe, and famous for its noble bridge. Its circumference is ſo large, that the grand Pruſſian army, in its laſt ſiege, never could completely inveſt it. For this reaſon it is able to make a vigorous defence in caſe of a regular ſiege.

Miles. — HUNGARY. — Degrees. Sq. Miles

Length 300 } lies between { 17 and 23 Eaſt long. } 36,060
Breadth 200 } lies between { 45 and 49 North lat. }

That part of Hungary which belongs to the houſe of Auſtria (for it formerly included Tranſylvania, Sclavonia, Croatia, Morlachia, Servia, Walachia, and other countries), is bounded by Poland, on the North; by Tranſylvania, and Walachia, Eaſt; by Sclavonia, South; and by Auſtria and Moravia, Weſt.

The Kingdom of Hungary is uſually divided into the Upper and Lower Hungary.

Upper Hungary, *North of the Danube*. — Chief Towns.

Preſburg, ſituate on the Danube, E. lon. 17-30. N. lat. 48-20. Newhauſel, N. W. Leopolſtadt, N. W. Chremnits, N. W. Schemnits, in the middle. Eſperies, N. Caſchaw, N. Tokay, N. E. Zotmar, N. E. Unguar, N. E. Mongats, N. E. Waradin, Great, E. Segedin, S. E. Agria, in the middle. Peſt, on the Danube, oppoſite to Buda.

Lower Hungary, *South of the Danube*. — Chief Towns.

Buda, on the Danube, E. lon. 19-20. N. lat. 47-40. Gran, on the Danube, above Buda. Comorra, on the Danube, in the iſland of Schut. Raab, on the Danube, oppoſite to the iſland of Schut. Atlenburg, W. oppoſite to the iſland of Schut. Weiſſenburg, or Alba Regalis, ſituated E. of the lake, called the Platten Sea. Kaniſba, S. W. of the Platten ſea. Five churches, N. of the river Drave.

To which may be added Temeſwar, which had been conſidered as diſtinct from Hungary, becauſe it was formerly governed by an independent king; and it has ſeveral times been in the poſſeſſion of the Turks; but the Auſtrians gaining poſſeſſion of it, it was incorporated into the kingdom of Hungary in 1778. The province of Temeſwar, is 94 miles long, and 67 broad, containing about 3850 ſquares miles; it has been divided into four diſtricts, Cſadar, Temeſwar, Werſchez, and Lugos. Temeſwar, the principal town, is ſituated E. lon. 22-15. N. lat. 45-54. The chief rivers are the Danube, Drave, Save, Teyeſſe, Meriſh, and the Temes. The chief mountains are the Carpathian, which divide Hungary from Poland on the north. Preſburg is a fortified town, in it the Hungarian regalia were kept, but were lately removed to Vienna.

TRANSYLVANIA, SCLAVONIA, CROATIA, AND HUNGARIAN DALMATIA.

Theſe countries are thrown under one diviſion, becauſe we have no account ſufficiently exact of their extent and boundaries. The beſt account of them is as follows: Tranſylvania belongs to the houſe of Auſtria, and is bounded on the North by the Carpathian mountains, which divide it from Poland; on the Eaſt by Moldavia, and Walachia; on the South by Walachia; and on the Weſt by Upper and Lower Hungary. It lies between 22 and 25 degrees of eaſt longitude, and 45 and 48 of north latitude. Its length is extended about 180, and its breadth 120 miles; and contains nearly 14,400 ſquare miles, but it is ſurrounded on all ſides by high mountains. The chief city is Hermanſtadt, and its interior government ſtill partakes greatly of the ancient feudal ſyſtem, being compoſed of many independent ſtates and princes. They owe not much more than a nominal ſubjection to the Auſtrians, who leave them in poſſeſſion of many of their privileges.

Sclavonia lies between the 16th and 23d degrees of eaſt longitude, and the 45th and 47th of north latitude. It is thought to be about 200 miles in length, and 60 in breadth, and contains about 10,000 ſquare miles. It is bounded by the Drave on the North, by the Danube on the Eaſt, by the Save on the South, and by Kiria in Auſtria on the Weſt. In 1746, Sclavonia was united to Hungary, and the ſtates ſend repreſentatives to the diet of Hungary.

Croatia lies between the 15th and 17th degrees of eaſt longitude, and the 45th and 47th of north latitude. It is 80 miles in length, and 70 in breadth. All the ſovereignty exerciſed over them by the Auſtrians ſeems to conſiſt in the military arrangements for bringing them occaſionally into the field.

Hungarian Dalmatia lies in the upper part of the Adriatic ſea, and conſiſts of five diſtricts, in which the moſt remarkable place is the following; Segna, which is a royal free town, fortified both by nature and art, and is ſituated near the ſea, in a bleak, mountainous, and barren ſoil.

POLAND, including LITHUANIA.

Miles. Degrees.

Length 700 } lies between { 16 and 34 eaſt longitude.
Breadth 680 } lies between { 46 and 57 north latitude.

Before the late extraordinary partition of this country, the kingdom of Poland, with the great duchy of Lithuania annexed, (anciently called Sarmacia) was bounded on the North by Livonia, Muſcovy, and the Baltic ſea; on the Eaſt by Muſcovy; on the South by Hungary, Turkey, and Little Tartary; on the Weſt by Germany; and had the form of its government been as perfect as its ſituation was compact, it might have been one of the moſt powerful kingdoms in the univerſe. Its grand diviſions were as follow,

	Poland.	Square Miles.	Length.	Breadth.	Chief Cities.	
Proteſtants.	Courland, ſubject to Ruſſia.	4,414	174	80	Mittaw	
Papiſts.	Lithuania,	64,800	333	310	Wilna	Great part of this diſtrict is now poſſeſſed by Ruſſia.
	Podolia,	29,000	360	120	Kaminieck	
	Volhinia,	25,000	305	150	Lucko	
	Great Poland,	19,200	208	180	Gneſna	
	Red Ruſſia,	25,200	232	185	Lemburg	Now chiefly ſubject to Auſtria.
	Little Poland,	18,000	230	130	Cracow	
	Poleſia,	14,000	186	97	Breſſici	
	Maſovia,	8,400	152	90	Warsaw	E. lon. 21-5. N. lat. 52-15.
	Samogitia,	8,000	155	98	Raſiem	
	Pruſſia Royal, or Poliſh Pruſſia,	6,400	118	104	Elbing	Now ſubject to Pruſſia
	Polachia,	4,000	133	42	Bielh	
	Total —	226,414				

Dantzic, Thorn, and Elbing, in Pruſſia Royal, are ſtyled free cities, and were under the protection of Poland; the two laſt were ſeized by the late king of Pruſſia, and moſt of the privileges of the firſt.

Poland is in general a level country, and the ſoil is fertile in corn, alſo the paſtures of Poland, eſpecially in Podolia, are rich beyond expreſſion. The chief rivers of Poland are, the Viſtula or Weyſel, the Neiſter, Neiper or Boriſthenes, the Bog, and the Dwina. Dantzic is the capital of Poliſh Pruſſia. It is ſituated on the Viſtula, near five miles from the Baltic, and is a large, beautiful, populous city; its houſes generally are five ſtories high; and many of its ſtreets are planted with cheſnut-trees. It has a fine harbour, and is a moſt eminent commercial city. It is a republic, claiming a ſmall adjacent territory about forty miles round it.

Miles. — SWITZERLAND. — Degrees.

Length 260 } lies between { 6 and 11 eaſt longitude.
Breadth 100 } lies between { 45 and 48 north latitude.

It it bounded by Alſace and Swabia in Germany, on the North; by the lake of Conſtance, Tirol, and Trent, on the Eaſt; by Italy, on the South; and by France, on the Weſt. Switzerland is divided into thirteen cantons, which ſtand in point of precedency as follows: 1. Zurich; 2. Berne; 3. Lucerne; 4. Uri; 5. Schweitz; 6. Underwalden; 7. Zug; 8. Glaris; 9. Baſil; 10. Fribourg; 11. Soleure; 12. Schaffhauſen; 13. Appenzel.

The beſt account we have of the dimenſions and principal towns of each canton, is as follows:

Switzerland.	Countries Names.	Square Miles.	Length.	Breadth.	Chief Cities.
Calviniſt.	Berne	2,346	111	87	Berne
	Zurich	728	34	33	Zurich
	Schaffhauſen	140	23	9	Schaffhauſen
	Baſil	240	21	18	BASIL } 47-40 N. Lat. 7-40 E. Lon.
Papiſts.	Lucerne	460	33	35	Lucerne
	Underwalden	270	23	16	Stantz
	Uri	612	48	21	Altorf
	Suiſſe	250	27	13	Suiſſe
	Fribourg	370	24	21	Fribourg
	Zug	112	18	10	Zug
	Soleure	253	31	24	Soleure, or Solothurn
Calviniſts & Papiſts.	Appenzel	270	23	21	Appenzel
	Glaris	257	24	18	Glaris
Allies of the Switzers, Calviniſts and Papiſts.	Baden Bremgarten Mellingen	216	26	12	Baden Bremgarten Mellingen
	Rheinthal	40	20	5	Rheineck
	Thurgau	119	18	11	Frowanfield
	Lugano Locarno Mendris Maggia	850	52	30	Lugano Locarno Mendris Maggia
Calviniſts	Griſons	2,270	100	62	Coire
Subjects of the Griſons, Calviniſts & Pap.	Chiavanna	472	42	34	Chiavanna
	Bormia and Valteline.	360	27	19	Sondrio
Calviniſts.	Tockenburg	168	27	8	Liechtenſteg
	Geneva	160	13	11	Geneva
	Neufchattel	320	32	20	Neufchattel
Papiſts.	Valais	1,287	80	30	Sion
	Baſle	270	13	16	Deſperg
	St. Gall	144	20	10	St. Gall
					Mulhauſen, in Alſace, is alſo united to them.
	Total	12,884			

This is a mountainous country, lying upon the Alps, (which form an amphitheatre of more than 100 miles) the hills are covered with ſnow ſometimes all the year long. On one ſide of thoſe mountains the inhabitants are often reaping, while they are ſowing on another. The vallies are warm and fruitful, and well cultivated, and nothing can be more delightful than the ſummer months in this charming country. The chief rivers are the Rhine, which riſes in the chain of mountains bordering on St. Gothard, the Aar, the Reuſs, the Teſin, the Oglio, and the Rhone. The moſt conſiderable city is Bern, ſtanding on the river Aar. All the other cities in Switzerland are excellently well provided with arſenals, bridges, and public edifices. Baſil is accounted by ſome the capital of all Switzerland. It is ſituated in a fertile and delightful country, on the banks of the Rhine, and the confines of Alſace and the empire. The ſituation of Baſil is pleaſing; the Rhine divides it into the upper and lower town, and it is conſidered as one of the keys of Switzerland. Baden is ſamous for its antiquity and baths. Zurich is far leſs conſiderable than Bern. The city of Geneva, which is an aſſociate of Switzerland, and is under the protection of the Helvetic body, but within itſelf is an independent ſtate, and republic. The city is well built, and well fortified, ſituated upon the afflux of the Rhone, from the large fine lake of Geneva. Neufchater, ſince the year 1707, hath been under the dominion of the king of Pruſſia, but the inhabitants are free to ſerve any prince whatever, and by no means bound to take an active part in his wars.

Miles. —— SPAIN. —— Degrees.

Length 700 } lies between { 10 and 3 eaſt longitude.
Breadth 500 } lies between { 36 and 44 north latitude.

It is bounded on the Weſt by Portugal and the Atlantic Ocean; by the Mediterranean, on the Eaſt; by the Bay of Biſcay and the Pyrenean mountains, which ſeparate it from France, on the North; and by the ſtrait of the ſea of Gibraltar, on the South. It is now divided into fourteen diſtricts, beſides iſlands of the Mediterranean.

	Countries Names.	Square Miles.	Length.	Breadth.	Chief Cities.
Spain.	Caſtile, New —	27,840	220	180	MADRID { N.Lat.40·30. W.Lon.4-15.
	Andaluſia —	16,500	273	135	Seville
	Caſtile, Old —	14,400	193	140	Burgos
	Arragon —	13,818	190	105	Saragoſſa
	Eſtremadura —	12,600	180	123	Badajos
	Galicia —	12,000	165	120	Compoſtella
	Leon —	11,200	167	96	Leon
	Catalonia —	9000	172	110	Barcelona
	Granada —	8100	200	45	Granada
	Valencia —	6800	180	75	Valencia
	Biſcay and Ipuſcoa	4760	140	55	Bilboa
	Aſturia —	4600	124	55	Oviedo
	Murcia —	3600	87	65	Murcia
	Upper Navarre —	3000	92	45	Pampeluna
In the Mediterranean.	Majorca I. —	1400	58	40	Majorca
	Yvica I. —	625	37	25	Yvica
	Minorca —	520	41	20	Citadella
	Total —	150,763			

The town and fortreſs of Gibraltar, ſubject to Great Britain.

Spain formerly included Portugal, and was known to the ancients by the name of Iberia, and Heſperia, as well as Hiſpania. It was, about the time of the Punic wars, divided into Citerior and Ulterior: the Citerior contained the provinces lying north of the river Ebro: and the Ulterior, which was the largeſt part, comprehended all that lay beyond that river. Innumerable are the changes that it afterwards underwent; but there is no country of whoſe ancient hiſtory, at leaſt the interior part of it, we know leſs than that of Spain.

The mountains in Spain are numerous, the chief, and the higheſt, are the Pyrenees, near 200 miles in length, which extend from the Bay of Biſcay to the Mediterranean, and divide Spain from France. The Cantabrian mountains (as they are called) are a kind of continuation of the Pyrenees, and reach to the Atlantic Ocean, ſouth of Cape Finiſterre. No Engliſhman ought to be unacquainted with Mount Calpe, now called the hill of Gibraltar, and in former times, one of the pillars of Hercules; the other, Mount Abyla, lying oppoſite to it in Africa. The mountain Montſerrat is one of the moſt ſingular in the world, for ſituation, ſhape, and compoſition. It ſtands in a vaſt plain, about thirty miles from Barcelona, and nearly in the centre of the principality of Catalonia. It is ſo broken and divided, and ſo crowned with an infinite number of ſpiring cones, or pine heads, that it has the appearance, at a diſtant view, to be the work of man, but upon a nearer approach, to be evidently the production of the God of nature; each cone appearing of itſelf a mountain; and the whole compoſing an enormous maſs about 14 miles in circumference; and the Spaniards compute it to be two leagues in height.

The chief rivers are the Duero, formerly Durius, which falls into the Atlantic Ocean below Oporto in Portugal; the Tajo or Tagus, which falls into the Atlantic Ocean below Liſbon; the Guadiana falls into the ſame ocean near Cape Finiſterre; as does the Guadalquiver, now Turio, at St. Lucar: and the Ebro, the ancient Iberus, falls into the Mediterranean ſea below Tortoſa. The river Tinto, the qualities of which are very extraordinary, riſes in Sierra Morena, and empties itſelf into the Mediterranean near Huelva, having the name of Tinto given it from the tinge of its waters, which are as yellow as the topaz, hardening the ſand, and petrifying it in a moſt ſurpriſing manner. The chief bays are thoſe of Biſcay, Ferrol, Corunna, (commonly called the Groyne,) Vigo, Cadiz, Gibraltar, Carthagena, Alicant, Altea, Valencia, Roſes, Majorca in that iſland, and the harbour of Port-Mahon in the iſland of Minorca. The ſtrait of Gibraltar divides Europe from Africa. In blowing up the rock of Gibraltar, many pieces of bones and teeth have been found incorporated with the ſtone, ſome of which have been brought to England.

Madrid, though unfortified, is the capital of Spain; it is ſurrounded with very lofty mountains, whoſe ſummits are frequently covered with ſnow. It is well paved and lighted, and ſome of the ſtreets are ſpacious and handſome. Cadiz is the great emporium of Spaniſh commerce. It ſtands on an iſland ſeparated from the continent of Andaluſia, without the ſtraits of Gibraltar, by a very narrow arm of the ſea, over which a fortified bridge is thrown, and joins it to the main land. Seville, the Julia of the Romans, is next to Madrid, the largeſt city in Spain, but is greatly decayed, both in riches and population. The ſhape is circular, and the walls ſeem of Mooriſh conſtruction; its circumference is five miles and a half. The ſuburb of Triana is as large as many towns, and remarkable for its gloomy Gothic caſtle. Barcelona, formerly Barcino, ſaid to be founded by Hamilcar Barcas, is a large circular trading city, ſituated on the Mediterranean facing Minorca, and is ſaid to be the handſomeſt place in Spain; the houſes are lofty and plain, and the ſtreets well lighted, and paved. The citadel is ſtrong, and the place and inhabitants famous for the ſiege they ſuſtained in 1714 againſt a formidable army, when deſerted both by Engand and the emperor, for whom they had taken up arms. Valencia is a large and almoſt circular city, with lofty walls. The ſtreets are crooked and narrow, and not paved, the houſes alſo are ill built. Carthagena is a large city, but has very few good ſtreets, and fewer remarkable buildings. The port however is very complete. Granada ſtands on two hills, and the ancient palace of the Alhambra, crowns the double ſummit between two rivers, the Douro, and the Xenil. Bilboa is ſituated on the banks of the river Ybaizabel, and is about two leagues from the ſea. The houſes are ſolid and lofty, and the ſtreets well paved and level; and the water is ſo conveyed into the ſtreets, that they may be waſhed at pleaſure. Malaga is an ancient city, large and populous, and of a circular form, ſurrounded with a double wall, ſtrengthened by ſtately towers, and has nine gates. A Mooriſh caſtle on the point of a rock commands every part of it.

The city of Salamanca is of a circular form, but on three hills and two vallies, and on every ſide ſurrounded with proſpects of fine houſes, noble ſeats, gardens, orchards, fields, and diſtant villages; and is ancient, large, rich, and populous. Toledo is one of the moſt ancient cities in Spain, and during ſeveral centuries it held the rank of its metropolis. It is now exceedingly ill-built, poor and mean, and the ſtreets very ſteep. Burgos was the ancient capital of the kingdom of Caſtile, but now in obſcurity. Gibraltar, once a celebrated town and fortreſs of Andaluſia, is at preſent in poſſeſſion of Great Britain. It is a commodious port, and formed naturally for commanding the paſſage of the Straits, or, in other words, the entrance into the Mediterranean and Levant ſeas. But the road is neither ſafe againſt an enemy nor ſtorms: the bay is about twenty leagues in circumference. The Straits are 24 miles long, and 15 broad; through which ſets a current from the Atlantic ocean into the Mediterranean, and for the ſtemming of it a briſk gale is required. There is not a town in Spain but what has a large ſquare for the purpoſe of exhibiting bull-fights: and it is ſaid that even the pooreſt inhabitants of the ſmalleſt villages will often club together in order to procure a cow or an ox, and fight them, riding upon aſſes for want of horſes. The chief iſlands belonging to Spain in Europe, are thoſe of Majorca and Yvica. Minorca alſo is now become a Spaniſh iſland.

Miles. —— PORTUGAL. —— Degrees.

Length 300 } lies between { 37 and 42 North lat.
Breadth 100 } lies between { 7 and 10 Weſt lon.

It is bounded by Spain on the North and Eaſt, and on the South and Weſt by the Atlantic Ocean, being the moſt Weſterly kingdom on the continent of Europe. This kingdom was, in the time of the Romans, called Luſitania. The etymology of the modern name is uncertain. It moſt probably is derived from ſome noted harbour or port, to which the Galls (for ſo ſtrangers are called in the Celtic) reſorted. By the form of the country, it is naturally divided into three parts, the north, middle, and ſouth Provinces.

	Provinces.	Chief Towns	Sq M.
The North Diviſion contains	Entre Minho	Braga	6814
	Duro and	Oporto and Viana	
	Tralos Montes	Miranda and Villa Real	
The Middle Diviſion contains	Beira	Coimbra	12640
		Guarda Caſtel Rodrigo	
		LISBON { 38-42N.la. 8 53W.lo	
	Eſtramadura	St. Ubes, and Leira.	
The South Diviſion contains	Entre Tago	Ebora, or Evora	8397
	Guardiana	Portalegre, Elvas, Beja	
	Alentejo	Legos	
	Algarva	Faro, Tavora, & Silves	

The face of Portugal is mountainous, or rather rocky, for their mountains are generally barren: the chief are thoſe which divide Algarva from Alentejo; thoſe of Tralos Montes, and the rock of Liſbon, at the mouth of the Tajo. Though every brook in Portugal is reckoned a river, yet the chief Portugueſe rivers are mentioned in Spain, all of them falling into the Atlantic ocean. The Tagus, or Tajo, was celebrated for its golden ſand. The dormontories or capes of Portugal are Cape Mondego, near the mouth of the river Mondego; Cape Roca, at the north entrance of the river Tajo; Cape Eſpithel, at the ſouth entrance of the river Tajo; and Cape St. Vincent, on the ſouth weſt point of Algarva. The bays are thoſe of Cadoan, or St. Ubes, ſouth of Liſbon, and Lagos bay in Algarva. Liſbon is the capital of Portugal. Great part of it was ruined by an earthquake, which alſo ſet the remainder on fire, upon All-Saints day, 1755. Its ſituation (riſing from the Tagus in the form of a creſcent) renders its appearance at once delightful and ſuperb, and it is deſervedly accounted the greateſt port in Europe, next to London and Amſterpam. The harbour is ſpacious and ſecure, and the city itſelf is guarded from any ſudden attack towards the ſea by forts. All that part of the city that was demoliſhed by the earthquake, is planned out in the moſt regular and commodious form. The ſecond city in this kingdom is Oporto.

Miles. —— ITALY. —— Degrees.

Length 600 } lies between { 38 and 47 north latitude.
Breadth 400 } { 7 and 19 eaſt longitude.

Nature has fixed the boundaries of Italy; for towards the Eaſt it is bounded by the Gulf of Venice, or Adriatic ſea; on the South and Weſt by the Mediterranean ſea; and on the North, by the lofty mountains of the Alps, which divide it from France and Switzerland.

The whole of the Italian dominions, comprehending Corſica, Sardinia, the Venetian and other iſlands, are divided and exhibited in the following table.

Italy.	Countries Names.	Square Miles.	Length.	Breadth.	Chief Cities.
To the king of Sardinia	Piedmont —	6619	140	98	Turin
	Savoy —	3572	87	60	Chambery
	Montſerrat —	446	40	22	Caſal
	Aleſſandrine —	204	27	20	Alexandria
	Oneglia —	132	24	7	Oneglia
	Sardinia I. —	6600	135	57	Cagliari
To the king of Naples	Naples —	22,000	275	200	Naples
	Sicily I. —	9400	180	92	Palermo
To the Emperor	Milan —	5431	155	70	Milan
	Mantua —	700	47	27	Mantua
	Mirandola —	120	19	10	Mirandola
	Pope's dominions	14,348	235	143	ROME
To their reſpective princes	Tuſcany —	6640	115	94	Florence
	Maſſa —	82	16	11	Maſſa
	Parma —	1225	48	37	Parma
	Modena —	1560	65	39	Modena
	Piombino —	100	22	18	Piombino
	Monaco —	24	12	4	Monaco
Republics	Lucca —	286	28	15	Lucca
	St. Marino —	8			St. Marino
	Genoa —	2400	160	25	Genoa
To France	Corſica I. —	2520	90	38	Baſtia
To the republic of Venice	Venice —	8434	175	95	Venice
	Iſtria P. —	1245	6	32	Capo d'Iſtria
	Dalmatia P. —	1400	135	20	Zara
	Iſles of Dalmatia —	1364			
Iſlands in the Venetian dominions	Cephalonia —	428	40	18	Cephalonia
	Corfu, or Corcyra	194	31	10	Corfu
	Zant, or Zacyn —	110	23	12	Zant
	St. Maura —	56	22	7	St. Maura
	Little Cephalonia	14	7	3	
	Ithacaolim —				
	Total —	75,056			

The Alps and Appennines are the chief mountains of Italy. The famous volcano of Mount Veſuvius lies in the neighbourhood of Naples. The rivers of Italy are the Po, the Var, the Adige, the Trebia, the Arno, and the Tiber, which runs through the city of Rome. The famous Rubicon forms the ſouthern boundary between Italy and the ancient Ciſalpine Gaul. The lakes of Italy are, the Maggiore, Lugano, Como, Iſco, and Garda in the North; the Perugia or Thraſimene, Bracciana, Terni, and Celano, in the middle. Rome is the chief city in the Pope's Territories, and was formerly the capital of the world. It is ſituate on the River Tiber, in lat. 41° 54′ N. and long. 12° 29′ E. being 140 miles N. W. of Naples, 140 S. of Florence, and 16 miles N. E. of the Tuſcan Sea. The walls ſurrounding the city make a circumference of about 12 miles, but not a third part of the ground is built upon. It is, however, a magnificent city, the ſtreets, in general, being ſpacious and adorned with a vaſt number of elegant buildings, ſuch as churches, palaces, convents, triumphal arches, pillars, obeliſks, ſtatues, &c. Alſo the various fountains are no ſmall addition to its beauty. Florence the capital of Tuſcany, ſituated on the River Arno, is one of the moſt elegant towns in Italy; of a round figure, and about 61 miles in circumference. It lies 58 miles S. of Bologna, 140. N. of Rome, and 45 E. of Leghorn and the Tuſcan Sea. Its lat. is 43° 46½′ N. and long. 11° 2′ E. Naples, the capital of the kingdom of Naples, is an elegant built town, ſtanding on an eminence which riſes gradually from the Sea. On the eaſt is a large plain, beyond which is Mount Veſuvius. It is about 7 miles in circumference, and 140 S. E. of Rome, in lat. 40° 50′ N. and long. 14° 13′ E.

Milan, the capital of the Milaneſe, is an elegant built town, having many ſpacious ſtreets and ſquares. It is ſituated on the Rivers Olana and Lombro, 250 miles N. W. of Rome, and 100 miles N. E. of Turin; lat. 45° 28′ N. and long. 6° 10′ E. Turin the capital of Piedmont, is a neat city, adorned with many lofty and magnificent buildings, and a beautiful royal palace. It is of a ſquare figure, about 3 miles in circumference, ſituated at the confluence of the river Po, and Doria being 100 miles S. W. of Milan, and 100 N. W. of Genoa, in lat. 45° 5′ N. and long. 7° 40′ E. Genoa, the capital of the republic of Genoa, ſtands near the ſea and has an excellent harbour, the city is about 6 miles in circumference, in lat. 44° 25′ N. and long. 8° 36′ E. Venice, the capital of the Duchy of Venice, is ſituated 220 miles N. of Rome, 150 E. of Milan, and 250 E. of Turin, ſtanding upon a vaſt number of little iſlands in the ſea. It is ſo happily ſituated that no army can approach it by land, nor any hoſtile fleet by ſea. The circumference of the city is about 6 miles. To any part of the city one may go by water, and there are no leſs than 450 bridges over the canals. It is in lat. 45. 26. N. and long. 12° 4½′ E. The reſt of the towns in Italy are in general agreeably built; and the country itſelf is ſo remarkably pleaſant and fertile, that it has been deemed the garden of the world.

TURKEY.

The Grand Signior's dominions are divided into

1. TURKEY IN EUROPE.
2. TURKEY IN ASIA.
3. TURKEY IN AFRICA.

} Sq. Miles 960,000

Miles. — TURKEY in EUROPE. — Degrees. Sq. Miles.

Length 1000 } lies between { 17 and 40 Eaſt long. } 151800
Breadth 900 } { 36 and 49 North lat.

Bounded by Ruſſia, Poland, and Sclavonia, on the north; by Circaſſia, the Black Sea, the Propontis, Helleſpont, and Archipelago, on the Eaſt; by the Mediterranean, on the South; by the ſame ſea, and the Venetian and Auſtrian territories, on the Weſt.

Diviſions.	Subdiviſions.	Chief Towns.	Sq. M.
On the N. coaſt of the Black Sea are the provinces of	Crim and Little Tartary, and the ancient Taurica Cherſoneſus Budziac Tartary	Precop Brachiſeria Kaffa Oczakow	26,200 12,000
North of the Danube are the provinces of	Beſſarabia Moldavia formerly Dacia — Walachia	Bender, Belgorod Jazy, Choczim Falczin Tergoviſe	8,000 26,000 10,500
South of the Danube are	Bulgaria, eaſt part of ancient Myſia Servia, the weſt part of Myſia Boſnia	Widin, Nicopoli Siliſtria, Scopia Belgrade Semendria, Niſſa Seraio	17,000 22,570 8,040
On the Boſphorus and Helleſpont	Romania, olim Thrace	Conſtantinople N. lat. 41, E. lon. 29. Adrianople	21,200
S. of Mount Rhodope or Argentum, the N. part of anc. Greece	Macedonia Theſſaly, now Janua Achaia and Bœotia, now Livadia	Strymon, Conteſſa Salonichi, Lariſſa Athens, Thebes, Lepanto	18,980 4,050 3,420
On the Adriatic ſea or Gulf of Venice, the anc. Illyricum	Epirus Albina Dalmatia Raguſa repub.	Chimera, Burtinto, Scodra Durazzo, Dulcigno Zara, Narenza Raguſa	7955 6375 4560 430
In the Morea, the ancient Peloponneſus, being the ſouth diviſion of Greece, are	Corinthia Argos Sparta Olympia, where the Games were Arcadia Elis	Corinth Argos Napoli de Romania Lacedæmon, now Miſitra Olympia, on the river Alpheus Modon, Coron Partas Elis or Belvidere on river Peneus.	7220

Nature has laviſhed upon the inhabitants of Turkey all her bleſſings in theſe four particulars. The ſoil, though unimproved, is luxuriant beyond deſcription. The air is ſalubrious, and friendly to the imagination, unleſs when it is corrupted from the neighbouring countries, or through the indolence or uncleanneſs of the Turkiſh manner of living. The ſeaſons are here regular and pleaſant, and have been celebrated from the remoteſt times of antiquity. The Turks are invited to frequent bathings, by the purity and wholeſomeneſs of the water all over their dominions.

The moſt remarkable mountains are Mount Athos, which lies on a peninſula, running into the Egean ſea; the mounts Pindus and Olympus, celebrated in Grecian fables, ſeparate Theſſaly from Epirus. Alſo Panaſſus, in Achaia, ſo famous for being conſecrated to the Muſes, Mount Haemus is likewiſe often mentioned by the poets; but moſt of the other mountains have changed their names. The principal rivers, are, the Danube, the Save, the Neiſter, and the Neiper. The ſeas are, the Euxine or Black Sea; the Palus Mæotis or ſea of Aſoph, the ſea of Marmora, which ſeparates Europe from Aſia; the Archipelago, the Ionian ſea, and the Levant, are ſo many evidences that Turkey in Europe, particularly that part of it where Conſtantinople ſtands, of all other countries had the beſt claim to be miſtreſs of the world. Conſtantinople, the capital

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MUSEUM

tioned in Spain, all of them falling into the Atlantic ocean. The Tagus, or Tajo, was celebrated for its golden ſand. The dormontories or capes of Portugal are Cape Mondego, near the mouth of the river Mondego; Cape Roca, at the north entrance of the river Tajo; Cape Eſpithel, at the ſouth entrance of the river Tajo; and Cape St. Vincent, on the ſouth weſt point of Algarva. The bays are thoſe of Cadoan, or St. Ubes, ſouth of Liſbon, and Lagos bay in Algarva. Liſbon is the capital of Portugal. Great part of it was ruined by an earthquake, which alſo ſet the remainder on fire, upon All-Saints day, 1755. Its ſituation (riſing from the Tagus in the form of a creſcent) renders its appearance at once delightful and ſuperb, and it is deſervedly accounted the greateſt port in Europe, next to London and Amſterpam. The harbour is ſpacious and ſecure, and the city itſelf is guarded from any ſudden attack towards the ſea by forts. All that part of the city that was demoliſhed by the earthquake, is planned out in the moſt regular and commodious form. The ſecond city in this kingdom is Oporto.

Miles. —— ITALY. —— Degrees.

Length 600 } lies between { 38 and 47 north latitude.
Breadth 400 } { 7 and 19 eaſt longitude.

Nature has fixed the boundaries of Italy; for towards the Eaſt it is bounded by the Gulf of Venice, or Adriatic ſea; on the South and Weſt by the Mediterranean ſea; and on the North, by the lofty mountains of the Alps, which divide it from France and Switzerland.

The whole of the Italian dominions, comprehending Corſica, Sardinia, the Venetian and other iſlands, are divided and exhibited in the following table.

Italy.	Countries Names.	Square Miles.	Length.	Breadth.	Chief Cities.
To the king of Sardinia	Piedmont	6619	140	98	Turin
	Savoy	3572	87	60	Chambery
	Montſerrat	446	40	22	Caſal
	Aleſſandrine	204	27	20	Alexandria
	Oneglia	132	24	7	Oneglia
	Sardinia I.	6600	135	57	Cagliari
To the king of Naples	Naples	22,000	275	200	Naples
	Sicily I.	9400	180	92	Palermo
To the Emperor	Milan	5431	155	70	Milan
	Mantua	700	47	27	Mantua
	Mirandola	120	19	10	Mirandola
	Pope's dominions	14,348	235	143	ROME
To their reſpective princes	Tuſcany	6640	115	94	Florence
	Maſſa	82	16	11	Maſſa
	Parma	1225	48	37	Parma
	Modena	1560	65	39	Modena
	Piombino	100	22	18	Piombino
	Monaco	24	12	4	Monaco
Republics	Lucca	286	28	15	Lucca
	St. Marino	8			St. Marino
	Genoa	2400	160	25	Genoa
To France	Corſica I.	2520	90	38	Baſtia
To the republic of Venice	Venice	8434	175	95	Venice
	Iſtria P.	1245	6	32	Capo d'Iſtria
	Dalmatia P.	1400	135	20	Zara
	Iſles of Dalmatia	1364			
Iſlands in the Venetian dominions	Cephalonia	428	40	18	Cephalonia
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South of the Danube are	Bulgaria, eaſt part of ancient Myſia Servia, the weſt part of Myſia Boſnia	Widin, Nicopoli Siliſtria, Scopia Belgrade Semendria, Niſſa Seraio	17,000 22,570 8,040
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S. of Mount Rhodope or Argentum, the N. part of anc. Greece	Macedonia Theſſaly, now Janua Achaia and Bœotia, now Livadia	Strymon, Conteſſa Salonichi, Lariſſa Athens, Thebes, Lepanto	18,980 4,650 3,420
On the Adriatic ſea or Gulf of Venice, the anc. Illyricum	Epirus Albina Dalmatia Raguſa repub.	Chimera, Burtinto, Scodra Durazzo, Dulcigno Zara, Narenza Raguſa	7955 6375 4560 430
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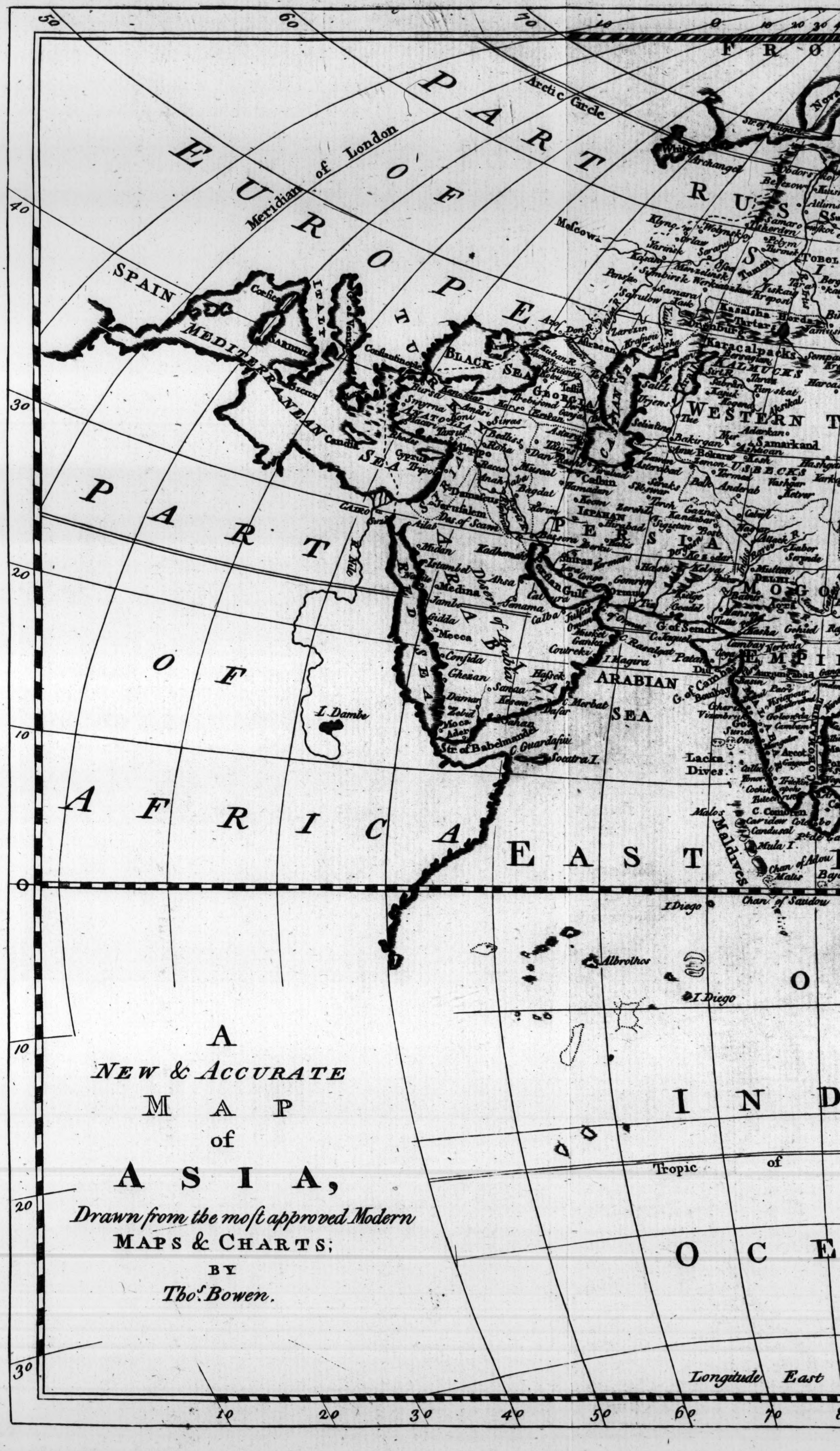

A
NEW & ACCURATE
MAP
of
ASIA,

Drawn from the most approved Modern
MAPS & CHARTS;
BY
Thoˢ. Bowen.

PART OF EUROPE
PART OF AFRICA
Arctic Circle
Meridian of London
SPAIN
ITALY
MEDITERRANEAN SEA
BLACK SEA
Mescow
Archangel
White Sea
RUSSIA
GEORGIA
NATOLIA
Constantinople
Smyrna
Candia
Cyprus
Tripoli
Damascus
Jerusalem
Cairo
Suez
R. Nile
Aleppo
Bagdat
Balsora
Ispahan
PERSIA
Ormus
Medina
Mecca
Gidda
RED SEA
ARABIA
Desert of Arabia
Sanaa
Mocha
Str. of Babelmandel
C. Guardafui
Socotra I.
ARABIAN SEA
G. of Cambay
Bombay
Goa
Calicut
Cochin
C. Comorin
Lacka Dives
Maldives
KALMUCKS
WESTERN TARTARY
Samarkand
USBECKS
Candahar
Cabul
MOGUL EMPIRE
Tobolski
I. Dambe
I. Diego
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Chan. of Sandou
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Longitude East
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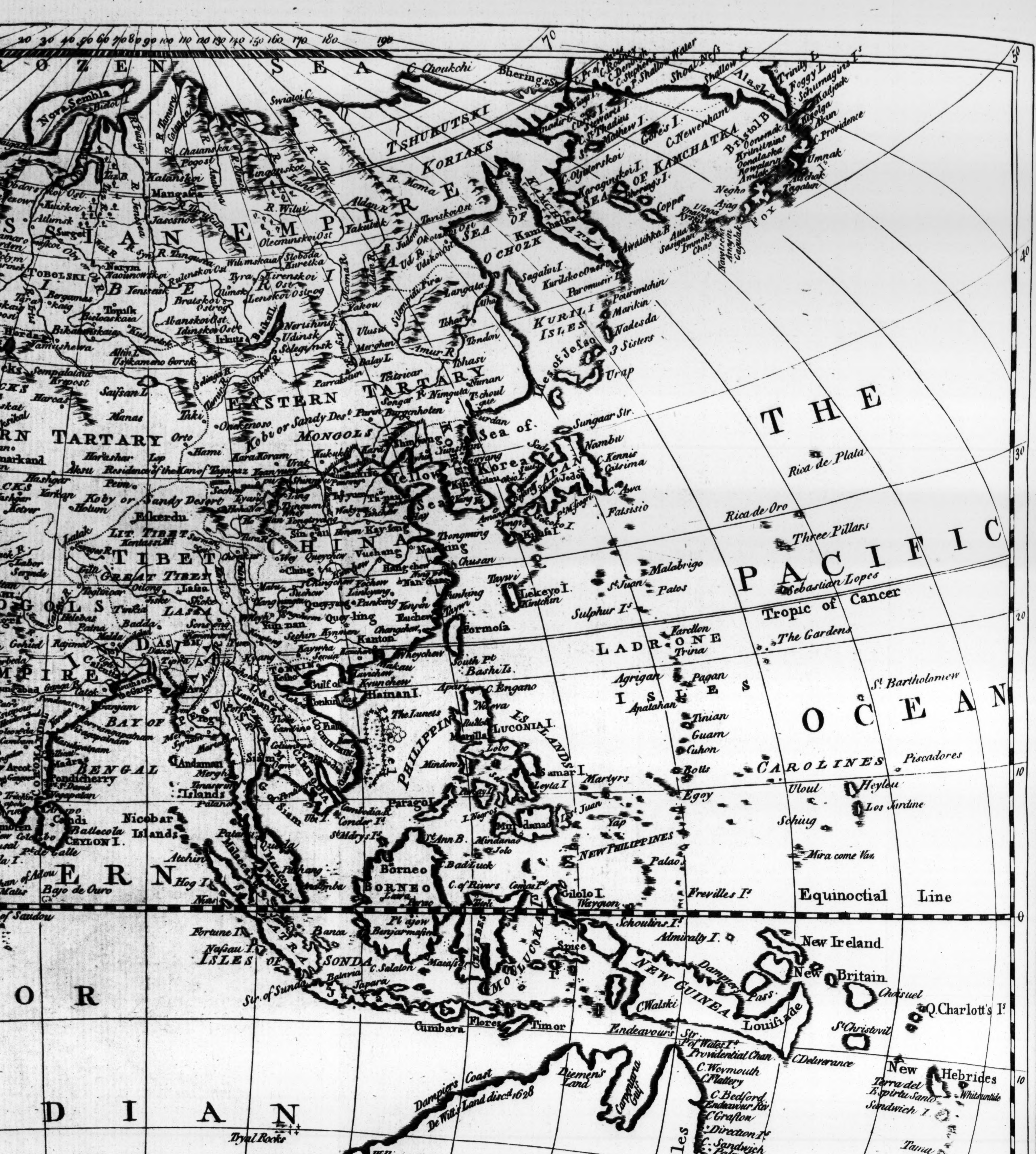


ROZEN SEA
C. Choukchi
Bherings Str.
TSHUKUTSKI
KORIAKS
Alaska
Trinity I.
Foggy I.
Schumagins Is.
Kadjack
C. Providence
Umnak
FOX
Shoal Ness
Shallow Water
Bristol B.
C. Newenham
SEA OF KAMCHATKA
KAMCHATKA
Gore's I.
Bherings I.
Copper
Nova Sembla
RUSSIAN EMPIRE
TOBOLSKI
Swiatoi C.
R. Lena
R. Wilui
Jakutskoi
Ochozk
SEA OF OCHOZK
Sagalin I.
Kurilskoi C.
Paromusir I.
KURILI ISLES
Pourimtchin
Marikin
Nadesda
3 Sisters
Urup
Land of Jesso
Sungaar Str.
Nambu
C. Kennis
Catsima
Awa
Fatsisio
JAPAN
Jedo
Korea
Sea of Korea
Yellow Sea
EASTERN TARTARY
Kobi or Sandy Des.
MONGOLS
Amur R.
Nimguta
Peking
CHINA
Nanking
Chusan
Kanton
Formosa
Lekeyo I.
Sulphur Is.
St. Juan
Malabrigo
Patos
THE PACIFIC OCEAN
Rica de Plata
Rica de Oro
Three Pillars
Sebastian Lopes
Tropic of Cancer
The Gardens
LADRONE ISLES
Farellon
Trina
Agrigan
Pagan
Apatahan
Tinian
Guam
Cuhon
Botts
Egoy
St. Bartholomew
CAROLINES
Piscadores
Uloul
Heyleu
Los Jardine
Schiug
Mira come Van
Palao
Frevilles Is.
Equinoctial Line
NEW PHILIPPINES
Yap
Martyrs
St. Juan
Bashi Is.
C. Engano
Hainan I.
Gulf of Tonkin
PHILIPPINE ISLANDS
LUCONIA I.
Manilla
Mindoro
Samar I.
Leyta I.
Mindanao
The Tunets
Paragoa I.
St. Ann B.
Borneo
BORNEO
Gilolo I.
Banca
Banjarmassin
SONDA
ISLES OF SONDA
Java
C. Salatan
MOLUCCA
Spice Is.
Celebes
Str. of Sunda
Cumbava
Flores
Timor
NEW GUINEA
C. Walski
Schoutins Is.
Admiralty I.
Dampier's Pass
New Ireland
New Britain
Louisiade
Choiseul
Q. Charlott's Is.
St. Christoval
Endeavour Str.
Pr. of Wales I.
Providential Chan.
C. Deliverance
New Hebrides
Terra del Espirtu Santo
Whitsuntide
Sandwich I.
Tanna
New Caledonia
C. Colnet
Q. Charlotte's Foreld.
Norfolk I.
New Zeeland
C. North
Diemen's Land
Carpentaria Gulf
Dampier's Coast
De Witts Land discd. 1628
Tryal Rocks
Williams Bay
NEW HOLLAND
Sharks B.
Barren I.
Dirk Hartogs I.
Red Point
Rottenest I.
Edell Land
Lyons Land
Peter Nuyts Land
New South Wales discd. 1770
C. Weymouth
C. Flattery
C. Bedford
Endeavour Riv.
C. Grafton
Direction Is.
C. Sandwich
Palm Is.
C. Glousester
Cumberland Is.
Keppel B.
Hervey B.
C. Townsend
C. Capricorn
Sandy C.
Wide Bay
C. Morton
Pt. Danger
C. Byron
Solitary Is.
Smoaky Cape
Pt. Stephens
Pt. Jackson
Botany Bay
Pt. Hicks
C. Howe
C. George
Pt. Solander
Furneaux Is.
Diemens Ld.
C. South
TARTARY
Samarkand
Kashgar
LIT. TIBET
TIBET
GREAT TIBET
Lassa
MOGOLS
EMPIRE
BAY OF BENGAL
Pegu
Siam
Camboja
Malacca
Sumatra
Andaman
Nicobar Islands
Ceylon I.
Pt. de Galle
Madras
Pondicherry
Hog I.
Atchin
Fortune I.
Nassau Is.
Bajo de Ouro
EASTERN OCEAN
INDIAN OCEAN
Capricorn
East from London
20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
70 80 90 100 110 120 130 140 150 160 170 180
50 40 30 20 10 0 10 20 30

tal of this great empire, is ſituated on the European ſide of the Boſphorus; and is at this day one of the fineſt cities in the world, by its ſituation and its port. The proſpect from it is noble. The moſt regular part is the Beſeſtin, incloſed with walls and gates, where the merchants have their ſhops excellently ranged. The city is built in a triangular form, with the Ottoman palace ſtanding on a point of one of the angles, from whence there is a proſpect of the delightful coaſt of the Leſſer Aſia, which is not to be equalled.

ISLANDS BELONGING TO TURKEY IN EUROPE, BEING PART OF ANCIENT GREECE.

Negropont, the ancient Euboea, ſtretches from the ſouth-eaſt to the north-weſt, and on the eaſtern coaſt of Achaia, or Levadia. It is 90 miles long, and 25 broad, and contains about 1300 ſquare miles. The iſland is very fertile, and all kinds of proviſions are extremely cheap. The chief towns in the iſland are, Negropont called by the Greeks Egripos, ſituated on the ſouth-weſt coaſt of the iſland, on the narroweſt part of the ſtrait; and Caſtel Roſſo, the ancient Caryſtus. Lemnos, or Stalimene, lies on the north part of the Egean ſea or Archipelago, and is almoſt a ſquare of 25 miles in length and breadth. Tenedos lies oppoſite to old Troy, and is mentioned by Virgil as the place to which the Greeks retired, and left the Trojans in a fatal ſecurity. Scyros is about 60 miles in circumference, and contains many remains of antiquity. Leſbos, or Mytelene, is about 60 miles long, and is famous for the number of philoſophers and poets it produced. Scio, or Chios, lies about 80 miles weſt of Smyrna, and is about 100 miles in circumference. It is inhabited by Greeks, Turks, and Latins. Samos lies oppoſite to Epheſus, on the coaſt of the Leſſer Aſia, about ſeven miles from the continent. It is 30 miles long, and 15 broad. This iſland gave birth to Pythagoras. To the ſouth of Samos lies Patmos, about 20 miles in circumference, but ſo barren, and dreary, that it may be called a rock rather than an iſland. It has, however, a convenient haven; and the few Greek monks who are upon the iſland ſhew a cave where St. John is ſuppoſed to have written the Apocalypſe. The Cyclades iſlands lie like a circle round Delos, the chief of them, which is ſouth of the iſlands of Mycone and Tirſe, and almoſt midway between the continents of Aſia and Europe. Delos is about ſix miles in circumference, and is almoſt deſtitute of inhabitants. Paros lies between the iſlands of Luxia and Melos. Like all the other Greek iſlands, it contains ſtriking and magnificent ruins of antiquity. Cerigo, or Cytherea, lies ſouth-eaſt of the Morea, and is about 50 miles in circumference, but is rocky and mountainous. Santoria is one of the moſt ſouthern iſlands in the Archipelago, and was formerly called Caliſta, and afterwards Thera. Near this iſland another aroſe of the ſame name, from the bottom of the ſea, in 1707. It is about 200 feet above the ſea; and at the time of its firſt emerging, it was about a mile broad, and five miles in circumference, but it has ſince increaſed. Several other iſlands of the Archipelago appear to have had the like original, but the ſea in their neighbourhood is ſo deep as not to be fathomed. The famous iſland of Rhodes is ſituated in the 28th degree of eaſt longitude, and 36 degrees 10 minutes north latitude, about 20 miles ſouth-weſt of the continent of Leſſer Aſia, being about 60 miles long, and 25 broad. This is a healthful and pleaſant iſland. The chief town, of the ſame name, ſtands on the ſide of a hill fronting the ſea, and is three miles in circumference. Candia, the ancient Crete, is ſtill renowned for its hundred cities. It lies between 35 and 36 degrees of north latitude, being 200 miles long, and 60 broad, almoſt equally diſtant from Europe, Aſia, and Africa, and contains 3220 ſquare miles. The famous Mount Ida ſtands in the middle of the iſland, and is no better than a barren rock; and Lethe, the river of oblivion, is a torpid ſtream.

Cyprus lies in the Levant ſea, about 20 miles diſtant from the coaſts of Syria and Paleſtine. It is 150 miles long, and 70 broad, and lies at almoſt an equal diſtance from Europe and Africa. The iſlands in the Ionian ſea are, Sapienza, Stivali, Zante, Cephalonia, Santamaura, Corfu, Fannu, and others of ſmaller note, particularly Iſola del Compare, the birth-place and kingdom of Ulyſſes. Zante has a populous capital of the ſame name, and is a place of conſiderable trade, the citadel is erected on the top of a large hill, ſtrong by nature, but now little better than a heap of ruins.

ASIA.

As Aſia exceeds Europe and Africa in the extent of its territories, it is alſo ſuperior to them in the ſerenity of its air, the fertility of its ſoil, the deliciouſneſs of its fruits, the fragrancy and balſamic qualities of its plants, ſpices, and gums; the ſalubrity of its drugs; the quantity, variety, beauty, and value of its gems, the richneſs of its metals, and the fineneſs of its ſilks and cottons. The continent of Aſia is ſituated between 25 and 180 degrees of eaſt longitude, and between the equator and 80 degrees of north latitude. It is about 4740 miles in length, from the Dardanelles on the weſt, to the eaſtern ſhore of Tartary; and about 4380 miles in breadth, from the moſt ſouthern part of Malacca, to the moſt northern cape of Nova Zembla. It is bounded by the Frozen ocean on the north; on the Weſt it is ſeparated from Africa by the Red Sea, and from Europe by the Levant or Mediterranean, the Archipelago, the Helleſpont, the ſea of Marmora, the Boſphorus, the Black Sea, the river Don, and a line drawn from it to the river Tobol, and from thence to the river Oby, which falls into the Frozen Ocean. On the Eaſt, it is bounded by the Pacific Ocean, or the South Sea, which ſeparates it from America; and on the South by the Indian Ocean; ſo that it is almoſt ſurrounded by the ſea. The principal regions which divide this country are as follow:

	Nations.	Length	Breadt.	Square Miles.	Chief Cities.	Diſt. and bearing fm. Lond.	Diff. of time from London.	Religions
Tartary.	Ruſſian	The bounds of theſe parts are unlimited, each power puſhing on his conqueſts as far as he can.		3,050,000	Tobolſk	2160 N.E.	4 10 bef	Ch & Pag
	Chineſe			644,000	Chynian	4480 N.E.	8 4 bef	Pagans
	Mogulean				Tibet	3780 E.	5 40 bef	Pagans
	Independ.			185,350 600,000	Samar Laſſa	2800 E. 4310	4 36 bef	Pagans
	China	1440	1000	1,105,000	Peking	4320 S.E.	7 24 bef	Pagans
	Moguls	2000	1500	1,116,000	Delhi	3720 S.E.	5 16 bef	Mah&P.
	Indi. beyond the Ganges	2000	1000	741,500	Siam Pegu	5040 S.E.	6 44 bef	Pag&M.
	Perſia	1300	1100	800,000	Iſpahan	2460 S.E.	3 20 bef	Mahom.
Turkey in Aſia.	Part of Arab.	1300	1200	700,000	Mecca	2640 S.E.	2 52 bef	Mahom.
	Syria	270	160	29,000	Aleppo	186 S. E.	2 30 bef	Ch & Ma
	Holy Land	210	90	7,600	Jeruſalem	1920 S.E.	2 24 bef	Ch & Ma
	Natolia	750	390	195,000	Burſa or Smyrna	1440 S.E.	1 48 bef	Mahom.
	Diarbeck or Meſopotam	240	210	27,000	Diarbeck	2060 S.E.	2 56 bef	Mahometans with ſome few Chriſtians.
	Irac, or Chaldea	420	240	50,400	Bagdad	2240		
	Turcomania or Armenia	360	300	55,000	Erzerum	1860 S.E.	24 4 bef	
	Georgia*	240	180	25,600	Teflis	1920 E.	3 10 bef	
	Curdiſtan or Aſſyria	210	205	23,903	Scherazer	2220 E.	3 bef	Mahom.

* *Georgia hath lately put itſelf under the protection of Ruſſia.*

All the iſlands of Aſia (except Cyprus belonging to the Turks) lie in the Pacific or Eaſtern Ocean, and the Indian Seas, of which the principal, where the Europeans trade or have ſettlements, are,

Iſlands		Towns.	Sq. Miles	Trade with or belong.
The Japaneſe iſles		Jeddo, Meaco	138,000	Dutch
The Ladrones		Guam		Spain
Formoſa		Tai-ouan-ſou	17,000	China
Anian		Kiontcheow	11,900	
The Philippines		Manilla	133,700	Spain
The Molucca or Clove iſles		Victoria fort, Ternate		Dutch
The Banda, or Nutmeg iſles		Lantor		Dutch
Amboyna	ſurrounding the Molucca & Banda iſles	Amboyna	400	Dutch
Celebes		Macaſſer	68,400	Dutch
Gilolo, &c		Gilolo	10,400	Dutch
The Sunda iſles	Borneo	Borneo, Caytongee	228,000	All nations
	Sumatra	Achen, Bencoolen	129,000	Engliſh and Dutch
	Java, &c.	Batavia, Bantam	38,250	Dutch
The Andama & Nicobar Iſles		Andaman, Nicobar		All nations
Celon		Candy	27,730	Dutch
The Maloives		Caridon		All nations
Bombay		Bombay		Engliſh
The Kurile iſles, and thoſe in the ſea of Kamtſchatka, lately diſcovered by the Ruſſians.				Ruſſia

Miles. — TURKEY IN ASIA. — Degrees. Sq. Miles.

Miles.		Degrees.	Sq. Miles.
Length 1000	lies between	27 and 46 eaſt longitude	520,820
Breadth 800		28 and 45 north latitude	

Bounded by the Black Sea and Circaſſia on the North; by Perſia, on the Eaſt; by Arabia and the Levant Sea, on the South; and by the Archipelago, the Helleſpont, and Propontis, which ſeparate it from Europe, on the Weſt.

Diviſions.	Subdiviſions.	Chief Towns.
The eaſtern provinces are	1 Eyraca Arabic or Chaldea	Baſſora and Bagdad
	2 Diarbec, or Meſopotamia	Diarbec Orfa, Monſ
	3 Curdiſtan or Aſſyria	Nineveh and Betlis
	4 Turcomania or Armenia	Erzerum and Van.
	5 Georgia, including Mengrelia and Imaretta, and part of Circaſſia	Teflis, Amarchia, & Gonie.
Natolia, or the Leſſer Aſia, on the Weſt.	1 Natolia Proper	Burſa, Nici, Smyrna and Epheſus
	2 Amaſia	Amaſia, Trapezond, and Sinope
	3 Aladulia	Ajazzo Marat
	4 Caramania	Satalia and Teraſſo
Eaſt of the Levant Sea.	Syria, with Paleſtine, or the Holy Land.	Aleppo, Antioch, Damaſcus, Tyre, Sidon, Tripoli, Scanderoon, & Jeruſalem

In Turkey and Aſia are the following mountains; famous in ſacred as well as profane writings.—Olympus; Taurus and Antitaurus; Caucaſus and Ararat; Lebanon; and Hermon: and the rivers of like note are the Euphrates; Tigris; Orontes; Meander; Sarabat; Kara; and Jordan.

Balbec is ſituated on a riſing plain, between Tripoli in Syria, and Damaſcus, at the foot of mount Libanus, and is the Heliopolis of Cælo Syria. *Palmyra*, or, as it was called by the ancients, Tadmor in the Deſert, is ſituated in the wilds of Arabia Petræa, about 33 deg. N. lat. and 200 miles to the ſouth-eaſt of Aleppo. It is approached through a narrow plain, lined with the remains or ruins of the moſt elegant ſtructures found in the world.

Mecca and *Medina* are much revered by the Mahometans, but their buildings are mean, and even the temple of Mecca, in point of architecture, makes but a ſorry appearance, though erected on a ſpot where the great prophet is ſaid to have been born. The ſame may be ſaid of the moſque at Medina, where that impoſtor was buried. The neighbourhood of Smyrna (now called Iſmir), contains many valuable antiquities. The ſame may be ſaid of Aleppo, and a number of other places celebrated in antiquity, and now known only by geographical obſervations. The ſeat of Old Troy cannot be diſtinguiſhed by the ſmalleſt veſtige, and is known only by its being oppoſite to the iſle of Tenedos, and the name of a brook which the poets magnified into a wonderful river. Scanderoon ſtands upon the ſite of Old Alexandria, but it is now almoſt depopulated. Aleppo preſerves a reſpectable rank among the cities of the Aſiatic Turkey. It is ſtill the capital of Syria, and is ſuperior in its buildings and conveniencies to moſt of the Turkiſh cities. Aleppo and its ſuburbs are ſeven miles in compaſs, ſtanding on eight ſmall hills, on the higheſt of which the citadel or caſtle is erected, but of no great ſtrength.

Bagdad, built upon the Tigris, not far it is ſuppoſed from the ſite of ancient Babylon, is the capital of the ancient Chaldea, and was the metropolis of the Caliphate, under the Saracens, in the twelfth century. This city retains but few marks of its ancient grandeur. It is in the form of an irregular ſquare, and rudely fortified, but the conveniency of its ſituation renders it one of the ſeats of the Turkiſh government, and it has ſtill a conſiderable trade, being annually viſited by the Smyrna, Aleppo, and weſtern caravans. Ancient Aſſyria is now called the Turkiſh Curdiſtan, though part of it is ſubject to the Perſians. The capital is Curdiſtan, the ancient Nineveh being now a heap of ruins. Georgia, or Gurgiſtan, now no longer ſubject to the Turks, is chiefly peopled by Chriſtians. Their capital Teflis, is a handſome city, and makes a fine appearance. It is ſituated at the foot of a mountain, by the ſide of the river Kur, and is ſurrounded by ſtrong walls, except on the ſide of the river. It has a large fortreſs on the declivity of the mountain. The ancient cities of Damaſcus, Tyre, and Sidon, ſtill retain part of their former trade. Damaſcus is called Sham, and the approach to it by Sidon, now Said, which likewiſe lies within the ancient Phœnicia, has ſtill ſome trade, and a tolerable harbour. Tyre, now called Sur, about 20 miles diſtant from Sidon, is now inhabited by few miſerable fiſhermen, who live in the ruins of its ancient grandeur. The circumference of the place is not more than a mile and a half, and ſome of the ruins of ancient Tyre are ſtill viſible. Natolia, or Aſia Minor, comprehending the ancient provinces of Lydia, Pamphylia, Piſidia, Lycaonia, Cilicia, Cappadocia, and Pontus, or Amaſia; all of them territories celebrated in the Greek and Roman hiſtory, are now, through the Turkiſh indolence and tyranny, either forſaken, or a theatre of ruins.

TARTARY IN ASIA.

Miles.		Degrees.
Length 4000	lies between	50 and 150 eaſt longitude.
Breadth 2400		30 and 72 north latitude.

It would be deceiving the reader to deſire him to depend upon the accounts given us by geographers, of the extent, limit, and ſituation of theſe vaſt regions. Even the empreſs of Ruſſia and her miniſtry are ignorant of her preciſe limits with the Chineſe, and the Perſians, and other nations. Tartary, taken in its fulleſt extent, is bounded by the Frozen Ocean on the North, by the Pacific Ocean on the Eaſt, by China, India, Perſia, and the Caſpian Sea, on the South; and by Muſcovy, on the Weſt.

Grand diviſions.	Subdiviſions.	Chief towns.	Sq. M.
N. eaſt diviſion	Kamtſchatka Tartars	Kamtſchatka	
	Jakutſkoi Tartars	Jakutſkoi	
S. E. diviſion	Bratſki	Braſki, Thibet	985380
	Thibet & Mogul Tartars	Poion, Kudak	
N. W. diviſion	Samoieda, Oſtiack.	Mangaſia, Kortſkoi.	
South-weſt diviſion	Circaſſian and Aſtrachan Tartary	Terki	
		Aſtrachan	
Middle diviſion	Siberia	Tobolſk	
	Kalmuc Tartary	Bokharia	850,000
	Uſbeck Tartary	Samarcand	339,840

Kamtſchatka is a great peninſula, which extends from North to South about ſeven degrees thirty minutes. It is divided into four diſtricts, Bolchereſk, Tigilſkaia Krepoſt, Verchnei or Upper Kamtſchatkoi Oſtrog, and Neſhnei or Lower Kamtſchatkoi Oſtrog. The principal mountains are Caucaſus in Circaſſia, and the mountains of Taurus and Ararat, ſo contiguous to it, that they appear like a continuation of the ſame mountains, which croſſes all Aſia from Mongalia to the Indies; and the mountains of Stolpt, in the North. The Seas are the Frozen Ocean, the Pacific Ocean, and the Caſpian Sea. The principal rivers are, the Wolga, which runs a courſe of two thouſand miles; the Obey, which divides Aſia from Europe; the Tabol, Irtis, Geneſa or Jenſka; the Burrumpooter; the Lena, and the Argum, which divide the Ruſſian and the Chineſe empire. We know little of the cities and towns but the names; and that they are in general no better than fixed hordes. They may be ſaid to be places of abode rather than towns or cities, for we do not find that they are under any regular government. Tobolſk and Aſtrachan are ranked as conſiderable cities.

THE EMPIRE OF CHINA.

Miles.		Degrees.	Sq. Miles.
Length 1450	lies between	20 and 42 north lat.	1,105,000
Breadth 1260		98 and 123 eaſt lon.	

CHINESE TARTARY. —— Sq. M. 644,000.

It is bounded by Tartary and an amazing ſtone wall on the North; by the Pacific ocean which divides it from North-America, on the Eaſt; by the Chineſian ſea, South; and by Tonquin, and the Tartarian countries and mountains of Thibet and Ruſſia, on the Weſt. The great diviſion of this empire, according to the authors of the Univerſal Hiſtory, is into fifteen provinces (excluſive of that of Lyau-tong, which is ſituated without the Great Wall, though under the ſame dominion); each of which might, for their largeneſs, fertility, populouſneſs, and opulence, paſs for ſo many diſtinct kingdoms. China, excepting to the north, is a plain country, and contains no remarkable mountains. The chief rivers are the Yamour and the Argum, which are the boundary between the Ruſſian and Chineſe Tartary; the Crocceus, or Whamboo, or the Yellow River; the Kiam, or the Blue River, and the Tay. Common water in China is very indifferent, and is in ſome places boiled to make it fit for uſe. The empire is ſaid to contain 4400 walled cities; the chief of which are Peking, Nanking, and Canton. Peking, the capital of the whole empire of China, and the ordinary reſidence of the emperors, is ſituated in a very fertile plain, 20 leagues diſtant from the Great Wall. It is an oblong ſquare, and is divided into two cities: that which contains the emperor's palace, is the Tartar city. The invention of gunpowder is juſtly claimed by the Chineſe, who made uſe of it againſt Zinzis Khan and Tamerlane.

INDIA IN GENERAL.

This vaſt country is ſituated between the 66th and 109th degrees of Eaſt longitude, and between 1 and 40 of North latitude. It is bounded, on the North, by the countries of Uſbec Tartary and Thibet; on the South, by the Indian Ocean; on the Eaſt, by China and the Chineſe ſea; and on the Weſt, by Perſia and the Indian ſea. India at large is divided into three parts; firſt, the Peninſula of India beyond the Ganges, called the Farther Peninſula; ſecondly, the main land, or the Mogul's empire; thirdly, the Peninſula within or on this ſide the Ganges; all of them vaſt, populous, and extended empires.

THE PENINSULA OF INDIA BEYOND THE GANGES, CALLED THE FARTHER PENINSULA.

Miles.		Degrees.
Length 2000	lies between	1 and 30 north lat.
Breadth 1000		92 and 109 eaſt long.

This Peninſula is bounded by Thibet and China, on the north; by China and the Chineſe ſea, on the Eaſt; by the ſame ſea and the ſtraits of Malacca, on the South: and by the bay of Bengal and the Hither India, on the Weſt. The ſpace between Bengal and China, is now called the province of Mecklus, and other diſtricts ſubject to the king of Ava or Burmah.

Gr. diviſi.	Subdiviſi.	Chief towns.	Sq. M.
On the north-weſt.	Acham	Chamdara	180,000
	Ava	Ava	
	Aracan	Aracan	
On the ſouth-weſt	Pegu	Pegu, E. lon. 97. N. lat. 17-30	50,000
	Martaband	Martaban	
	Siam	Siam, E. lon. 100 55. N. l. 14-18	170,000
	Malacca	Malacca, E. lon. 101. N. l. 2-12	48,000
On the n. eaſt	Tonquin	Cachao,	112,000
	Laos	Lanchang	59,400
On the ſouth-eaſt.	C. China	Thoanoa	61,900
	Cambodia	Cambodia	60,200
	Chiampa	Padram	

The name of India is taken from the River Indus, which of all others was the beſt known to the Perſians. There are mountains from North to South almoſt the whole length of the country; but the lands near the ſea are low, and annually overflowed in the rainy ſeaſon. The chief rivers are Senpoo or Burrumpooter, Domea, Mecon, Menan, and Ava, or the great river *Nou Kian*.

In this peninſula are many kingdoms, but they are little known. The few accounts that have been given of them are not to be depended on, and of courſe they are not worth enumerating here.

INDIA *within the* Ganges, *or the Empire of the* Great Mogul.

Situation *and* Extent, *including the Peninſula weſt of the* Ganges.

Miles.		Degrees.
Length 2000	lies between	7 and 40 north latitude.
Breadth 1500		66 and 92 eaſt longitude.

This empire is bounded by Uſbec Tartary, and Thibet on the North; by Thibet and the Bay of Bengal, on the Eaſt; by the Indian Ocean, on the South; by the ſame and Perſia, on the Weſt. The main land being the Mogul empire, or Indoſtan properly ſo called.

Grand diviſions.	Provinces.	Chief Towns.	
The north-eaſt diviſion of India, containing the provinces of Bengal, on the mouths of the Ganges, and thoſe of the mountains of Naugracut	Bengal proper	Calcutta	
		Fort William	Engliſh
		Hugley, Dacca	
		Malda, Engliſh and Dutch	
		Chatigan, Caſſumbazar	
	Naugracut	Naugracut	
	Jeſuat - -	Rajapour	
	Patna - -	Patna	
	Necbal - -	Necbal	
	Gore - -	Gore	
	Rotas - -	Rotas	

Grand diviſions	Provinces.	Chief Towns.
The north-weſt diviſion on the frontiers of Perſia, and on the river of Indus.	Soret - -	Jaganal
	Jeſſelmere -	Jeſſelmere
	Tata, or Sinda	Tata
	Bucknor - -	Bucknor
	Moultan - -	Moultan
	Haican - -	Haican
	Cabul - -	Cabul
The middle diviſion	Candiſh - -	Medipour
	Berar - -	Berar
	Chitor - -	Chitor
	Ratipor - -	Ratipor
	Navar - -	Navar
	Gualeor - -	Gualeor
	Agra - -	Agra
	Delhi - -	DELHI
	Lahor, or Pencah	Lahor
	Hendowns -	Hendowns
	Caſſimere -	Caſſimere
	Jengapour -	Jengapour
	Aſmer, or Bando	Aſmer

The Britiſh nation poſſeſs in full ſovereignty, the whole ſoubah of Bengal, and the greateſt part of Bahar. In Oriſſa or Orixa, only the diſtricts of Midnapour. The whole poſſeſſions contain about 150,000 ſquare miles. With their allies and tributaries, they now occupy the whole navigable courſe of the Ganges from its entry on the plains to the ſea, which by its winding courſe is more than 1350 miles. The moſt remarkable mountains are thoſe of Caucaſus and Naugracut, which divide India from Perſia, Uſbec Tartary, and Thibet; and are inhabited by Matattas, Afghans, or Patans, and other people more warlike than the Gentoos. As to the mountains of Balegant which run almoſt the whole length of India, from north to ſouth, they are ſo high as to ſtop the weſtern monſoon; the rains beginning ſooner on the Malabar, than they do on the Coromandel coaſt. The chief rivers are the Indus called by the natives Sinda and Sindeh, and the Ganges, both of them known to the ancients. Beſides thoſe rivers, many others water this country.

The ſeas, bays, and capes, are the Indian ocean; the bay of Bengal; the gulf of Cambaya: the ſtraits of Ramanakoel; Cape Comorin and Diu. The province of Adgra is the largeſt in all Indoſtan, containing 40 large towns and 340 villages. The city of Delhi, which is the capital of that province, is likewiſe the capital of Indoſtan. It is a fine city, and containing the imperial palace, which is adorned with the uſual magnificence of the Eaſt. Its ſtables formerly contained 12,000 horſes, brought from Arabia, Perſia, and Tartary; and 500 elephants. When the forage is burnt up by the heats of the ſeaſon, as is often the caſe, theſe horſes are ſaid to be fed in the morning with bread, butter, and ſugar, and in the evening with rice-milk properly prepared. Tarta, the capital of Sindia, is alſo a large city; the province of Moultan is not very fruitful, but it yields excellent iron and canes. The province of Caſſimere, is ſurrounded with mountains, and is difficult of acceſs, but when entered, it appears to be the paradiſe of the Indies. It is ſaid to contain 100,000 villages.

The province and city of Lahor formerly made a great figure in the Indian hiſtory, and is ſtill one of the largeſt and fineſt provinces in the Indies. Its capital was once about nine miles long, but is now much decayed: the provinces of Ayud, Varad, Bekar, and Hallabas, are inhabited by a hardy race of men, who ſeem never to have been conquered. Bengal, is eſteemed the ſtorehouſe of the Eaſt Indies. Its fertility exceeds that of Egypt, after being overflowed by the Nile. The country is interſected by canals cut out of the Ganges, for the benefit of commerce; and extends near 100 leagues on both ſides the Ganges, full of cities, towns, caſtles, and villages. The capital of Bengal, where the nabob keeps his court, is Patna or Moorſhedabad. Chandenagore is the principal place poſſeſſed by the French in Bengal; it lies higher up the river than Calcutta. Hugley, which lies fifty miles to the north of Calcutta upon the Ganges, is a place of prodigious trade for the richeſt of all Indian commodities. Dacca is ſaid to be the largeſt city of Bengal, and the tide comes up to its walls. The other chief towns are Caſſumbazar, Chinchura, Barnagua, and Maldo: beſides a number of other places of leſs note, but all of them rich in the Indian manufactures. We know little concerning the province or ſubah of Malva, which lies to the weſt of Bengal, but that it is as fertile as the other provinces, and that its chief cities are Ratiſpor, Ougein, and Indoor. The province of Candiſh includes that of Berar and part of Orixa, and its capital is Brampur, or Burhampoor, a flouriſhing city.

The rivers are, The Cattack or Mahanada, the Soane and Nerbudda, the Pudder, and the famous Kiſtna. This peninſula is rather to be divided into great governments, or ſoubahſhips, than into provinces. One ſoubah often engroſſes ſeveral provinces, and fixes the ſeat of his government according to his own conveniency. I ſhall ſpeak of thoſe provinces as belonging to the Malabar, or Coromandel coaſt, the two great objects of Engliſh commerce in that country; and firſt, of the eaſtern, or Coromandel coaſt. Madura begins at Cape Comorin, the ſouthernmoſt point of the peninſula. It is about the extent of the kingdom of Portugal. Tanjour is a little kingdom, lying on the eaſt of Madura. The ſoil is fertile, within it lies the Daniſh Eaſt India ſettlement of Tranquebar, and the fortreſs of Negapatam, which was taken from the Dutch the laſt war, and confirmed to the Engliſh by the late treaty of peace; the capital city is Tanjour. The Carnatic, as it is now called, is well known to the Engliſh. It is bounded on the eaſt by the bay of Bengal; on the north by the river Kiſtna, which divides it from Golconda; on the weſt by Viſiapour; and on the ſouth by the kingdoms of Meſſaur and Tanjour; being in length, from ſouth to north, about 345 miles, and 276 in breadth from eaſt to weſt. The capital of the Carnatic is Biſnagar, and of our ally, the nabob of Arcot. The country in general is eſteemed healthful, fertile, and populous. Within this country, upon the Coromandel coaſt, lies fort St. David's, or Cuddalore, belonging to the Engliſh, with a diſtrict round it. Five leagues to the north lies Pondicherry, once the emporium of the French in the Eaſt Indies, but which hath been repeatedly taken by the Engliſh, and as often reſtored by the treaties of peace.

Grand Di.	Provinces.	Chief towns.	Sq. M.
The ſouth-eaſt coaſt of India, ſituate on the bay of Bengal, uſually called the coaſt of Coromandel.	Madura	Madura	16,400
	Tanjour	Tanjour	83,550
	Eaſt ſide of Biſnagar, or Carnatic	Tranquebar, Danes, Negapatam, Engliſh, Biſnagar, Portnova, Dutch, Fort St. David, Engliſh Pondicherry, Conymere, French Coblon, Sadraſpatan, Dutch, St. Thomas, Portugueſe, Fort St. George or Madras, E. lon. 80-32. N. lat. 13-11. Engliſh, Pellicate, Dutch	
	Golconda	Golconda —— —— Gani, or Coulor, diamond mines Maſulipatan, Engliſh and Dutch	62,100
	Orixa	Vizigapatan, Engliſh, Bimlipatan, Dutch, Orixa, Ballaſore, Engliſh	
The ſouth-weſt coaſt of India, uſually called the coaſt of Malabar.	Weſt ſide of Biſnagar, or Carnatic	Tegapatan, Dutch, Anjengo, Engliſh, Cochin, Dutch, Calicut, Tillichery, Engliſh; Canannore, Dutch, Monguelore, Baſſilore, Dutch and Portugueſe;	83,040
	Decan or Viſiapour	Raolconda, diamond mines; Cawar, Engliſh; Goa, Portugueſe; Rajapore, French; Dabal, Engliſh; Dundee, Shoule, Portugueſe; Bombay, iſle and town, Engliſh; 19-18. N. lat. 73-6. E. lon.	
	Cambaya, or Guzarat	Baſſaim, Portugu. Salſette, Engliſh Damon, Portugueſe; Surat, Swalley, Barak, Engliſh and Dutch; Amedabat, Cambaya, Dieu, Portugueſe.	

Fort St. George, better known by the name of Madras, is the capital of the Engliſh Eaſt India Company's dominions in that part of the Eaſt Indies, and is diſtant eaſtward from London, about 4800 miles. Golconda is ſubject to a prince, called the Nizam, or Soubah of the Deccan. The capital of his dominions is Bagnagur, or Hyderabad, but the kingdom takes its name from the city of Golconda. Eaſt-ſouth-eaſt of Golconda lies Maſulipatan, where the Engliſh and Dutch have factories. The Engliſh have alſo factories at Ganjam and Vizigapatan, on this coaſt; and the Dutch at Narſipore. The province of Orixa, lies to the north of Golconda, extending in length from eaſt to weſt about 550 miles, and in breadth about 240. It is governed chiefly by Moodajee Booſlah, and his brother, allies to the Marattas.

The country of Decan comprehends ſeveral large provinces, and ſome kingdoms; particularly thoſe of Baglana, Balagate, Telenga, and the kingdom of Viſiapour. Modern geographers are not agreed upon their ſituation and extent, but we are told that the principal towns are Aurengabad, and Doltabad or Dowletabad; and the latter is the ſtrongeſt place in all Indoſtan. Near it lies the famous pagod of Flora, in a plain about two leagues ſquare. Telanga lies on the eaſt of Golconda; and its capital is Beder. Baglana lies to the weſt of Telenga, and forms the ſmalleſt province of the empire; its capital is Mouler. The Portugueſe territory begins here at the port of Daman, twenty-one leagues ſouth of Surat, and extends almoſt twenty leagues to the north of Goa. Viſiapour is a large province, the weſtern part is called Konkan. The principal places on this coaſt are, Daman, Baſſaim Trapor or Tarapor, Chawl, Dandi-Rajahhpur, Dabul-Rajupur, Ghiria, and Vingurla. Guzerat is a maritime province on the gulf of Cambaya, and one of the fineſt in India, but inhabited by a fierce rapacious people. It is ſaid to contain 35 cities. Amed-Abad is the capital of the province. About 43 French leagues diſtant lies Surat, where the Engliſh have a flouriſhing factory.

Among the iſlands lying upon the ſame coaſt is that of Bombay, belonging to the Engliſh Eaſt India company. The iſland itſelf is about ſeven miles in length, and twenty in circumference; but its ſituation and harbour are its chief recommendations, being deſtitute

ſtitute of almoſt all the conveniences of life. The town is about a mile long, and poorly built. Near Bombay are ſeveral other iſlands not worth enumerating. The iſland and city of Goa, the capital of the Portugueſe ſettlements in the Eaſt Indies, lie about thirty miles ſouth of Vingurla. The iſland is about twenty-ſeven miles in compaſs. It is one of the fineſt and beſt fortified ports in the Indies. Sunda lies ſouth of the Portugueſe territories, and is governed by a rajah, tributary to the Mogul. The Engliſh factory of Corwar, is one of the moſt pleaſant and healthy of any upon the Malabar coaſt. Kanora lies about forty miles to the ſouth of Goa, and reaches to Calicut. Though Malabar gives name to the old ſouth-weſt coaſt of the peninſula, yet it is confined at preſent to the country ſo called, lying on the weſt of Cape Comorin, and called the dominions of the Samorin. The country itſelf is rich and fertile, but peſtered with green adders, whoſe poiſon is incurable. The moſt remarkable places in Malabar are Kannamore, containing a Dutch factory and fort; Tellicherry, where the Engliſh have a ſmall ſettlement. Calicut, where the French and Portugueſe have ſmall factories, beſides various other diſtinct territories and cities. Cape Comorin is the ſouthernmoſt part of this peninſula, and extends about three leagues.

PERSIA.

Miles.		Degrees.	Sq. Miles.
Length 1300	lies between	44 and 70 Eaſt lon.	800,000
Breadth 1100		25 and 44 North lat	

Modern Perſia is bounded by the mountains of Ararat, or Daghiſtan, which divide it from Circaſſian Tartary, on the North-Weſt; by the Caſpian ſea, which divides it from Ruſſia, on the North; by the river Oxus, which divides it from Uſbec Tartary, on the North-Eaſt; by India, on the Eaſt; and by the Indian ocean, and the gulfs of Perſia and Ormus, on the South; and by Arabia and Turkey, on the Weſt. This kingdom is divided into the following provinces: on the frontiers of India are Coraſan, part of the ancient Hyrcania, including Herat and Eſterabad; Sableuſtan, including the ancient Bactriana and Candahor; and Sigiſtan, the ancient Drangiana. The ſouthern diviſion contains Makeran, Kerman, the ancient Gedroſlia, and Farſiſtan, the ancient Perſia. The ſouth-weſt diviſion, on the frontiers of Turkey, contains the provinces of Chuſiſtan, the ancient Suſiana, and Irac-Agem, the ancient Parthia. The North-weſt diviſion, lying between the Caſpian ſea and the frontiers of Turkey in Aſia, contains the provinces of Aderbeitzen, the ancient Media; Gangea, and Daghiſtan, part of the ancient Iberia and Colchis; Chilan, part of the ancient Hyrcania; Shirvan, and Mazanderan.

Perſia, according to the poets, derived its name from Perſeus, the ſon of Jupiter and Danae. Leſs fabulous authors ſuppoſe it derived from Paras, which ſignifies a horſeman; the Perſians or Parthians, being always celebrated for their ſkill in horſemanſhip. Here are the mountains of Caucaſus and Ararat, which are called the mountains of Daghiſtan: alſo the vaſt collection of mountains called Taurus, and their diviſions, run through the middle of the country from Natolia to India. The moſt conſiderable rivers are thoſe of Kur, anciently Cyrus; and Aras, anciently Araxes, which riſe in or near the mountains of Ararat, and, joining their ſtreams, fall into the Caſpian ſea. The Oxus can ſcarcely be called a Perſian river, though it divides Perſia from Uſbec Tartary. Perſia has the river Indus on the eaſt, and the Euphrates and Tigris on the weſt. Iſpahan or Spahawn, the capital of Perſia, is ſeated on a fine plain within a mile of the river Zenderhend, which ſupplies it with water. It is ſaid to be twelve miles in circumference. Sciras lies about 200 miles to the ſouth of Aſtrachan. It is an open town, and its neighbourhood is inexpreſſibly rich and beautiful. This town is the capital of Pars, the ancient Perſia. The cities of Ormus and Gombroon, on the narrow part of the Perſian Gulf, were formerly places of great commerce and importance

Miles.	— ARABIA. —	Degrees.	Sq. Miles
Length 1300	lies between	35 and 60 Eaſt long.	700,000
Breadth 1200		12 and 30 North lat.	

Bounded by Turkey, on the North; by the gulfs of Perſia or Baſſora, and Ormus, which ſeparate it from Perſia, on the Eaſt; by the Indian Ocean, South; and the Red Sea, which divides it from Africa, on the Weſt.

Diviſions.	Subdiviſions.	Chief Towns.
1. Arabia Petræa, N. W.	——	SUEZ
2. Arabia Deſerta, in the middle.	Haggiaz or Mecca	MECCA, E. lon. 43-30. lat. 21. 20.
		Siden, Medina
	Tehama	Dhafar
3. Arabia Felix, S. E.	Mocha —	MOCHA
		Sibit
	Hadramut —	Hadramut
	Caſſeen —	Caſſeen
	Segur —	Segur
	Oman or Muſcat	Muſcat
	Jamama —	Jamama
	Bahara —	Elcalf.

It is remarkable that this country has always preſerved its ancient name. The word *Arab*, it is generally ſaid, ſignifies a robber, or freebooter. The word *Saracen*, by which one tribe is called, is ſaid to ſignify both a thief and an inhabitant of the deſert. They belong to the Arabians, for they ſeldom let any merchandiſe paſs through the country without extorting ſomething from the owners, if they do not rob them. The mountains of Sinai and Horeb, lying in Arabia Petræa, eaſt of the Red Sea, and thoſe called Gabel el Ared, in Arabia Felix, are the moſt noted. There are few mountains, ſprings, or rivers in this country, except the Euphrates, which waſhes the north eaſt limits of it. It is almoſt ſurrounded with ſeas; as the Indian Ocean, the Red ſea, the gulfs of Perſia and Ormus. The chief capes or promontories are thoſe of Roſalgate and Muſledon.

What is called the Deſert of Sinai, is a beautiful plain near nine miles long, and about three in breadth; it lies open to the north-eaſt, but to the ſouthward is cloſed by ſome of the lower eminences of Mount Sinai, and other parts of that mountain makes ſuch encroachments upon the plain as to divide it in two, each ſo capacious as to be ſufficient to receive the whole camp of the Iſraelites. From Mount Sinai may be ſeen Mount Horeb, where Moſes kept the flocks of Jethro, his father-in-law, when he ſaw the burning buſh. The chief cities in Arabia are Mocha, Aden, Muſcat, Suez, and Judah, where moſt of the trade of this country is carried on. Mocha is well built, the houſes very lofty, and are with the walls and forts covered with a chinam or ſtucco, that gives a dazzling whiteneſs to them. The harbour is ſemicircular, the circuit of the walls is two miles, and there are ſeveral handſome moſques in the city. Suez, the Arſinoe of the ancients, is ſurrounded by the Deſert, and but a ſhabby ill-built place. Judah is the place of the greateſt trade in the Red Sea, for there the commerce between Arabia and Europe meets.

At Mecca, the birth place of Mahomet, is a moſque ſo ſuperb, that it is generally counted the moſt magnificent of any temple in the Turkiſh dominions: its lofty roof being raiſed in faſhion of a dome, and covered with gold, with two beautiful towers at the end, of extraordinary height and architecture, make a delightful appearance, and are conſpicuous at a great diſtance. The moſque hath a hundred gates, with a window over each; and the whole building within is decorated with the fineſt gildings and tapeſtry.

The INDIAN *and* ORIENTAL ISLANDS.

The Japan Iſlands form together what has been called the empire of Japan, and are governed by a moſt deſpotic prince, who is ſometimes called emperor, and ſometimes king. They are ſituated about 150 miles eaſt of China, and extend from the 30th to the 41ſt degree of north latitude, and from the 130th to the 147th of eaſt longitude. The chief town is Jeddo, in the 141ſt degree of eaſt longitude, and the 36th of north latitude. The iſlands are very inacceſſible, through their high rocks and tempeſtuous ſeas; they are ſubject to earthquakes, and have ſome volcanoes.

The LADRONE ISLANDS, of which the chief town is ſaid to be Guam, eaſt longitude 140, north latitude 14: they are about twelve in number.

FORMOSA is likewiſe an oriental iſland. It is ſituated to the eaſt of China, near the province of Fo-kien, and is divided into two parts by a chain of mountains, which runs through the middle, beginning at the ſouth coaſt, and ending at the north. This is a very fine iſland, and abounds with all the neceſſaries of life. That part of the iſland which lies to the weſt of the mountains belongs to the Chineſe. The Chineſe have likewiſe made themſelves maſters of ſeveral other iſlands in theſe ſeas, of which we ſcarcely know the names; that of Ainan is between ſixty and ſeventy leagues long, and between fifty and ſixty in breadth, and but twelve miles from the province of Canton.

The PHILIPPINES, of which there are 1100 in number, lying in the Chineſe ſea (part of the Pacific Ocean) 300 miles ſouth-eaſt of China, of which Manilla, or Luconia, the chief, is 400 miles long and 200 broad. The inhabitants conſiſt of Chineſe, Ethiopians, Malays, Spaniards, Portugueſe, Pintados, or painted people, and Meſtes, a mixture of all theſe. The property of the iſlands belongs to the king of Spain.

The MOLUCCAS, commonly called the SPICE or CLOVE ISLANDS. Theſe are not out of ſight of each other, and lie all within the compaſs of twenty-five leagues to the ſouth of the Philippines, in 125 degrees of eaſt longitude, and between one degree ſouth, and two north latitude. They are in number five, viz. Bachian, Machian, Motyr, Ternate, and Tydor. Theſe iſlands after being ſubject to various powers, are now governed by three kings, ſubordinate to the Dutch. Ternate is the largeſt of them though no more than thirty miles in circumference.

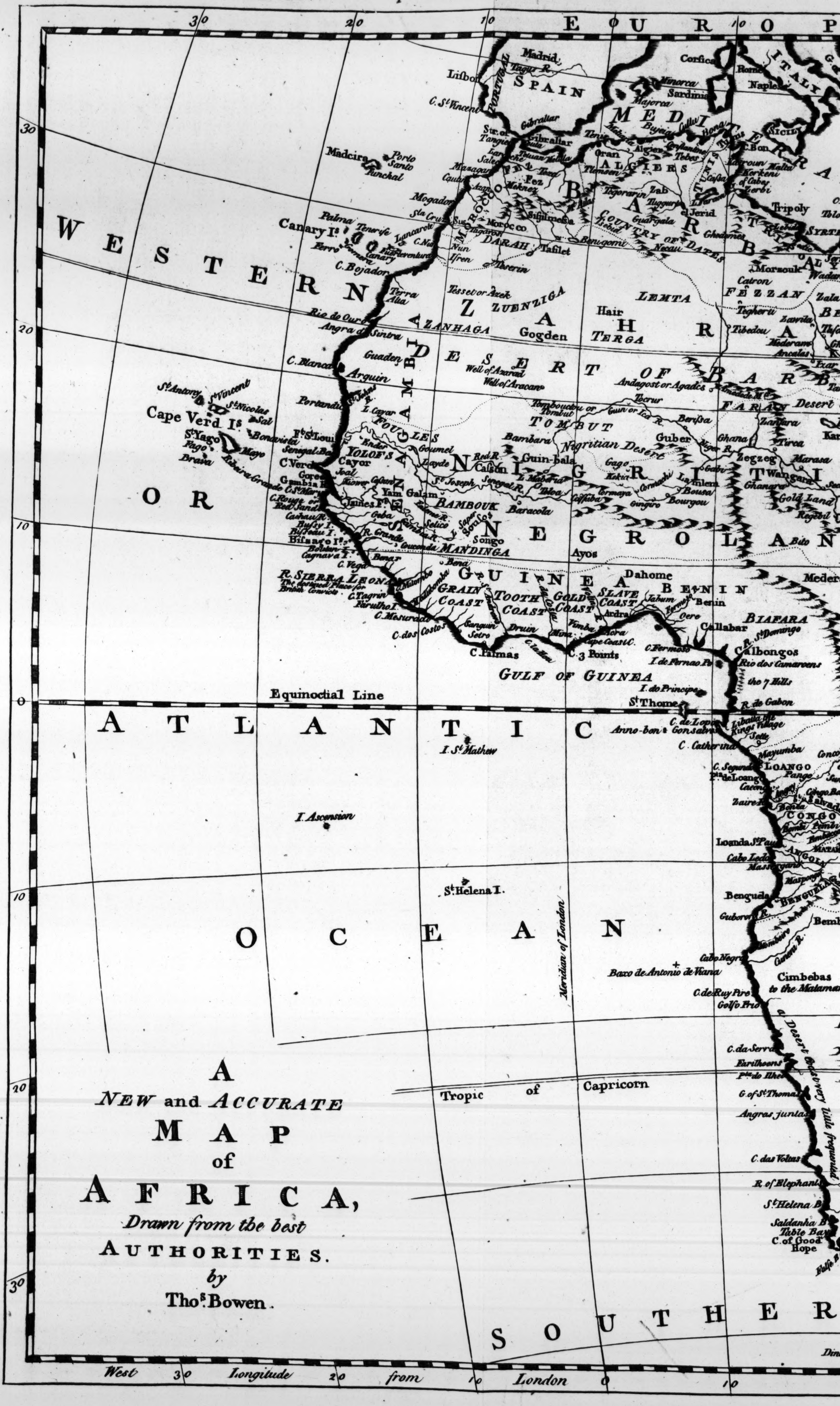
The BANDA, or NUTMEG ISLANDS, are ſituated between 127 and 128 degrees eaſt longitude, and between four and five ſouth latitude, comprehending the iſlands of Lantor, the chief towns of which are Lantor, Poleron, Roſinging, Pooloway, and Gonapi. The chief forts belonging to the Dutch on theſe iſlands are thoſe of Revenge and Naſſau.

AMBOYNA. This iſland, taken in a large ſenſe, is one and the moſt conſiderable of the Moluccas, which, in fact, it commands. It is ſituated in the Archipelago of St. Lazarus, between the third and fourth degree of ſouth latitude, and 120 leagues to the eaſtward of Batavia. It is about ſeventy miles in circumference.

The iſland of CELEBES, or MACASSAR, is ſituated under the equator, between the iſland of Borneo and the Spice iſlands, at the

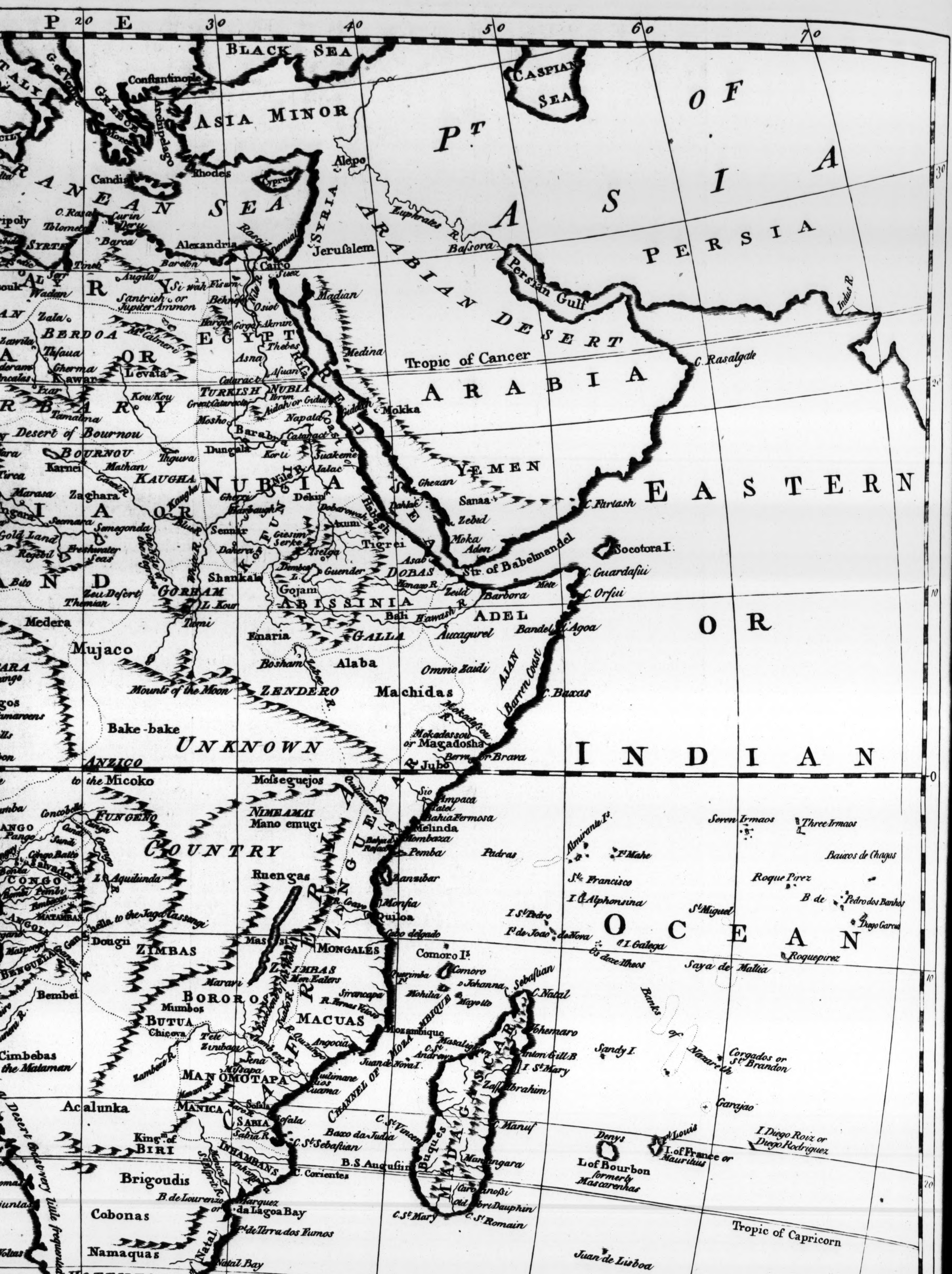
diſtance

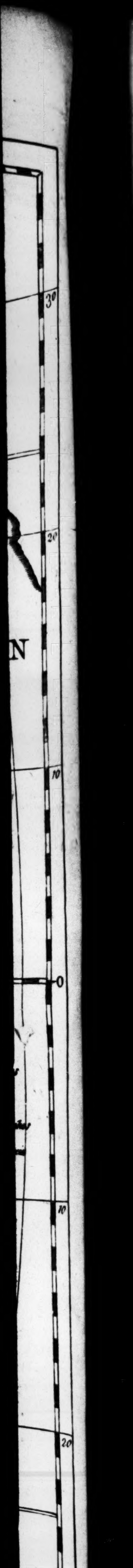
BRITISH 18 MR 63 MUSEUM



A
NEW and *ACCURATE*
MAP
of
AFRICA,
Drawn from the best
AUTHORITIES.
by
Thos. Bowen.

EUROPE
Madrid
Lisbon
PORTUGAL
SPAIN
C. St. Vincent
Corsica
Rome
Naples
ITALY
Minorca
Sardinia
Majorca
MEDITERRANEAN
Gibraltar
Tangier
Oran
ALGIERS
Bona
Tunis
Tripoly
Madeira
Porto Santo
Funchal
Mogador
Fez
Mequinez
MOROCCO
Tafilet
DARAH
Sigilmessa
COUNTRY OF DATES
BARBARY
Canary Is.
Palma
Tenerife
Lancarote
Ferro
Canary
Fuerteventura
C. Non
C. Bojador
Terra Alta
Rio do Ouro
Angra de Sintra
C. Blanco
Arguin
Portandic
ZUENZIGA
AZANHAGA
ZAHARA
LEMTA
TERGA
Gogden
Hair
Wadan
Mornouk
FEZZAN
DESERT OF BARBARY
Well of Azaraad
Well of Aracan
Andagost or Agades
Tombouctou or Tombut
TOMBUT
St. Antony
St. Vincent
St. Nicolas
Sal
Cape Verd Is.
Bonavista
St. Yago
Fogo
Mayo
Brava
Ft. St. Louis
Senegal R.
YOLOFS
FOULES
C. Verd
Goree
Cayor
Gambia R.
James Ft.
Yam Galam
BAMBOUK
Bambara
Guin-bala
Negritian Desert
NIGRITIA
NEGROLAND
Gago
Ghana
Guber
Berissa
Zegzeg
Wangara
Gold Land
MANDINGA
Songo
Baracola
Bissago Is.
R. Grande
Bissao
C. Verga
R. Sierra Leona
The designed place for British Convicts
C. Tagrin
C. Mesurado
C. dos Costos
C. Palmas
GUINEA
GRAIN COAST
TOOTH COAST
GOLD COAST
SLAVE COAST
Dahome
Ardra
Ayos
BENIN
Benin
Callabar
BIAFARA
C. 3 Points
Cape Coast C.
GULF OF GUINEA
I. de Fernao Po
C. Formoso
Calbongos
Rio dos Camaroens
the 7 Hills
R. de Gabon
I. do Principe
St. Thome
Equinoctial Line
C. de Lopez Gonsalvo
Anno-bon
C. Catherina
Majumba
LOANGO
Pta. de Loango
Zaire R.
CONGO
Londa St. Paul
ANGOLA
Benguela
Cabo Negro
Cimbebas to the Matamans
C. de Ruy Pire
Golfo Frio
Baxo de Antonio de Viana
C. da Serra
G. of St. Thomas
Angras juntas
C. das Voltas
R. of Elephants
St. Helena B.
Saldanha B.
Table Bay
C. of Good Hope
Desert Country little frequented
WESTERN OR ATLANTIC OCEAN
I. St. Mathew
I. Ascension
St. Helena I.
Meridian of London
Tropic of Capricorn
SOUTHERN
West Longitude from London
30
20
10
0
10
20
30


EUROPE
BLACK SEA
CASPIAN SEA
Constantinople
ASIA MINOR
Archipelago
Candia
Rhodes
Cyprus
MEDITERRANEAN SEA
Alexandria
Cairo
Suez
Aleppo
SYRIA
Jerusalem
Euphrates R.
Bassora
Persian Gulf
PT OF ASIA
PERSIA
Indus R.
C. Rasalgate
ARABIAN DESERT
Madian
Medina
Tropic of Cancer
ARABIA
Juddah
Mokka
YEMEN
Ghezan
Sanaa
Zebid
Moka
Aden
C. Fartash
Str. of Babelmandel
Socotora I.
C. Guardafui
C. Orfui
EASTERN OR INDIAN OCEAN
Tripoly
Tolometa
Barca
Derne
Augila
Siwah
Santrieh or Jupiter Ammon
EGYPT
Thebes
Asna
Assuan
TURKISH NUBIA
Berdoa
Kawana
Desert of Bournou
Bournou
Karnei
Kaugha
NUBIA
Dongola
Dungala
Korti
Napata
Suakem
Dahlak
Habesh
Sennar
Gojam
Tigrei
Axum
ABISSINIA
DOBAS
Zeila
Barbora
ADEL
Bali
Aucagurel
GALLA
Enaria
Alaba
Machidas
AJAN Barren Coast
Bandel
C. Agoa
C. Baxas
Mugadoxo
Magadosha
Juba
Brava
Mounts of the Moon
ZENDERO
UNKNOWN
Bake-bake
Mujaco
Medera
ANZICO
to the Micoko
Mosseguejos
NIMEAMAI
Mano emugi
FUNGENO
CONGO
COUNTRY
Ruengas
ZANGUEBAR
Melinda
Mombaza
Pemba
Zanzibar
Monfia
Quiloa
Cabo delgado
MONGALES
ZIMBAS
Dougii
Maravi
Mumbos
BOROROS
BUTUA
Chicova
MACUAS
Mosambique
Angocia
Comoro Is.
Johanna
Mayotto
MONOMOTAPA
Quilimane
Cuama
Sofala
Manica
SABIA
INHAMBANS
C. St. Sebastian
Baxo da Judia
B.S. Augustin
C. Corientes
Marquez
da Lagoa Bay
Pt. de Terra dos Fumos
Natal Bay
Land of Natal
CHANNEL OF MOZAMBIQUE
MADAGASCAR
C. Natal
Sebastian
Vohemaro
Anton Gill B.
I. St. Mary
Ibrahim
Manof
Matatana
Carcanossi
Fort Dauphin
C. St. Mary
C. St. Romain
Masalagem
Bugues
Acalunka
Kingm. of BIRI
Brigoudis
Cobonas
Namaquas
HOTENTOTS
Cimbebas
the Mataman
Bembei
Desert Country little frequented
Table Bay
C. of Good Hope
C. Agulhas or Needles Cape
Saldanha B.
St. Helena B.
Rio de Infante
St. Christopher
Bahia de Lagoa
Formosa or Mossel Bay
Dina
Marseveen
SOUTHERN OCEAN
Padras
Almirante Is.
I. Mahe
Sts. Francisco
I. Alphonsina
I. St. Pedro
Seven Irmaos
Three Irmaos
Baixos de Chagas
Roque Pirez
Pedro dos Banhos
Diego Garcia
St. Miguel
I. Galega
Os doze Ilheos
Saya de Malha
Roquepirez
Banks of Nazareth
Sandy I.
Corgados or St. Brandon
Garajao
Denys
St. Louis
I. of France or Mauritius
I. of Bourbon formerly Mascarenhas
I. Diego Roiz or Diego Rodriguez
Tropic of Capricorn
Juan de Lisboa
Romeiros
New I.
20
30
40
50
60
70
East Longitude from London
30
20
10
0
10
20
30



diſtance of 160 leagues from Batavia, and is 500 miles long and 200 broad.

The SUNDA ISLANDS. These are ſituated in the Indian Ocean, between 93 and 120 degrees of eaſt longitude, and between eight degrees north and eight degrees ſouth latitude, comprehending the iſlands of Borneo, Sumatra, Java, Bally, Lamboe, Banca, &c.

BORNEO is ſaid to be 800 miles long, and 700 broad, and is therefore thought to be the largeſt iſland in the world except New Holland. The inland part of the country is marſhy and unhealthy; and the inhabitants live in towns built upon floats in the middle of the rivers.

SUMATRA has Malacca on the north, Borneo on the eaſt, and Java on the ſouth-eaſt, from which it is ſeparated by the ſtraits of Sunda; it is divided into two equal parts by the equator, extending five degrees, and upwards, north-weſt of it, and five on the ſouth-eaſt; and is 1000 miles long, and 100 broad. The iſland produces ſo much gold, that it is thought by ſome, to be the Ophir mentioned in the ſcriptures. There is alſo a mountain in the iſland which is called Ophir by the Europeans, whoſe ſummit above the level of the ſea is 13,842 feet, exceeding in height the peak of Teneriff by 577 feet.

The ANDAMAN and NICOBAR iſlands are inconſiderable, and lie at the entrance of the bay of Bengal.

CEYLON. This iſland, though not the largeſt, is thought to be by nature the richeſt and fineſt iſland in the world. It is ſituated in the Indian Ocean, near Cape Comorin: the ſouthern extremity of the Hither Peninſula of India, being ſeparated from the coaſt of Coromandel by a narrow ſtrait, and is 250 miles long, and 200 broad. The natives call it, the terreſtrial paradiſe.

The MALDIVES. Theſe are a vaſt cluſter of ſmall iſlands or little rocks juſt above the water, lying between the equator and eight degrees north latitude, near Cape Comorin. The ſea which ſeparates the ſouthern point of the peninſula of Kamtſchatka from Japan, contains a number of iſlands in a poſition from north-north-eaſt to ſouth-ſouth-weſt, which are called the KURILE ISLANDS. They are upwards of twenty in number, are all mountainous, and in ſeveral of them are volcanos and hot ſprings. The principal of theſe iſlands are inhabited; but ſome of the little ones are entirely deſert and unpeopled.

AFRICA.

Africa, the third grand diviſion of the globe, is generally repreſented as bearing ſome reſemblance to the form of a pyramid, the baſe being the northern part of it, which runs along the ſhores of the Mediterranean, and the point or top of the pyramid, the Cape of Good Hope. Africa is a peninſula of a prodigious extent, joined to Aſia only by a neck of land, about ſixty miles over, between the Red Sea and the Mediterranean, uſually called the Iſthmus of Suez, and its utmoſt length from north to ſouth, from Cape Bona in the Mediterranean, in 37 degrees north, to the Cape of Good Hope in 34-7 ſouth latitude, is 4300 miles; and the broadeſt part from Cape Verd, in 17-20 to Cape Guardafui, near the ſtraits of Babel-Mandel, in 51-20 eaſt longitude, is 3500 miles from eaſt to weſt. It is bounded on the north by the Mediterranean ſea, which ſeparates it from Europe; on the eaſt by the Iſthmus of Suez, the Red Sea, and the Indian Ocean, which divides it from Aſia; on the ſouth by the ſouthern ocean; and on the weſt by the great Atlantic ocean, which ſeparates it from America. As the equator divides this extenſive country almoſt in the middle, and the far greateſt part of it is within the tropics, the heat is in many places almoſt inſupportable to an European; it being there increaſed by the rays of the ſun from vaſt deſerts of burning ſands. The coaſts, however, and banks of rivers, ſuch as the Nile, are generally fertile; and moſt parts of this region are inhabited, though it is far from being ſo populous as Europe or Aſia.

The moſt conſiderable rivers in Africa, are, the Niger, which falls into the Atlantic or weſtern ocean at Senegal, after a courſe of 2800 miles. It increaſes and decreaſes as the Nile, fertiliſes the country, and has grains of gold in many parts of it. The Gambia and Senegal are only branches of this river. The Niel, which dividing Egypt into two parts, diſcharges itſelf into the Mediterranean, after a prodigious courſe from its ſource in Abyſſinia. The moſt conſiderable mountains in Africa are the Atlas, a ridge extending from the weſtern ocean, to which it gives the name of Atlantic Ocean as far as Egypt. The Mountains of the Moon, extending themſelves between Abyſſinia and Monomotapa, and are ſtill higher than thoſe of Atlas. Thoſe of Sierra Leona, or the mountain of the Lions, which divide Nigritia from Guinea, and extend as far as Ethiopia. Theſe were ſtyled by the ancients the Mountains of God, on account of their being ſubject to thunder and lightning. The Peak of Teneriffe, which the Dutch make their firſt meridian, is ſaid to be about three miles high in the form of a ſugar-loaf, and is ſituated on an iſland of the ſame name near the coaſt. The moſt noted capes, or promontories, in this country, are Cape Verd, ſo called, becauſe the land is always covered with green trees and moſſy ground. It is the moſt weſterly point of the continent of Africa. The Cape of Good Hope, is the ſouth extremity of Africa, the country of the Hottentots; and at preſent in the poſſeſſion of the Dutch; there is but one ſtrait in Africa, which is called Babel-Mandel, and joins the Red Sea, with the Indian Ocean.

Africa is divided according to the following Table:

	Nations.	Length	Bread.	Square Miles.	Chief Cities.	Diſt. & bear fr. London	Diff. of time fr. Lond.	Religions
Barbary.	Morocco, Tafilet, &c	500	480	219,400	Fez	1080 S.	0 24 aft	Mahom
	Algiers	480	100	143,600	Algiers	920 S	0 13 bef	Mahom
	Tunis	220	170	54,400	Tunis	990SE	0 39 bef	Mahom
	Tripoli	700	240	75,000	Tripoli	1260SE	0 56 bef	Mahom
	Barca	400	300	66,400	Tolemeta	1440SE	1 26 bef	Mahom
	Egypt	600	250	140,700	Grand Cairo	1920SE	2 21 bef	Mahom
	Biledulgerid	2500	350	485,000	Dara	1565 S.	0 32 aft	Pagans
	Zaara	3400	660	739,200	Tegeſſa	1840 S.	0 24 aft	Pagans
	Negroland	2200	840	1,026,000	Madinga	2500 S.	0 38 aft	Pagans
Up. Ethiopia	Guinea	1800	360	510,000	Benin	2700 S.	0 20 bef	Pagans
	Nubia	940	600	264,000	Nubia	2418SE	2 12 bef	Ma& Pa
	Abyſſinia	900	800	378,000	Gondar	2880SE	2 20 bef	Chriſtia
	Abex	540	130	160,000	Doncala	3580SE	2 36 bef	Ch& Pa
	The middle parts called Lower Ethiopia are very little known to the Europeans, but are computed at 1,200,000 ſquare miles.							
Lower Guinea	Loango	410	300	40,400	Loango	3300 S.	0 44 bef	Ch& Pa
	Congo	540	420	172,800	St. Salvador	3480 S.	1 0 bef	Ch& Pa
	Angola	360	250	38,400	Loando	3750 S.	0 58 bef	Ch& Pa
	Benguela	430	180	64,000	Benguela	3900 S	0 58 bef	Pagans
	Mataman	450	240	144,000	No Towns	* * *	* * *	Pagans
	Ajan	900	300	234,000	Brava	3702SE	2 40 bef	Pagans
	Zanguebar	1400	350	275,000	Melinda or Mozambiq	4440SE	2 38 bef	Pagans
	Monomotap	960	660	222,500	Monomotap	4500 S	1 18 bef	Pagans
	Monemugi	900	660	310,000	Chicova	4260 S.	1 44 bef	Pagans
	Sofol	480	300	97,500	Sofola	4600SE	2 18 bef	Pagans
	Terra de Nat	600	350	184,900	No Towns	* * *	* * *	Pagans
	Caffraria or Hottentot	708	660	200,340	Cape of G. Hope.	5200 S.	1 4 bef	Moſt ſtupid P.

The principal iſlands of Africa lie in the Indian ſeas and Atlantic Ocean: of which the following belong to, or trade with, the Europeans, and ſerve to refreſh their ſhipping to and from India:

Iſlands.	Sq. Mil.	Towns.	Trade with or belong to
Babel-Mandel, at the entrance of the Red-Sea —		Babel Mandel —	All Nations
Zocotra, Indian Ocean —	3,600	Calauſia —	Ditto
The Comora iſles, ditto —	1,000	Joanna —	Ditto
Madagaſcar, ditto —	168,000	St. Auſtin —	Ditto
Mauritius, ditto — —	1,840	Mauritius — —	French
Bourbon, ditto — —	2,100	Bourbon —	Ditto
St. Helena, Atlantic Ocean	—	St. Helena —	Engliſh
Aſcenſion, ditto — —	—	—	Uninhabited
St. Matthew, ditto — —	—	—	Ditto
St. Thomas, Anaboa, Princes-iſland, Fernandopo do.	—	St. Thomas, Anaboa	Portugueſe
Cape Verd Iſlands, ditto —	2,000	St. Domingo —	Ditto
Goree, ditto — —	—	Port St. Michael	French
Canaries, ditto — —	—	Palma, St Criſtopher's	Spaniſh
Madeiras, ditto — —	1,500	Santa Cruz, Funchal	Portugueſe
Azores, or Weſtern Iſles, ditto	2,000	Angra, St. Michael	Ditto

Having given the reader ſome idea of Africa in general, with the principal kingdoms, and their ſuppoſed dimenſions, we ſhall now conſider it under the three grand diviſions: firſt, Egypt; ſecondly, the ſtates of Barbary, ſtretching along the coaſt of the Mediterranean, from Egypt in the eaſt, to the Atlantic Ocean weſt; and laſtly, that part of Africa, between the tropic of Cancer and the Cape of Good Hope.

Miles.	— EGYPT. —	Degrees.	Sq. Miles
Length 600 Breadth 250	lies between	20 and 32 North lat. 28 and 36 Eaſt lon.	140,700

It is bounded by the Mediterranean Sea, North; by the Red Sea, Eaſt; by Abyſſinia, or the Upper Ethiopia, on the South; and by the deſert of Barca, and the unknown parts of Africa, Weſt.

Diviſions.	Subdiviſions.	Chief Towns.
Northern diviſion contains	Lower Egypt	GRAND CAIRO, E. lon. 32. N. lat. 30. Bulac, Alexandria Roſetto, Damietta
So. diviſion contains	Upper Egypt	Sayd or Thebes, Coſſiar

Alexandria, which lies on the Levant coaſt, was once the emporium of all the world. It owes its name to the founder, Alexandria the Great. It ſtands forty miles weſt from the Nile, and a hundred and twenty north weſt of Cairo. Roſetta, or Raſchid, ſtands twenty five miles to the north weſt of Alexandria, and is recommended for its beautiful ſituation, and delightful proſpects, which command the iſland of Delta, formed by the Nile, near its mouth. Cairo, the preſent capital of Egypt, is a large and populous, but a diſagreeable reſidence, on account of its peſtilential air, and its narrow ſtreets. It is divided into two towns, the Old and the New, and defended by an old caſtle, the works of which are ſaid to be three miles in circumference. The other towns of note in Egypt are Damietta, ſuppoſed to be the ancient Peluſium; Bulac; Seyd, on the weſt banks of the Nile, 200 miles ſouth of Cairo, ſaid to be the ancient Egyptian Thebes. In April and May the air is hot, and often infectious; and the inhabitants are almoſt blinded with drifts of ſand. Theſe evils are remedied by the riſing and overflowing of the Nile. Whoever is in the leaſt acquainted with literature, knows that the vaſt fertility of Egypt is not owing to rain (little falling in that country), but to the annual overflowing of the Nile. It begins to riſe when the ſun is vertical in Ethiopia, and the annual rains fall there, viz. from the latter end of May to September, and ſometimes October. At the height of its flood in the Lower Egypt, nothing is to be ſeen in the plains, but the tops of foreſts and fruit trees, their towns and villages being built upon eminences either natural or artificial. When the river is at its proper height, the inhabitants celebrate a kind of jubilee, with all ſorts of feſtivities.

The States of BARBARY.

Under this head I ſhall rank the countries of Morocco and Fez; Algiers; Tunis; Tripoli and Barca. The empire of Morocco, including Fez, is bounded on the North by the Mediterranean ſea; on the South, by Tafilet: and on the Eaſt, by Segelmeſſa and the kingdom of Algiers; being 500 miles in length, and 480 in breadth. Fez, which is now united to Morocco, is about 125 miles in length and much the ſame in breadth. It lies between the kingdom of Algiers to the Eaſt, and Morocco on the South, and is ſurrounded in other parts by the ſea. Algiers, formerly a kingdom, is bounded on the Eaſt by the kingdom of Tunis, on the North by the Mediterranean, on the South by Mount Atlas, and on the Weſt by the kingdom of Morocco and Tafilet. According to Dr. Shaw, this country extends in length 480 miles along the coaſt of the Mediterranean, and is between 40 and 100 miles in breadth. Tunis is bounded by the Mediterranean on the North and Eaſt; by the kingdom of Algiers on the Weſt; and by Tripoli with part of Biledulgerid, on the South; being 220 miles in length from North to South, and 170 in breadth from Eaſt to Weſt. Tripoli, including Barca, is bounded on the North by the Mediterranean ſea; on the South by the country of the Beriberies; on the Weſt by the kingdom of Tunis, Biledulgerid, and a territory of the Gadamis; and on the Eaſt by Egypt; extending about 1100 miles along the ſea-coaſt; and the breadth is from 1 to 300 miles. Each capital bears the name of the ſtate or kingdom to which it belongs. Morocco is the capital of the kingdom of Morocco, but now almoſt in ruins, the court having removed to Mequinez, a city of Fez.

The city of Algiers is not above a mile and a half in circuit. The proſpect of the country and ſea from Algiers is very beautiful, being built on the declivity of a mountain; but the city, though for ſeveral ages it has braved ſome of the greateſt powers in Chriſtendom, could make but a faint defence againſt a regular ſiege. The mole of the harbour is 500 paces in length, extending from the continent to a ſmall iſland where there is a caſtle and large battery. The kingdom of Tunis, which is naturally the fineſt of all theſe ſtates, contains the remains of many noble cities, ſome of them ſtill in good condition. The town itſelf has fortifications, and is about three miles in circumference; but like Algiers, is diſtreſſed for want of freſh water. The city of Tripoli conſiſts of an old and new town, the latter being the moſt flouriſhing: but great inconviences attend its ſituation, particularly the want of ſweet water: the city of Oran, lying upon this coaſt, is about a mile in circumference, and is fortified both by art and nature. It was a place of conſiderable trade, and the object of many bloody diſputes between the Spaniards and the Moors. Conſtantina was the ancient Cirta, and one of the ſtrongeſt cities of Numidia, being inacceſſible on all ſides, excepting the ſouth-weſt.

Beſides the above towns and cities, many others, formerly of great renown, lie ſcattered up and down this immenſe tract of country. The city of Fez, at preſent is the capital of the kingdom ſo called. Mequinez is eſteemed the great emporium of all Barbary. Sallee was formerly famous for the piracies of its inhabitants. Tangier is ſituated about two miles within the ſtraits of Gibraltar. It was formerly one of the fineſt cities of Africa, but is now little better than a fiſhing town. Ceuta, upon the ſame ſtrait, almoſt oppoſite to Gibraltar, is in the hands of the Spaniards. Tetuan, which lies within twenty miles of Ceuta, is now but an ordinary town, though the inhabitants are ſaid to be rich, and tolerably civilized in their manners. The provinces of Suz, and Geſula, form no part of the ſtates of Barbary, though the king of Morocco pretends to be their ſovereign.

Of AFRICA, from the Tropic of Cancer to the Cape of Good-Hope.

This immenſe territory is little known; no modern traveller having penetrated into the interior parts; ſo that we are ignorant not only of the bounds, but even of the names of ſeveral inland countries. The countries of Mandingo, Ethiopia, Congo, Angola, Batua, Truticui, Monomotapa, Caſatia, and Mehenemugi, are extremely rich in gold and ſilver. On the Guinea or weſtern coaſt, the Engliſh trade to James Fort, and other ſettlements near the river Gambia, where they exchange their woollen and linen manufactures, their hard ware and ſpirituous liquors, for the perſons of the natives. Among the Negroes, a man's wealth conſiſts in the number of his family, whom he ſells like ſo many cattle, and often at an inferior price. The Portugueſe are in poſſeſſion of the eaſt and weſt coaſt of Africa, from the Tropic of Capricon to the Equator; which immenſe tract they became maſters of by their ſucceſſive attempts and happy diſcovery and navigation of the Cape of Good Hope. The Dutch have ſettlements towards the ſouthern parts of the continent, in the country called Caffraria, or the land of the Hottentots, where their ſhips bound for India uſually put in.

AFRICAN ISLANDS.

Of the African iſlands, ſome lie in the Eaſtern or Indian Ocean, and ſome in the Weſtern, or Atlantic. We ſhall begin with thoſe in the Indian Ocean, the chief of which are Zocotra, Babelmandel, Madagaſcar, the Comora Iſlands, Bourbon, and Mauritius.

ZOCOTRA. This iſland is ſituated in eaſt lon. 53. north lat. 12. 30 leagues eaſt of Cape Guardafui, on the continent of Africa; it is 80 miles long, and 54 broad, and has two good harbours, where the European ſhips uſed formerly to put in when they loſt their paſſage to India. It is a populous plentiful country. The inhabitants are Mahometans, of Arab extraction, and are under the government of a prince who is probably tributary to the Porte.

BABELMANDEL. The iſland of Babelmandel gives name to the ſtraits at the entrance of the Red Sea, where it is ſituated in eaſt lon 44-30. north lat. 12. about four miles both from the Arabian and Abyſſinian ſhores. The iſland is of little value, being a barren ſandy ſpot of earth not five miles round.

COMORA. Theſe iſlands are five, Joanna, Mayotta, Mohilla, Angazeia, and Comora, ſituated between 41 and 46 eaſt long. and between 10 and 14 ſouth lat. at an equal diſtance from Madagaſcar and the continent of Africa. Joanna, the chief, and which exacts tribute from the others, is about 30 miles long and 15 broad, Eaſt India ſhips, bound to Bombay, uſually touch here for refreſhments.

MADAGASCAR. This is the largeſt of the African iſlands, and is ſituated between 43 and 51 deg. eaſt long. and between 10 and 26 ſouth lat. 300 miles ſouth eaſt of the continent of Africa; it being near 1000 miles in length from north to ſouth; and generally between 2 and 300 miles broad.

MAURITIUS, or Maurice, was ſo called by the Dutch, who firſt touched here in 1598, in honour of prince Maurice their ſtadtholder. It is ſituated in eaſt long. 56, ſouth lat. 20, about 400 miles eaſt of Madagaſcar. It is of an oval form, about 150 miles in circumference, with a fine harbour.

BOURBON. The iſle of Bourbon is ſituated in eaſt long. 54, ſouth lat. 21, about 300 miles eaſt of Madagaſcar, and is about 90 miles round. On the ſouthern extremity of the coaſt is a volcano, which continually throws out flames, ſmoke, and ſulphur, with a hideous roaring noiſe. There are conſiderable towns in the iſland, with a governor. There are many more ſmall iſlands about Madagaſcar, and on the eaſtern coaſt of Africa, laid down in maps, but no where deſcribed. Leaving therefore the eaſtern world and the Indies, we now turn round the Cape of Good Hope, which opens to our view the Atlantic, an immenſe ocean lying between the two grand diviſions of the globe, having Europe, Aſia, and Africa, on the eaſt; and America, on the weſt: towards which diviſions we now ſteer our courſe, touching in our way at the following iſlands upon the African coaſt, that have not yet been deſcribed, viz. St. Helena, Aſcenſion, St. Matthew, St. Thomas, &c. Goree, Cape Verd, the Canary and Madeira iſlands.

St. HELENA. The firſt iſland on this ſide the Cape is St. Helena, ſituated in weſt lon. 6-4, ſouth lat. 16, being 1200 miles weſt of the continent of Africa, and 1800 eaſt of South America. The iſland is a rock about 21 miles in circumference, very high and very ſteep, and only acceſſible at the landing place, in a ſmall valley at the eaſt ſide of it.

ASCENSION. This iſland is ſituated in 7 deg. 40 min. ſouth lat. 600 miles north-weſt of St. Helena: it received its name from its being diſcovered by the Portugueſe on Aſcenſion day; and is a mountainous barren iſland, about 20 miles round, and uninhabited.

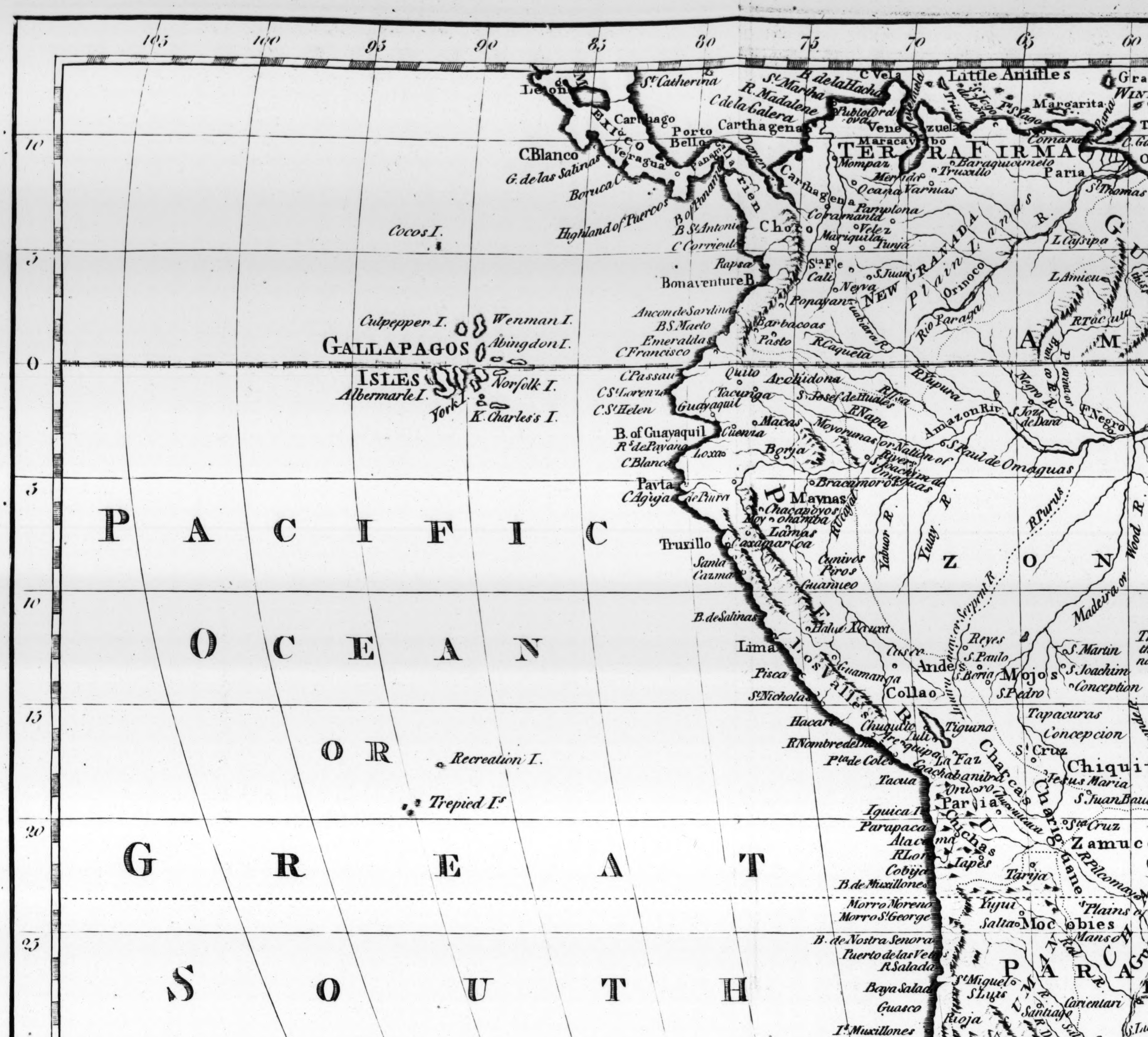
St. MATTHEW. This is a ſmall iſland, lying in 6-1 weſt lon. and 1-30 ſouth lat. 300 miles on the north eaſt of Aſcenſion. This iſland remains uninhabited. The four following iſlands, viz. St. THOMAS, ANABOA, PRINCES ISLAND, and FERNANDO PO, are ſituated in the gulf of Guinea, between Congo and Benin; all of them are in the poſſeſſion of the Portugueſe.

CAPE VERD ISLANDS. Theſe iſlands are ſo called from a cape of that name on the African coaſt, near the river Gambia, over againſt which they lie, at the diſtance of 300 miles, between 21 and 26 deg. weſt lon. and 14 and 18 deg. north lat. They are about 20 in number; but ſome of them being only barren uninhabited rocks, are not worth notice. St. Jago, Bravo, Fogo, Mayo, Bonaviſta, Sal, St. Nicholas, St. Lucia, St. Vincent, Santa Cruz, and St. Antonio, are the moſt conſiderable, and are ſubject to the Portugueſe.

GOREE is ſituated within cannon-ſhot of Cape Verd. N. lat. 14-43, W. long. 17-20, and was ſo called by the Dutch from an iſland and town of the ſame name in Holland.

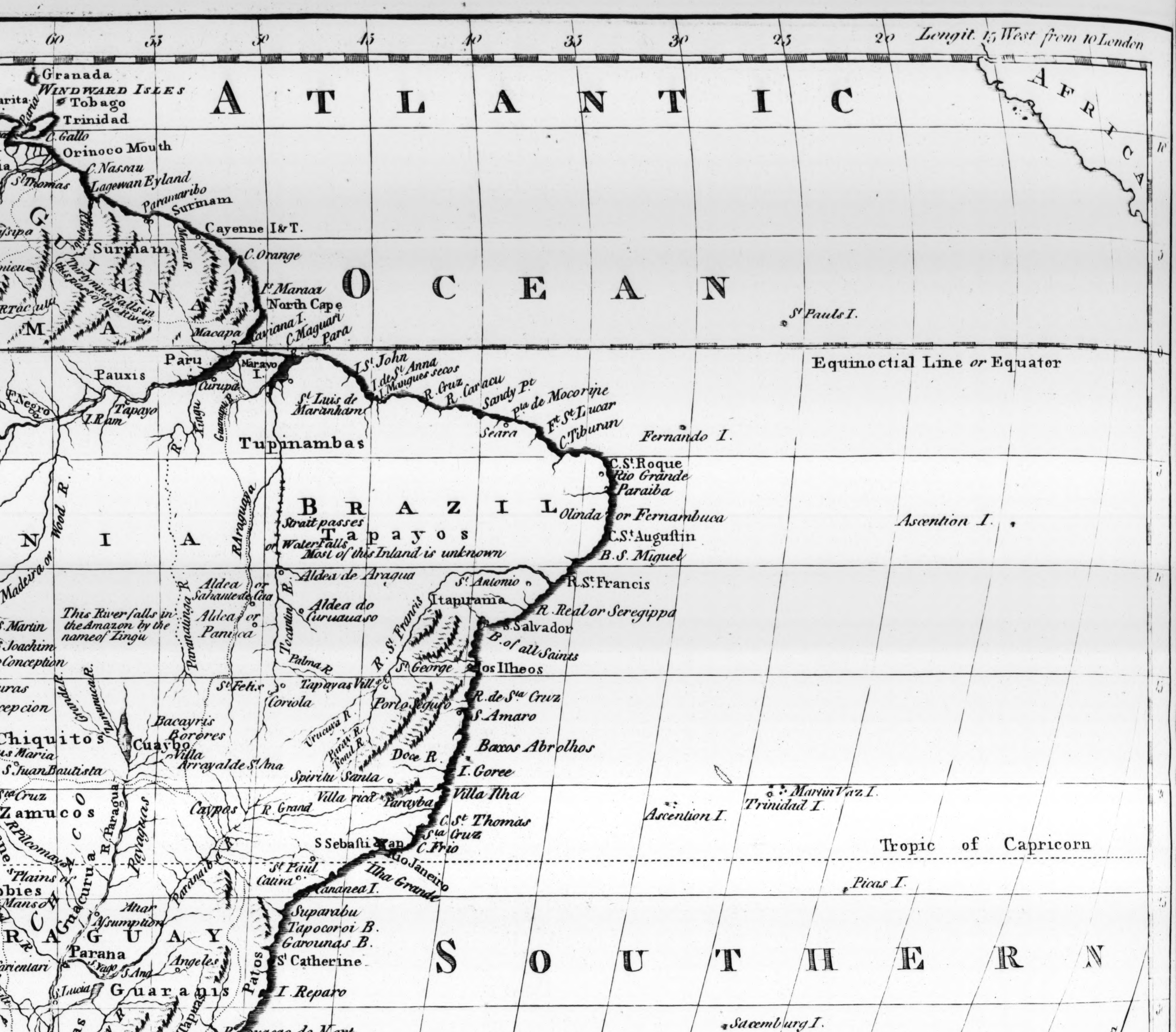
CANARIES. The Canaries, anciently called the Fortunate Iſlands, are ſeven in number, and ſituated between 12 and 19 deg. weſt long. and between 27 and 29 deg. north lat. about 150 miles ſouth-weſt of Morocco. Their particular names are Palma, Hiero, Gomera, Teneriffe, Grand Canaria, Fuerteventura, and Langarote. Grand Canary, which communicates its name to the whole, is about 150 miles in circumference, and ſo extremely fertile

BRITISH 18 MR 63 MUSEUM



An accurate Map of
SOUTH AMERICA,
from the best Modern
MAPS AND CHARTS.
By Thos. Bowen
Geogr.

PACIFIC OCEAN OR GREAT SOUTH SEA
GALLAPAGOS ISLES
Culpepper I.
Wenman I.
Abingdon I.
Albermarle I.
Norfolk I.
York I.
K. Charles's I.
Cocos I.
Recreation I.
Trepied Is
Juan Fernandes Is
C. Blanco
G. de las Salinas
Highland of Puercos
Cartago
Porto Bello
Veragua
Darien
Choco
Bonaventure B.
Little Antilles
Margarita
TERRA FIRMA
Carthagena
Venezuela
Maracaybo
Caraccas
Paria
NEW GRANADA
Popayan
Sta Fe
Pasto
Quito
Guayaquil
B. of Guayaquil
Payta
Trusillo
Lima
Pisca
Cusco
Andes
Collao
Arequipa
Amazon Riv.
Maynas
S. Paul de Omaguas
AMAZONIA
Mojos
Chiquitos
Charcas
Potosi
Atacama
Tarija
Plains of Manso
PARAGUAY
Tucuman
Santiago
St. Fe
Coquimbo
Valparaiso
St. Jago
Mendoza
Buenos Ayres
Pampas
CHILI
Conception
Baldivia
Chiloe
Cordillera Mountains
Cesares
PATAGONIA
C. Blanco
Penguin I.
C. Lookout
C. de Matas
Magalhaens St.
TERRA DEL FUEGO
Staten
CAPE HORN
Long. East from London
235 240 245 250 255 260 265 270 275 280 285 290 295
105 100 95 90 85 80 75 70 65 60
10 5 0 5 10 15 20 25 30 35 40 45 50 55



Longit. 15 West from London
60
55
50
45
40
35
30
25
20
ATLANTIC
OCEAN
AFRICA
Granada
Windward Isles
Tobago
Trinidad
C. Gallo
Orinoco Mouth
C. Nassau
Lagewan Eyland
St. Thomas
GUIANA
Paramaribo
Surinam
Cayenne I & T.
Surinam
Thirty nine falls in this part of the river
C. Orange
Pt. Maraca
North Cape
Caviana I.
C. Maguari
Para
Macapa
St. Pauls I.
Equinoctial Line or Equator
Paru
Pauxis
Maravo I.
P. Negro
Tapayo
Curupa
I. St. John
I. de St. Anna
I. Mangues secos
St. Luis de Maranham
R. Cruz
R. Caracu
Sandy Pt.
Pta. de Mocoripe
Seara
Ft. St. Lucar
C. Tiburun
Fernando I.
Tupinambas
C. St. Roque
Rio Grande
Paraiba
BRAZIL
Olinda or Fernambuca
C. St. Augustin
B. S. Miguel
Ascention I.
Tapayos
Strait passes or Water Falls
Most of this Inland is unknown
Madeira or Wood R.
R. Araguaya
Aldea de Araqua
Aldea or Sahante de Cua
Aldea or Panica
Aldea do Curuauaso
This River falls in the Amazon by the name of Zingu
St. Antonio
R. St. Francis
Itapurama
R. Real or Seregippa
S. Salvador
B. of all Saints
St. Martin
St. Joachim
Conception
St. George
Os Ilheos
Palma R.
St. Felis
Coriola
Tapayas Vill.
R. St. Francis
R. de Sta. Cruz
Porto Seguro
S. Amaro
Baxos Abrolhos
Chiquitos
Cuaybo
Bacayris
Borores
Villa Arrayal de St. Ana
Doce R.
I. Goree
S. Juan Bautista
Spiritu Santa
Villa Ilha
Martin Vaz I.
Trinidad I.
Ascention I.
Zamucos
Caipos
R. Grand
Villa rica
Parayba
C. St. Thomas
Sta. Cruz
C. Frio
S. Sebastian
Rio Janeiro
Ilha Grande
Tropic of Capricorn
St. Paul
Catira
Cananea I.
Picas I.
Plains of Manso
PARAGUAY
Paraguay
Paranaiba
Suparabu
Tapocoroi B.
Garounas B.
St. Catherine
SOUTHERN
Parana
Asumption
Angeles
Guaranis
Patos
I. Reparo
Charuas
Uruguay R.
R. Negro
Land of Ytapua
Pt. Povacao do Nort
Port St. Peter de Joze Maria
Ft. Mongareira
Saxemburg I.
Colonia di Sacramento
Monte Video
Ft. St. Miguel
C. de St. Mary
River of Plate
Atalaya
Conception de los Pampas
C. St. Antony
Pampas
C. de Arenas gord
C. St. Andre
Anegada B.
Sinfondo Bay
Tristan da Cunha Is.
Diego Alvares I.
Goughs I.
Meridian of London
OCEAN
I. Grande disco. 1675
British Statute Miles 69½ to a Degree
50 100 200 300 400 600 900
British & French Marine Leagues 20 to a Degree
10 30 50 100 150 200 250 300
Spanish Leagues 17½ to a Degree
10 30 50 100 150 200 250
Matas
Three Points
B. of Hope
Blanco
Peppy's I. Imaginary
Penguin I.
Lookout
C. Carefort
Egmont
Byron's Sd.
Berkley's Sd.
Falkland Isles
C. Pembroke
Porpus Pt.
Beauchenes I.
Str. le Maire
Staten Land
Good Success
Nassau
CAPE HORN
Georgia I.
discovered by the Spaniards 1756 and explored by C. Cook 1775
295
300
305
310
315
320
325
330
335
340
345
350
355
0
5
10
15
Long. East from London

London
I C A
London

tile as to produce two harveſts in a year. Teneriffe, the next largeſt iſland is about 120 miles round: it is pretty much encumbered with mountains, particularly the Peak, which in clear weather may be eaſily diſcerned at 120 miles diſtance, and in ſailing from it at 150. The Peak is an aſcent in the form of a ſugar-loaf, about 15 miles in circumference, and ſaid to be three miles perpendicular. This mountain is a volcano.

MADEIRAS. The three iſlands called the Madeiras, are ſituated in 32-27 north lat. and from 18-30 to 19-30 weſt long. about 100 miles north of the Canaries, and as many weſt of Sallee, in Morocco. The largeſt, from which the reſt derive the general name of Madeiras, or rather Mattera, on account of its being formerly almoſt covered with wood, is about 75 miles long, 60 broad, and 180 in circumference. It is compoſed of one continued hill, of a conſiderable height, extending from eaſt to weſt. There is but one conſiderable town in the whole iſland, which is named Funchal, ſeated on the ſouth part of the iſland, at the bottom of a large bay. The Portugueſe are almoſt the only people who inhabit it.

The AZORES, or, as they are called, the Weſtern Iſlands, are ſituated between 25 and 32 deg. weſt long. and between 37 and 40 north lat. 900 miles weſt of Portugal, and as many eaſt of Newfoundland, lying almoſt in the mid-way between Europe and America. They are nine in number, and are named Santa Maria, St. Miguel or St. Michael, Tercera, St. George, Gracioſa, Fayal, Pico, Flores, and Corvo. It is ſaid that no poiſonous or noxious animal breeds on the Azores, and that if carried thither they will expire in a few hours.

AMERICA IN GENERAL.

This great weſtern continent, frequently denominated the NEW WORLD, extends, from the 80th degree North, to the 56th degree South latitude; and where its breadth is known, from the 55th to the 136th degree of weſt longitude from London; ſtretching between 8 and 9000 miles in length, and in its greateſt breadth 3690. It ſees both hemiſpheres, has two ſummers, and a double winter, and enjoys all the variety of climates which the earth affords. It is waſhed by the two great oceans. To the eaſtward it has the Atlantic, which divides it from Europe and Africa. To the weſt it has the Pacific, or great South Sea, by which it is ſeparated from Aſia. By theſe ſeas it may, and does, carry on a direct commerce with the other three parts of the world. It is compoſed of two great continents, one on the North, the other on the South, which are joined by the kingdom of Mexico, which forms a ſort of iſthmus 1500 miles long, and in one part, at Darien, ſo extremely narrow, as to make the communication between the two oceans, by no means difficult, being only 60 miles over. In the great gulf, which is formed between the iſthmus and the northern and ſouthern continents, lie a multitude of iſlands, many of them large, and moſt of them fertile, and denominated the Weſt Indies, in contradiſtinction to the countries and iſlands of Aſia, beyond the Cape of Good Hope, which are called the Eaſt Indies.

Though America in general be not a mountainous country, it has the greateſt mountains in the world. In South America, the Andes, or Cordelleras, run from north to ſouth along the coaſt of the Pacific Ocean. They exceed in length any chain of mountains in the other parts of the globe; extending from the iſthmus of Darien to the ſtraits of Magellan, they divide the whole ſouthern parts of America, and run a length of 4300 miles. Their height is as remarkable as their length, for though in part within the torrid zone, they are conſtantly covered with ſnow. Chimborazo, the higheſt of the Andes, is 20,633 feet: of this about 2400 feet from the ſummit are always covered with ſnow. Carazon was aſcended by the French aſtronomers, and is ſaid to be 15,800 feet high. In North America, which is chiefly compoſed of gentle aſcents, or level plains, we know of no conſiderable mountains, except thoſe towards the pole, and that long ridge which lies on the back of the American States, ſeparating them from Canada and Louiſiana, which we call the Apalachian or Alligany mountains. In North America, ſuch is the wiſdom and goodneſs of the Creator of the univerſe, thoſe vaſt tracts of country, ſituated beyond the Apalachian mountains, at an immenſe and unknown diſtance from the ocean, are watered by inland ſeas, called the Lakes of Canada, which not only communicate with each other, but give riſe to ſeveral great rivers, particularly the Miſſiſſippi, running from North to South, till it falls into the gulf of Mexico, after a courſe, including its turnings, of 4500 miles, and receiving in its progreſs the vaſt tribute of the Illinois, the Maſaures, the Ohio, and other great rivers, ſcarcely inferior to the Rhine, or the Danube; and on the North, the river St. Laurence, running a contrary courſe from the Miſſiſſippi, till it empties itſelf into the ocean near Newfoundland; all of them being almoſt navigable to their heads, lay open the inmoſt receſſes of this great continent, and afford a great inlet for commerce. The eaſtern ſide of North America, beſides the noble rivers Hudſon, Delawar, Suſquehana, and Potowmack, ſupplies the ſeveral others of great depth, length, and commodious navigation. South America ſupplies much the two largeſt rivers in the world, the river of Amazons, and the Rio de la Plata, or Plate river. The firſt riſing in Peru, not far from the South Sea, paſſes from Weſt to Eaſt, and falls into the ocean between Brazil and Guiana, after a courſe of more than 3000 miles, in which it receives a prodigious number of great and navigable rivers. The Rio de la Plato riſes in the heart of the country, and having its ſtrength gradually augmented, by an acceſſion of many powerful ſtreams, diſcharges itſelf with ſuch vehemence into the ſea, as to make it taſte freſh for many leagues from land. Beſides theſe there are other rivers in South America, of which the Oronoko is the moſt conſiderable. The multitude of iſlands, which lie between the two continents of North and South America, are divided amongſt the Spaniards, Engliſh, and French. The Dutch indeed poſſeſs three or four ſmall iſlands, which in any other hands would be of no conſequence: and the Danes have one or two, but they hardly deſerve to be named among the proprietors of America. We ſhall now proceed to the particular provinces, beginning with the North; but as Labrador, or New Britain, and the country round Hudſon's Bay, with thoſe vaſt regions towards the pole, are little known, we can only include within the following Table, the colonies that have been formed into regular governments which bring us to the 50th degree of north lat.

The Grand Diviſions of NORTH AMERICA.

Colonies.	Leng.	Bread.	Sq. Mil.	Chief Towns.	diſt. & bearing from London.	Belongs to
New Britain	850	750	318,750			Gr. Brit
Province of Quebec	600	200	100,000	Quebec		Ditto
New Scotland New Brunſw.	350	250	57,000	Halifax Shelburne		Ditto
New England	550	200	87,000	Boſton	2760 W.	Un. Stat
New York	300	150	24,000	New York		Ditto
New Jerſey	160	60	10,000	Perth Amboy		Ditto
Pennſylvania	300	240	15,000	Philadelphia		Ditto
Maryland	140	135	12,000	Annapolis		Ditto
Virginia	750	240	80,000	Williamſb		Ditto
North Caro. South Caro. Georgia	700	380	110,000	Edenton Charles-town Savannah		Ditto Ditto Ditto
Eaſt Florida Weſt Florida	500	440	100,000	St. Auguſtine Penſacola		Spain Ditto
Louiſiana	1200	645	516,000	New Orleans	4080 S. W.	Ditto
New Mexico & California	2000	1000	600,000	St. Fee St. Juan	4320 S. W.	Ditto Ditto
Mexico, or New Spain	2000	600	318,000	Mexico	4900 S. W.	Ditto

Grand Diviſions of SOUTH AMERICA.

Nations.	Len.	Bread.	Sq. Miles.	Ch. Cities	Diſt & bearing from London	Belongs to
Terra Firma	1400	700	700,000	Panama	4650 S. W.	Spain
Peru	1800	600	970,000	Lima	5520 S. W.	Ditto
Amazonia, a very large country, but little known to the Europeans 1200 L. 960 B.						
Guiana	780	480	250,000	Surinam Cayenne	3840 S. W	Dutch French
Brazil	2500	700	940,000	St. Sebaſt.	6000 S. W.	Portugal
Parag. or La Plata	1500	1000	1,000,000	Buen Ayre	6040 S. W.	Spain
Chili	1200	500	206,000	St. Jago	9600 S. W.	Ditto
Terra Magellanica, or Patagonia.	1400	460	325,000	The Spaniards took poſſeſſion of it, but did not think it worth while to ſettle there.		

The principal Iſlands of NORTH AMERICA belonging to the EUROPEANS are,

	ISLANDS.	Length	Bread.	Square Miles.	Chief Towns.	Belongs to
In the Gulf of St. Lawr.	Newfoundland	350	200	35,500	Placentia	Great Britain
	Cape Breton	110	80	4,000	Louiſburg	Ditto
	St. John's	60	30	500	Charlotte-Town	Ditto
In the Atlan.	Bermuda iſles	20,000 acres		40	St. George	Ditto
	Bahama ditto	very numerous			Naſſau	Ditto
Weſt India iſlands, lying in the Atlantic, between North and South America	Jamaica	140	60	6,000	Kingſton	Ditto
	Barbadoes	21	14	140	Bridgetown	Ditto
	St. Chriſtoph.	20	7	80	Baſſe-terre	Ditto
	Antigua	20	20	100	St. John's	Ditto
	Nevis and Montſerrat	each of theſe is 18 circum.			Charles-Town Plymouth	Ditto Ditto
	Barbuda	20	21	60		Ditto
	Anguilla	30	10	60		Ditto
	Dominica	28	13	150		Ditto
	St. Vincent	24	18	150	Kingſton	Ditto
	Granada	30	15	150	St. George's	Ditto
	Tobago	32	9	80		France
	Cuba	700	90	38,400	Havannah	Spain
	Hiſpaniola	450	150	3 0	St. Domingo	Do. & France
	Porto Rico	100	49	3,200	Porto Rico	Spain
	Trinidad	90	60	2,897	St. Joſeph	Ditto
	Margarita	40	24	624		Ditto
	Martinico	60	30	300	St. Peter's	France
	Guadaloupe	45	38	250	Baſſe-terre	Ditto
	St. Lucia	23	12	90		Ditto
	St. Bartholo. Deſeada, & Marigalanta	all of them inconſiderable.				Ditto Ditto Ditto
	St. Euſtatia	29 circum.			The Bay	Dutch
	Curaſton	30	10	342		Ditto
	St. Thomas	15 circum.				Denmark
	St. Croix	30	10		Baſſe End	Ditto

BRITISH AMERICA.

NEW BRITAIN, or the country lying round Hudſon's Bay, and commonly called the country of the Eſquimaux, comprehending Labrador, now North and South Wales, is bounded by unknown lands, and frozen ſeas, about the pole, on the North; by the Atlantic ocean, on the Eaſt; by the bay and river of St. Lawrence and Canada, on the South; and by unknown lands on the Weſt. Its length is computed at 850 miles, and 750 broad.

CANADA, or the Province of QUEBEC.

Miles.		Degrees.	Sq. Miles.
Length 600	lies between	61 and 81 weſt long.	100,000
Breadth 200		45 and 52 north lat.	

Bounded by New Britain and Hudſon's Bay, on the North and Eaſt; by Nova Scotia, New England and New York, on the South; and by unknown lands on the Weſt. The principal rivers are, the Outtauais, St. John's, Seguinai, Deſprairies, and Trois Rivers, but they are all ſwallowed up by the river St. Lawrence. This river iſſues from the lake Ontario, and taking its courſe north-eaſt, waſhes Montreal, where it receives the Outtauais, and forms many fertile iſlands. It continues the ſame courſe, and meets the tide upwards of 400 miles from the ſea. After receiving in its progreſs innumerable ſtreams, this great river falls into the ocean at Cape Roſiers, where it is 90 miles broad, and where the cold is intenſe, and the ſea boiſterous. In its progreſs it forms a variety of bays, harbours, and iſlands, many of them fruitful and extremely pleaſant. Here are alſo five lakes, the ſmalleſt of which is a piece of ſweet water, greater than any in the other parts of the world; this is the lake Ontario, which is not leſs than 200 leagues in circumference; Erie, or Oſwego, longer, but not ſo broad, is about the ſame extent. That of the Huron ſpreads greatly in width, and is in circumference not leſs than 300, as is that of Michigan, though, like lake Erie, it is rather long and comparatively narrow. But the lake Superior, which contains ſeveral large iſlands, is 500 leagues in the circuit. All of theſe are navigable by any veſſels, and they all communicate with one another, except that the paſſage between Erie and Ontario is interrupted by a ſtupendous fall or cataract, which is called the Falls of Niagara. The town called Trois Rivieres, or the Three Rivers, is about half way between Quebec and Montreal, and has its name from the three rivers which join their currents here, and fall into the river St. Laurence. Montreal ſtands on an iſland in the river St. Laurence, which is ten leagues in length and four in breadth, at the foot of a mountain which gives name to it, about half a league from the ſouth ſhore, and 170 miles from Quebec.

Miles. — NOVA SCOTIA. — Degrees. Sq. M.

Miles.		Degrees.	Sq. M.
Length 350	lies between	43 and 49 North lat.	57,000
Breadth 250		60 and 67 Eaſt long.	

Bounded by the river St. Laurence on the North; by the gulf of St. Laurence, and the Atlantic ocean, Eaſt; by the ſame ocean, South; and by Canada and New England, Weſt. In the year 1784, this province was divided into *two governments*; the province and government, now ſtyled NEW BRUNSWICK, is bounded on the weſtward of the river St. Croix, by the ſaid river to its ſource, and by a line drawn due north from thence to the ſouthern boundary of the province of Quebec; to the northward by the ſame boundary as far as the weſtern extremity of the Bay de Chaleurs; to the eaſtward by the ſaid bay to the gulf of St. Laurence to the bay called Bay Verte; to the ſouth by a line in the centre of the Bay of Fundy, from the river St. Croix, aforeſaid, to the mouth of the Muſquat River; by the ſaid river to its ſource, and from thence by a due eaſt line acroſs the iſthmus into the Bay Verte, to join the eaſtern lot above deſcribed, including all iſlands with ſix leagues of the coaſt.

The rivers Riſgouche and Nipiſiguit run from Weſt to Eaſt, and fall into the bay of St. Laurence. The rivers of St. John, Paſſamagnadi, Penobſcot, and St. Croix, which run from North to South, fall into Fundy Bay, or the ſea a little to the eaſtward of it. The ſeas adjoining to it are, the Atlantic ocean, Fundy Bay, and the gulf of St. Laurence. The leſſer bays are Chenigto and Green Bay upon the iſthmus, which joins the north part of Nova Scotia to the ſouth; and the bay of Chaleurs on the north-eaſt; the bay of Chedibucto on the ſouth-eaſt; the bay of the iſlands, the ports of Bart, Chebucto, Proſper, St. Margaret, La Heve, port Maltois, port Ryſignol, port Vert, and port Joly, on the ſouth; port la Tour, on the ſouth-eaſt; port St. Mary, Annapolis, and Minas, on the ſouth ſide of Fundy Bay, and port Roſeway, now the moſt populous of all.

UNITED STATES OF AMERICA.

Miles. — NEW ENGLAND. — Degrees. Sq. Miles.

Miles.		Degrees.	Sq. Miles.
Length 550	lies between	41 and 49 north lat.	87,000
Breadth 200		67 and 74 weſt lon.	

Bounded on the North-eaſt by Nova Scotia; on the Weſt by Canada; on the South by New York; and on the Eaſt by the Atlantic.

Diviſions.	Provinces.	Chief Towns.
The N. diviſion, or government.	New Hampſhire.	Portſmouth.
The middle diviſion	Maſſachuſett's Colony	BOSTON, N. lat. 42-25 W. Lon. 70-37.
The ſouth diviſion.	Rhode Iſland, &c.	Newport.
The weſt diviſion.	Connecticut.	New London. Hertford.

Their rivers are, the Connecticut; Thames; Patuxent; Merimac; Piſcataway; Saco; Cuſco; Kennebeque; and Ponobſcot, or Pentagonet. The moſt remarkable bays and harbours are thoſe formed by Plymouth, Rhode Iſland, and Providence plantations; Monument-Bay, Weſt-Harbour, formed by the bending of Cape-Cod; Boſton-Harbour; Piſcataway, and Caſco-Bay. Boſton, the capital of New England, ſtands on a peninſula at the bottom of Maſſachuſett's Bay, about nine miles from its mouth. At the entrance of this bay are ſeveral rocks, which appear above water, and upwards of a dozen ſmall iſlands, ſome of which are inhabited. There is but one ſafe channel to approach the harbour, and that ſo narrow, that two ſhips can ſcarcely ſail through abreaſt. On one of the iſlands of the bay, ſtands Fort William, the moſt regular fortreſs in all the plantations. The greateſt part of the town lies round the harbour, in the ſhape of a half moon; the country beyond it riſing gradually, and affording a delightful proſpect from the ſea. The other towns in New England, are generally neat, well built, and commodiouſly ſituated upon fine rivers, with capacious harbours. Cambridge, in the ſame province, is four miles from Boſton, and has an univerſity, containing two ſpacious colleges, with a well furniſhed library.

Miles. — NEW YORK. — Degrees. — Sq. Miles.

Miles.		Degrees.	Sq. Miles.
Length 300	lies between	40 and 46 north lat.	24,000
Breadth 150		72 and 76 weſt lon.	

New York is bounded on the South and South-weſt by Hudſon's and Delaware rivers, which divide it from New Jerſey and Pennſylvania; on the Eaſt and North-eaſt by New England and the Atlantic Ocean; and on the North-weſt by Canada.

This province, including the iſland of New York, Long Iſland, and Staten Iſland, is divided into the ten following counties:

COUNTIES.—New York, Albany, Ulſter, Ducheſs, Orange, Weſt Cheſter, King's, Queen's, Suffolk, Richmond. CHIEF TOWNS.—New York, Albany, Orange, Weſt Cheſter, Jamaica, Southampton, and Richmond.

NEW JERSEY.

SITUATION AND EXTENT.

Miles.		Degrees.	Sq. Miles.
Length 160	lies between	39 and 43 north lat.	10,000
Breadth 60		74 and 76 weſt long.	

New Jerſey is bounded on the Weſt and South-weſt, by Delaware river and Bay; on the South-eaſt and Eaſt, by the Atlantic Ocean; and by the Sound which ſeparates Staten Iſland from the continent, and Hudſon's river, on the North.

Diviſions.	Counties.	Chief Towns.	
Eaſt Diviſion contains	Middleſex	Perth-Amboy & New-Brunſwick	
	Monmouth	None	
	Eſſex	Elizabeth and Newark	
	Somerſet	None	
	Bergen	Bergen	
Weſt Diviſion contains	Burlington	Burlington	40-8 N. lat. 75-0 W. long.
	Glouceſter	Glouceſter	
	Salem	Salem	
	Cumberland	Hopewell	
	Cape May	None	
	Hunderton	Trenton	
	Morris	Morris	
	Suſſex	None	

The Rivers are the Delaware, Raritan, and Paſſaick, on the latter of which is a remarkable cataract; the height of the rock from which the water falls is ſaid to be about 70 feet perpendicular.

Miles. — PENNSYLVANIA. — Degrees. Sq. Miles.

Miles.		Degrees.	Sq. Miles.
Length 300	lies between	74 and 81 weſt long.	15,000
Breadth 240		39 and 44 north lat.	

Bounded by the country of the Iroquois, or Five Nations, on the North; by Delaware river, which divides it from the Jerſeys, on the Eaſt; and by Maryland, on the South and Weſt; and contains the following counties:

COUNTIES. — Philadelphia, Cheſter, Bucks, Berks, Northampton, Lancaſter, York, Cumberland. CHIEF TOWNS. Philadelphia, Cheſter, Newton, Reading, Eaſton, Lancaſter, York, Carliſle.

Bedford, a county weſtward of the mountains upon Ohio, purchaſed from the Indians in 1761, by Mr. Penn, and eſtabliſhed in 1771.

Beſides the above, there are the three following:

Counties.		Chief Towns.
Newcaſtle	on the Delaware	Newcaſtle
Kent and		Dover
Suſſex		Lewes

which form a diſtinct government, and are now called "the Delaware State," having a preſident, council of nine perſons, and houſe of aſſembly of twenty-one repreſentatives: the judges and other officers of ſtate, civil and military, are choſen by the preſident and general aſſembly. The rivers are, Delaware, the Suſquehanna and Schylkill. This province contains many very conſiderable towns, ſuch as German-Town, Cheſter, Oxford, Radnor, but the city of Philadelphia, which is beautiful beyond any city in America, and in regularity unequalled by any in Europe, totally eclipſes the reſt. It is ſituated 100 miles from the ſea, between two navigable rivers, the Delaware, where it is above a mile in breadth on the north, and the Schuylkill, on the ſouth, which it unites as it were, by running in a line of two miles between them.

MARYLAND.

Miles.		Degrees.	Sq. Miles.
Length 140 Breadth 135	lies between	75 and 80 weſt long. 37 and 40 north lat.	12,000

Bounded by Pennſylvania, on the North; by another part of Pennſylvania, and the Atlantic Ocean, on the Eaſt; by Virginia, on the South; and by the Apalachian mountains on the Weſt. Maryland is divided into two parts by the bay of Cheſapeak, viz. 1. The eaſtern; and 2. The weſtern diviſion.

Diviſions.	Counties.	Chief Towns.
The Eaſt diviſion contains the counties of	Worceſter —	Princeſs Anne
	Somerſet —	Snow Hill
	Dorſet —	Dorſet, or Dorcheſter
	Talbot —	Oxford
	Cecil —	
	Queen Anne's —	Queen's town
	Kent —	Cheſter
The Weſt diviſion contains	St. Mary's county	St. Mary
	Charles	Briſtol
	Prince George	Maſterkout
	Calvert	Abington
	Arundel	Annapolis
	Baltimore county	Baltimore
	Frederic county	

This country is indented with a vaſt number of navigable creeks and rivers; the chief are Patowmac, Pocomoac, Patuxent, Cheptonk, Severn, and Saſſafras.

VIRGINIA.

Miles		Degrees	Sq. M.
Length 750 Breadth 140	lies between	75 and 90 weſt lon. 36 and 40 north lat.	80,000

Bounded by the river Potowmac, which divides it from Maryland, on the North-eaſt; by the Atlantic ocean, on the Eaſt; by Carolina, on the South; and the river Miſſiſſippi, on the Weſt. It may be divided into four parts viz. the North, the Middle, the South, and the Eaſtern diviſion.

Diviſions.	Counties.	Pariſhes.
The north diviſion contains	1. Northumberland	Wincomoca
	2. Lancaſhire —	Chriſt Church
	3. Weſtmoreland	
	4. Richmond —	
	5. Stafford —	St. Paul's
The middle diviſion contains	6. Eſſex —	Farnham
	7. Middleſex —	Chriſt Church
	8. Glouceſter —	Abingdon
	9. King & Queen co	Stratton
	10. King Williamco	St. John's
	11. New Kent	St. Peter's
	12. Elizabeth —	Elizabeth
	13. Warwick —	Denby
	14. York —	York
	15. Princeſs Anne	Lynhaven
The South diviſion contains	16. Norfolk —	Elizabeth
	17. Nanſamund	Chutakuk
	18. Iſle of Wight	Newport
	19. Surry —	Southwark
	20. Prince George	Wayanoke
	21. Charles —	Weſtover
	22. Henrico —	Briſtol
	23. James —	James Town
		WILLIAMSBURG.
Eaſtern diviſion.	24. Acomac county	Acomac

In ſailing to Virginia or Maryland, you paſs a ſtrait between two points of land, called the Capes of Virginia, which opens a paſſage into the bay of Cheſapeak, one of the largeſt and ſafeſt in the whole world; for it enters the country near 300 miles from the ſouth to the north, is about 18 miles broad for a conſiderable way, and ſeven where it is the narroweſt, the waters in moſt places being nine fathoms deep.

NORTH AND SOUTH CAROLINA, WITH GEORGIA.

Miles.		Degrees.	Sq. Miles.
Length 700 Breadth 380	lies between	76 and 91 weſt longitude. 30 and 37 north latitude.	110,000

Bounded by Virginia on the North; by the Atlantic Ocean, on the Eaſt; by the river St. John, which ſeparates Georgia from Florida, on the South; and by the Miſſiſſippi, on the Weſt.

Diviſions.	Counties.	Towns.
North Carolina, contains the counties of	Albemarle —	Edenton
	Bath and Clarendon	Wilmington
The middle diviſion, or South Carolina, contains the counties of	Clarendon in part	St. James
	Craven	Chriſt-Church
	Berkley	
	Colleton	CHARLES-TOWN
	Granville	Port Royal
The South Diviſion contains only	Georgia —	SAVANNAH
		Frederica
		Puriſburgh

The rivers are the Roanoke, or Albemarle river; Pamtico; Neus; Cape Fear, or Clarendon river; Pedee; Santee; Savannah; Alatamaha, or George River; and St. Mary's which divide Georgia from Florida: all which riſe in the Apalachian mountains, and, running eaſt, fall into the Atlantic ocean. The only town in either of the Carolinas worthy of notice is Charles-Town, the metropolis of South Carolina, which for ſize, beauty, and trade, may be conſidered as one of the firſt in North America. It is admirably ſituated at the confluence of two navigable rivers, one of which is navigable for ſhips 20 miles above the town, and for boats and large canoes near 40. The harbour is good in every reſpect, but that of a bar, which hinders veſſels of more than 200 tuns burthen, loaded from entering.

WEST INDIES.

Such of the Weſt India iſlands as are worth cultivating belong to five European powers, viz. Great Britain, Spain, France, Holland and Denmark. The iſlands of the Weſt Indies lie in the form of a bow, or ſemicircle, ſtretching almoſt from the coaſt of Florida north, to the river Oronoque, in the main continent of South America. Some call them the Caribbees, from the firſt inhabitants; though this is a term that moſt geographers confine to the Leeward Iſlands, bnt geographical tables and maps diſtinguiſh them into the Great and Little Antilles. The firſt that we come to belonging to Great Britain, is Jamaica, which lies between the 75th and 79th degrees of weſt longitude from London, and between 17 and 18 north latitude. From the eaſt and weſt it is in length about 140 miles, and in the middle about 60 in breadth, growing leſs towards each end, in the form of an egg. It lies near 4500 miles ſouth-weſt of England. Port Royal was formerly the capital of Jamaica. It ſtood upon the point of a narrow neck of land, which, towards the ſea, formed part of the border of a very fine harbour of its own name; but Kingſton a handſome built town is now the capital. Not far from Kingſton, ſtands St. Jago de la Vega, or Spaniſh town, which, though at preſent inferior to Kingſton, was once the capital of Jamaica, and is ſtill the ſeat of government, and the place where the courts of juſtice are held. As for Savannah it is a ſmall ſea-port.

BARBADOES. This iſland the moſt eaſterly of all the Caribbees, is ſituated in 59 degrees weſt long. and 13 degrees north lat. It is 21 miles in length, and in breadth 14. The capital is Bridgetown, where the governor reſides.

ST. CHRISTOPHER's. This iſland, commonly called by the ſailors St. Kitt's, is ſituated in 62 degrees weſt long. and 17 degrees north lat. about 14 leagues from Antigua, and is twenty miles long and ſeven broad. It has its name from the famous Chriſtopher Columbus, who diſcovered it for the Spaniards.

ANTIGUA. Situated in 61 deg. W. lon. and 17 deg. N. lat. is of a circular form, near 20 miles over every way.

NEVIS AND MONTSERRAT. Two ſmall iſlands, lying between St. Chriſtopher's and Antigua, neither of them exceeding 18 miles in circumference. Both were taken by the French in the year 1782, but reſtored at the peace.

BARBUDA. Situated in 18 deg. N. lat. 35 miles north of Antigua, is 20 miles in length, and 12 in breadth.

ANGUILLA. Situated in 19 deg. N. lat. 60 miles north-weſt of St. Chriſtopher's is about 30 miles long and 10 broed. This iſland is perfectly level.

DOMINICA. Situated in 16 deg. N. lat. and in 62 W. lon. lies about half way between Guadaloupe, and Martinico. It is near 28 miles in length and 13 in breadth: it got its name from being diſcovered by Columbus on a Sunday. It was taken by the French in 1778; but was reſtored again to Great Britain by the late peace.

ST. VINCENT. Situated in 13 deg. N. lat. and 61 deg. W. long. 50 miles north-weſt of Barbadoes, 30 miles ſouth of St. Lucia, is about 24 miles in length, and 18 in breadth. The French got poſſeſſion of it in 1789; but it was reſtored to Great Britain by the late treaty of peace.

GRANADA AND THE GRANADINES. Granada is ſituated in 12 deg. north lat. and 62 deg. weſt long. about 30 leagues ſouth-weſt of Barbadoes, and almoſt the ſame diſtance north of New Andaluſia, or the Spaniſh main. This iſland is ſaid to be 30 miles in length, and 15 in breadth. In July, 1779, the French again made themſelves maſters of this iſland, though it was reſtored to Great Britain by the late treaty of peace.

NEWFOUNDLAND is ſituated to the eaſt of the gulf of St. Lawrence, between 46 and 52 deg. north lat. and between 53 and 59 deg. weſt long. ſeparated from Labrador or New Britain by the Straits of Belleiſle, and from Canada by the bay of St. Lawrence, being 350 miles long, and 200 broad. The chief towns in Newfoundland are Placentia, Bonaviſta, and St. John.

CAPE BRETON. This iſland, ſeated between Newfoundland and Nova Scotia, is in length 110 miles, it has good harbours, particularly that of Louiſburgh, which is near four leagues in circumference; it was ceded to the crown of Great Britain by the peace of 1763, ſince which the fortifications have been blown up, and the town of Louiſburgh diſmantled.

ST. JOHN's. Situated in the Gulf of St. Lawrence, is about 60 miles in length, and 30 or 40 broad, and has many fine rivers; and though lying near Cape Breton and Nova Scotia, has greatly the advantage of both in pleaſantneſs and fertility of ſoil.

BERMUDAS, or SUMMER ISLANDS, are ſituated at a vaſt diſtance from any continent, in 32 deg. north lat. and in 65 degrees weſt long. Their diſtance from the Land's End is computed to be near 1500 leagues, from the Madeiras about 1200, and from Carolina 300. The Bermudas are but ſmall, not containing in all above 20,000 acres; and are very difficult of acceſs, being, as Waller, the poet, expreſſes it, "walled with rocks." The town of St. George, which is the capital, is ſeated at the bottom of a haven in the iſland of the ſame name.

LUCAY's, OR BAHAMIA ISLANDS. The Bahamas are ſituated to the South of Carolina, between 12 and 27 degrees north lat. and 73 and 81 degrees weſt lon. They extend along the coaſt of Florida quite down to the iſle of Cuba; and are ſaid to be 500 in number, ſome of them only mere rocks; but 12 of them are large and fertile: they are, however, almoſt uninhabited, except Providence, which is 200 miles eaſt of the Floridas; though ſome others are larger and more fertile, on which the Engliſh have plantations. Between them and the continent of Florida is the gulf of Bahama, or Florida. The Spaniards captured theſe iſlands during the laſt war, but they were retaken by a detachment from St. Auguſtine, April 7th, 1783.

FALKLAND ISLANDS. Leaving the Bahama and Weſt India iſlands, we ſhall now proceed along the ſouth-eaſt coaſt of America, as far as the 52 deg. of ſouth lat. where the reader, by looking into the Map, will perceive the Falkland Iſlands ſituated near the Straits of Magellan, at the utmoſt extremity of South America.

SPANISH DOMINIONS IN NORTH AMERICA.

EAST AND WEST FLORIDA.

Miles.		Degrees.
Length 500	lies between	80 and 91 weſt longitude.
Breadth 440		25 and 32 north latitude.

This country, which was ceded by Great Britain to Spain by the late treaty of peace, is bounded by Georgia on the North; by the Miſſiſſippi on the Weſt; by the Gulf of Mexico on the South; and by the Bahama Straits on the Eaſt.

The chief river is the Miſſiſſippi, which is one of the fineſt in the world, as well as the largeſt; for, including its turnings and windings, it is ſuppoſed to run a courſe of 4500 miles. The chief bays are St. Bernard's Aſcenſion, Mobille, Penſacola, Dauphin, Joſeph, Apalaxy, Spiritu, Sancto, and Charles Bay. The capes are, Cape Blanco, Samblas, Anclote, and Cape Florida, at the extremity of the peninſula. The chief town in Weſt Florida is Penſacola, N. lat. 30-22 W. long. 87-20, which is ſituated within the bay of the ſame name, on a ſandy ſhore that can only be approached by ſmall veſſels. St. Auguſtine, the capital of Eaſt Florida, N. lat. 29-45 W. long. 81-12, runs along the ſhore, and is of an oblong form. The town is fortified with baſtions, and encloſed with a ditch.

NEW MEXICO, INCLUDING CALIFORNIA.

Miles		Degrees.
Length 2000	lies between	94 and 126 weſt longitude.
Breadth 1600		23 and 43 north latitude

Bounded by unknown lands on the north; by Louiſiana, on the Eaſt; by Old Mexico, and the Pacific Ocean, on the South; and by the ſame ocean on the Weſt.

Diviſions.	Subdiviſions.	Chief Towns.
North-eaſt diviſion	New Mexico Proper	SANTA FE.
South-eaſt diviſion	Apacheira ——	St. Antonio.
South diviſion	Sonora ——	Tuape.
Weſt diviſion	California, a peninſula	St. Juan.

OLD MEXICO, OR NEW SPAIN.

Miles		Degrees.
Length 2000	lying between	83 and 110 Weſt longitude.
Breadth 600		8 and 30 north latitude.

Bounded by New Mexico, or Granada, on the north; by the gulf of Mexico, on the North-eaſt; by Terra Firma, on the South-eaſt; and by the Pacific Ocean, on the South Weſt; containing three audiences, viz.

Audiences.	Chief Towns.
1. Galicia or Guadalajarra. ——	Guadalajarra.
2. Mexico Proper ——	MEXICO, Acapulco, Vera Cruz.
3. Guatimala —— ——	Guatimala

On the north ſea are the gulfs or bays of Mexico, Campeachy, Vera Cruz, and Hondurus; in the Pacific Ocean or South Sea, are the bays Micoya and Amapalla, Acapulco and Salinas.

SPANISH DOMINIONS IN SOUTH AMERICA,

TERRA FIRMA, OR CASTILE DEL ORO.

Miles.		Degrees.
Length 1400	lies between	60 and 82 weſt longitude.
Breadth 700		the equator, and 12 north latitude.

Bounded by the North Sea (part of the Atlantic Ocean), on the North; by the ſame ſea and Surinam, on the Eaſt; by the country of the Amazons and Peru, on the South; and by the Pacific Ocean and New Spain, on the Weſt.

Diviſions.	Subdiviſions.	Chief Towns.
The north diviſion contains the provinces of	1. Terra Firma Proper, or Darien	Porto Bello PANAMA
	2. Carthagena	Carthagena
	3. St. Martha	St. Martha
	4. Rio de la Hacha	Rio de la Hacha
	4. Venezuela	Venezuela
	6. Comana	Comana
	7. New Andaluſia	St. Thomas
The ſouth diviſion contains the provinces of	1. New Granada	Santa Fé de Bagota
	2. Popayan	Popayan.

The iſthmus of Darien, or Terra Firma Proper, joins North and South America. A line drawn from Porto Bello in the North to Panama in the South Sea, or rather a little weſt of theſe two towns, is the proper limit between North and South America, and here the iſthmus or neck of land is only 60 miles over. The principal bays in Terra Firma are, the bay of Panama, and the bay of St. Michael's, in the South Sea; the bay of Porto Bello, the gulf of Darien, Sino bay, Carthagena bay and harbour, the gulf of Venezuela, the bay of Maracaibo, the gulf of Trieſto, the bay of Guaira, the bay of Curiaco, and the gulf of Paria, or Andaluſia, in the North Sea.

PERU.

Miles.		Degrees.
Length 1800	lies between	the equator and 23 ſouth lat.
Breadth 500		60 and 81 weſt long.

Bounded by Terra Firma, on the North; by the mountains, or Cordeleiras des Andes, Eaſt; by Chili, South; and by the Pacific Ocean, Weſt.

Diviſions.	Provinces.	Chief Towns.
The north diviſion	Quito	Quito Payta
The middle diviſion	Lima, or Los Reyes	LIMA, Cuſco, and Callao.
The ſouth diviſion	Los Charcos	Potoſi, Porco.

The only ſea which borders on Peru is the Pacific Ocean, or South Sea. The principal bays and harbours are Payta, Malabrigo, Cuanchaco, Coſma, Vermeio, Guara, Callao the port-town to Lima, Ylo, and Arica. There is a river whoſe waters are as red as blood. The rivers Granada or Cagdalena, Oronoque, Amazon, and Plate, riſe in the Andes, and fall into the Pacific Ocean, between the equator and eight deg. S. lat. The city of Lima is the capital of Peru, and of the whole Spaniſh empire: its ſituation in the middle of a ſpacious and delightful valley, was fixed upon by the famous Pizarro, as the moſt proper for a city, which he expected would preſerve his memory. In the year 1747, a moſt tremendous earthquake laid three-fourths of this city level with the ground, and entirely demoliſhed Callao, the port-town belonging to it. Cuſco, the ancient capital of the Peruvian empire, lies in a mountainous country, and at a diſtance from the ſea, and has been long on the decline.

CHILI.

Miles.		Degrees.
Length 1200	lies between	25 and 45 ſouth latitude.
Breadth 500		65 and 85 weſt longitude.

Bounded by Peru, on the north; by La Plata, on the Eaſt; by Patagonia, on the ſouth; and by the Pacific Ocean, on the Weſt.

Diviſions.	Provinces.	Chief Towns.
On the weſt ſide of the Andes.	Chili Proper.	St. Jago, Baldivia
On the eaſt ſide of the Andes.	Cuyo, or Cutio.	St. John d'Frontiera

The principal lakes are thoſe of Tagatagua near St. Jago, and that of Paren. Beſides which they have ſeveral ſalt-water lakes, that have a communication with the ſea, part of the year.

PARAGUAY, OR LA PLATA.

Miles.		Degrees.
Length 1500	lies between	12 and 37 ſouth latitude.
Breadth 1000		50 and 75 weſt longitude.

Bounded by Amazonia, on the north; by Brazil, Eaſt; by Patagonia, on the ſouth; and by Peru and Chili, Weſt.

Diviſions.	Provinces.	Chief Towns.
Eaſt diviſion contains	Paraguay	Aſſumption
	Parana	St. Anne
	Guaira	Civadad Real
	Uragua	Los Reyes
South diviſion	Tucuman	St. Jago
	Rio de la Plata	BUENOS AYRES.

The principal bay is that at the mouth of the river La Plata, on which ſtands the capital city of Buenos Ayres; and Cape St. Antonio, at the entrance of that bay, is the only promontory. This country abounds with lakes, one of which is 100 miles long. This country, beſides an infinite number of ſmall rivers, is watered by three principal ones, which, united near the ſea, form the famous Rio de la Plato, or Plate River, and which annually overflow their banks: and, on their receſs, leave them enriched with a ſlime, that produces the greateſt plenty of whatever is committed to it. The Spaniards firſt diſcovered this country, by ſailing up the river la Plata in 1515, and founded the town of Buenos Ayres, ſo called on account of the excellence of the air, on the ſouth ſide of the river, fifty leagues within the mouth of it, where the river is ſeven leagues broad. This is one of the moſt conſiderable towns in South America.

SPANISH ISLANDS IN AMERICA.

CUBA. The iſland of Cuba is ſituated between 19 and 23 degrees north lat. and between 74 and 87 degrees weſt lon. 100 miles to the ſouth of Cape Florida, and 75 north of Jamaica, and is near 700 miles in length, and generally about 70 miles in breadth. A chain of hills runs through the middle of the iſland from eaſt to weſt; but the land near the ſea is in general level and flooded in the rainy ſeaſon when the ſun is vertical.

HISPANIOLA, or St. DOMINGO. This iſland was at firſt poſſeſſed by the Spaniards alone; but by far the moſt conſiderable part is now in the hands of the French. However, as the Spaniards were the original poſſeſſors, and ſtill continue to have a ſhare in it, Hiſpaniola is commonly regarded as a Spaniſh iſland. It is ſituated between the 17th and 21ſt degrees north lat. and the 67th and 74th of weſt lon. lying in the middle between Cuba and Porto-Rico, and is 450 miles long, and 150 broad. The moſt ancient town in this iſland, and in all the New World, built by Europeans, is St. Domingo. It was founded by Bartholomew Columbus, brother to the admiral, in 1504, who gave it that name in honour of his father Dominic, and by which the whole iſland is ſometimes named, eſpecially by the French. It is ſituated on a ſpacious harbour, and is a large well-built city.

The French towns are Cape St. Francois the capital, Leogane, Petit Guaves, and Port Louis.

PORTO RICO. Situated between 64 and 67 degrees weſt lon. and in 18 degrees north lat. lying between Hiſpaniola and St. Chriſtopher's, is 100 miles long, and 40 broad. Porto Rico, the capital town, ſtands in a little iſland on the north ſide of the main iſland, forming a capacious harbour, and joined to the chief iſland by a cauſey, and defended by forts and batteries, which render the town almoſt inacceſſible.

VIRGIN ISLANDS. Situated at the eaſt end of Porto Rico, are extremely ſmall.

TRINIDAD. Situated between 59 and 62 degrees weſt lon. and in 10 degrees north lat. lies between the iſland of Tobago and the Spaniſh Main; from which it is ſeparated by the ſtreights of Paria. It is about 90 miles long, and 60 broad; and is an unhealthful ſoil.

MARGARETTA. Situated in 64 degrees weſt lon. and 11-30 north lat. ſeparated from the northern coaſt of New Andaluſia, in Terra Firma, by a ſtrait of 24 miles, is about forty miles in length, and 24 in breadth; and being always verdant, affords a moſt agreeable proſpect.

JUAN FERNANDES. Lying in 83 degrees weſt lon. and 33 ſouth lat. 300 miles weſt of Chili. This iſland is uninhabited: but is famous for having given riſe to the celebrated romance of Robinſon Cruſoe.

PORTUGUESE AMERICA. — CONTAINING BRAZIL.

Miles		Degrees.
Length 2500	lies between	the equator and 35 ſouth latitude
Breadth 700		35 and 60 weſt longitude.

Bounded by the mouth of the river Amazon, and the Atlantic Ocean, on the north; by the ſame ocean on the eaſt; by the mouth of the river Plata ſouth; and by a chain of mountains, which divide it from Paraguay and the country of Amazons on the weſt. On the coaſt are three ſmall iſlands, where ſhips touch for proviſions in their voyage to the South Seas, viz. Fernando, St. Barbara, and St. Catherine's. The Atlantic Ocean waſhes the coaſt of Brazil on the north-eaſt and eaſt, upwards of 3000 miles, forming ſeveral fine bays and harbours: as the harbours of Panambuco, All Saints, Porto Seguro, the port and harbour of Rio Janeiro, the port of St. Vincent, the harbour of St. Gabriel, and the port of St. Salvador, on the north ſhore of the river la Plata. St. Salvador, or the city of Bahia, the capital, commands a noble, ſpacious, and commodious harbour. It is built upon a high and ſteep rock, having the ſea upon one ſide, and a lake, forming a creſcent, inveſting it almoſt wholly ſo as nearly to join the ſea, on the other. The ſituation makes it in a manner impregnable by nature; and they have beſides added to it very ſtrong fortifications.

FRENCH ISLANDS IN AMERICA.

MARTINICO. Which is ſituated between 14 and 15 deg. of north lat. and in 61 degrees weſt lon. lying about 40 leagues north-weſt of Barbadoes, is about 60 miles in length, and half as much in breadth. The inland part of it is hilly, from which flow upon every ſide, a number of agreeable and uſeful rivers, which adorn and enrich this iſland in a high degree.

GUADALOUPE. So called by Columbus, from the reſemblance of its mountains to thoſe of that name in Spain, is ſituated in 16 degrees north lat. and in 62 weſt lon. about 30 leagues north of Martinico, and almoſt as much ſouth of Antigua; being 45 miles long, and 38 broad. It is divided into two parts by a ſmall arm of the ſea, or rather a narrow channel, through which no ſhips can venture; but the inhabitants paſs it in a ferry-boat.

St. LUCIA. Situated in 14 deg. north lat. and in 61 deg. weſt lon. 80 miles north-weſt of Barbadoes, is 23 miles in length and 12 in breadth.

TOBAGO. This iſland is ſituated in 11 degrees odd min. north lat. 120 miles ſouth of Barbadoes, and about the ſame diſtance from the Spaniſh Main. It is about 32 miles in length, and nine in breadth.

St. BARTHOLOMEW, DESEADA AND MARIGALANTE, are three ſmall iſlands lying in the neighbourhood of Antigua, and St. Chriſtopher's, and are of no great conſequence to the French, except in time of war, when they give ſhelter to an incredible number of privateers, which greatly annoy our Weſt India trade.

DUTCH AMERICA.

Containing SURINAM, on the Continent of SOUTH AMERICA.

Dutch Guiana is ſituated between five and ſeven degrees north lat. extending 100 miles along the coaſt from the mouth of the river Oronoque, north, to the river Maroni, or French Guiana, ſouth. The climate of this country is generally reckoned unwholeſome; and a conſiderable part of the coaſt is low, and covered with water. The chief ſettlement is at Surinam, a town built on a river of the ſame name. Connected with Surinam, we ſhall mention the two Dutch Colonies of Demerary and Iſſequibo on the Spaniſh Main, which ſurrendered to the Engliſh in the year 1781.

DUTCH ISLANDS IN AMERICA.

St. EUSTATIUS. Situated in 17° 29′ N. lat. 63° 10′ W. long. and three leagues north-weſt of St. Chriſtopher's, is only a mountain about 29 miles in compaſs, riſing out of the ſea like a pyramid, and almoſt round. The ſides of the mountain, are laid out in very pretty ſettlements; but they have neither ſprings nor rivers.

CURASSOU. Situated in 12 degrees north lat. 9 or 10 leagues from the continent of Terra Firma, is 30 miles long, and 10 broad. All kinds of labour are here performed by engines: ſome of them ſo well contrived, that ſhips are at once lifted into the dock. The other iſlands, Bonaire and Aruba, are inconſiderable in themſelves, and ſhould be regarded as appendages to Curaſſou. The ſmall iſlands of Saba and St. Martin's, ſituated at no great diſtance from St. Euſtatia, hardly deſerve to be mentioned; they were both captured by admiral Rodney and General Vaughan, at the time when St. Euſtatia ſurrendered to the arms of Great Britain; but were afterwards retaken by the French.

DANISH ISLANDS IN AMERICA.

St. THOMAS. An inconſiderable member of the Caribbees, ſituated in 64 degrees weſt lon. and 18 north lat. about 15 miles in circumference, and has a ſafe and commodious harbour.

St. CROIX, or SANTA CRUZ. Another ſmall and unhealthy iſland, lying about five leagues eaſt of St. Thomas, ten or twelve leagues in length, and three or four where it is broadeſt.

TERRA-INCOGNITA, or unknown Countries.

Notwithſtanding the amazing diſcoveries of navigators, and the progreſs made in geography, ſince the firſt voyage of Columbus, anno 1492, there ſtill remain ſome countries, either abſolutely unknown, or very ſuperficially ſurveyed.

IN AFRICA. — Of this quarter of the globe the moderns are acquainted with the ſea-coaſts only, and theſe very imperfectly; the internal parts being little known to us, nor have we any ſatisfactory accounts of their inhabitants, their productions, or their trade. It is well known, however, that the rivers of Africa bring down large quantities of gold, and it is equally certain, that the ancients drew prodigious riches from a country bleſſed with a variety of climates, ſome of them the fineſt in the world.

IN AMERICA. — In North America, towards the Pole, are Labrador, or New Britain, New North, and South Wales, New Denmark, &c. very little known. All that vaſt tract on the back of the Britiſh ſettlements, from Canada and the lakes to the Pacific Ocean, which waſhes America on the weſt, is perfectly unknown to us, no European having ever travelled thither. In South America, the country of Guiana, extending from the equator to the eighth degree of north latitude, and bounded by the river Oronoque on the north, and the Amazons on the ſouth, is unknown, except a ſlip along the coaſt, where the French at Cayenne, and the Dutch at Surinam, have made ſome ſettlements; which from the unhealthfulneſs of the climate, almoſt under the equator, and other cauſes, can hardly be extended any conſiderable way back. The country of Amazonia, ſo called from the great river of that name, has never been thoroughly diſcovered, though it is ſituated near the European colonies of Peru and Braſil, and every where navigable by means of that great river and its branches. Patagonia, at the ſouthern extremity of America, is ſometimes deſcribed as part of Chili: but as neither the Spaniards, nor any other European nation, have any colonies here, it is almoſt unknown, and is generally repreſented as a barren, inhoſpitable country. And here in 52½ degrees ſouth lat. we fall in with the Straits of Magellan, having Patagonia on the north, and the iſlands of Terra del Fuego on the ſouth. Theſe Straits extend from eaſt to weſt 110 leagues, but the breadth in ſome places falls ſhort of one.

Our knowledge of the globe has been conſiderably augmented by the late diſcoveries of the Ruſſians, in the northern Archipelago, and ſtill more by thoſe that have been made Britiſh navigators in the preſent reign, which have been numerous and important; of theſe diſcoveries we ſhall therefore give a compendious account.

NORTHERN ARCHIPELAGO.

This conſiſts of ſeveral groups of iſlands, which are ſituated between the eaſtern coaſt of Kamtſchatka and the weſtern coaſt of the continent of America. Mr. Muller divides theſe iſlands into four principal groups, the two firſt of which are ſtyled the Aleutian iſlands. The firſt group, which is called by ſome of the iſlanders

Saſignan, comprehends, Beering's iſland; Copper Iſland; Otma; Samyra, or Shemvia; Anakta. The ſecond group is called Kaho, and comprizes eight iſlands, viz. Immak; Kiſka; Tchetchia; Ava; Kavia; Tſchangulak; Ulagama; Amtſchidga. The third general name is Neglio, and comprehends the iſlands known to the Ruſſians under the name of Andleanoffski Oſtrova; ſixteen of which are mentioned under the following names: Amatkinak; Ulak; Unalga; Navotſha; Uliga; Anagin; Kagulak; Illaſk, or Illak; Takavanga, upon which is a volcano; Kanaga, which has alſo a volcano; Leg; Sketſhuna; Tagaloon; Gorleoi; Otchu; Amla. The fourth group is called Kavalang, and comprehends ſixteen iſlands; which are called by the Ruſſians Lyſſic Oſtrova, or the *Fox Iſlands*; and which are named, Amuchta; Tſchigama; Tſchegula; Uniſtra; Ulaga; Tauagulana; Kagamin; Kigalga; Skelmaga; Umnak; Agun-Alaſhka; Unimma; Uligan; Auturo Leiſſume; Semidit; Senagak.

NEW DISCOVERIES.

In conſequence of an order of his preſent majeſty, for making diſcoveries in the ſouthern hemiſphere, voyages were undertaken, and ſucceſſively performed, by Commodore Byron, Captain Wallis, Captain Carteret, and Captain Cook; the latter of whom accompliſhed a very important purpoſe, in aſcertaining that immenſe tract, in the ſouthern clime, called New Holland, to be an iſland, which had ever before been ſuppoſed continental.

OTAHEITE, or KING GEORGE'S ISLAND.

This iſland was diſcovered by captain Wallis, in the Dolphin, on the 19th of June, 1767. It is ſituated between the 17th degree 28 min. and the 17th degree 53 min. ſouth latitude; and between the 149th degree 11 min. and the 149th degree 39 minutes weſt long. It conſiſts of two peninſulas, of a ſomewhat circular form. joined by an iſthmus, and is ſurrounded by a reef of coral rocks, which form ſeveral excellent bays and harbours, where there is room and depth of water for almoſt any number of the largeſt ſhips; it is known by the general name *Otaheite*, forms two diſtinct kingdoms, which are united by a narrow neck of land. The largeſt of theſe kingdoms is called by the natives *Tiarrabou*, or *Otaheite-nue*; the ſmaller *Opoureonu*, or *Otaheite-Ete*. It is ſurrounded by a reef of coral rocks, forming ſeveral bays, among which the principal is Port Royal, called by the natives Matavai. The country affords a beautiful proſpect. It riſes in ridges, forming mountains in the middle of the iſland that may be ſeen at the diſtance of ſixty miles. Towards the ſea it is level, and covered with fruit trees of divers kinds, but particularly the cocoa-nut. In this part are the houſes of the inhabitants, which do not form villages, being ranged along the whole border at about fifty yards diſtance from each other. The ſoil, which is of a blackiſh colour, being watered by a number of rivulets, is rich, and of courſe luxuriant in its products. On the borders of the valley through which the river flows there are ſeveral houſes with walled gardens, and plenty of fowls and hogs. Channels are cut in many places to conduct the water from the hills to the plantations. Streams meander through various windings, and ſtupendous mountains overhang the vallies. Towards the ſea the view is delightful, the ſides of the hills being covered with trees, and the vallies with graſs. No underwood was found beneath the trees, neither on the ſides or bottoms of the hills, but there was plenty of good graſs. Many fine ſprings guſh from the borders of the mountains, all of which are covered with wood on the ſides, and fern on the ſummits. Sugar cane grows without cultivation on the high land, as do alſo turmeric and ginger.

This iſland is not only one of the moſt delightful but healthy ſpots in the world. The heat is tempered by the pureſt air. It is not ſubject conſtantly to the bleak winds from the eaſt, but generally under the milder breezes from eaſt to ſouth-ſouth-eaſt. From theſe ſingular endowments of nature, this charming ſpot is juſtly denominated "The Queen of Tropical Iſlands." The vegetable productions of this iſland are as various as numerous in their reſpective ſpecies. There are bread fruit, cocoa nuts, bananas of many ſorts, ſweet potatoes, plantains, yams, a delicious fruit known here by the name of *jambu*, ſugar cane, the paper mulberry, ginger termeric, and ſeveral ſorts of figs, all of which the ſoil produces ſpontaneouſly, or with very little culture.

THE SOCIETY ISLANDS. Theſe iſlands, which were diſcovered and ſo called by Captain Cook in the year 1769, compoſe a group of ſix in number, under the following names, by which they are called by the natives, viz. Huaheine, Ulietea, or Raietea, Bolabola, Otaha, Tubai and Mawrua, or Moroua. They lie contiguous between the latitude of 16 deg. 10 min. and 16 deg. 55 min. ſouth, and between the longitude of 150 deg. 57 min. and 152 deg. weſt. The luxuriant productions of theſe iſlands, and benevolent diſpoſition of the natives, are highly celebrated by different voyagers. The country is richly endowed by nature, and the people, as poſſeſſing an extreme liberality of mind, evinced in a more particular manner by their chearfully contributing to ſupply the wants of ſuch navigators whom chance or deſign might direct to this hoſpitable ſpot. Nor are they leſs friendly than munificent, as appeared from the very condeſcending aſſiduities ſhewn to their European viſitors. In a word, their hoſpitality upon every occaſion appeared ſo diſtinguiſhed, that it is mentioned as a virtue worthy not only of the warmeſt commendation, but preciſe imitation of the moſt civilized parts of the globe. The propriety, therefore, of the appellation given them by Captain Cook is clearly evident.

The iſland of Huaheine is the principal, it was diſcovered by Captain Cook two days after his departure from Otaheite, in 1769, lies in latitude 16 deg. 43 min. ſouth, and longitude 150 deg. 52 min. weſt. It is about 30 leagues diſtant from Otaheite, and about 20 miles in circumference, having a commodious harbour on the weſt ſide. It is divided into two peninſulas, joined by an iſthmus, which at high water is overflowed; it ſeems to have been diſturbed by volcanoes; and the face of the country reſembles that of Otaheite. The level part of this iſland is very fertile, and abounds with bread-fruit and cocoa-nut trees, yams, plantains; and its productions are more forwardthan thoſe at Otaheite; they have alſo hogs, and fowls.

FRIENDLY ISLANDS are thoſe under which we muſt include not only Tongataboo, Eaoo, and Annamooka, which were ſo named by Capt. Cook, in 1773, on account of the friendſhip that ſubſiſted among the inhabitants, and their courteous behaviour towards ſtrangers; but alſo the group at Hapaee, viſited by him in 1777, and all the iſlands that have been diſcovered, nearly under the ſame meridian, from Pilſtart, diſcovered by Taſman, in lat. 22-26. S. down to Boſcawen's and Keppel's iſles, diſcovered by Wallis, in lat. 15-53. and thence weſtward to Taſman's Prince William's iſlands, in long. 179 W. Within theſe limits the Archipelago will be found to be very extenſive. Above 150 iſlands are reckoned up by the natives, who aſſign its proper name to each. Fifteen of them are ſaid to be high: 35 larger than Annamooka, and the reſt ſmall; many of them, perhaps, mere ſpots without inhabitants. Sixty-one of theſe iſlands are laid down in Capt. Cook's chart of the Friendly Iſlands. The three firſt mentioned were diſcovered by Taſman in 1642, and by him called Amſterdam, Middleburgh, and Rotterdam. They were twice viſited by Capt. Cook in 1773, and 1774; and in 1777, Hapaee was added to the number. Theſe extend from north to ſouth, between the lat. of 19-39. and 21-30. S. and between the long. 174-15. and 175-18. W. They are interſperſed with many ſmaller iſlands. The general appearance of theſe iſlands conveys an idea of the moſt exuberant fertility; the ſurface, at a diſtance, ſeems entirely clothed with trees of various ſizes, ſome of which are very large, particularly the tall cocoa-palm, and a ſpecies of fig with narrow-pointed leaves. On cloſer examination, it is almoſt wholly laid out in plantations, in which are planted ſome of the richeſt productions of nature; ſuch as bread-fruit, cocoa-nut trees, plantains, bananas, ſhadocks, yams, and ſome other roots, ſugar-cane, and a fruit like a nectarine. In ſhort, here are moſt of the articles which the Society Iſlands produce, and ſome alſo which they have not. Their ſtock of quadrupeds is as ſcanty as that of the Society Iſlands; but they received from Capt. Cook the ſame valuable additions, both to the animal and vegetable kingdom. Their domeſtic fowls are as large and as good as thoſe of Europe. Among the birds are parrots and parroquets of various ſorts, which furniſh the red feathers ſo much eſteemed at the Society Iſles. The ſea abounds with fiſh, and the numerous reefs and ſhoals afford ſhelter for an endleſs variety of ſhell-fiſh. Agriculture, architecture, boat-building, and fiſhing, are the employments of the men; the province of the women is far leſs laborious, for to their care is confined the manufacture of their cloth.

It was natural to ſuppoſe, on a review of theſe iſlands, and the remote diſtance at which ſome of them are ſituated from the ſeat of government, that many efforts would have been made to throw of the yoke of ſubjection. But ſuch a circumſtance never happens. One reaſon of their not being thus embroiled in domeſtic commotions may be this, that all the principal chiefs take up their reſidence at Tongataboo. They alſo ſecure the dependance of the other iſles, by the deciſive celerity of their operations; for if a ſeditious and popular man ſhould ſtart up in any of them, the commander is immediately diſpatched thither to put him to death, by which means they extinguiſh an inſurrection while it is yet in embryo. The tides are more conſiderable at the Friendly Iſlands than at any other of Captain Cook's diſcoveries, in this ocean, that are ſituate within either of the tropics. At Annamooka the tide riſes and falls about ſix feet upon a perpendicular. At Tongataboo it riſes and falls four feet and three quarters on the full and change days, and three feet and an half at the quadratures.

THE NEW HEBRIDES. This name was given by captain Cook to a cluſter of iſlands, the moſt northerly of which was ſeen by Quiros, the Spaniſh navigator, in 1606, and by him named Tierra del Eſpiritu Santo. From that time till captain Cook's voyage in the Endeavour, in 1769, this land was ſuppoſed to be part of a great ſouthern continent, called *Terra Auſtralis incognita*. But when captain Cook had ſailed round New Zealand, and along the eaſtern coaſt of New Holland, this opinion was fully confuted. The Hebrides are ſituated between the latitudes of 14 deg. 29 min. and 20 deg. 4 min. ſouth; and between 66 deg. 41 min. and 170 deg. 21 min. eaſt longitude. They conſiſt of the following iſlands, ſome of which have received names from the different European navigators, and others retain the names which they bear among the natives, viz. Tierra del Eſpiritu Santo, Mallicollo, St. Bartholomew, Iſle of Lepers, Aurora, Whitſuntide, Ambrym, Immer, Appee, Three Hills, Sandwich, Montagu, Hinchinbrook, Shepherd, Eorromanga, Irronan, Annatom, and Tanna. Captain Cook, beſides aſcertaining the extent and ſituation of theſe iſlands, added the knowledge of ſeveral in this groupe that were before unknown. He explored the whole cluſter, and thence claiming a right to affix to them a general appellation, named them THE NEW HEBRIDES.

During captain Cook's continuance at Tanna, a volcano emitted, at different times, vaſt quantities of fire and ſmoke, accompanied with an exploſion about once in five minutes. Some of theſe exploſions reſembled violent claps of thunder. The whole air was filled with ſmoaky particles and aſhes, which occaſioned much pain when they fell into the eye. At one time great ſtones were thrown up into the air, ſome of which were at leaſt as large as the hull of a ſhip's long boat. It firſt preſented a moſt magnificent ſight. The ſmoke, which rolled up, from time to time, in thick and heavy volumes, was coloured with all the various hues of yellow, orange, crimſon, and purple, which died away into a reddiſh grey and brown. As often as a new exploſion happened, the whole country, with its ſhaggy foreſts, were tinged with the ſame orange and purple, according to its diſtance, or particular expoſure to volcanic light. It ſometimes continued quite ſilent for five or ſix days together. It was remarked, that the exploſions of the volcanos recommenced after a ſhower of rain; ſo that it ſhould ſeem that rain excites them, by promoting or increaſing the fermentation of various mineral ſubſtances in the mountain. The black aſhes, with which the whole country was ſtrewed, were found to be long, needle like, and ſemi-tranſparent, and to contribute greatly to that luxuriance of vegetation, which is remarkable on this iſland; many plants here attaining twice the height which they reach in other countries. Their leaves are broader, their flowers larger, and more richly ſcented. Theſe iſlands in general are high and mountainous, abounding with wood and water, and the uſual productions of the tropical iſlands. The bread fruit, cocoa-nuts and plantains are not ſo good, nor ſo plentiful as at Otaheite; on the other hand, ſugar-canes and yams are not only in greater plenty, but of ſuperior quality, and much larger; ſome of the latter weighing fifty ſix pounds.

NEW CALEDONIA. — This iſland was called New Caledonia, by Captain Cook, in conſequence of his having diſcovered it in 1774, after many fruitleſs endeavours to learn from the natives the Indian name. Indeed, it is probable that it was not known by one general name, as it has been repreſented as the largeſt iſland that has been diſcovered in the Southern Pacific Ocean, New Zealand and New Holland excepted; extending from 19 deg. 37 min. to 22 deg. 30 min. ſouth latitude; and from 163 deg. 37 min. to 167 deg. 14 min. eaſt long. In length it is computed to be 87 leagues, in the direction of north-weſt and ſouth-eaſt; but its breadth no where exceeds 10. It is ſituated about 12 deg. diſtant from New Holland. The country is deſcribed as a ſpot diverſified by hills and vallies of various extent. From the hills iſſue many fine ſtreams, which render the vallies both fertile and pleaſant; and, but for which, the whole ſpot might be called a dreary waſte; nature having been leſs bountiful to New Caledonia than to the other tropical iſlands in the South Seas. The mountains, and other high parts, are, in general, incapable of cultivation, conſiſting chiefly of barren rocks. The whole coaſt appeared ſurrounded by reefs or ſhoals, which render the acceſs to it very dangerous. The inhabitants ſubſiſt chiefly on roots and fiſh. Plantains and ſugar canes are not plenty; bread fruit is very ſcarce, and the cocoa-nut trees are but thinly planted; but their yams and taras are in great abundance. Theſe people are of a pacific diſpoſition, and their women are far more chaſte than thoſe of the more eaſtern iſlands.

NEW ZEALAND. This country was firſt diſcovered by Taſman, the Dutch navigator, in the year 1642, who gave it the name of Staten Land, though it has been generally diſtinguiſhed, in our maps and charts, by the name of New Zealand, and was ſuppoſed to be part of a ſouthern continent; but it is now known, from the late diſcoveries of captain Cook, who ſailed round it in 1770, and found it to conſiſt of two large iſlands, divided by a paſſage (now called Cook's Straits) about four or five leagues broad, and lying nearly north and ſouth of each other, between the latitudes of 34 deg. 22 min. and 47 deg. 25 min. ſouth; and between the longitude of 166 and 180 deg. eaſt from Greenwich. The ſame navigator viſited it again in 1773; and, for the third time, in 1774. The two iſlands are nearly of the ſame extent, and, taken together, as large as Great Britain, having many ſmall iſlands about them. The northernmoſt is called, by the natives, Eahei-nomarve; and the ſouthernmoſt, Tovy, or Tovai-Poenammoo. The latter is moſtly hilly, and, to appearance, barren, and thinly inhabited: but the former, though very mountainous, is tolerably fertile, and can boaſt of a rivulet running through every valley. Though theſe vallies do not abound with wood, yet, from the apparent nature of the ſoil, it was the opinion of our ingenious and ſpeculative countryman, that every kind of European grain would flouriſh here; and that, through the exertion of induſtry in cultivation, not only the neceſſaries, but luxuries of life, might be obtained in rich variety. The climate, upon the whole, is ſaid to be more temperate than that of England, from the vegetables that were found growing there in the winter ſeaſon.

From the lateſt account it appears, that the vegetable productions of this country ſufficiently indicate the quality of the ſoil: indeed, the ſtrength in vegetation muſt be greatly aſſiſted by the temperature of the climate. The hills, except a few towards the ſea, are one continued foreſt of lofty trees, which flouriſh with uncommon vigour: and it was remarked, that no country abounded, upon the whole, ſo much with trees and plants, that were entirely unknown to the naturaliſts of Europe, as New Zealand. The ſize, growth, and durability of the timber, render it fit for any kind of building.

The only quadrupeds here are dogs and rats, both of which are eaten by the natives. Birds are very plentiful, and a perſon by remaining in one place, may ſhoot as many in a day as will ſerve for a meal for ſix. The country has been much enriched by Captain Cook, who introduced a variety of plants and European poultry, which he had the ſatisfaction on a reviſit to find greatly encreaſed. They have ſweet potatoes and yams, but nothing is raiſed by cultivation. The inhabitants are ſcattered along the coaſts in ſingle families or in larger tribes, and each in a ſtate of perpetual hoſtility with all the reſt. The unhappy ſubjects of conqueſt in theſe continental wars, fall victims to the ſavage rapacity of the conquerors, who glut themſelves with the inhuman banqueſt of the fleſh of their fellow creatures. Nor can this practice be wondered at among ſavages, as hunger amongſt civilized nations will abſorb every feeling; and he who has once learned to eat what he kills, will eaſily be induced to kill when he wants to eat. See the article CANNIBAL in the Alphabet.

NEW GUINEA, lies to the northward of New Holland, from which it is ſeparated by Endeavour Strait. The length of this ſtrait, from north-eaſt to ſouth-weſt, is ten leagues, and its breadth about five, except at the north-eaſt entrance, where it is contracted to ſomewhat leſs than two miles, by a congeries of iſlands, called Prince of Wales's Iſlands. Except this ſtrait, and the land of Cape Deliverance, the whole coaſt, and the circumjacent iſlands, ſeem to have been minutely examined both by the Dutch and Spaniards. Some traces of a paſſage, between New Holland and New Guinea, are alſo to be found in the accounts of former voyages; but Capt. Cook, in 1770, had the merit of eſtabliſhing the fact beyond diſpute. New Guinea was thus found to be a long narrow iſland, extending ſouth-eaſt from the equator to 12 S. lat. and from 131 to 153 E. lon. The land in general is very low, but covered with ſuch luxuriance of wood and herbage, as can ſcarcely be conceived. The nut-meg, cocoa-nut, bread fruit, and plantain-trees, beſides moſt of the trees, ſhrubs, and plants, that are common to the South-ſea iſlands, are found here in the greateſt perfection. The inhabitants make much the ſame appearance as the New Hollanders, and like them go naked.

NEW BRITAIN, is ſituated in the 4th degree of ſouth latitude, and 152 deg. 19 min. eaſt longitude from Greenwich. It was ſuppoſed to be part of an imaginary continent till captain Dampier found it to be an iſland, and ſailed through a ſtrait which divides it from New Guinea.

NEW IRELAND extends in length, from the north eaſt to the ſouth eaſt, about two hundred and ſeventy miles, but is in general very narrow. It abounds with a variety of trees and plants, and with many pigeons, parrots, rooks, and other birds. North weſtward of New Ireland a cluſter of iſlands was ſeen by captain Carteret, lying very near each other, and ſuppoſed to conſiſt of twenty or thirty in number. One of theſe, which is of very conſiderable extent, was named NEW HANOVER; but the reſt of the cluſter received the name of the ADMIRALTY ISLANDS.

EASTER ISLAND lies in the South Sea, and is of a triangular ſhape; it is about 10 or 12 leagues in circuit, has a hilly and ſtony ſurface, and an iron bound ſhore. The hills are of ſuch a height, as to be ſeen 15 or 16 leagues. No nation need contend for the honour of this diſcovery; for it affords neither ſafe anchorage, freſh water, nor wood for fuel. It is, however, the ſame that was ſeen by Davis in 1686; it was next viſited by Roggewein in 1722, and again by Capt. Cook in 1774. The country is naturally barren, and without wood; what little it yields muſt be raiſed by cultivation. Rats are the only quadrupeds, and birds there are but few. The ears of theſe people are long beyond proportion, and their bodies are ſcarcely any thing of the human figure. Lon. 109-46. W. lat. 27-5. S.

SANDWICH ISLANDS. — Theſe iſlands were diſcovered by Captain Cook in 1778, during the courſe of his laſt voyage to the Pacific Ocean, in order to ſearch for a north weſt paſſage, between the continents of Aſia and America. They form a magnificent groupe, and were among the laſt diſcoveries of Capt. Cook, who ſo named them in honour of the Earl of Sandwich, under whoſe adminiſtration theſe diſcoveries were made. They conſiſt of eleven iſlands, extending in latitude from 18-54. to 160 24 W. They are called by the natives, Owhyhee, Mowee, Ranai, Morotoi, Tahoorowa, Woahoo, Atooi, Neeheeheow, Oreehoua, Morotinne, and Tahoora, all inhabited except the two laſt. The climate of theſe iſlands differs very little from that of the Weſt Indies in the ſame latitude, though perhaps more temperate; and there are no traces of thoſe violent winds and hurricanes, which render the ſtormy months in the Weſt Indies ſo dreadful. There is alſo more rain at the Sandwich iſles, where the mountainous parts being generally enveloped in a cloud, ſucceſſive ſhowers fall in the inland parts, with fine weather, and a clear ſky, on the ſea-ſhore. Hence it is, that few of thoſe inconveniences, to which many tropical countries are ſubject, either from heat or moiſture, are experienced here. The winds, in the winter months, are generally from E. S. E. to N. E. The vegetable productions are nearly the ſame as thoſe of the other iſlands in this ocean; but the taro root is here of a ſuperior quality. The bread-fruit trees thrive not in ſuch abundance as in the rich plains of Otaheite, but produce double the quantity of fruit. The ſugar-canes are of a very unuſual ſize, ſome of them meaſuring eleven inches and a quarter in circumference, and having fourteen feet eatable. There is alſo a root of a brown colour, ſhaped like a yam, and from ſix to ten pounds in weight, the juice of which is very ſweet, of a pleaſant taſte, and is an excellent ſubſtitute for ſugar. The quadrupeds are confined to the three uſual ſorts, hogs, dogs, and rats. The fowls are alſo of the common ſort; and the birds are beautiful and numerous, though not various. Goats, pigs, and European ſeeds, were left by Capt. Cook; but the poſſeſſion of the goats ſoon gave riſe to a conteſt between two diſtricts, in which the breed was entirely deſtroyed. The food of the lower claſs conſiſts principally of fiſh and vegetables, to which the people of higher rank add the fleſh of dogs and hogs. Their idle hours are filled up with various amuſements, ſuch as dancing, boxing, wreſtling, &c. As the iſlands are not united under one ſovereign, wars are frequent among them, which, no doubt, contribute greatly to reduce the number of inhabitants, which, according to the proportion aſſigned to each iſland, does not exceed 400,000. The ſame ſyſtem of ſubordination prevails here as at the other iſlands, the ſame abſolute authority on the part of the chiefs and the ſame unreſiſting ſubmiſſion on the part of the people. The government is likewiſe monarchical and hereditary. At Owhyee there is a regular ſociety of prieſts living by themſelves, and diſtinct in all reſpects from the reſt of the people. Human ſacrifices are here frequent; not only at the commencement of a war, or any ſignal enterprize, but the death of every conſiderable chief, calls for a repetition of theſe horrid rites, which are nearly the ſame as thoſe practiſed at Otaheite, and other iſlands in the South Seas. For a particular deſcription of this barbarous ceremony, ſee the article EATOOA, in the Alphabetical Arrangement.

Notwithſtanding the irreparable loſs in the death of Capt. Cook, who was here murdered through ſudden reſentment and violence, they are acknowledged to be of the moſt mild and affectionate diſpoſition. They live in the utmoſt harmony and friendſhip with each other; and in hoſpitality to ſtrangers they are not exceeded even by the inhabitants of the Friendly Iſlands. Their natural capacity ſeems, in no reſpect, below the common ſtandard of mankind; and their improvements in agriculture, and the perfection of their manufactures, are certainly adequate to the circumſtances of their ſituation, and the natural advantages which they enjoy.

KING GEORGE's SOUND, an iſland ſo named by Capt. Cook; but by the natives it is called Nootka. Upon the ſea-coaſt, the land is tolerably high and level; but, within the Sound, it riſes into ſteep hills, which have an uniform appearance. The trees, of which the woods are compoſed, are the Canadian pine, white cypreſs, and two or three other ſorts of pine. In general, the trees grow here with great vigour, and are of a large ſize. About the rocks and borders of the woods, were ſeen ſome ſtrawberry plants and raſberry, currant, and gooſeberry buſhes, and in a flouriſhing ſtate. The principal animals ſeen here were racoons, martins, and ſquirrels. Birds are far from being numerous. Their bodies are always covered with red paint, but their faces are ornamented with variety of colours, a black, a bright red, or a white colour; the laſt of which gives them a ghaſtly and horrible appearance. They appear to be docile, courteous, and good-natured; but they are quick in reſenting injuries, and, like moſt other paſſionate people, as quickly forgetting them. A rattle and a ſmall whiſtle are the only inſtruments of muſic that were ſeen among them. Their houſes conſiſt of very long broad planks, reſting upon the edges of each other, tied, in different parts, with wiſhes of pine-bark. The furniture of their houſes conſiſts principally of cheſts and boxes of various ſizes, piled upon each other, at the ſides or ends of their houſes, in which are depoſited their garments, and whatever they deem valuable. They have alſo ſquare and oblong pails, bowls to eat their food out of, &c. The irregularity and confuſion of their houſes is far exceeded by their naſtineſs and ſtench. They not only dry their fiſh within doors, but they alſo gut them there; which, together with their bones and fragments, thrown upon the ground at meals, occaſions ſeveral heaps of filth, which are never removed, till it becomes troubleſome, from their bulk, to paſs over them. Every thing about the houſe ſtinks of train-oil, fiſh, and ſmoke; and every part of it is as filthy as can be imagined. Lon. 233·12. E. lat. 49·33. N.

PRINCE WILLIAM's SOUND. This inlet on the coaſt, diſtinguiſhed by Captain Cook under the name of Prince William's Sound, is ſituated to the northward of King George's Sound, in long. 215·21 E. lat. 59·33 N. The perſons and dreſs of the natives much reſemble thoſe of King George's Sound, but they are by no means ſo filthy in their cuſtoms and manners; the productions are nearly the ſame kind, excepting that they abound more in animals which produce furs, ſuch as bears, common and pine martins, ſea otters, ſeals, racoons, ſmall ermines, foxes, and the whiteſt cats, or lynx, and a variety of others. In conſequence of the abundance of furs this place produced, a trade has been eſtabliſhed by the ſome of the Britiſh merchants; who ſend trinkets and utenſils to this place, exchange them for furs, and convey them to China, where they have a quick and profitable ſale for them. An extenſive river flows here, and runs many miles up the country. Captain Cook called it after his own name.

NORTON's SOUND. This inlet to which Captain Cook gave the name of Norton's Sound, in honour of Sir Fletcher Norton, afterwards Lord Grantley, lies between the lat. of 64° and 65° north. It was the opinion of Captain Cook, that this peninſula had been an iſland at ſome diſtant, for there were marks of the ſea, having formerly flowed over the iſthmus; and even at preſent it appeared to be kept out by a bank of ſand, ſtones, and wood, which the waves had thrown up.

He alſo diſcovered Sandwich Sound, proceeded and ſtill continued to trace the American Coaſt, till he diſcovered the ſtrait which ſeparates it from the continent of Aſia. They paſſed the ſtrait, and arrived on the 20th of Auguſt 1778, in lat. 70 deg. 54 min. long. 194 deg. 55 min. where they found themſelves almoſt ſurrounded with ice, and the farther they proceeded to the eaſtward, the cloſer the ice became compacted. They continued labouring among the ice till the 25th, when a ſtorm came on, which made it dangerous for them to proceed; and a conſultation was therefore held on board the Reſolution, as ſoon as the violence of the gale abated, when it was reſolved, that as this paſſage was impracticable for any uſeful purpoſe of navigation, which was the great object of the voyage, it ſhould be proſecuted no farther; and eſpecially on account of the condition the ſhips were in, the approach of winter, and their great diſtance from any known place of refreſhment. The voyage indeed afforded ſufficient evidence, that no practicable paſſage exiſts between the Atlantic and Pacific Oceans towards the north; and this voyage alſo aſcertained the weſtern boundaries of the great continent of America.

Captain Cook thought it now high time to quit theſe northerly regions, and retire to ſome place for the winter, where he might obtain proviſions and refreſhments. He did not conſider Petropaulowſka, or the harbour of St. Peter and St. Paul, in Kamtſchatka, as likely to furniſh a ſufficient ſupply. He had likewiſe other reaſons for not going thither at preſent; the principal of which was his great unwillingneſs to remain inactive for ſix or ſeven months, which would have been the conſequence of paſſing the winter in any of theſe northern countries. He at length concluded that no ſituation was ſo convenient as the Sandwich Iſlands. To them, therefore, he formed a reſolution of repairing. But a ſupply of water being neceſſary before he could execute that deſign, he determined, with a view of procuring this eſſential article, to ſearch the coaſt of America for a harbour, by proceeding along it to the ſouthward.

When he arrived at the Sandwich iſlands and anchored in Karakakooa Bay, to his great diſappointment, inſtead of meeting with that hoſpitable reception he had before experienced, he found the natives diſpoſed to hoſtility, and unwilling to furniſh thoſe ſupplies they had ſo liberally contributed on his firſt viſit. The cauſe of this ſudden change of behaviour in the natives is not accounted for in any of the narratives of the voyage; but we are credibly informed that it originated from ſome of the common ſailors, having diſturbed the Morais, or places of burial, which they hold of the moſt ſacred nature. After a variety of ſkirmiſhes between our people and the natives, one of the ſhip's boats was ſtolen, Captain Cook was therefore determined on its reſtitution; to effect which, according to his uſual practice, he endeavoured to get the king on board, in order to detain him as an hoſtage till the boat was returned. The king was willing to go on board, but the natives, from an attachment of zeal and loyalty, would not permit him to depart. This occaſioned ſeveral affrays, in one of which a chief was ſlain; at length, in purſuing the attempt, Capt. Cook, with many of the crew, fell victims to the fury of the natives. This dreadful cataſtrophe did not go unrevenged; the natives, through the ſuperior force of arms, were brought to ſubjection, and ſued for peace, which was granted upon condition of bringing back the body of Capt. Cook; the mangled remains of which being produced, together with a number of preſents and many conceſſions, peace was reſtored previous to the departure of our people from the iſland.

Thus ended the life of the greateſt navigator that this or any other nation ever could boaſt, after having ſucceſsfully led his crews of gallant Britiſh ſeamen thrice round the world. We ſhall now turn from this calamitous ſcene, and endeavour to pay a juſt tribute to the memory of our celebrated navigator, in a ſhort ſketch of his character.

Captain James Cook raiſed himſelf ſolely by his merit from a very obſcure birth to the rank of Poſt Captain in the Royal Navy. He poſſeſſed, in an eminent degree, all the qualifications requiſite for his profeſſion and great undertakings. Deliberate in judging; ſagacious in determining; active in executing; unſubdued by labour, difficulties and diſappointments; fertile in expedients, never wanting preſence of mind, but ever poſſeſſing the full uſe of a ſound underſtanding. In diſcipline, though mild and juſt, he was exact: he was a father to his people, who were attached to him from affection, and obedient from confidence. That ſpirit of humanity and juſtice with which he treated the ſavages wherever he found them, when oppoſed to the ferocious and inhuman conduct of the firſt conquerors in the New World, does honour to his age and country, and will hand him down with reverence to poſterity.

We cannot conclude without remarking that no ſcience ever received greater additions from the labours of a ſingle man, than Geography has done from thoſe of Captain Cook. In his firſt voyage to the South Seas, he diſcovered the Society Iſlands; determined the inſularity of New Zealand; diſcovered the ſtraits which ſeparate the two iſlands, and are called after his name; and made a complete ſurvey of both. He afterwards explored the Eaſtern coaſt of New Holland, hitherto unknown; an extent of twenty-ſeven degrees of latitude, or upwards of two thouſand miles. In his ſecond expedition, he reſolved the great problem of a ſouthern continent, having traverſed that hemiſphere between the latitude of 40° and 70°, in ſuch a manner as not to leave a poſſibility of its exiſtence, unleſs near the Pole, and out of the reach of navigation. During this voyage, he diſcovered New Caledonia, the largeſt iſland in the Southern Pacific Ocean, except New Zealand; the iſland of Georgia; and an unknown coaſt, which he named Sandwich Sound, the Thule of the Southern hemiſphere; and having twice viſited the tropical ſeas, he ſettled the ſituations of the old, and made ſeveral new diſcoveries. But the laſt voyage is diſtinguiſhed above all the reſt, by the extent and importance of its diſcoveries. Beſides ſeveral ſmaller iſlands in the Southern Pacific, he diſcovered, to the North of the Equinoctial Line, the group called the Sandwich Iſlands, which, from their ſituation and productions, bid fairer for becoming an object of conſequence in the ſyſtem of European navigation, than any other diſcovery in the South Sea. He afterwards explored what had hitherto remained unknown of the Weſtern coaſt of America from the latitude of 43° to 70° North, containing an extent of three thouſand and five hundred miles; aſcertaining the proximity of the two great continents of Aſia and America; paſſed the ſtraits between them, and ſurveyed the coaſt on each ſide, to ſuch a height of northern latitude, as to demonſtrate the impracticability of a paſſage, in that hemiſphere, from the Atlantic into the Pacific Ocean, either by an Eaſtern or a Weſtern courſe. In ſhort, if we except the Sea of Amur, and the Japaneſe Archipelago, which ſtill remain imperfectly known to Europeans, he has completed the hydrography of the habitable globe.

PELEW ISLANDS.

That chain of iſlands called the PALOS, or PELEW ISLANDS, ſituated in the weſt part of the Pacific Ocean, between the 5th and 9th degrees of north latitude, and between 130 and 136 degrees of eaſt longitude, though heretofore imperfectly noticed by ſome ſhips making the eaſtern paſſage from China, were never viſited by any Europeans, till the crew of the Antelope, captain Wilſon, a packet belonging to the Eaſt India Company, which was wrecked in Auguſt 1783, landed there, and were the means of diſcovering to us, a new world, or ſet of human beings, who, though of an uncultivated nature, appeared to be greatly different from thoſe commonly termed ſavages, and evinced principles of humanity and generoſity, that would reflect the higheſt honour on the moſt exalted of our race. A very ſingular circumſtance much facilitated the intercourſe between our countrymen and the natives. A Malay, who ſometime before was caſt away upon this iſland, had acquired the language; and it happened that one of the Antelope's men was a native of Bengal, and ſpoke the Malay tongue, by which means a ready communication was maintained on both ſides. Theſe people were entirely naked. They were of a deep copper colour, and their ſkins ſoft and gloſſy, owing to the external uſe of cocoa nut oil. Each chief had a baſket of beetle nut, and a bamboo, finely poliſhed, and inlaid at each end, in which they carried a kind of coral, burnt to a lime, called *chinam*. It was obſerved that all their teeth were black, and that the beetle nut, of which they had always a quid in their mouths, rendered the ſaliva red, which together with their black teeth, gave their mouths a very diſguſting appearance. They were of a middling ſtature, ſtrait, and muſcular, their limbs well formed, and they had a majeſtic gait. Their hair was black, long, and rolled up behind cloſe to their heads, which appeared neat and becoming. They tatooed their legs a little above the ancles to the middle of their thighs, which gave them a deeper colour than the other parts of their bodies. The principal women and particularly the wives of the Rupacks or great officers of ſtate, were rather fairer than the reſt of their ſex, had little ornaments about them, and their faces and breaſts were rubbed over with turmeric.

Whatever ſurprize the ſingularity of theſe natives might excite in the minds of our people, the natives were no leſs wrapt in admiration at their appearance. The whiteneſs of colour attracted them ſo much, that it was evident they had never before ſeen any Europeans. They were continually exclaiming, *weel, weel!* and *weel-a-trecoy*; words which implied that they were perfectly pleaſed with their viſitors. They ſtroked their bodies and arms outſide the garments, ſeeming to doubt whether their coverings were not a part of their real body, being totally ignorant of the uſe of cloaths. The hands of the Europeans next engaged their attention, and particularly the black veins of the wriſts. They probably imagined the whiteneſs of the hands and face to be artificial; and the blackneſs of the veins cauſed them to think, that it was a mode of tatooing; for they deſired to look at the top parts of the arms, and to ſee if the whiteneſs was continued. As the natives expreſſed a deſire that captain Wilſon would ſend one of his people to Pelew, that the king might ſee what kind of beings white men were, the captain complied, and appointed his brother for that purpoſe, giving him a ſmall remnant of blue cloth, a canniſter of tea, another of ſugar-candy, and a jar of preſerved fruit, as a preſent for the king. The natives behaved in the moſt friendly manner to the Engliſh; and their monarch ſoon after paid them a viſit, with his ſon and brother. His majeſty was perfectly naked, and had no kind of ornament or mark of diſtinction, like his principal officers, who wore a bracelet of bone at their wriſts. He bore a hatchet on his ſhoulder, the head of which was made of iron, a circumſtance which ſurprized our people much, as all the other hatchets they had ſeen were of ſhell. The handle of it, which formed a ſharp angle, ſtuck cloſe to his ſhoulder, lying before and behind, and wanting no tying to keep it ſteady in walking.

Captain Wilſon availed himſelf of this opportunity to obtain permiſſion from the king to build a veſſel, in order to convey the crew to ſome European ſettlement; and highly gratified him by cauſing a party of men to be drawn up, and fire three vollies. This occaſioned ſuch hooting and chattering, as equalled in noiſe the report of the pieces. Captain Wilſon dreſſed the king in a ſilk coat and blue trowſers. He was extremely well made, but had loſt his noſe, whether in battle, or from a ſcrophulous diſeaſe, which is prevalent there, was not known. Arra Kooker, one of the king's brothers, requeſted a white ſhirt, and as ſoon as it was given him, he put it on, in tranſports of joy, which he indicated by dancing and jumping, and in forming a humourous contraſt between his ſhirt and his ſkin. This prince had a great propenſity to mimicry, and often amuſed our people by taking off their manners, but with ſo much good nature, that no one could feel the leaſt offence. He entertained a great partiality for their Newfoundland dog, which he often fed; till at length the creature felt a partiality for him, and, at his appearance, would jump, bark, leap, and play a variety of tricks. Arra Kooker would often imitate him in the ſame mode of ſalutation, by barking, jumping, &c. which could not fail of exciting the riſible faculties. This prince was ſeemingly about forty years of age, ſhort in ſtature, but ſo plump and fat, that he was almoſt as broad as he was long. After various ceremonies had paſſed, the captain preſented his majeſty with a ſcarlet coat; who then making ſigns to go on ſhore, jumped into the water, and ſwam to land.

The employment of the men ſeemed to be that of gathering cocoa-nuts, felling trees, and making ſpears and darts, the chief warlike inſtruments of the Pelewans. In the uſe of theſe they were remarkably expert, as they afforded abundant proof in divers engagements with the ſubjects of a neighbouring prince; in which they were aided by a ſelect party of the Engliſh at the requeſt of Abba Thulle, and obtained a compleat victory by dint of the ſuperior force of our fire arms. As the Engliſh had been uſeful in their aſſiſtance againſt the enemy, the king was deliberating what preſent or compenſation he ſhould make to the Engliſh leader. After a while he ſent him, as a particular mark of his gratitude and eſteem, two lovely young women. Captain Wilſon, who was a grave ſober man, and had his ſon with him, a youth about ſeventeen, was particularly embarraſſed. He, however, thought proper to ſend them back again; the king of Pelew was exceedingly unhappy that his preſent was not accepted, and concluded, in his own mind, that their being rejected was owing to their not being ſufficiently young. To obviate this objection, after ſome ſtrong parental ſtruggles, he actually ſent captain Wilſon his own daughter, a ſweet little girl, who was no more than twelve years old. She was of courſe returned alſo; but it was extremely difficult to ſatisfy the king that in this rejection of his preſents no inſult was intended. We cannot omit mentioning at the cloſe of this account, that a ſhort time before the departure of our people, the king of Pelew requeſted captain Wilſon to take with him his ſecond ſon, whoſe name was Lee Boo, to England, expreſſing a patriotic hope that he would acquire many things which, at his return, would greatly benefit his native country. This youth, who added to an active and penetrating mind, the moſt ingenuous and endearing manners, was treated with the greateſt care and attention by captain Wilſon, and was advancing rapidly in a knowledge of the Engliſh language, and of writing, when he fell a victim to the ſmall pox, at the age of 20 years.

In the extremity of his laſt illneſs he made uſe of theſe words to a perſon who came over with him. “When you go to Pelew,
“ tell Abba Thulle that his ſon take much drink to make
“ ſmall-pox go away, but he die;—that the captain and mother
“ (meaning Mrs. Wilſon) very kind;—all Engliſh very good
“ men;—was much ſorry I could not ſpeak to the king my fa-
“ ther the number of fine things the Engliſh had got.” He was buried in Rotherhithe church, where a tomb was erected to his memory by the Eaſt-India Company.

GEOGRAPHY.

NEW HOLLAND is the largeſt known land that does not bear the name of a continent; it extends from latitude 43-42. South, to within 10-30. of the equator; and from 110-30. to 153-30. E. long. ſo that its ſquare ſurface conſiderably exceeds that of Europe. When this vaſt iſland was firſt diſcovered is uncertain: towards the beginning of the laſt century, the north and weſt coaſts were traced by the Dutch; the ſouthern extremity was diſcovered by Taſman in 1642; in 1770, Capt. Cook explored the eaſt and north-eaſt ſide, from 38. S. and aſcertained its ſeparation from New Guinea; and in 1773, Capt. Furneaux, by connecting Taſman's diſcoveries with Capt. Cook's, compleated the circuit. In that part of it, which Taſman diſtinguiſhed by the name of Van Diemen's Land, and which was viſited by Capt. Furneaux in 1773, and again by Capt. Cook in 1777.

New Holland, in general, is diverſified with hills and vallies, and every where of a greeniſh hue; the ſides of the hills are covered with large trees, and plenty of water falls from the rocks in beautiful caſcades, two or three hundred feet perpendicular, into the ſea; but, in the interior parts, it bears marks of being a very dry country. The ſoil, in ſome places, is black and rich, though thin; and, in others, it is either ſandy, or conſiſts of a yellowiſh mould. The foreſt trees grow to a great height, and in general quite ſtraight, branching but little till towards the top. The only quadruped, beſides the kanguroo, is a ſort of opoſſum, about twice the ſize of a large rat. Birds are neither ſo numerous, nor in ſuch variety, as in the more northern parts: the ſea is ſtored with its uſual plenty, and the rocks with muſſels and other ſhell-fiſh. They have neither houſes, canoes, vegetable productions, nor any method of catching large fiſh; their habitations are the trunks of trees hollowed by fire; and their food ſhell-fiſh, birds, and the kanguroo. Of their method of hunting no idea can be formed, the only weapon that was ſeen among them being a ſhort pointed ſtick, in the uſe of which they ſhewed no dexterity: they have little of that wild or fierce appearance, common to people in their ſituation; on the contrary, they are mild and cheerful, without reſerve or jealouſy of ſtrangers; the number of inhabitants appears to be very ſmall, in proportion to the extent of the country.

It is ſtrange to remark that both ſexes in this country go ſtark naked, and ſeem to have no more ſenſe of indecency in diſcovering their whole body, than the inhabitants of England have in the diſcovery of their hands and face. In ſhort, in point of intellectual faculties, or obſervations of what the poliſhed part of mankind call the laws of decorum, they ſeemed as deficient as the brutal creation.

VAN DIEMEN's LAND. The inhabitants of Van Diemen's Land are from the ſame ſtock with thoſe of the northern parts of New Holland: tho' the account of thoſe met with by Capt. Cook on the eaſt, ſhews that they differ in many reſpects; yet, upon the whole, it muſt be allowed, that diſtance of place, entire ſeparation, diverſity of climate, and length of time, all concurring to operate, will account for greater differences, both as to their perſons, manners, and cuſtoms, than really exiſt between the natives of Van Diemen's Land, and thoſe of Botany Bay, deſcribed in Captain Cook's firſt voyage to this iſland. The author of the narrative of the late expedition to New Holland, remarks, that, to the geographical knowledge of this country, ſupplied by Captain Cook, and Captain Furneaux, the adventurers were able to add nothing. The latter explored the coaſt from Van Diemen's Land to the latitude of 39 deg. ſouth; and Capt. Cook from Point Hicks, which lies 37 deg. 58 min. to Endeavour Straits. The intermediate ſpace between the end of Furneaux's diſcovery and Point Hicks, is, therefore, the only part of the ſouth-eaſt coaſt unknown.

BOTANY BAY, ſo called by Captain Cook, who diſcovered it from the great number of plants collected at this place, is ſituated on the eaſtern coaſt of New Holland, denominated, by that celebrated navigator, New South Wales, in the latitude of 34 deg. ſouth longitude, 208 deg. 37 min. weſt. The climate is very deſirable to live in. In ſummer the heats are uſually moderated by the ſea breeze, which ſets in early; and in winter the degree of cold is ſo ſlight, as to occaſion no inconvenience.

Botany Bay was the ſpot deſtined for the planting a new colony in this part of the globe, the fleet, therefore fitted out by government for the expedition, ſailed from England in March, 1787; reached and anchored in the bay on the 20th of January, 1788, after a paſſage of thirty-ſix weeks, in which a moſt arduous undertaking was effected, with more ſucceſs, and leſs loſs, than hardly ever afforded a fleet in ſuch a predicament. Previous to the ſettlement on the ſpot under immediate conſideration, an expedition up the bay was deemed expedient, in order to explore the nature of the country, and ſelect a place for carrying into execution their plan and deſign. None being diſcovered that appeared very convenient for the purpoſe, the governor and the lieutenant-governor proceeded in a boat to examine an opening, to which Captain Cook had given the name of Port Jackſon, preſuming that good anchorage might be found within it. Nor did they ſearch in vain; for ſuch was their account of the harbour, and the advantages attending the place, upon their return, that a reſolution was formed of evacuating Botany Bay. According to the account of thoſe who have formed the new ſettlement at Port Jackſon, they are utterly ſtrangers to the cultivation of the ground, and wholly depend for food on the few fruits they gather; the roots they dig up in the ſwamps; and the fiſh they pick up along ſhore, or contrive to ſtrike from their canoes with ſpears. Fiſhing, indeed, ſeems to engroſs nearly the whole of their time, probably from its forming the chief part of a ſubſiſtence, which, obſervation has proved, nothing ſhort of the moſt painful labour, and unwearied aſſiduity, can procure.

PORT JACKSON.

The paſſage from Botany Bay, to Port Jackſon, was both ſpeedy and pleaſant. Having paſſed between the capes which form its entrance, the fleet arrived in a port ſuperior, in extent and excellence, to all that had been obſerved before. During a run up the harbour of about four miles, in a weſternly direction, a luxuriant proſpect preſented itſelf on the ſhores, covered with trees to the water's edge, among which many of the Indians were frequently ſeen, till the fleet arrived at a ſmall ſnug cove to the ſouthward, on the banks of which the plan of operations was deſtined to commence. The neceſſary previous buſineſs having been tranſacted; upon an appointed day, the commiſſions were read, and poſſeſſion was taken of the ſettlement in form. The marine battalion being drawn up, and the convicts aſſembled on the occaſion, his Majeſty's commiſſion was read, appointing his Excellency Arthur Phillip, eſq. Governor and Captain General in and over the territory of New South Wales, and its dependencies; together with the acts of parliament for eſtabliſhing trials by law within the ſame: and the patents under the great ſeal of Great Britain, for holding civil and criminal courts of judicature, by which all caſes of life and death, as well as matters of property, were to be decided. The extent of this authority is defined in the governor's commiſſion, to reach from the latitude of 43 deg. 49 min. ſouth, to the latitude of 10 deg. 37 min. ſouth, being the northern and ſouthern extremities of New Holland. It commences again at the 135th degree of longitude eaſt, and proceeding in an eaſternly direction, comprehends all iſlands within the limits of the above ſpecified latitudes in the Pacific Ocean. As the diſcoveries of Engliſh navigators alone are compriſed in this territory, it is preſumed this partition will obviate all cauſe of future litigation between us and the Dutch. Perſons induced to emigrate hither, are recommended, before they quit England, to provide all their wearing apparel for themſelves, family and ſervants; their furniture, tools of every kind, and implements of huſbandry, (among which a plough need not be included, the hoe being uſed,) as they will touch at no place where theſe articles can be purchaſed to advantage. If the ſheep and hogs are Engliſh alſo it will be the better. With reſpect to wines, ſpirits, tobacco, ſugar, coffee, tea, rice, and many other articles, they may venture to rely on Teneriffe, or Madeira, the Brazils, and Cape of Good Hope. It will not be their intereſt to draw bills on their voyage out, as the exchange of money will be found invariably againſt them, and a large diſcount alſo deducted. Drafts on the places they are to touch at, or caſh, (dollars if poſſible,) will beſt anſwer their purpoſe.

In order to render this Syſtem as uſeful and conciſe as poſſible, I have introduced a variety of Tables, exhibiting the extent, boundaries, diviſions, ſubdiviſions, chief towns, &c. of each country, kingdom, and province, in one point of view; by which means I have been enabled to comprize, in this limited ſpace, the fundamental principles of Geography: and as this conciſe plan has never been adopted in any Dictionary of Arts and Sciences before, I preſume it will be conſidered as an addition of an important nature. To render this Syſtem ſtill more valuable, the Readers will be preſented, excluſive of the General Map of the World, with accurate and comprehenſive whole ſheet Maps of Europe, Aſia, Africa, North America, and South America.

The manners, cuſtoms, laws, &c. of the inhabitants of the ſeveral countries are mere hiſtorical matters, and therefore purpoſely omitted as they do not, ſtrictly ſpeaking, belong to Geography; but ſuch narratives as ſerve to illuſtrate the detached alphabetical parts, have already been introduced in the work, and will alſo be noticed as they hereafter occur, ſince their inſertion tends to explain many circumſtances, both intereſting and entertaining.

Thoſe who wiſh to be acquainted with theſe particulars, are referred to Bankes's Syſtem of Geography, containing the whole of Cook's voyages, where, independent of the geographical deſcriptions, are introduced copious narratives, including very minute accounts of his various interviews with the natives of the different regions he diſcovered; together with extracts from all the works of a ſimilar nature that have been publiſhed from the death of that illuſtrious navigator to the preſent time.

As the uſe of the celeſtial GLOBE *was omitted in Aſtronomy, I deemed it more eligible to omit that of the terreſtrial in this Syſtem, in order to bring them into one point of view: I ſhall therefore give them both under the article* GLOBE *in the order of the alphabet, and further, under that head I ſhall alſo introduce ſome mathematical problems, tending to illuſtrate the terreſtrial Globe, and other eſſential matters in geography.*

As the New Diſcoveries have ſo univerſally excited the public curioſity, and particularly the New Settlement formed at Port Jackſon in New Holland; I have been induced to treat more copiouſly on thoſe particulars than on the other parts of the Syſtem; and, in order to gratify the ſpeculative enquirer, have related many circumſtances highly intereſting, which, though not ſtrictly geographical, will, I preſume, from their importance, and the entertainment they will afford the Readers in general, ſufficiently apologize for their introduction.

PARLIAMENT STREET,
WESTMINSTER.

T. MARQUOIS.

Elements of the Higher Geometry, containing the Conic Sections & other Curve Lines. See the System of Geometry. Part II.

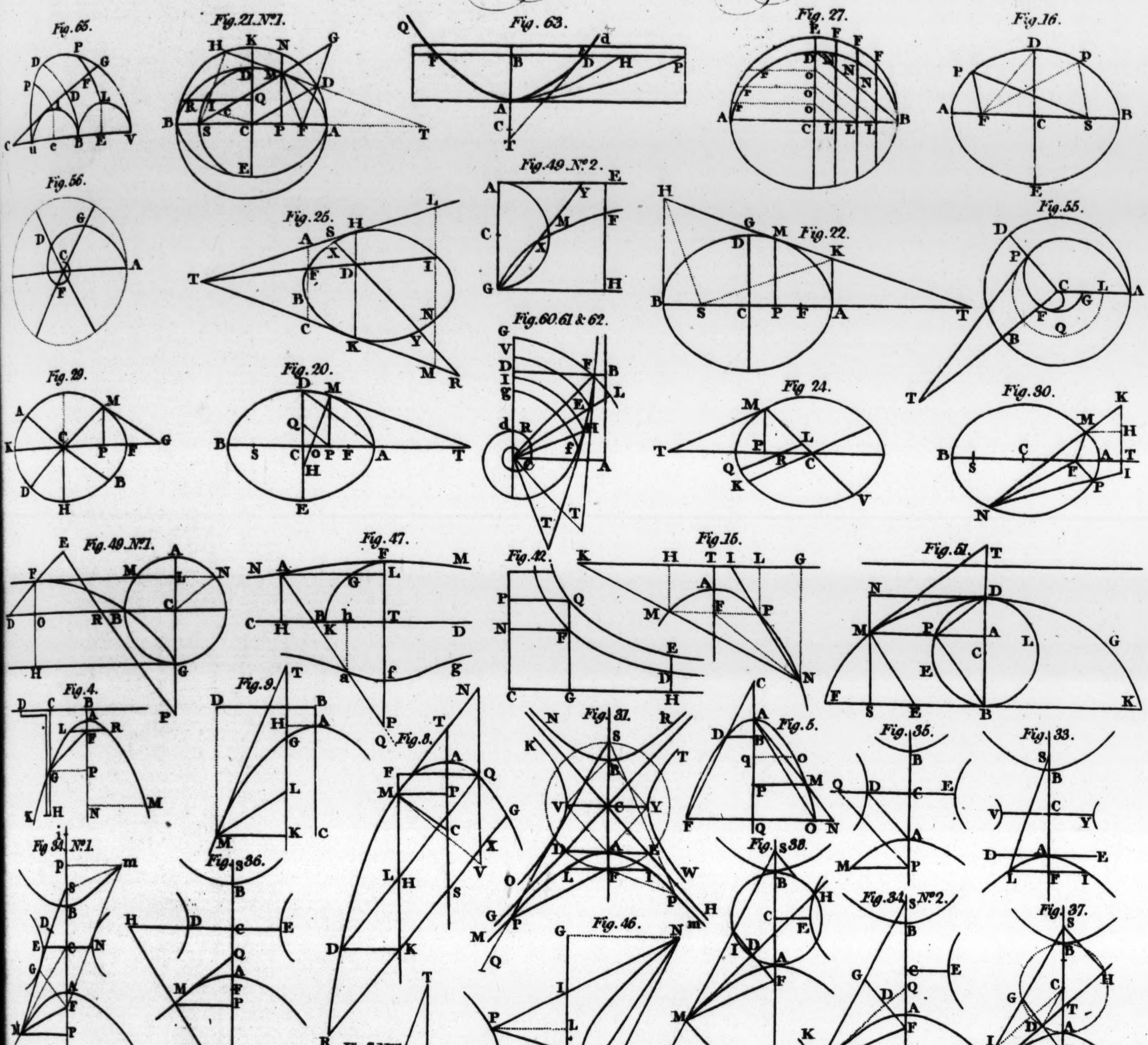


Fig. 65.
Fig. 21. No. 1.
Fig. 63.
Fig. 27.
Fig. 16.
Fig. 56.
Fig. 25.
Fig. 49. No. 2.
Fig. 22.
Fig. 55.
Fig. 60. 61 & 62.
Fig. 29.
Fig. 20.
Fig. 24.
Fig. 30.
Fig. 49. No. 1.
Fig. 47.
Fig. 42.
Fig. 15.
Fig. 51.
Fig. 4.
Fig. 9.
Fig. 8.
Fig. 31.
Fig. 5.
Fig. 35.
Fig. 33.
Fig. 34. No. 1.
Fig. 36.
Fig. 38.
Fig. 34. No. 2.
Fig. 37.
Fig. 46.
Fig. 7. No. 1.
Fig. 41.
Fig. 39.
Fig. 32.
Fig. 57.
Fig. 64.
Fig. 44.
Fig. 40.
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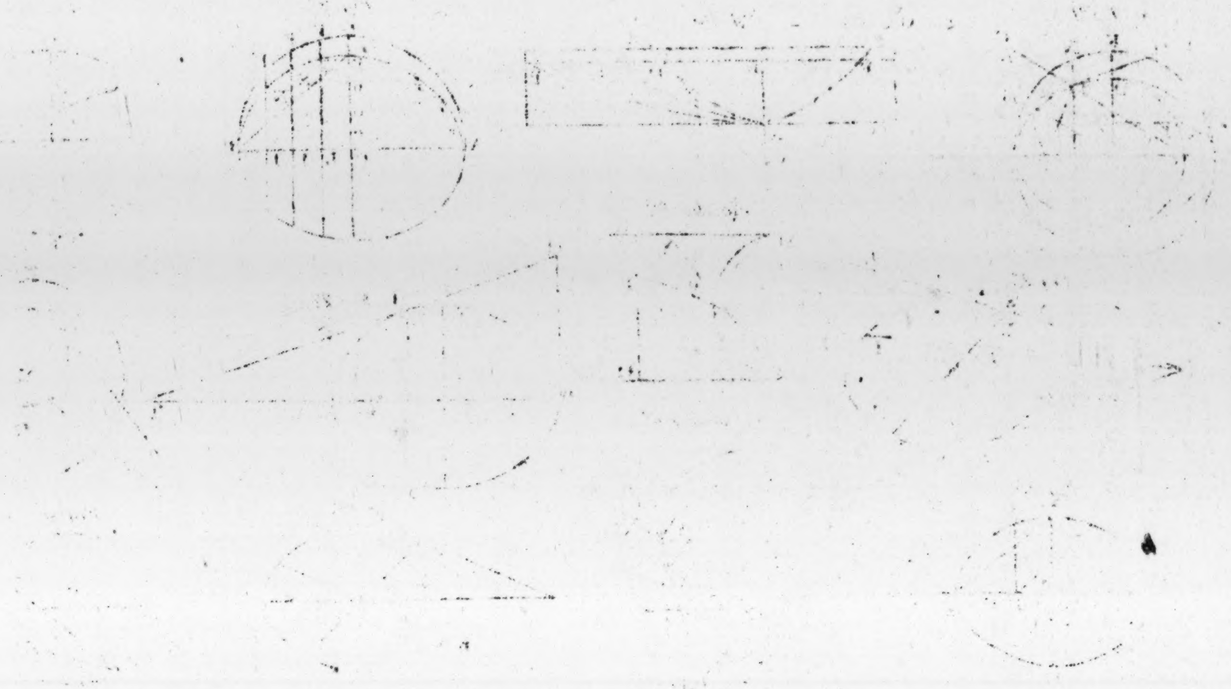
Fig. 53.
Fig. 43.
Fig. 54.
Fig. 58.
Fig. 14.
Fig. 7. No. 2.
Fig. 50.
Fig. 1.
Fig. 2.
Fig. 59.
Fig. 6.
Fig. 23.
Fig. 12.
Fig. 48.
Fig. 10.
Fig. 3.
Fig. 52.
Fig. 11.
Fig. 13.
Fig. 17.
Fig. 21. No. 2.
Fig. 26.
Fig. 28.
Fig. 18.
Fig. 19.

Engraved for the Royal Encyclopædia, & Published as the Act directs, by C. Cooke, No. 17 Paternoster Row.

Lodge sculp.



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SYSTEM OF GEOMETRY.

HISTORY OF GEOMETRY.

GEOMETRY, the ſcience, or doctrine of extenſion, or extended things; that is, of lines, ſurfaces, or ſolids. The word is Greek, γεωμετρεα, formed of γεα, or γη, *earth*; and μετρεω, *meaſure*; it being the neceſſity of meaſuring the earth, and the parts and places thereof, that gave the firſt occaſion to the invention of the principles and rules of this art, which has ſince been extended and applied to numerous other things; inſomuch that *geometry* with arithmetic, is now the general foundation of all mathematics. Herodotus, Diodorus and Strabo, aſſert that the Egyptians were the firſt inventors of *geometry*; and that the annual inundations of the Nile were the occaſion of it; for that river bearing away all the bounds and land-marks of men's eſtates, and covering the whole face of the country, the people, ſay they, were obliged to diſtinguiſh their lands by the conſideration of their figure and quantity; and thus, by experience and habit, formed themſelves a method, or art, which was the origin of *geometry*. Joſephus attributes the invention to the Hebrews. From Egypt *geometry* paſſed into Greece, where it was much cultivated and improved by Thales, Pythagoras, Anaxagoras of Clazomene, Hippocrates of Chios, and Plato, who teſtified his conviction of the neceſſity and importance of *geometry*, in order to the ſucceſsful ſtudy of philoſophy by the following inſcription on the door of his academy, ȣδεις αγεωμέτρητος εισειτω, *let no one ignorant of geometry enter here.* About fifty years after Plato, lived Euclid, who collected together all thoſe theorems which had been invented by his predeceſſors in Egypt and Greece, and digeſted them into fifteen books, entitled the **Elements** of *Geometry*; and thoſe propoſitions which were not ſatisfactorily proved, he more accurately demonſtrated. The next to Euclid of thoſe ancient writers, whoſe works are extant, is Apollonius, Pergæus, who flouriſhed in the time of Ptolemy Euergetes, about two hundred and thirty years before Chriſt, and about a hundred years after Euclid. The third ancient geometer, whoſe writings remain, is Archimedes of Syracuſe, who was famous about ten years after Apollonius.

We can only mention Eudoxus of Cnidus, Archylas of Tarentum, Philolaus, Eratoſthenes, Ariſtarchus of Samos, Dinoſtratus, the inventor of the Quadratrix, Menechmus, his brother and the diſciple of Plato, the two Ariſteus's, Conon, Thraſideus, Nicoteles, Leon, Theudius, Hermotimus, and Nicomedes, the inventor of the Conchoid; beſides whom, there are many other ancient geometers, to whom this ſcience is indebted. The Greeks continued their attention to *geometry*, even after they were ſubdued by the Romans. But the Romans themſelves were ſo little acquainted with this ſcience, even in the moſt flouriſhing time of their republic, that they gave the name of mathematicians, as Tacitus informs us, to thoſe who purſued the chimeras of divination and judiciary aſtrology. Among the Greeks we find many excellent geometers ſince the commencement of the Chriſtian æra, and after the tranſlation of the Roman empire. Ptolemy lived under Marcus Aurelius; and we have extant the works of Pappus of Alexandria who lived in the time of Theodoſius; the commentary of Eutocius, the Aſcalonite, who lived about the year of Chriſt 540, on Archimedes's menſuration of a circle; and the commentary on Euclid, by Pappus, who lived under the empire of Anaſtaſius. The conſequent inundation of ignorance and barbariſm was unfavourable to *geometry* as well as the other ſciences; and thoſe few who applied themſelves to this ſcience, &c. were calumninated as magicians. However, in theſe times of European darkneſs, the Arabians were diſtinguiſhed as the guardians and promoters of ſcience; and from the ninth to the fourteenth century they produced many aſtronomers, geometers, geographers, &c. At the revival of letters, there was ſcarcely one European capable of tranſlating and commenting on the works of the ancient geometers; and *geometry* made little progreſs till the time of Des Cartes, who publiſhed his *Geometry* in 1637. However, in 1635, Bonaventure Cavalerius, an Italian of the order of Jeſuits, publiſhed his *Geometry of Indiviſibles*; Gregory St. Vincent, in 1647, publiſhed his treatiſe, intitled Quadratura Circuli & Hyperbolæ, a work abounding with excellent theorems and paralogiſms; and Paſcal, about the ſame time, publiſhed his treatiſe of the Cycloid. Geometry, as far as it was capable of deriving aid and improvement from the arithmetic of infinites, was indebted to the labours of Fermat, Barrow, Wallis, Mercator, Brounker, J. Gregory, Huygens, and others; to whom we may add Newton and Leibnitz. See **Fluxions**.

But Sir Iſaac Newton contributed to the progreſs of pure geometry by his two treatiſes *De Quadratura Curvarum*, and *Enumeratio Linearum Tertii Ordinis*; and ſtill farther by his incomparable and immortal work, intitled *Philoſophiæ Naturalis Principia Mathematica*, which will always be conſidered as the moſt extenſive and ſucceſsful application of *geometry* to phyſics. We cannot forbear tranſcribing in this place the compliment paid to this author by the editors of the French *Encyclopedie*, who, conſidering the various monuments of the author's genius, and that he had made his principal diſcovery before the age of twenty-four, are tempted, they ſay, to ſubſcribe the words of Pope, that the ſagacity of Newton aſtoniſhes even celeſtial intelligencies, and that they contemplate him as a being occupying a kind of middle ſtation between man and themſelves; or at leaſt they cannot forbear exclaiming, *homo homini quid præſtat!* what a diſtance does there ſubſiſt between one man and another! The modern geometers are innumerable; and the names of Cotes, Maclaurin, Simpſon, Emerſon, &c. will always be held in eſteem and veneration by thoſe that are devoted to the ſtudy of *geometry* and mathematics. The province of *geometry* is almoſt infinite: few of our ideas but may be repreſented to the imagination by lines, upon which they become of *geometrical* conſideration; it being *geometry* alone that makes compariſons, and finds the relations of lines. Aſtronomy, muſic, mechanics, and, in a word, all the ſciences which conſider things ſuſceptible of more or leſs, i. e. all the preciſe and accurate ſciences may be referred to *geometry*; for all ſpeculative truths conſiſting only in the relations of things, and in the relations between thoſe relatious, they may be all referred to lines. Conſequences may be drawn from them; and theſe conſequences, again, being rendered ſenſible by lines, they become permanent objects, which may be conſtantly expoſed to a rigorous attention and examination: and thus we have infinite opportunities both of enquiring into their certainty, and purſuing them farther.

Geometrical lines and figures are not only proper to repreſent to the imagination the relations between magnitudes or between things ſuſceptible of more and leſs; as ſpaces, times, weights, motions, &c. but they may even repreſent things which the mind can no otherwiſe conceive, e. gr. the relations of incommenſurable magnitudes.

The ancient *geometry* was confined to very narrow bounds, in compariſon of the modern. It only extended to right lines and curves of the firſt order, or conic ſections; whereas into the modern *geometry* new lines of infinitely more and higher orders are introduced. *Geometry*, is diſtinguiſhed into *theoretical* or *ſpeculative*, and *practical*. The firſt contemplates the properties of continuity; and demonſtrates the truth of general propoſitions, called **Theorems**. The ſecond applies thoſe ſpeculations and theorems to particular uſes in the ſolution of problems. It is the firſt of theſe that we ſhall chiefly inſiſt upon in this place, referring for the other to menſuration, and gauging, ſurveying, trigonometry, navigation, and ſuch other ſciences as have their dependence thereon.

Theoretical **Geometry** is diſtinguiſhed into *elementary* and *ſublime*.

Elementary or *Common* **Geometry**, is employed in the conſideration of right lines, and plain ſurfaces, and ſolids generated therefrom.

The Higher or Sublime **Geometry** is employed in the conſideration of conic ſections, curve lines, &c.

PART I. SECT. I.

OF LINES, ANGLES, &c.

Definitions. 1. A point is that which has no parts. 2. A line is that, which has length without breadth, and its bounds or extremes are points. 3. A ſurface is that, which has length and breadth only, and the bounds thereof are lines. 4. A ſolid is that, which has length, breadth, and thickneſs, and the bounds are ſurfaces. 5. A right (or ſtrait) line is that which lies evenly between its extremes; or it is the neareſt diſtance between two points. 6. A plane ſurface is that, which is every where perfectly flat and even. 7. An angle is the inclination, or opening of two right lines meeting in a point, as D. Plate I. (*fig.* 1.) 8. When one right line DC, (*fig.* 2.) ſtanding upon another AB, makes the angles on both ſides equal, thoſe angles are called right angles; and that line CD is ſaid to be perpendicular to the other AB on which it inſiſts. 9. An acute-angle is that, which is leſs than a right angle, as D, (*fig.* 1.) 10. An obtuſe angle is that, which is greater than a right angle, as F, (*fig.* 3.) 11. The proper diſtance of two points, is the neareſt diſtance or right line reaching from the one to the other. 12. The proper diſtance of a point from a line, is its neareſt diſtance, and is a right line drawn from that point, perpendicular to, and terminating in, the line given. 13. Parallel (or equidiſtant) right lines, are ſuch, which being in the ſame plane ſurface, if infinitely produced, would never meet. 14. A figure is a bounded ſpace, and is either a ſurface, or a ſolid. 15. A right lined plane figure is that, formed in a plane ſurface, whoſe terms, or bounds, are right-lines. 16. All plane figures, bounded by three right lines, are called triangles. 17. An equilateral triangle is that, whoſe bounds or ſides are all equal. 18. An iſoſceles triangle is, that which has two of its ſides equal, the other ſide being either greater or leſs than thoſe equal ſides. 19. A ſcalene triangle is one which has all the three ſides unequal. 20. A right angled triangle is that which has one right angle, as ACB; (*fig.* 4.) whereof the ſide AB oppoſite to the right angle, is called the hypothenuſe. 21. An obtuſe angled triangle is that which has one obtuſe angle. 22. An acute angled triangle is that which has all its angles acute. 23. Every plane figure bounded by four right lines, is called a quadrangle, or quadrilateral. 24. Any quadrangle, whoſe oppoſite ſides are parallel, is called a parallelogram, as ABCD, (*fig.* 35.) 25. A parallelogram, whoſe angles are all right ones, is called a rectangle, as ABCD, (*fig.* 36.) 26. A ſquare is a parallelogram whoſe ſides are all equal, and its angles all right ones, as ABCD, or EFGH, (*fig.* 37 and 38.) 27. A rhombus is a parallelogram whoſe ſides are all equal, but its angles not right. 28. All other plane four-ſided figures, beſides theſe, are called trapeziums. 29. A right line joining any two oppoſite angles of a four-ſided figure, is called a diagonal. 30. That ſide AB, (*fig.* 5.) upon which any parallelogram ACEB, or triangle ACB is ſuppoſed to ſtand, is called the baſe; and the perpendicular CD falling thereon from the oppoſite angle C, is called the altitude of the parallelogram, or triangle. 31. All plane figures contained under more than four ſides, are called polygons; whereof thoſe having five ſides, are called Pentagons; thoſe having ſix ſides, hexagons; and ſo on. 32. A regular polygon is one whoſe angles, as well as ſides, are all equal. 33. A circle is a plane figure, bounded by one curve line APCD, (*fig.* 6.) called its circumference, every where equally diſtant from a point E within the circle, called the center thereof. 34. The radius of a circle, is the diſtance of the center from the circumference, or a right line EA drawn from the center to the circumference.

AXIOMS, or SELF-EVIDENT TRUTHS.

1. Things, equal to one and the ſame thing, are alſo equal to each other. 2. Every whole is greater than its part. 3. Every whole is equal to all its parts taken together. 4. If to equal things, equal things be added, the wholes will be equal. 5. If from equal things, equal things be taken away, the remainders will be equal. 6. If to, or from unequal things, equal things be added, or taken away, the ſums, or remainders, will have the ſame difference, as the unequal things firſt propoſed. 7. More than one right-line cannot be drawn from one given point A to another point B. A————B.

LEMMA I. If two points, D, F, (*fig.* 7.) in a right-line MN, are poſited at unequal diſtances DC, FE, from another right-line AB in the ſame plane ſurface; thoſe two lines, being infinitely produced, on the ſide of the leaſt diſtance EF, will meet each other. For if they will not meet, then muſt the lines be parallel; and conſequently every where equidiſtant, (by Definition 13) which is contrary to the hypotheſis.

LEMMA II. If two right lines (*fig.* 8 and 9.) CA, CB, making an angle C, be reſpectively equal to two other right lines FD, FE, making an angle F, and the angles which they make C, and F, be likewiſe equal; the right-lines AB, DE joining their extremes will be equal, and the two triangles ACB, DFE, equal in all reſpects. For, conceive the triangle DFE to be removed, and ſo applied to the triangle ABC, that the point F may coincide with C, and the ſide FD fall upon the ſide CA; then, becauſe FD is ſuppoſed equal to CA, the point D will alſo fall upon A. And, the angle F being equal to the angle C, the ſide FE will fall upon CB; and conſequently the point E upon the point B, becauſe FE is ſuppoſed equal to CB. Therefore, all the bounds of the two triangles coincide, and the baſes, AB, and DE, and the angles oppoſite to the equal ſides, are alſo equal.

The Signification of SIGNS.

Two letters with the power of 2 or 3 over the latter, denotes the ſquare or cube of a line denoted by ſuch letters; thus, AB^2; AB^3, &c. denote the ſquare and cube of the line AB reſpectively; when three letters come together they denote an angle, of which the middle letter is the angular point. The ſign ⊏, denotes that the quantity preceding it, is greater than that which comes after it. The ſign ⊐, denotes that the quantity preceding it, is leſs than that which comes after it. For the other marks and characters, ſee Syſtem of ALGEBRA.

THEOREM I. A line (AB) (*fig.* 10) ſtanding upon another line (CD) makes with it two angles (ABC), (ABD) which, taken together, are equal to two right angles. If the angles ABC, ABD, are equal, it is plain they make two right-angles (by Def. 8.) if unequal, let BE be perpendicular to CD, dividing the greater of them (ABC) into the parts EBC, EBA; then the former part EBC being a right-angle, and there maining part EBA, together with the whole leſſer angle ABD, equal to another right-angle EBD, (by Ax. 3.) the whole of both the propoſed angles, taken together, muſt neceſſarily be equal to two right-angles.

COROL. Hence (by Ax. 3.) all the angles at the ſame point on the ſame ſide of a right line are equal to two right-angles.

THEOREM II. If one line (AB) (*fig.* 11.) meeting two others (BC, BD) in the ſame point (B), makes two angles with them (ABC, ABD) which together are equal to two right angles; theſe lines (BC, BD) will form one continued right-line. For, if poſſible, let BH, and not BD, be the continuation of the right-line CB; then the angles ABC and ABH being = two right angles = ABC and ABD; if from theſe equal quantities, ABC, which is common to both, be taken away, there will remain ABH = ABD.

THEOREM III. The oppoſite angles (DEB, AEC), (*fig.* 12.) made by two lines (DC, BA) interſecting each other, are equal. For DEB + DEA = two right angles, (by Theorem I.) = AEC + DEA; whence, by taking away DEA, common, there remains DEB = AEC.

THEOREM IV. Two right lines (AB,CD) (*fig.* 13.) perpendicular to one and the ſame right line (EF), are parallel to each other. If you ſay, they are not parallel; then let them, when produced out, meet in ſome point, as G. In EA, produced (if neceſſary) let there be taken EH = EG; and let the right line FH be drawn. The triangles EHF and EGF, having EH = EG, the angle HEF = GEF, (by Def. 8.) and EF common, are therefore equal in all reſpects (by Ax. 10.) and ſo, the angle EFH being = EFG (EFD) = a right angle, HFDG (as well as HEG) muſt be one continued right-line: (by Theorem II.) which, by Axiom 8, is impoſſible. Therefore AB and CD are parallels.

THEOREM V. Perpendicular (EF, GH) (*fig.* 14.) to one (AB) of two parallel lines (AB, CD) terminated by thoſe lines, are equal to each other; and alſo perpendicular to the other of the two parallels (CD). For, AB and CD being parallel to each other, GH can neither be greater, nor leſs than EF; and therefore muſt be equal to it. If you ſay, that EF is not perpendicular to CD; then let FM be perpendicular to EF, meeting GH produced (if neceſſary) in M; ſo ſhall FM be parallel to AB by Theorem IV; and conſequently GM = EF by Theorem V. = GH; which by Axiom 2. is impoſſible. Therefore EF is perpendicular to CD. And by the ſame argument, GH is perpendicular to CD.

COROLLARY. Hence, through the ſame point F, more than one parallel cannot be drawn to the ſame line AB.

THEOREM VI. A line (AB) (*fig.* 15.) interſecting two parallel lines (SR, QP) makes the alternate angles SDC, PCD, equal to each other.

Let CF and DE be perpendicular to QP, and SR; then theſe lines FC and DE are likewiſe parallels by Theorem IV; and ſo the triangles CFD and CDE, having the ſide CF = DE, FD = CE, and the angle F = E they will alſo have the angle FDC = ECD by Lemma 2.

COROLLARY I. Hence, a line interſecting two parallel lines, makes the angles on the ſame ſide, equal to each other.

COROLLARY II. Hence, alſo, a line falling upon two parallel lines, makes the ſum of the two internal angles on the ſame ſide of it, equal to two right-angles.

THEOREM VII. If a line (AB) (*fig.* 16.) interſecting two other lines (PQ, RS), makes the alternate angles (DCP, CDS) equal to each other; then are thoſe two lines parallel. For, if poſſible, let ſome other line DT, and not DS, be parallel to PQ; then muſt CDT = DCP = CDS, which is impoſſible.

COROLLARY. Hence, if a line falling on two others, makes the angles above them, on the ſame ſide, equal to each other; then thoſe two lines are parallels.

THEOREM VIII. If one ſide (AB) (*fig.* 17.) of a triangle (ABC) be produced, the external angle (CBD) will be equal to both the internal oppoſite angles (A, C) taken together. For, let BE be parallel to AC; then will the angle C = CBE and the angle A = DBE; therefore C + A = CBE + DBE = CBD.

COROLLARY. Hence the external angle of a triangle is greater than either of the internal oppoſite angles.

THEOREM IX. The three angles of any plane triangle (ABC) (*fig.* 18.) taken together, are equal to two right angles. For, if AB be produced to D, then C + A = CBD by the laſt theorem, to which equal quantities let the angle CBA be added, then will C + A + CBA = CBD + CBA = two right angles, by Theorem I.

COROLLARIES. 1. If two angles in one triangle, be equal to two angles in another triangle, the remaining angles will alſo be equal. 2. If one angle in one triangle, be equal to one angle in another, the ſums of the remaining angles will be equal. 3. If one angle of a triangle be right, the other two taken together, will be equal to a right angle. 4. The two leaſt angles, of every triangle, are acute.

THEOREM X. The four inward angles of a quadrangle (AB CD) (*fig.* 10.) taken together, are equal to four right-angles Draw the diagonal AC, then the three angles of the triangle ABC being = two right-angles (by laſt theorem) and thoſe of the triangle ACD equal alſo to two right angles; it follows that the ſum of all the angles of both triangles, which make the four angles of the quadrangle, muſt be equal to four right-angles.

COROLLARY I. Hence, if three of the angles be right ones, the fourth will alſo be a right-angle.

COROLLARY II. Moreover, if two of the four angles, be equal to two right-angles, the remaining two together will likewiſe be equal to two right-angles.

SCHOLIUM. If from any point P, (*fig.* 20) within a polygon ABCDE, lines be drawn to all the angles, the ſum of all the angles of the triangles, thus formed, will be equal to twice as many right-angles as the polygon has ſides. Therefore, ſeeing all the angles about the point P, are equal to four right-angles, it is manifeſt, that all the angles of the polygon, taken together, will be equal to twice as many right-angles, wanting four, as the polygon has ſides.

THEOREM XI. The angles (A, B,) (*fig.* 21) at the baſe of an iſoſceles triangle (ABC) are equal to each other. For, let the line CD biſect, or divide the angle ACB into two equal parts ACD, BCD, and meet AB in D; then the triangles ACD, BCD, having AC = BC, CD common, and the angle ACD = BCD, will alſo have the angle A = B, by Lemma 2.

COROLLARY I. Hence, the line which biſects the vertical angle of an iſoſceles triangle, biſects the baſe, and is perpendicular to it.

COROLLARY II. Hence it appears alſo, that every equilateral triangle is likewiſe equiangular.

THEOREM XII. In any triangle (ABC) (*fig* 22) the greateſt ſide ſubtends the greateſt angle. Let AB be greater than AC; in which let there be taken AD = AC; drawing CD. The triangle ADC being iſoſceles, the angles ACD are ADC and therefore equal; whence ACB, which exceeds the former of them, muſt alſo exceed the latter ADC, and conſequently, much more exceed B, which is leſs than ADC.

Theorem XIII. If the three ſides (AB, AC, CB) (*fig.* 23) of one triangle, be equal to the three ſides (DE, DF, FE) of another triangle, (*fig.* 24) each to each reſpectively; then the angles oppoſed to the equal ſides will alſo be equal. Let the angle BA G = DAG = DF, and let GB and GC be drawn; ſo ſhall the triangles ABG and DEF be equal in all reſpects, by Lemma 2; therefore, AG being = DF = AC, and BG = EF = BC, the angle ACG is alſo = AGC, and BCG = BGC by theorem 11; and conſequently ACB = AGB = DFE: therefore the triangles ABC, DEF are equal in all reſpects.

Theorem XIV. If two triangles (ABC, DEF) (*fig.* 25, and 26,) mutually equiangular, have two correſponding ſides (AB, DE) equal to each other, the other correſponding ſides will alſo be equal. If you ſay BC is greater than EF; from BC let a part BG be taken = EF, and let AG be drawn. The triangles ABG, DEF, having AB = DE, BG = EF, and B = E (by hypotheſis), will alſo have BAG = D; but D = BAC; therefore BAG = BAC; which is impoſſible.

Corollary. Hence, equiangular triangles, having any two correſponding ſides equal, are equal to each other.

Theorem XV. If two right angled triangles (ABC, DEF) (*fig.* 27 and 28) having equal hypothenuſes (AC, DF), have two other ſides (BC, EF) likewiſe equal; the remaining ſides (AB, DE) will be equal, and the two triangles equal in all reſpects. In AB produced, take BG = ED, and let GC be drawn: then, the triangles BCG and DEF, having BG = ED, BC = EF, and the angle CBG = E, will alſo have the angle G = D, and CG = DF = AC: whence, the triangle ACG being iſoſceles, the angle G, or D, will be = A; and conſequently F alſo = ACB; therefore the triangles ABC and DEF, being mutually equiangular, and having AC = DF, they are equal in all reſpects.

Theorem XVI. If two angles (A, B) of a triangle (ABC) (*fig.* 29) be equal, the ſides (BC, AC) ſubtending them will likewiſe be equal. Let CD biſect the angle ACB, and meet AB in D; then the triangles ACD, BCD being equiangular, and having CD common to both, they will alſo have AC = BC.

Theorem XVII. Of all the right lines (PA, PB, PC) (*fig.* 30) falling from a given point (P) upon an infinite right-line (RS), that (PA) is the leaſt which is perpendicular to it; and, of the reſt, that (PB) which is the neareſt the perpendicular is leſs than any other (PC) at a greater diſtance. For BAP being a right-angle, ABP will be acute (by Cor. 4 to Theorem 9) and therefore $AP \sqsupset BP$ by Cor. to Theo. 12. Again, when PB and PC are both on the ſame ſide of the perpendicular PA; then is $BCP \sqsubset$ right angle $\sqsubset BCP$, and conſequently $PC \sqsubset PB$. If PB be on the contrary ſide of the perpendicular to PC, from AC, let AB be taken = AB; then the two lines PB, PB, will be alſo equal; and therefore PC, which exceeds the one (by the preceding caſe) will alſo exceed the other.

Theorem XVIII. The oppoſite ſides (AB, DC) of any parallelogram (ABCD) (*fig.* 31) are equal, as are alſo the oppoſite angles (B, D); and the diagonal (AC) divides the parallelogram into two equal parts. For, AB, DC, and AD, BC, being parallels, the angle BAC is = DCA, and BCA = DAC, therefore the equiangular triangles ABC, ADC having AC common, are equal in all reſpects, by Theorem 14.

Cor. Hence, if one angle (B) of a parallelogram be a right-angle, all the other three will be right ones: for D, being = B, is a right angle; and BCD is = B, and DAB = D, by Theor. V.

Theorem XIX. Every quadrilateral (ABCD) whoſe oppoſite ſides are equal, is a parallelogram.

Let the diagonal AC (*fig.* 31) be drawn; then the triangles ABC, ADC, being mutually equilateral, they will alſo be mutually equiangular (by Theo. 13); conſequently AB will be parallel to DC, and AD to BC, (by Theo. 7)

Theorem XX. The lines (AD, BC) (*fig.* 32) joining the correſponding extremes of two equal and parallel lines (AB, DC) are themſelves equal and parallel. Let the diagonal BD be drawn. Becauſe AB and DC are parallel, the angle ABD is = CDB; therefore, BA being = DC and BD common, the remaining ſides and angles will likewiſe be reſpectively equal; and conſequently AD parallel to BC.

Theorem XXI. If, in one ſide (AB) of a triangle (ABC), (*fig.* 33) from three points (D, F, H) at equal diſtances (DF, FH), lines (DEM, FG, HI) be drawn parallel to the baſe, the parts (EG, GI) of the other ſide (AC) intercepted by them, will alſo be equal to each other. Let NGM be parallel to AB, interſecting HI and DE in N and M. Then, the triangles IGN, MGE, having the angle IGN = EGM, ING = M, (by Theo. 7) and (by Theo. 18) GN (= FH = FD) = GM, will alſo have GI = GE (by Theo. 14).

Cor. I. Hence, if one ſide of a triangle be divided into any number of equal parts, and from the points of diviſion lines be drawn parallel to the baſe, cutting the other ſide, they will alſo divide it into the ſame number of equal parts.

Cor. II. Alſo if two lines FG, HI, cutting the ſides of a triangle, be parallel to each other, and another line DE be ſo drawn as to cut off FD = FH and GE = GI, this line DE will be parallel to the two former.

Theorem XXII. If in the ſides of a ſquare (ABCD), (*fig.* 34) equally diſtant from the four angular points, there be taken four other points, (EF, G, H,) the figure (EFGH) thus formed, ſhall alſo be a ſquare. For the wholes AD, DC, CB, BA, being equal, and alſo the parts AE, DF, CG, BH, the remaining parts ED, FC, GB, HA, muſt conſequently be equal; (by Ax. 5) whence all the angles D, C, B, A, being equal (by Ax. 7) the ſides EF, FG, GH, HE, will be equal likewiſe (by Lemma 2) and the angle DEF, = AHE. Therefore becauſe DEH is = A + AHE, (by Theo. 8) if from theſe, the equal angles DFF, AHE, be taken away, there will remain HEF = A = a right-angle. By the ſame argument (or by Theor. 19th, and the Carol. to the 18th) the other three angles will be right-angles.

SECT. II. *Of Parellograms, Rectangles, &c.*

Definitions. 1. In a parallelogram ABCD, (*fig.* 35) if two right-lines GI, FH, parallel to the ſides, interſecting the diagonal in the ſame point E, be drawn, dividing the parallelogram into four other parallelograms; thoſe two EA, and EC, through which the diagonal does not paſs, are called complements; and the other two FG, and HI, parallelograms about the diagonal. 2. Every rectangle is ſaid to be contained under the two right-lines AB, BC, (*fig.* 36) that are the baſe and altitude thereof.

Theorem I. The rectangles (BD, FH) *fig.* 37 and 38) contained under equal lines, are equal. For, let the diagonals AC, EG, be drawn: then becauſe AB = EF, BC = FG, and B = F, the triangles ABC, EFG, are equal. And in the very ſame manner will ADC and EHG appear to be equal; therefore the whole rectangle ABCD is alſo equal to the whole rectangle EFGH.

Theorem II. Parallelograms (ABCD, BCFE) (*fig.* 39 and 40) ſtanding upon the ſame baſe (BC) and between the ſame parallel (BC, AF) are equal. For, ſince (in *fig.* 39.) the angle F = BEA, and CDF = A, the triangles FDC, EAB, are equiangular; they are alſo equal, becauſe CF = BE: therefore, if each be taken from the whole figure ABCF, there will remain ABCD = EBCF.

Corol. I. Hence, triangles BAC, BFC, (*fig.* 40) ſtanding upon the ſame baſe, and between the ſame parallels, are equal.

Corol. II. Hence all parallelograms, or triangles, whatever, whoſe baſes and altitudes are equal, are equal among themſelves.

Theorem III. The complements (EC, EA) (*fig.* 35.) of any parallelogram (AC) are equal. For, the whole triangle DCB being equal to the whole triangle DAB, and the parts DIE, EFB, reſpectively equal to the parts DHE, EGB, the remaining parts EC, EA, muſt likewiſe be equal.

Theorem IV. If a right-line (AB) (*fig.* 41.) be any wiſe divided into two parts (AC, BC), the ſquare of the whole line will be equal to the ſquares of both the parts, together with two rectangles under the ſame parts. Let ABGI be the ſquare of AB, and CBEF that of BC, and let EF and CF be produced to meet the ſides of the ſquare ABGI in M and N. From the equal quantities CM, EN, take the equal quantities CF and EF; and there remains FM = FN; therefore, all the angles of the figure being right ones, NM is a ſquare upon FN (= AC); and AF, FG are equal to two rectangles under BC and AC, by theorem 1, of this ſection: but AG = BF + FI + AF + FG, or $AB^2 = BC^2 + AC^2 + 2AC \times BC$.

Corol. I. Hence, the ſquare of any line is equal to four times the ſquare of half that line.

Corol. II. Hence, alſo, if two ſquares be equal, their ſides muſt be equal.

Theorem V. The difference of the ſquares (ABEH, ACIK) (*fig.* 42.) of any two unequal lines (AB, AC), is equal to a rectangle under the ſum and difference of the ſame lines. In EB, produced, take BF = AC; let FG be drawn parallel to EH, and let CI be produced both ways, to meet EH and FG in D and G. It is evident that DF is a rectangle, whoſe baſe GF (= CB) = the difference of the given lines AB, AC; and whoſe altitude FE (becauſe BE = BA, and BF = AC) is = the ſum of the ſame lines: but this rectangle DF is = DB + GB = DB + DK (becauſe DK = GB) = the ſquare AE—the ſquare AI.

Theorem VI. The ſquare made upon the ſide (AC) ſubtending the right-angle of a plane triangle (ABC), is equal to both the ſquares (BE, BG) made upon the ſides (AB, BC) containing that angle. Let the ſides of the ſquares BE, BG be produced to meet each other in L and D; in which take KL and IG each equal to AE (or AB); and let CI, IK, and KA be drawn. Since ABH and FBC (which are continued right lines) are equal to each other; EL, DG, ED, and LG, will be all equal among themſelves; and ſo the angles E, D, G and L, being all right ones, EDGL will be a ſquare, and conſequently ACIK a ſquare likewiſe (by Theorem 21, Sect. I. Now, if from the ſquare DL, the four equal triangles ADC, CGI, ILK, and KEA, be taken away, there will remain the ſquare AI; and, if from the ſame DL, the two equal parallelograms DB, BL (which are equal to the ſaid four triangles, becauſe DB = two of them) be taken away; then there will remain the two ſquares BE and BG. Conſequently the ſquare AI is = the two ſquares BE and BG.

Cor. Hence, the ſquare upon either of the ſides, including the right angle, is equal to the difference of the ſquares of the hypothenuſes and the other ſide.

Theorem XII. The difference of the ſquares of the two ſides (AC, BC) of any triangle (ABC) (*fig.* 43 and 44.) is equal to the difference of the ſquares of the two lines, or diſtances (AD, BD) included between the extremes of the baſe (AB) and the perpendicular (CD) of the triangle. For, ſince $AC^2 = DC^2 + AD^2$, and $BC^2 = DC^2 + BD^2$ (by the precedent), it is evident that the difference of AC^2 and BC^2 will be equal to the difference between $DC^2 + AD^2$ and $DC^2 + BD^2$, or between AD^2 and BD^2, by taking away DC^2, common, from both.

Cor. I. The difference of the ſquares, or the rectangle under the ſum and difference of the two ſides of any triangle, is equal to the rectangle under the ſum and difference of the diſtances included between the perpendicular and the two extremes of the baſe.

ELEMENTS OF GEOMETRY.

SECT. III. *Of the Circle.*

Definitions. 1. Any right-line DP, paſſing through E (*fig.* 6.) the center of a circle, and terminating in the circumference at both ends, is called a diameter. 2. An arc of a circle, is any portion of the periphery, or circumference, as BAF. 3. The chord, or ſubtenſe of an arc BAF, is a right-line BF, joining the two extremes of that arc. 4. A ſemi-circle is a figure contained under any diameter and either part of the circumference cut off by that diameter, as DAPE. 5. A ſegment of a circle is a figure contained under an arc BAF, and its chord BF. 6. A ſector of a circle is a figure contained under two right-lines ED, EC, drawn from the center to the circumference, and the arc DC included betwixt them. When the two lines ſtand perpendicular to each other, then the ſector is called a quadrant. 7. An angle ABC (*fig.* 45,) is ſaid to be a ſegment of a circle ABC, when, being in the periphery thereof, the right-lines BA, BC, by which it is formed, paſs through the extremes of the chord AC bounding that ſegment. 8. An angle ABC (*fig.* 45) in the periphery, comprehended by two right-lines BA, BC, including an arc of the circle, ADC, is ſaid to ſtand upon that arc. 9. A right-line is ſaid to be applied, or inſcribed in a circle, when both its extremes are in the periphery thereof. 10. A right-lined figure is ſaid to be inſcribed in a circle, when all its angles are in the circumference of the circle. 11. A circle is ſaid to be deſcribed about a right-lined figure, when the periphery of the circle paſſes through all the angles of that figure. 12. A right-lined figure is ſaid to be deſcribed about a circle, when all the ſides thereof touch the circle. 13. A circle is ſaid to be inſcribed in a right-lined figure, when it is touched by all the ſides of the right-lined figure. 14. A right-lined figure is ſaid to be inſcribed in a right-lined figure, when all the angles of the former are ſituate in the ſides of the latter.

Theorem I. If the ſides (AB, BC, CD, &c.) (*fig.* 46,) of a polygon inſcribed in a circle, be equal, the angles (AOB, BOC, COD, &c.) at the center of the circle, ſubtended by them, will likewiſe be equal. For AO, BO, CO, &c. being equal to each other, as well as AB, BC, CD, &c. the triangles AOB, BOC, COD, are mutually equilateral; and therefore have all the angles AOB, BOC, &c. equal to each other by Theo. 13, Section I.

Theorem II. Any chord (AB) of a circle, (*fig.* 47,) falls wholly within the ſame; and a perpendicular (CD) let fall thereon, from the center of the circle, will divide it into two equal parts. Let C, A, and C, B, be joined; and through any point E in the chord AB, let the right-line CEF be drawn, meeting the circumference in F. It is evident, becauſe $CA = CB$, that theſe equal lines are on different ſides of the perpendicular CD; by Theory 17. Sect. 1; and ſo, CE being $\sqsupset$ CA or CF, the point E (take it where you will in the line AB) and conſequently the line AB itſelf, will fall within the circle. Moreover, becauſe the triangles ACD, BCD, have $CA = CB$, and CD common, thence will AD be alſo $= BD$.

Cor. Hence a line biſecting any chord at right-angles, paſſes through the center of the circle.

Theorem III. Any two chords (AB, DE) (*fig.* 48.) equally diſtant from the center (O) of a circle, are equal to each other. Let the perpendiculars OF, OC, be drawn, and let O, D, and O, A, be joined. Becauſe $OF = OC$, $OD = OA$, and F and C are both right angles, therefore is $DF = AC$ by Theorem 15, Sect. I. and conſequently $DE = 2DF = 2AC = AB$.

Theorem IV. A right line (FD) (*fig.* 49,) drawn through any point (A) in the circumference of a circle, at right angles to the radius (EA) terminating in that point, will touch the circle. From any point in FD, to the center E, let the right line BE be drawn; which being greater than AE, the point B muſt, neceſſarily, fall out of the circle: and therefore, as the ſame argument holds good with regard to every other point in the line FD (except A), it is manifeſt that this line cuts off no part of the circle, but touches it in one point only.

Theorem V. The angle (BDC) at the center of a circle, is double to the angle (BAC) at the circumference, when both angles ſtand upon the ſame arch (BC). See *fig.* 50, 51, and 52. Let the diameter ADE be drawn. In the firſt caſe (where AB paſſes through the center) $BDC = A + C = 2A$. In the ſecond caſe, $BDE = 2BAE$, (by caſe 1.); to which adding $CDE = 2CAE$, we have $BDC = 2BAC$. In the third caſe, $CDE = 2CAE$ (by caſe 1.) from whence, ſubtracting $BDE = 2BAE$ there remains $BDC = 2BAC$.

Theorem VI. All angles (EAF, EBF) *fig.* 53, 54. in the ſame ſegment (EABF) of a circle, are equal to each other.

Case I. If the ſegment be greater than a ſemi circle, from the center C draw CE and CF; then EAF and EBF, being each of them = to half ECF, they muſt neceſſarily be equal to each other.

Case II. If the ſegment be leſs than a ſemi-circle, let H be the interſection of EB and AF, then the triangles AEH and BFH, having the angle $AHE = BHF$, and $AEH = BFH$ (by caſe 1.) they will alſo have $EAH = FBH$ by Cor. to Theory 9, Sect. I.

Cor. Angles in the circumference ſtanding upon equal chords of the ſame circle are equal; and from the ſameneſs of equal circles it may be added as a further corollary, that all angles in the circumferences, ſtanding upon equal ſubtenſes of circles, having equal diameters, are equal to each other. And the ſubtenſes of equal angles, in the circumference of circles, having equal diameters, are alſo equal.

Theorem VII. The angle ACB (*fig.* 55,) in a ſemi-circle, is a right angle. Let the diameter CDE be drawn. Becauſe $ACD =$ half ADE, and $BCD =$ half BDE, by Theorem V. of this Section; therefore is $ACD + BCD$ $(= ACB) =$ half of ADE and BDE $=$ half two right angles $=$ one right angle.

Theorem VIII. The angle CAB (*fig.* 56.) included by a tangent to a circle and a chord (AC) drawn from the point of contact (A), is equal to the angle (AEC) in the alternate ſegment. Let the diameter AOF be drawn, and E, F, be joined. The line DB, falling wholly above the circle, OA is the leaſt line that can be drawn to it from the center O, by Theorem 17, Sect. I. and Theorem 4 of this Section; for OAB is a right-angle; and FEA is alſo a right angle by the preceding theorem; therefore, if from theſe equal angles, the equal angles, FAC, FEC, (ſtanding on the ſame arc FC) be taken away, there will remain $BAC = AEC$.

Theorem IX. The vertical angle (ABC) of any oblique-angled triangle (ACB) inſcribed in a circle (ABCD) is greater or leſs than a right-angle, by the angle (CAD) comprehended under the baſe (AC) and the diameter (AD) drawn from the extremity of the baſe. For, BD being drawn, ABD will be a right angle, and $CAD = CBD$; therefore, in the firſt caſe, $ABC =$ right angle $+ CAD$; and in the ſecond, $ABC =$ right-angle $- CAD$.

Theorem X. If any ſide (BC) (*fig.* 59.) of a quadrilateral (ABCD) inſcribed in a circle, be produced out of the circle, the external angle (ECD) will be equal to the oppoſite internal angle (BAD). Let the diameter BF be drawn, and let AF and CF be joined; then the angle BAF being a right angle $(= BCF) = ECF$, and DAF alſo $= DCF$, ſtanding both on the ſame arc DF; thence will the remainders BAD and ECD be alſo equal.

Cor. Hence the oppoſite angles BAD, BCD of any quadrilateral inſcribed in a circle, are together equal to two right angles.

Theorem XI. If two lines AB, CD (*fig.* 60 and 61) terminated by the periphery on both ſides, cut each other within a circle, the rectangle $(AP \times BP)$ contained under the parts of the one, will be equal to the rectangle $(CP \times DP)$ contained under the parts of the other.

Case I. If one of the two lines (AB) paſſes through the center O; then let OQ be drawn perpendicular to the other CD, and let OC be joined; then becauſe $QD = QC$, DP is equal to the difference of the ſegments CQ and PQ: but the rectangle under the ſum and difference of the two ſides OC, OP, of any triangle COP, is equal to the rectangle under the whole baſe CP, and the difference of its two ſegments by Cor. to Theory VII. Sect. II. therefore, the ſum of the two ſides OC, OP being $(= OA + OP) = AP$, and their difference $(= OB - OP) = BP$, thence is the rectangle contained under AP and BP equal to the rectangle contained under CP and DP.

Case II. If neither of the two lines paſs through the center, let the diameter EPF be drawn; then, by the preceding caſe, $AP \times BP = FP \times EP = CP \times DP$.

Theorem XII. If from two points (A,) C (*fig.* 62.) in the circumference of a circle, two lines (AP, CP) be drawn, to paſs through and meet without the circle, the rectangle $(AP \times BP)$ contained under the whole and the external part of the one, will be equal to the rectangle $(CP, \times DP)$ contained under the whole, and the external part of the other. Through the center O, let PF be drawn, meeting the circumference in E and F; let OQ be perpendicular to AP, and let A, O, be joined. Then, the rectangle contained under PF $(= PO + OA)$ and PE $(= PO - OA)$ is $=$ the rectangle contained under AP and PB. After the very ſame manner, $PF \times PE = CP \times DP$: therefore $AP \times BP = CP \times DP$.

Cor. I. Hence, if PS be a tangent at S, and the radius OS be drawn; then, PF being $=$ the ſum of PO and OS, and PE $=$ their difference; it follows, that $PS^2 = PF \times PE = PC \times PD$.

Theorem XIII. If from the center (C) (*fig.* 63.) of a circle, to a point (A) in any chord (BD), a line (CA) be drawn; the ſquare of that line, together with the rectangle contained under the two parts of the chord, will be equal to a ſquare made upon the radius of the circle. Let EAF be another chord, perpendicular to CA, and let C, E, be joined. Since AF = AE, thence will AE × AE = AB × AD by Theorem 11, of this Sect. to which equal quantities, adding AC^2 we have $CE^2 = AB \times AD + AC^2$ by theorem 6, Sect. II.

Cor. Hence the ſquare of a line (AC) drawn from any point in the baſe of an iſoſceles triangle (BCD) to the oppoſite angle, together with the rectangle of the parts of the baſe, is equal to a ſquare made upon one of the equal ſides of the triangle.

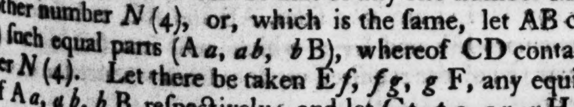
Theorem XIV. The rectangles contained under the correſponding ſides of the equiangular triangles (ABC, DEF) *fig*. 64, taken alternately, are equal. I ſay, if A = D, B = E and C = F, then will AB × DF = AC × DE. In BA produced, let AG be taken = DF; let GCB be the circumference of a circle paſſing through the three points B, C, G, meeting CA produced in H; and let G, H, be joined. Becauſe the angle H = B, by Theor. VI. Sect. III. = E, HAG = BAC = D, and AG = DE, thence is AH = DE; and therefore AC × DE = AC × AH = AB × AG = AB × DF.

SECT. IV. *Of the Ratios of Geometrical Quantities.*

Definitions. Ratio is the proportion which one magnitude bears to another magnitude of the ſame kind, with reſpect to quantity. 2. Three quantities, or magnitudes A, B, C, are ſaid to be proportional, when the ratio of the firſt A to the ſecond B, is the ſame as the ratio of the ſecond B, to the third C. 3. Four quantities A, B, C, D, are ſaid to be proportional, when the ratio of the firſt A to the ſecond B, is the ſame as the ratio of the third C to the fourth D. 4. Of three proportional quantities, the middle one is ſaid to be a mean-proportional between the other two; and the laſt, a third-proportional to the firſt and ſecond. 5. Of four proportional quantities, the laſt is ſaid to be a fourth-proportional to the other three, taken in order. 6. Quantities are ſaid to be continually proportional (or in continued proportion) when the firſt is to the ſecond, as a ſecond to the third, as the third to the fourth, as the fourth to the fifth, and ſo on. 7. In a ſeries, or rank of quantities continually proportional, the ratio of the firſt and third, is ſaid to be duplicate to that of the firſt and ſecond; and the ratio of the firſt and fourth, triplicate to that of the firſt and ſecond. 8. Any number of quantities, A, B, C, D, being given, or propounded, the ratio of the firſt (A) to the laſt (D) is ſaid to be compounded of the ratios of the firſt to the ſecond, of the ſecond to the third, and ſo on. 9. Ratio of equality, is that which equal quantities bear to each other. 10. Inverſe ratio is, when the antecedent is made the conſequent, and the conſequent the antecedent. Thus, if 2 : 1 :: 6 : 3; then, inverſly, 1 : 2 :: 3 : 6. 11. Alternate proportion is, when antecedent is compared with antecedent, and conſequent with conſequent. As, if 2 : 1 :: 6 : 3; then, by alternation (or permutation) it will be 2 : 6 :: 1 : 3. 12. Compounded ratio is, when the antecedent and conſequent, taken as one quantity, are compared either with the conſequent, or with the antecedent. Thus, if 2 : 1 :: 6 : 3; then, by compoſition, 2 + 1 : 1 :: 6 + 3 : 3, and 2 + 1 : 2 :: 6 + 3 : 6. 13, Divided ratio is, when the difference of the antecedent and conſequent is compared, either with the conſequent, or with the antecedent. Thus, if 3 : 1 :: 12 : 4; then by diviſion, 3 — 1 : 1 :: 12 — 4 : 4, and 3 — 1 : 3 :: 12 — 4 : 12. 14. Similar (or like) right lined figures are ſuch, which have all their angles equal, one to another reſpectively, and alſo the ſides about the equal angles proportional.

Axioms. 1. The ſame quantity being compared with ever ſo many equal quantities, ſucceſſively, will have the ſame ratio to them all. 2. Equal quantities, have to one and the ſame quantity, the ſame ratio. 3. Quantities having the ſame ratio to one and the ſame quantity, or to equal quantities, are equal among themſelves. 4. Quantities, to which one and the ſame quantity has the ſame ratio, are equal. 5. If two quantities be referred to a third, that which is the greateſt will have the greateſt ratio. 6. If two quantities be referred to a third, that is the greateſt which has the greateſt ratio. 7. Ratios, equal to one and the ſame ratio, are alſo equal, one to the other. 8. If two quantities be divided into, or compoſed of parts, that are equal among themſelves, or all of the ſame magnitude; then will the whole of the one, have the ſame ratio to the whole of the other, as the number of the parts in the one, has to the number of equal parts in the other. 9. If the double, treble, or quadruple, &c. of every part of any quantity be taken, the aggregate will be the double, treble, or quadruple, &c. of the whole quantity propounded.

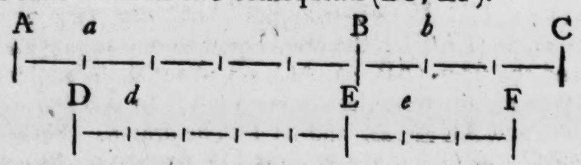
Theorem I. Equimultiples of any two quantities (AB, CD) are in the ſame ratio as the quantities themſelves.



Let the ratio of AB to CD be that of any one number *M* (3) to any other number *N* (4), or, which is the ſame, let AB contain *M* (3) ſuch equal parts (A*a*, *ab*, *b*B), whereof CD contains the number *N* (4). Let there be taken E*f*, *fg*, *g* F, any equimultiples of A*a*, *a b*, *b* B, reſpectively; and let G*p*, *p q*, *q r*, *r* H, be the ſame multiples of C*c*, *cd*, *de*, *e*D; ſo ſhall the whole EF be the ſame aſſigned multiple of the whole AB, and the whole GH of the whole CD, as each part in the one, is of its correſpondent in the other. And, ſince the parts A*a*, *ab*, *b*B, C*c*, *cd*, &c. are all equal, their equimultiples E*f*, *fg*, *g*F, G*p*, *pq*, &c. will alſo be equal. Therefore EF is in proportion to GH, as the number of the parts in EF is to the number of equal parts in GH, or (which is the ſame) as the number of parts in AB to the number of parts in CD, that is, as AB is to CD; which was to be demonſtrated.

Cor. Hence, like parts of quantities, have the ſame ratio as the wholes.

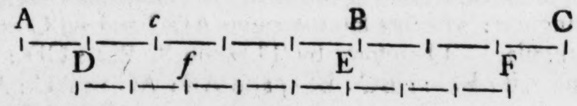
Theorem II. The two antecedents (AB, DE) of four proportional quantities, of the ſame kind (AB, BC, DE, EF) are in the ſame ratio with the two conſequents (BC, EF).



Let the common ratio of AB to BC, and of DE to EF, be that of any one number *M* (5) to any other number *N* (3); then will AB contain *M* (5) ſuch equal parts (A *a*) whereof BC contains *N* (3); and DE will, in like manner, contain *M* (5) ſuch equal parts (D*d*), whereof EF contains *N* (3); and ſo, AB and DE, as well as BC and EF, being equimultiples of A *a* and D *d*, thence will AB : DF :: A *a* (B *b*) : D *d* (E *e*) :: BC : EF.

Cor. The proportionality will ſubſiſt, when the conſequents are taken as antecedents, and the antecedents as conſequents.

Theorem III. Of four proportional quantities, (AB, BC, DE, EF) the ſum, or difference of the firſt antecedent and conſequent (AB ± BC) is to the firſt antecedent, or conſequent, as the ſum, or difference of the ſecond antecedent and conſequent (DE ± EF) is to the ſecond antecedent, or conſequent. Let what was premiſed in the demonſtration of the preceding theorem, be retained here: then will



AC (AB + BC) be in proportion to AB, as the number of parts in AC is to the number of equal parts in AB, or as the number of parts in DF (DE + EF) to the number of equal parts in DE, that is, as DF (DE + EF) is to DE. Again, if from AB and DE, be taken away B*c* = BC, and E*f* = EF, then will the difference A*c* be in proportion to AB, as the number of parts in A*c* (or D*f*) is to the number of parts in AB (or DE); that is, as D*f* is to DE. In the ſame manner it will appear, that AB + BC : BC :: DE + EF : EF; and AB — BC : BC :: DE — EF : EF.

Cor. Hence the ſum of the greateſt and leaſt of four proportional quantities, of the ſame kind, will exceed the ſum of the two means.

Theorem IV. Triangles (ACD, BCD) (*fig*. 65.) and alſo parallelograms (ADCQ, BDCP), having the ſame altitude, are to one another, in the ſame ratio, as their baſes (AD, BD). Let the baſe AD be to the baſe BD in the ratio of any one number *m* (3) to any other number *n* (2); or, which is the ſame, let AD contain *m* (3) ſuch equal parts whereof BD contains the number *n* (2). Then, the triangles AC*p*, *p*C*q*, BC*r*, *&c.* made by drawing lines from the points of diviſion to the vertex C, being all equal among themſelves; the triangle ACD will therefore be in proportion to the triangle BCD, as the number of equal parts in the former to the number of equal parts in the latter, or as the number of parts in AD to the number of parts in BD, that is, as AD to BD; whence, alſo, the parallelograms ADCQ, BDCP, being the doubles of their reſpective triangles, are likewiſe in the ſame ratio as their baſes AD and BD.

Theorem V. Triangles (ABC, DEF), (*fig*. 66 and 67) ſtanding upon equal baſes (AB, DE) are to one another, in the ſame ratio as their altitudes (CH, FI.) Let BP be perpendicular to AB, and equal to CH; in which let there be taken BQ = FI, and let AP and AQ be drawn. The triangle ABP is = ABC, and ABQ = DEF; but ABP (ABC) : ABQ (DEF) :: BP (HC) : BQ (FI), by laſt Theorem.

Theorem VI. If four lines are proportional (*fig*. 68 and 69,) (AB : CD :: DE : BF), the rectangle (AF) under the two extremes will be equal to the rectangle (CE) under the two means: and, if the rectangles under the extremes and means of four given lines (AB, CD, DE, BF) be equal, then are thoſe four lines proportional. In DE let DG be taken = BF, and let GH, parallel to DC, be drawn. 1. Hyp. AF : CG :: AB : CD by Theorem 4, in this Section, :: DE : BF :: DE : DG :: CE : CG; therefore, the conſequents of the firſt and laſt of theſe equal ratios being the ſame quantity CG, the two antecedents AF and CE muſt be equal. 2. Hyp. AB : CD :: AF : CG :: CE : CG :: DE : DG (BF.)

Cor. The two antecedents of four proportional lines are in the ſame ratio to each other, as the two conſequents.

Theorem VII. A line (BE) (*fig*. 70) drawn parallel to one ſide (CD) of a triangle (ACD) divides the other two ſides proportionally. (I ſay, AB : AC :: AE : AD, AB : BC :: AE : ED, and AC : BC :: AD : ED). Draw CE and DB; then will the triangles BEC and EBD be equal to each other; whence, by adding BEA to both, AEC will be alſo = ABD. But, AB : AC :: triangle AEB : triangle AEC (ABD) :: AE : AD; and

AB : BC : : triangle AEB : triangle CEB (DEB) : : AE : ED.

Cor. Hence a right-line, which divides two ſides of a triangle proportionally, is parallel to the remaining ſide.

Theorem VIII. In triangles (ABC, *abc*) (*fig* 71 and 72) mutually equiangular, the correſponding ſides (AB, *ab*, AC, *ac*) containing the equal angles (A, *a*) are proportional. In AB and AC (produced if neceſſary) take AD = *ab*, and AE = *ac*, and join D, E. Then, becauſe AB × AC = *ab* × AC, therefore is AB : *ab* : : AC : *ac*.

Cor. Hence equiangular triangles are ſimilar to each other.

Theorem IX. If two triangles (ABC, *abc*) (*fig*. 71 and 72) have one angle (BAC) in the one, equal to one angle (*bac*) in the other, and the ſides (AB, *ab*, AC, *ac*) about thoſe angles proportional; then are the triangles equiangular. In AB and AC, take AD = *ab*, and AE = *ac*, and let DE be drawn. Since AB : *ab* (AD) : : AC : *ac* (AE), therefore is DE parallel to BC, by Cor. to Theo. 7; whence the angle B = ADE = *b*, and the angle C = AED = *c*.

Theorem X. A right line (CD) (*fig*. 73.) biſecting any angle (ACB) of a triangle (ABC) divides the oppoſite ſide (AB) into two ſegments (AD, BD) having the ſame ratio with the ſides (AC, CB) containing that angle. Let AE and BF be perpendicular to CDE. Then the triangles ACE, CBF, and ADE, BDF, being, reſpectively, equiangular, it will be AD : BD : : AE : BF : : AC : BC, by Theorems 8 and 2, of this Section.

Theorem XI. A perpendicular (CD) (*fig*. 74.) let fall from the right angle (C) upon the hypothenuſe (AB) of a right-angled triangle (ABC) will be a mean proportional between the two ſegments (AD, BD) of the hypothenuſe; and each of the ſides containing the right angle, will be a mean proportional between its adjacent ſegment, and the whole hypothenuſe. For ſince the angle BDC is = BCA, and B common, the triangles BDC, BCA, are equiangular: after the ſame manner ADC and ABC appear to be equiangular. Therefore, by Theorem 8, BD : CD : : CD : AD; and AB : BC : : BC : BD; alſo AB : AC : : AC : AD.

Cor. Becauſe the angle in a ſemi-circle is a right-angle, it follows, that $CD^2 = BD \times AD$, $BC^2 = AB \times BD$, and $AC^2 = AB \times AD$. See Theo. 6, of this Section.

Theorem XII. If, in ſimilar triangles (ABC, EFG) (*fig*. 75 and 76) from any two equal angles (ACB, EGF) to the oppoſite ſides, two right-lines (CD, GH) be drawn, making equal angles with the homologous ſides (CB, GF); thoſe right-lines will have the ſame ratio as the ſides (AB, EF) on which they fall, and will alſo divide thoſe ſides proportionally. For, the triangles ADC, EHG, and BDC, FHG, (as well as the wholes ABC, EFG) being equiangular; thence is by Theorem 8 and Axiom 7, AB : EF (: : AC : EG) : : CD : GH; and AD : EH (: : DC : HG) : : BD : FH.

Theorem XIII. Equiangular triangles (ABC, EFG) (*fig*. 77 and 78) are in proportion to one another, as the ſquares (AK, EM) of their homologous ſides. Upon AB and EF let fall the perpendiculars CD and GH, and let the diagonals BI, FL, be drawn. Becauſe by Theorem 5 of this Sect. ABC : ABI : : CD : AI (AB); and by Theorem 12 : : GH : EF (EL) : : EFG : EFL; therefore, alternately, ABC : EFG : : ABI : EFL : : AK : EM. Cor. ſimilar right-lined figures as to one another as the ſquares of their homologous ſides.

SECT. V. *Geometrical Problems.*

Prob. I. At a given point (A) in an infinite right-line, (PQ) to erect a perpendicular; (*fig*. 79.) From any point D above the line PQ, as a center, through the given point A, let the circumference of a circle be deſcribed, interſecting PQ in E; draw the diameter EDB, and alſo BA; then the angle EAB, being in the ſemicircle EAB, is a right-angle.

Prob. II. From a given point (A) upon an infinite right line (PQ) to let fall a perpendicular (AB) (*fig*. 80.) From any point C in the line PQ, as a center, let the circumference of a circle be deſcribed through the given point A, interſecting PQ in D; and from the center D, with a radius equal to the diſtance of the points A and D, let another circle *m* E *n* be alſo deſcribed, cutting the former ADE in E; then draw ABE for the perpendicular required. For, conceiving right lines to be drawn from C to A and E, the triangle ACE, is iſoſceles; alſo the angle ACE, being biſected by the line PQ, the angles ACB and BCE are equal, and therefore the angles at B are equal or right angles.

Prob. III. To biſect or divide into two equal parts, any given right lined angle PAQ (*fig*. 81.) In the lines containing the given angle, take AC = AD; and upon the centers C and D, with any equal radii, let two circles be deſcribed, ſo as to interſect each other; and from the point of interſection E draw EA, and the thing is done. For, let CD, CE, and DE, be drawn; then, the triangles ACD and ECD, being both iſoſceles, the angle ACD will be = ADC, and ECD = EDC; and conſequently the whole angle ACE = the whole angle ADE; whence (AC being = AD, and EC = ED) the angle CAE is alſo = the angle DAE.

☞ *As it would ſwell the Syſtem beyond the limits of our plan to give the demonſtration of every problem, we ſhall therefore, in the remaining problems, confine ourſelves to the conſtruction only.*

Prob. IV. To biſect a given right-line (AB); (*fig*. 82.) From the extremes A, B, of the given line, with equal radii, deſcribe two arcs, ſo as to cut each other; and between the two points of interſection draw CD, cutting AB in E; and the thing is done.

Cor. Here CD not only biſects AB, but is alſo perpendicular to it.

Prob. V. From a given point (A) in a given right-line (AQ) to draw a line (AK) which ſhall make with the former an angle, equal to an angle given (HBG) (*fig*. 83 and 84.) In BG and AQ take two equal diſtances BC, AD; and at C and D erect the two perpendiculars CI and DF to BG and AQ; and in DF take DE equal to the part CD of the former, intercepted by the lines containing the given angle HBG; then through E draw AEK, and the thing is done.

Prob. VI. To deſcribe a triangle, whoſe three ſides ſhall be equal to three given lines (A, B, C); provided any two of them, taken together, be greater than the third, (*fig*. 85.) Make FG = B, and from the centers F and G, with the intervals or diſtances A and C, let two circles DKL, HKL, be deſcribed; which will cut each other; and, if from the point of interſection K, the lines KF and KG be drawn, then will FKG be the triangle required.

Prob. VII. Through a given point (A), to draw a right-line (RS) parallel to a given right-line, (PQ); (*fig*. 86.) At any point B in the given line, make BC equal to the diſtance of the points A and B; and from the centers A and C, with an interval equal to CB, let two arcs be deſcribed, then through their interſection D, let the line RS be drawn, and the thing is done.

Prob. VIII. Upon a given line (AB) to deſcribe a ſquare, (ABCD), (*fig*. 87). Make AC perpendicular, and equal to AB; and from the centers B and C, let two arcs, with the radius AB or AC, be deſcribed, interſecting each other in D; from which point draw DB and DC, and it is done.

Prob. IX. To divide a given line (AB) into any propoſed number of equal parts, (*fig*. 88). From the extremes of the given line AB, draw two indefinite lines AP, BQ, parallel to each other; in each of which lines let there be taken as many equal diſtances AM, MN, NO, OC; B *o*, *o n*, *n m*, *m a*, (of any length at pleaſure) as you would have AB divided into; then draw M *m*, N *n*, O*o*, interſecting AB in E, F, G, and the thing is done.

Prob. X. To two given lines (AB, BC) to find a third proportional (*fig*. 89.) From any point A, draw two indefinite lines AP, AQ, in which take A*b* = AB, A*c* = BC, and *b*D = BC; draw *bc*, and parallel to *bc* draw DE, cutting AQ in E; then *c*E will be the third proportional required.

Prob. XI. To three given lines (AB, AC, BD) to find a fourth proportional, (*fig*. 90.) Having drawn AP and AQ, as in the preceding problem, take therein A*b* = AB, A*c* = AC, and *b*D = BD; draw *bc*, and parallel to it, draw DE, interſecting AQ in E; then is *c*E the fourth proportional required.

Prob. XII. Between two given lines (AB, BC) to find a mean proportional (*fig*. 91.) In the indefinite line AP, take A*b* = AB, and *b*C = BC; biſect AC in E, and from the center E, at the diſtance of EA, or EC, let a ſemicircle ADC be deſcribed; erect *b*D perpendicular to AC, cutting the circumference in D; then will *b*D be the mean-proportional required.

Prob. XIII. To divide a given line (AC) into two parts (AB, BC) having the ſame proportion as two given lines (AM, AN). (*fig*. 92.) From A draw AD, making any angle with AB; in which take A*m* = AM, and *mn* = MN; draw *n*C, and *m*B parallel thereto, meeting AC in B. Then will AB : BC : : A*m* (AM) : *mn* (MN).

Prob. XIV. To draw a tangent to a given circle (C) through a given point (A). (*fig*. 93, 94.)

Case I. If the given point be in the circumference; then, to the center C, draw AC, and perpendicular to AC draw BAD; which will touch the circle at A.

Case II. If the point A be without the circumference; then draw AC, which biſect in P; and from the center P, at the diſtance of AP, or CP, let a ſemi-circle AEC be deſcribed, cutting the given circle in E; then draw AED, which will be the tangent required.

Prob. XV. Upon a given line (PQ) to deſcribe a ſegment of a circle (PEQ) to contain an angle (E) equal to a given angle (BAC), (*fig*. 95 and 96.) Make AD perpendicular to AB; alſo make PQO, and QPO, each, equal to DAC (the difference between the given angle and a right one); then upon the point of interſection O, as a center, at the diſtance of OP (or OQ), let a circle be deſcribed; and the thing is done.

Scho. In the ſame manner the problem may be conſtructed, when the given angle is acute; only the lines PO, QO, muſt then be drawn on the other ſide of (PQ) as is manifeſt from the 9th theorem of the 3d Sect.

Prob. XVI. About a given triangle (ABC) to deſcribe a circle (*fig*. 97.) Let any two ſides, AB and AC, be biſected by two perpendiculars DF and EF; which will interſect each other in the center (F) of the required circle; from whence the circle may be deſcribed.

Scho. By the ſame method, the circumference of a circle may be deſcribed through any three given points, not ſituate in the ſame right line: alſo from hence, the center of a circle may be found, by having a ſegment of the circle given.

Prob. XVII. To inſcribe a circle in a given triangle (ABC). (*fig.* 98.) Biſect any two of the angles, A and B, by the lines AD and BD, meeting each other in D; make DE perpendicular to AB; then if from the center D, at the diſtance of DE, a circle be deſcribed, it will touch all the ſides of the triangle.

Prob. XVIII. In a given circle (AFB) to deſcribe a triangle, equiangular to a given triangle (PQR), (*fig.* 99, and 100). From the center C, draw the radii CA, CE, CB, making the angles ACE and BCE equal, each to the angle R; join A, B, and make the angle ABF = Q, and from the point F, where BF cuts the circle, draw FA; ſo ſhall AFB be the triangle required.

Prob. XIX. About a given circle (O), to deſcribe a triangle, equiangular to a given triangle (ABC), (*fig.* 101 and 102). Produce out the ſide AB both ways; and draw the radii OP, OR, OQ, ſo as to make the angle POR = EBC, and POQ = DAC; then draw three right lines to touch the circle in the points P, Q and R, and the thing is done.

Prob. XX. In a circle given (ABCD) to inſcribe a ſquare. (*fig.* 103.) Draw two diameters AC and BD perpendicular to each other; then draw AB, BC, CD and DA; ſo ſhall ABCD be a ſquare inſcribed in the circle.

Scholium. If two other diameters *ac*, *bd*, be drawn to biſect the angles AOB, BOC, a regular octagon A*a*B*b*C*c*D*d* may be inſcribed in the circle. And if all the angles at the center O, be again biſected, a regular poligon of ſixteen ſides, may in like manner be determined; and ſo on, at pleaſure.

Pro. XXI. In a circle given (ABGE) to inſcribe a regular pentagon, (*fig.* 104.) At the center O, upon the diameter FG, erect the perpendicular OB, meeting the circumference in B; divide OG in H, ſo that $OH^2 = GH \times OG$; that is, take $OR = \frac{1}{2}OF$, and RH = diſt. RB. Then draw BH; which will be equal to the ſide of the pentagon; from whence the figure itſelf may be deſcribed.

Scho. Hence a regular decagon may be inſcribed in the circle; the ſide thereof being = OH.

Prob. XXII. In a circle given, to inſcribe a regular hexagon (ABCDEF) (*fig.* 105.) From the extremes of any diameter AD, apply AB, AF, DC, and DE equal, each, to the radius AO; then join B, C, and E, F; and the thing is done.

Cor. Hence it appears, that the ſide of a regular hexagon, inſcribed in a circle, is equal to the ſemi-diameter, or radius.

Prob. XXIII. About a given circle to deſcribe a regular polygon, of the ſame number of ſides with a regular polygon (ABC DEF) inſcribed in the circle, (*fig.* 106) From the center O, to the angles of the inſcribed polygon, draw OA, OB, OC, &c. and perpendicular thereto draw PAQ, QBR, RCS, &c. interſecting in P, Q, R, S, T, V; ſo ſhall PQRSTV be the polygon that was to be deſcribed.

Prob. XXIV. To make a ſquare equal to a given rectangle (ABCD) (*fig* 107.) In one ſide AB of the rectangle, produced, take BE = the other ſide BC; biſect AE in O; and from the center O, at the diſtance of OA, or OE, let a ſemi-circle AFE be deſcribed; and let CB be produced to meet the circumference thereof in F; then a ſquare deſcribed on BF will be equal to the given rectangle ABCD.

Prob. XXV. To make a ſquare equal to the ſum of two given ſquares. Let AB and BC (*fig.* 108.) be the ſides of the two given ſquares. Draw two indefinite lines BP, BQ, at right angles to each other; in which take BA = BA, BC = BC, and join A, C; then a ſquare deſcribed on AC will be equal to the ſum of the two ſquares deſcribed upon AB and BC.

Scho. In the ſame manner a ſquare may be made equal to the ſum of three, or more, given ſquares: for if AB, BC, CE, be taken as the ſides of the given ſquares, then, by making BH = AC, BE = CE, and drawing EH, it is evident that a ſquare upon EH will be equal to the ſum of the three ſquares upon AB, BC, and CE.

Prob. XXVI. To make a ſquare equal to the difference of two given ſquares, (*fig.* 109.) Let AB and BC (taken in the ſame ſtrait line) be equal to the ſides of the two given ſquares. Upon the center B, with the radius BA, let a circle be deſcribed, and make CE perpendicular to BC, meeting the circumference thereof in E; ſo ſhall a ſquare deſcribed on CE be equal to BE^2 (BA^2) $-BC^2$.

Prob. XXVII. To make a triangle equal to a given quadrilateral (ABCD) (*fig.* 110.) Draw the diagonal AC, alſo draw DE parallel to AC, meeting BA produced in E, and join CE; then will the triangle BCE = the given quadrilateral ABCD.

Prob. XXIII. To make a triangle equal to a given pentagon (ABCDE) (*fig.* 111.) Draw DA and DB, and alſo EH and CF parallel to them, meeting AB produced in H and F; then draw DH and DF; ſo ſhall the triangle DHF = the pentagon ABCDE.

Prob. XXIX. Upon a given line (EF), to make a rectangle equal to a given triangle (ABC) (*fig.* 112 and 113.) From the vertex C, upon the baſe AB, let fall the perpendicular CD; make EH perpendicular to EF, and equal to a fourth proportional to 2EF, AB, and CD; then the rectangle EG contained under EF and EH will be equal to the triangle ABC.

Scho. By the preceding method, a parallelogram having a given angle may be deſcribed upon a given line, equal to a given triangle; if, inſtead of BDC, FEH, being right angles, you make them all equal to the angle given; the reſt of the conſtruction being the ſame.

Prob. XXX. Upon a given line (AB) to deſcribe a rectangle equal to a given right-lined figure (PQRS) (*fig.* 114, and 115.) Let the given figure be divided into triang. PQR, PRS: and upon the given line AB (by the precedent) let a rectangle ABDC, equal to the triangle PQR, be deſcribed; alſo upon CD make the rectangle CDFE equal to the triangle PRS; ſo ſhall ABEF, which is a rectangle, be = PQR + PRS = PQRS; which was to be done.

Prob. XXXI. To deſcribe a rectangle equal to the ſum or difference of two given right lined figures, (*fig.* 116 and 117.) Let the two given figures be ABN and P. By the precedent, let two rectangles AD and AF, reſpectively equal to ABN and P, be deſcribed on the ſame, or different ſides of AB; according as the difference, or ſum, of the two figures is required: then will the rectangle CF be equal to that ſum or difference.

Cor. Hence two lines having the ſame ratio with two given right-lined figures, are determined; for AC : AE : : AD (ABN) : AF (P) by Theorem 4, of Sect. 4.

Prob. XXXII. To make a ſquare equal to any right-lined figure given (ABCDF) (*fig.* 118.) Upon AB deſcribe a rectangle AE equal to ABC DF; then make a ſquare BH equal to that rectangle, and the thing is done.

Scholium. After the ſame manner a ſquare may be deſcribed equal to the ſum, or difference, of any two given right-lined figures.

Prob. XXXIII. To deſcribe a figure (FGHIK) equal, and ſimilar to a given right-lined figure (ABCDE) (*fig.* 119 and 120.) Draw AC and AD, and alſo FG equal to AB; make the angle GFH = BAC, HFI = CAD, and IFK = DAE; likewiſe make FH = AC, FI = AD, and FK = AE; then draw GH, HI, and IK, and the thing is done.

Prob. XXXIV. Upon a given line (AB) to deſcribe a figure (ABCDE) ſimilar to a given right-lined figure (PQRST) (*fig.* 121 and 122. Draw PR and PS, and in PQ (produced if needful) take P*q* = AB; draw *qr* parallel to QR, meeting PR in *r*; alſo draw *rs* and *st*, parallel to RS and ST, interſecting PS and PT in *s* and *t*; then upon AB, by the precedent, deſcribe a polygon equal and ſimilar to P*qrst*; and the thing is done.

Prob. XXXV. To deſcribe a figure, ſimilar to a right lined figure given (PQRST,) which ſhall be to it in a given ratio of one right-line to another, (*fig.* 123.) In PQ (produced if neceſſary) take P*n* to PQ in the given ratio of the figure to be deſcribed to the figure given; and, in the ſame line PQ, take P*q* equal to a mean-proportional between P*n* and PQ; upon which (by the precedent) let P*qrst*, ſimilar to PQRST, be deſcribed, and the thing is done.

Prob. XXXVI. To deſcribe a figure that ſhall be equal to one right-lined figure given (P,) and ſimilar to another (ABCD,) (*fig.* 124 and 125.) Upon AB make the rectangle ABFG = ABCD, and upon AG make the rectangle AGNE = P; in AB take AI equal to a mean proportional between AB and AE; and upon AI let AIKH be deſcribed ſimilar, and alike ſituate, to ABCD, and the thing is done.

SECT. VI. *Of the Interſection of Planes, &c.*

Definitions — 1. A right-line is ſaid to be perpendicular to a plane, when it is perpendicular to all right-lines, that can be drawn in that plane, from the point on which it inſiſts. 2. One plane is ſaid to be perpendicular to another, when all right-lines drawn in the one, perpendicular to the common ſection, are perpendicular to the other. 3. Parallel planes are thoſe, which are every where equally diſtant, the one from the other. 4. Similar ſolids are ſuch, as are bounded by an equal number of ſimilar planes.

Theorem I. The common ſection of two planes (AB, CD) is a right-line, (*fig.* 126.) For, between the two extreme points E, F, of the common ſection, let a right-line EF be drawn; then that line being in the plane AB and alſo in the plane CD, it muſt, of conſequence, be the common ſection of them both.

Theorem II. If a right-line (AB) be perpendicular to two other right-lines (CE, DF) cutting each other, at the common ſection (A), it will be perpendicular to the plane (CDEF) paſſing by thoſe two lines (*fig.* 127.) Take AC, AD, AE, AF, all equal to one another; and, having joined CD, DE, EF, CF, let there be drawn through A, in the plane CDEF, any right-line GH, meeting CF and DE in G, and H; and let BC, BG, BF, BD, BH, and BE be alſo joined. Becauſe AC = AE = AD = AF, and CAF = DAE, therefore is CF = DE, and the angle FCA (or GCA) = DEA or (HEA); and ſo, GAC being likewiſe = HAE and AC = AE, thence will AG = AH, and GC = HE. Again, ſince the right-angled triangles CAB, DAB, EAB, FAB have their baſes all equal, and the perpendicular AB common, their hypothenuſes BC, BD, BE, BF will be equal too; and therefore the triangles CBF, DBE, being mutually equilateral, the angle FCB (or GCB) muſt be = DEB (or HEB); whence, GC being alſo = HE, and BC = BE, thence is BG = BH: Therefore, AG being likewiſe (as is proved above) = AH, and AB common, the angles GAB, HAB, are equal, and conſequently right-angles. In the ſame manner, AB is perpendicular to every other right line drawn through A in the plane CDEF; which was to be demonſtrated.

Cor. Hence if one right line meeting ſeveral others in the ſame point is perpendicular to them all; theſe laſt will be all in the ſame plane.

Theorem III. If through any given point (A) in a given plane (BCD,) a line (CD) be drawn, and perpendicular to that line, at the ſame point (A) two other lines (AB, AE) be alſo drawn, the one (AB) in the plane given (BCD), and the other in any other plane (CDE) paſſing by the firſt line (CD); then, I ſay, that a right line (AF) drawn from the given point (A), at right angles to the firſt perpendicular (AB) in the plane (BAE of the two, will be perpendicular to the given plane (BCD) at the given point (A) (*fig.* 128.) For CA being perpendicular both to AB and AE, it will likewiſe be perpendicular to AF, by the laſt theorem; and ſo FA, being perpendicular to AB (as well as to CA) is alſo perpendicular to the plane BCD, in which AB and CA are drawn.

The. IV. Two right lines (AB, CD), perpendicular to the ſame plane (EF), are parallel to each other, *fig.* 129. Draw in the plane EF, the right line AD, and alſo DG perpendicular to AD; make DG = AB, and let AG, BG, and BD be drawn. The triangles BAD, ADG, having AB = DG, AD common, and the angle BAD (= right-angle = ADG,) will alſo have BD = AG; and ſo, the triangles BDG, BAG, being mutually equilateral, the angle BDG muſt be = BAG = right angle. But the line CD (as well as BD and AD) being perpendicular to DG, it is therefore in the ſame plane (CDAB) with BD and AD, by Cor. to Theorem 2, of this ſection; and conſequently, as the angles BAD, CDA, are both right-ones, it muſt be alſo parallel to BA.

Cor. I. Hence it follows, that from the ſame given point, to one and the ſame plane, more than one perpendicular right-line cannot poſſibly be drawn: becauſe all perpendiculars to the ſame plane, are parallels; but lines drawn from the ſame point are not parallels.

Cor. II. If, of two parallel right-lines the one is perpendicular to any plane, the other ſhall alſo be perpendicular to the ſame plane.

Theorem V. If a right-line (PQ) be perpendicular to plane (AB), any plane (ED) paſſing by that line, will be perpendicular to the ſame plane (AB), (*fig.* 130.) In the plane ED, from any point K, draw KI perpendicular to the common ſection CD. Then, the angle DIK being a right angle = DQP, IK, will be parallel to PQ, and therefore perpendicular to the plane AB by Cor. 2 to Theo. 4. of this ſection. By the ſame inference, all other right-lines drawn in the plane ED, perpendicular to the common ſection CD, are alſo perpendicular to the plane AB. Therefore the plane ED itſelf is perpendicular to the plane AB.

Cor. I. Hence the plane AB, is perpendicular to the plane ED.

Cor. II. Hence alſo a line ſtanding at right-angles to one of two perpendicular planes at any point (I) in the common ſection (CD) muſt be in the other plane

Theorem VI. Planes (EF, GH) to which one and the ſame right line (AB) is perpendicular, are parallel to each other, *fig.* 131.

From any point C, in the plane EF, let CD be drawn parallel to AB; which, as well as AB, will be perpendicular to both the planes by Cor. 2, to Theor. 4 of this ſection; and ſo the angles A, B, C, D (when AC and BD are joined) being all right-ones, the figure ABCD (whereof the ſides AC, BD, are in the ſame plane with the parallels AB, CD) will therefore be a rectangular parallelogram; and conſequently CD = AB. By the very ſame argument, all other perpendiculars, terminated by the two planes, are equal among themſelves; which was to be demonſtrated.

Cor. Hence, all right-lines perpendicular to one of two parallel planes, are alſo perpendicular to the other.

Theorem VII. Right lines (AB, CD) parallel to one and the ſame right-line (EF), though not in the ſame plane with it, are alſo parallel to each other (*fig.* 132.) Let GH and GI be drawn perpendicular to EF, in the planes AF and ED of the propoſed parallels. Then by Theorem 2 of this ſection ſhall GF be perpendicular to the plane paſſing by HGI; and HB, ID, will alſo be perpendicular to the ſame plane and therefore parallel to each other by Theorem 4. Cor. 2.

Theo. VIII. If two right lines (AB, AC) meeting each other, be reſpectively parallel to two other right-lines (DE, DF) alſo meeting each other, and not being in the ſame plane with them; the angles (BAC, EDF) contained by thoſe lines, will be equal, (*fig.* 133.) Take AB, AC, DE, DF, all equal to each other, and let BE, AD, CF, BC, EF, be drawn. Then, AB and ED, as well as AC and DF, being equal, and parallel, BE and CF will be both equal and parallel to AD; and therefore equal and parallel to each other by the laſt Theorem, and Axiom 1; whence BC is alſo equal to EF; and ſo, the triangles ABC, DEF, being mutually equilateral, the angles BAC, EDF, are likewiſe equal.

Theorem IX. If two right angles (AB, AC) meeting each other, be reſpectively parallel to two other right-lines (DE, DF) alſo meeting each other, and not being in the ſame plane with them, the planes (BAC, EDF) extended by thoſe lines, will be parallels, (*fig.* 134.) Let AG be perpendicular to the plane BAC, meeting the plane EDF in G; in which laſt plane, let GH and GI be drawn parallel to ED and DF; and they will alſo be parallel to AB and AC, by Theorem 7 of this ſection; whence, ſeeing the angles GAB and GAC are both right, AGH and AGI muſt likewiſe be right-angles; and ſo AG being perpendicular to the plane EDF by Theorem 2 of this ſection, (as well as to BAC), the two planes are parallel to each other by Theorem 6.

Theorem X. The ſections (EF, GH) made by a plane (EFHG) cutting two parallel planes (AB, CD) are alſo parallel, the one to the other, (*fig.* 135.) Let EG and FH be drawn parallel to each other, in the plane EFHG; alſo let EI, FK, be perpendicular to the plane CD, and let IG, KH be joined; then, EG being parallel to FH, and EI to FK, the angle GEI by Theorem 8 of this ſection, is = HFK; but the angle EIG is alſo = FKH, being both right-angles; and EI is = FK; therefore EG will be equal (as well as parallel) to FH; and conſequently EF likewiſe parallel to GH.

Cor. It appears from hence, that parallel lines, terminated by the ſame parallel planes, are equal to each other.

Theorem XI. If from the two extremes of a right-line (AB cutting a plane, CD), two perpendiculars (AF, BG) be drawn to the plane; the right line (FG) joining the points where they meet the plane, will paſs through the point (E) in which the propoſed line (AB) cuts the plane, ſo as to be divided by it into two parts (FE, EG), having the ſame ratio to each other as thoſe two perpendiculars (AF, BG) *fig.* 136. For, if AF be produced to *f*, the lines A*f* and BG (which are both perpendicular to the plane CD) will be parallel to each other; therefore A B and FG being both in the ſame plane with theſe parallels, in which their extremes are poſited, they muſt neceſſarily (as they are not themſelves parallels) interſect each other; and ſo the alternate angles FAE, GBE being equal, as well as the oppoſite ones FEA, GEB, thence will FE : EG :: AF : BG; which was to be demonſtrated.

Cor. Hence, if in the plane CD, the lines FC, GD, be made parallel, the one to the other, and in them be taken F*a* = FA, and G*b* = GB; then will the line (*ab*) joining the points *a* and *b*, cut FG in the very ſame point in which it is cut by AB. For, if *e* be taken as the interſection of *ab* and FG, the triangles *a*F*e*, G*eb* will be equiangular; whence by Theory 8 of ſection 4, and the preceding theorem, F*e* : *e* G :: F*a* (FA,) G*b* (GB) :: FE : EG. Therefore, ſeeing FG is divided in one and the ſame ratio, both by *e* and E, theſe points muſt neceſſarily coincide.

Theorem XII. If two planes (AB, CD) cutting each other, be both perpendicular to a third plane (GH), their common ſection will alſo be perpendicular to the ſame plane (GH). (*fig.* 137.)

For from the extreme point F of the common ſection, let the right line FE be erected perpendicular to the plane GH, which line being in both the planes, AB, and CD, (by Cor. 2, of Theorem 5 of this ſection) it muſt neceſſarily be their common ſection. Therefore from the conſtruction the common ſection is perpendicular to the plane GH.

N. B. The theorems introduced in this ſection have been thought ſufficient in this place. Other propoſitions pertaining to the relative magnitude of ſolids will be given in the ſyſtem of Menſuration.

PART II. CONIC SECTIONS.

Genesis.

1. If a right cone, ABC, be cut into two parts by the plane LDG, (Plate II. *fig.* 1.) parallel to one of its ſides, as AB, the ſection LDG, will be a curve, called a parabola. 2. If any cone, as ABC, (*fig.* 2) be cut by a plane paſſing through both its ſides, and not parallel to the baſe BC, the ſection BNDK, will be a curve, named an elipſes, or oval. 3. If a cone, MDN, (*fig.* 3.) be cut by a plane parallel to any plane, DXY within the cone, which paſſes through the vertex D; the ſection LAT, will be a curve called an hyperbola. Alſo, if a cone were cut by a plane paſſing through the vertex and the centre of the baſe, the ſection would be a triangle; or if cut by a plane, parallel to the baſe, the ſection would be a circle. But as the triangle is a plain right lined figure, and the circle is ſimply deſcribed by the rotation of a right line round a point, the parabola, elipſes, and hyperbola, are the only figures that bear the name of conic ſections; for though the circle is not a right lined figure, yet on account of the ſimplicity of its geneſis, it has been ever treated of under plain geometry. And the conic ſections themſelves may be generated *in plano*, independent of the cone; which alſo affords the eaſieſt and ſimpleſt methods of demonſtrat ing their ſeveral properties. I ſhall therefore conſider them in thi light, and treat of each in due order.

SECT. I. OF THE PARABOLA.

Definitions. 1. If one end of a thread equal in length t CH (*fig.* 4.) be fixed at the point F, and the other end fixed at H the end of the ſquare DCH; and if the ſide (CD) of the ſqua be moved along the right line BD, and do always coincide wi it; and further, if the ſtring FGH, be always kept tight, an cloſe to the ſide (GH) of the ſquare, then the point or pin G (where it leaves the ſquare) will deſcribe a parabola MRALGK 2. The fixed point F, is called the focus. 3. The right line B is named the directrix. 4. If the right line BN, be drawn throu the focus F, perpendicular to BD, then AN is called the axis, a A, the vertex of the parabola. 5. A line drawn through the f cus F, perpendicular to the axis, as LR is named the *parameter* *latus rectum*. 6. Any line drawn within the curve, parallel to t axis, as GH is named a diameter; and the point G, where cu cuts the curve, is the vertex. 7. A right line meeting the curve in any point G, but not cutting the ſame, is called a tangent in that point. 8. A right line drawn from any diameter to the curve and parallel, to the tangent at the vertex, as PM, is called an ordinate. If it go quite through the curve, it is named a double ordinate. 9. The part of the diameter between the vertex and ordinate, as GP, is named the abſciſſa.

Prop. I. If G be any point in the curve, the line GC, drawn to the directrix BD, parallel to the axis, is equal to the line FG, drawn from the ſame point to the focus. For $HG + GF =$ length of ſtring $= HD$; and taking away GH from both, there remains $GD = GF$.

Cor. I. Hence the diſtances of the focus, and the directrix from the vertex are equal.

Cor. II. If GP, be an ordinate to the axis, then $AP + AF = FG$.

Cor. III. $FG - FP =$ half the latus rectum.

Prop. II. The diſtance of the focus, or the directrix from the vertex is $\frac{1}{4}$ the latus rectum, viz. AF (or AB) $= \frac{1}{4} LR = \frac{1}{2} LF$. For, when the pin G, comes to L, then $LF = FB$ (= by Prop. 1. Cor. 1.) $2FA$, and $AF = \frac{1}{2} FL$. Alſo $FA = \frac{1}{2} FR$, and conſequently $FA = \frac{1}{4} LR$. Scholium, In any other diameter GH, four times the diſtance of its vertex from the focus, is called its latus rectum.

Prop. III. The ſquare of any ordinate to the axis, is equal to the rectangle of the latus rectum, and abſciſſa, viz. $GM^2 = LR \times AP$. Demonſtration, by Prop. 1. Cor. 2. $GF = AF + AP =$ (Prop. 2.) $AP + \frac{1}{4} LR$, and $FP = AP - AF = AP - \frac{1}{4} LR$. And in the *right angle triangle*, GFP, $GP^2 = GF^2 - FP^2 = \overline{GF + FP} \times \overline{GF - FP} = 2AP \times \frac{1}{2} LR = AP \times LR$.

Cor I. If F is the focus, $GP^2 = AP \times 4AF$.

Cor. II. The abſciſſas are as the ſquares of the ordinates, viz. $AP : AN :: GP^2 : NM^2$. For, $AP : AN :: AP \times LR : AN \times LR$; and therefore, as GP^2 to $NM^2 = NK^2$.

Cor. III. The latus rectum, is a third proportional to the abſciſſa and ordinate.

Prop. IV. As the latus rectum (RL) is to the ſum of any two ordinates (as $GP + NM$ ($= HN + NM$) ſo is their difference $NM - GP$ ($= HK$) to the difference of the abſciſſa, PN.

Demonst. By Prop. III. $LR \times AP = GP^2$, and $LR \times AN = NK^2$; and, by ſubtraction, $\overline{LR \times AN} - \overline{LR \times AP} = NK^2 - PG^2$. Therefore, $LR : NK + PG :: NK - PG : AN$, viz. $LR : HM :: HK : PN$.

Cor. I. If GH be the axis, KM, an ordinate to it, then the rectangle $KH \times HM = GH \times$ parameter.

Cor. II. The rectangle $KH \times HM$ is every where as GH.

Prop. V. If a line AN, (*fig.* 5.) be drawn from the vertex, to cut the curve in M, and the ordinate QO in N; and the ordinate PM, being likewiſe drawn, then will the rectangle $PM \times QN = AQ \times$ parameter. For, let $L =$ latus rectum, then (by Prop. 3. $QO^2 = L \times AQ$ and (by Cor. 2. of the ſame) $PM^2 : QO^2$ or $L \times AQ :: AP : AQ$: and by ſimilar triangles $:: PM : QN$; and $PM^2 \times QN = PM \times L \times AQ$, or $PM \times QN = L \times AQ$.

Cor. I. $PM \times QN = QO^2$.

Cor. II. Any line beſide the axis, paſſing through the vertex A, will cut the curve again in ſome point M.

Prop. VI. If from any point C, in the axis, the line CF be drawn, cutting the curve in D and F, and alſo the ordinates, DB and FQ. Then $CA^2 = AB \times AQ$. For, by Prop. 3. Cor. 2. $Ab : AQ :: BD^2 : QF^2$; and by ſimilar triangles $:: \overline{CA + AB}^2 : \overline{CA + AQ}^2$; whence $AB \times \overline{CA^2 + 2CA \times AQ + AQ^2} = AQ \times \overline{CA^2 + 2CA \times AB + AB^2}$, and $AB \times CA^2 + AQ^2 = AQ \times \overline{CA^2 + AB^2}$; therefore $\overline{AQ - AB} \times CA^2 = AQ^2 \times AB - AB^2 \times AQ = \overline{AQ - AB} \times AQ \times AB$. Conſequently $CA^2 = AQ \times AB$.

Prop. VII. If AB (*fig.* 6,) be perpendicular to the axis AE; and if EG be an ordinate and AG be drawn. Then any line BF being drawn parallel to the axis AE, cutting the curve in M, and EG in F, the lines BM, BD, and BF, will be in continued proportion. For (by Prop. 3, Cor. 2) $AP : AE :: PM^2$ or $CD^2 : EG^2$; and by ſimilar triangles $:: AC^2 : AE^2$; conſequently $AP : AC :: AC :: AE$; that is $BM : BD :: DD : BF$.

Prop. VIII. If from any point in the curve, as M (*fig.* 7.) a line be drawn to the focus, as MF; and if MD be drawn parallel to the axis, cutting the directrix BD in D, and DF be joined; then the line MG drawn through the middle of DF will touch the curve in M. Demonſtration. From any other point *m* in the line MG, draw MF to the focus, and *md* perpendicular to BD; then ſince $MF = MD$, and $mF = mD$, the triangles FMD and F*m*D are iſoceles, and $FG = GD$; but the angle D*dm* being right, D*m*, or *m*F is greater than *dm*; therefore the point *m*, by the generation of the parabola is without the curve.

Cor. I. If the tangent MD be continued to cut the axis at T, the diſtance of the focus and interſection is equal to the diſtance of the focus and point of contact, viz. $FT = FM$.

Cor. II. The tangent MG biſects the angle DMF, made by the line perpendicular to the directrix, and that drawn to the focus.

Cor. III. A line drawn from any point M to the focus, parallel to the axis, make equal angles with the curve, viz. $FMm = OMr$.

As it is incompatible with the bulk and nature of this work to lay down the demonſtration of every truth we advance, and as it is only the propoſitions, or properties of the curves, that are wanted in uſeful occurrences, we judge it will be more acceptable to our readers to ſuppreſs many of the demonſtrations, than to omit informing them of thoſe propoſitions and properties, which may ſerve as rules or theorems for reſolving many practical matters; thoſe who are curious in demonſtrations may exerciſe themſelves therein; and if they have attained a tolerable knowledge in plain geometry, and trigonometry, and have a perfect underſtanding of thoſe demonſtrations that are given, they will not find much difficulty in demonſtrating the remaining propoſitions.

Prop. IX. If the tangent at M cut the axis AB at T, then the diſtance of the interſection from the vertex (AT) $=$ AP, the abſciſſa to the ordinate PM. From this propoſition are alſo derived the following Corollaries.

Cor. I. The ſubtangent PT is double the abſciſſa AP.

Cor. II. The tangent at the vertex A is perpendicular to the Axis AB.

Cor. III. All parabolas having the ſame abſciſſa will have their tangents meeting in the ſame point of the axis.

Prop. X. If two parabolas be deſcribed on the ſame axis, the ordinates will be proportional, or in a given ratio. This is eaſily demonſtrated from Prop. 3, and alſo this following Corollary, viz. The correſpondent ordinates of two parabolas deſcribed on the ſame axis, are in the ſubduplicate ratio of the parameters.

Prop. XI. If F be the focus, MR, perpendicular to the tangent MT, then the ſubnormal (PR) or diſtance of the ordinate from the point of interſection $=$ half the latus rectum.

Cor I. $FT = FM = FR$; and a circle deſcribed with the radius FM, and centre F, will paſs through T, M and R.

Cor. II. The angle MFR is double the angle MTR.

Cor. III. If RS be perpendicular to MF; then $MS =$ half the latus rectum.

Cor. IV. Hence $MS = RP = 2\,AF = \frac{1}{2}$ parameter.

Prop. XII. If MT be a tangent at any point M, AG a tangent at the vertex; and if FG be perpendicular to MT, from the focus, it will paſs through the interſection G.

Cor. I. If MP, be an ordinate, then will $AG^2 = AP \times \frac{1}{4}$ latus rectum, $= AG^2 \times AF$.

Cor. II. $AG =$ half the ordinate MP.

Cor. III. FA, FG, and FM, are in continued proportion.

Prop. XIII. If F be the focus, MR perpendicular to the curve at M, then $RM^2 = RF \times$ latus rectum.

Prop. XIV. If FH be an ordinate at the focus (*fig.* 7.) FHG a tangent at H, PM an ordinate continued to the tangent at G, then $TP = FM = PG$.

Cor. If AL be a tangent at the vertex, then $TA = AL = AF = \frac{1}{4}$ parameter; and $TF = FH = \frac{1}{2}$ parameter.

Prop. XV. In any diameter as MK (*fig.* 8,) the abſciſſas are as the ſquares of the ordinates, viz. $ML : MK :: LQ^2 : KG^2$.

Cor. Any diameter interſects the curve only in one point, viz. in the vertex to the diameter.

Prop. XVI. In any diameter as FH (*fig.* 8.) the ſquare of any ordinate (LQ) is equal to the rectangle of its parameter, and the abſciſſa ML.

Cor. I. The parameter is a third proportional to the abſciſſa and ordinate.

Cor. II. If MP be perpendicular to the axis AP, then the latus rectum of the diameter ML, exceeds the latus rectum of the axis by $4AP$.

Cor. III. If MC is perpendicular to the tangent MT, then $TC = \frac{1}{2}$ latus rectum of the diameter ML.

Cor. IV. The line GC (*fig.* 4) perpendicular to the directrix $BD = \frac{1}{4}$ of the latus rectum of the diameter GH.

Prop. XVII. In any diameter, the whole ordinate paſſing through the focus, is the latus rectum to that diameter, and is equal to four times its abſciſſa.

Cor. I. The abſciſſa in ſuch caſe is equal to the diſtance of the focus from the vertex.

Cor. II. The rectangle of the two parts of the whole ordinate intercepted between the focus and the curve, is equal to the rectangle of half the whole ordinate by half the parameter.

Prop. XVIII. If MK (*fig.* 8.) be any diameter, and DL be an ordinate to it, and DK perpendicular to it, then $DK^2 = ML \times$ latus rectum of the axis.

Cor. I. The ſquares of the perpendiculars DK, are as the abſciſſas ML.

Cor. II. If from the vertices M, G, of two diameters, MK and QV, two ordinates be drawn, QL and MV, then the abſciſſas MK and QV, will be equal.

Prop. XIX. If from any point M, a tangent be drawn, to cut any diameter QV, in N, (*fig.* 8.) and the ordinate MV be drawn, then the diſtance QN, from the interſection to the vertex, is equal to the abſciſſa QV.

Cor. I. The ſubtangent VN, is double the abſciſſa QV.

Prop. XX. If BD, be a directrix, (*fig.* 9.) GL, any diameter, ML, an ordinate, MT, a tangent, MK, perpendicular to GL, then the ſquare of the tangent (MT^2) is to the ſquare of the ordinate, (ML^2) as the diſtance of the point of contact from the directrix (MD) to $\frac{1}{4}$ the latus rectum of GL. From this propoſition are deduced the following corollaries. 1. If the diameter GL, becomes the axis, then the ſquare of the tangent (MT^2) is to the ſquare of the ordinate (MP^2) as $AF + AP$ to AF, that is as the latus rectum of MK, to the latus rectum of the axis. 2. The ſquare of the tangent MT, is to the ſquare of the perpendicular MK, as the diſtance of the point of contact and directrix MD, $\frac{1}{4}$ the parameter of the axis AB. 3. $ML^2 : MK^2 :: FG : AB$. 4. $LK^2 = 4HG \times GL$. 5. $MT^2 =$ rectangle $4FK \times GL$.

Prop. XXI. If any diameter interſect two parallel lines, the rectangle of the ſegments of the lines will be as the ſegments of the diameter, viz. in (*fig.* 8.) $DL \times LQ : RK \times KG :: ML : MK$.

Cor. If any line RG, be cu tby two diameters, QX and AS, the rectangle of the parts are as the ſegments of the diameters, viz. $RX \times XG : RS \times SG :: QX : AS$.

Prop. XXII. In any diameter, as its latus rectum, is to the ſum of any two ordinates, ſo is their difference to the difference of the abſciſſas.

Prop XXIII. *fig.* 10. If AC be a tangent at A, AH any line drawn within the parabola, DF any diameter, cutting the tangent in B, and the line AH in F, then $AF : FH :: BD : DF$.

Cor. I. If LG be any diameter, AH an ordinate; AC a tangent at A; HC parallel to GL, then $AH^2 = HC \times$ parameter of LG, alſo $HC = 4LG$; and $AF^2 = BD \times$ parameter of LG.

Prop. XXIV. If any circle, cut a parabola in four points, and from the points of interſection ordinates be drawn to the axis, the ſum of the ordinates, or one ſide of the axis, is equal to the ſum of the ordinates on the other.

Prop. XXV. If LC, NC, DF, (*fig.* 11.) be three tangents, at LN and A, then will $DA : AF :: LD : DC :: CF : FN$.

Prop. XXVI. All parabolas are ſimilar figures, and therefore if their parabolas have their parameters and abſciſſas equal, they will be both equal and ſimilar.

Prop. XXVII. Two equal parabolas upon the ſame axis, but havihg different vertices, approach infinitely near one another, but never meet.

PROBLEMS RELATING TO THE PARABOLA.

Prob. I. To deſcribe a parabola by local motion. This is done by Definition I.

Prob. II. The axis and parameter being given to deſcribe the parabola, (*fig.* 12.) Let AC be the axis, make $AF = AB = \frac{1}{4}$ latus rectum. Draw KCL perpendicular to AC. From the center F with the radius BC, cut KL in K and L, which are the points of the curve; and the like for more points.

Prob. III. Any diameter in a parabola being given to draw an ordinate from a given point in the curve. Let AB (*fig.* 13) be the diameter, H the given point; through H draw HC parallel to AB; and at the ſame diſtance from AB on the other ſide, draw DL parallel to AB, to cut the curve in L; then draw HL, which will be a double ordinate to AB.

Prob. IV. To any given point M of a parabola, (*fig.* 14) to draw a tangent. From the given point M draw MG parallel to the axis AB, and make $MG = MF$. Draw GF, and biſect it in D, and draw DM for the tangent at M.

Prop. V. The focus F of a parabola being given, (*fig.* 15) and three points in the curve M, N, P, to deſcribe the parabola. Through NM and alſo NP, draw the lines NK and NI; and draw MF, NF, PF, to the focus. Then make $FN : FM :: NK : MK$; and $FN : FP :: NI : PI$. Through K and I draw the line KI, and FT perpendicular to it from the focus; biſect FT in A, for the vertex; then with the focus F, and directrix IK, deſcribe a parabola through the point M (by Prob. 2), which will paſs through the points NP.

SECT. II. OF THE ELLIPSES.

Definitions. 1. If two pins be fixed at the points F and S (*fig.* 16;) and if a thread PSFP, be put about them and knotted at P, and if the ſame be drawn tight, and the point P and the thread be moved about the fixed centres F, S, the point P will deſcribe the curve PD*p*BEAP, called an ellipſes. 2. The points or centres F and S are named the *foci*. 3. The line AB drawn through the foci to the curve, is called the *tranſverſe axis*. 4. The point C in the middle of the axis AB is the centre. 5. The line DE (drawn through the centre C) perpendicular to the tranſverſe axis, is called the *conjugate axis*. 6. Any line (TO) (*fig.* 17.) drawn through the centre C to the curve, is named a *diameter*, and the extremity T (or O) its vertex. 7. If TO be a diameter, then the diameter GK drawn parallel to the tangent at its vertex T is named its *conjugate*, and the two diameters TO, and GK are ſaid to be conjugates to one another. 8. The line LR drawn through the focus F perpendicular to the tranſverſe axis AB, is called the *parameter*, or latus rectum. 9. A line drawn from any point of the curve, as HI perpendicular to the tranſverſe axis, is called an ordinate to the tranſverſe; and in general, any line drawn from the curve to any diameter TO parallel to its conjugate GK (as HN) is an ordinate to that principal diameter TO. If it go quite through the figure as H *h*, it is called a double ordinate. 10. A right line meeting the ellipſes in one point, M, but which does not cut the ſame, is named a tangent, to it in that point, as TM. 11. The part of the diameter between the vertex, and the ordinate, is named the *abſciſſa*.

Prop. I. FP, SP, drawn from the foci to any point of the curve is equal to the tranſverſe axis AP, (*fig.* 16.) For by conſtruction $PF + PS = AF + AS = AF + AF + FS = 2AF + FS$. And the ſame $PF + PS = 2BS + FS$. Therefore $2AF + FS = 2BS + FS$, and $2AF = 2BS$ or $AF = BS$; whence $PF + PS = 2AF + FS = AF + BS + FS = AB$.

Cor. The two foci are equally diſtant from the vertices, and alſo equally diſtant from the centre.

Prop. II. A line drawn from the end of the conjugate axis to the focus, is equal to half the tranſverſe, viz. $DF = AC$ (*fig.* 16.) Draw DS to the other focus, then the two triangles CDF and CDS are equal and ſimilar; for $SC = CF$, the angles at C are right, and CD is common; and conſequent $SD = DF$ and as their ſum $(SD + DF) =$ the tranſverſe by the laſt propoſition, one of them $DF =$ half the tranſverſe CA.

Cor. the diſtance of the foci is a mean proportional between the ſum and difference of the tranſverſe and conjugate axes.

Prop. III. The rectangle of the focal diſtances from either vertex, is equal to the ſquare of the ſemi-conjugate, $AF \times FB = DC^2$. For $DC^2 = DF^2 - CF^2 =$ (by Prop. 2.) $CA^2 - CF^2 = \overline{CA + CF} \times \overline{CA - CF}$, by Theorem V. Sect. II. of Plain Geometry $= \overline{BC + CF} \times \overline{CA - CF} = BF \times FA$.

Prop. IV. As the tranſverſe axis is to the conjugate ſo is the conjugate to the latus rectum of the tranſverſe, viz. $AB : DE :: DE : LR$. For $SL + LF = BA = 2CA$ (Prop. 1.) and $SL = 2CA - LF$, and by ſquaring, $SL^2 = 4CA^2 - 4CA \times LF + LF^2$. And in the right angled triangle SLF $+ SL^2 = SF^2 + LF^2$; whence $4AC^2 - 4CA \times LF = SF^2 = 4CF^2$, and $4AC^2 = 4CA \times LF + 4CF^2 = 4CA \times LF + 4DF^2 - 4DC^2$; and $4AC^2 + 4DC^2 = 4CA \times LF + 4DF^2$; but $CA^2 = DF^2$ (by Prop. 2.); therefore $4DC^2 = 4CA \times LF = 2CA \times 2LF$; that is $DE^2 = BA \times LR$.

Cor. I. As the ſemi-tranſverſe is to the ſemi-conjugate, ſo is the ſemi-conjugate to half the latus rectum, viz. $CA : DC :: DC : LF$.

Cor. II. As the ſemitranſverſe is to the diſtance of the focus from the centre, ſo is the ſame diſtance to the difference between the ſemitranſverſe, and half the latus rectum, viz. $FC^2 = CA \times \overline{CA - LF}$.

Cor. III. The rectangle $BFA =$ half the tranſverſe $\times$ half the latus rectum $= CA \times FL$.

Schol. Since the tranſverſe axis is to the conjugate, as the conjugate is to the latus rectum of the tranſverſe axis; therefore in any other diameters, the third proportional to the diameter and its conjugate is called the *latus rectum* of that diameter.

Prop. V. From any point M in the curve, (*fig.* 18) if the lines to the foci MF and MS be drawn, and the ordinate MP, perpendicular to the axis BA, it will be as the ſemitranſverſe (CA) is to the diſtance of the focus from the centre (CF), ſo is the diſtance of the ordinate from the centre (CP) to half the difference of the lines MF and MS; or to $\frac{MS - MF}{2}$.

For make $SD = CA$, then $SM = CA + DM$ and $FM = 2CA - SM = CA - DM$. In the right angled triangle SMP, SM^2, or $CA^2 + 2CA \times DM + DM^2 = SP^2 + PM^2 = \overline{CF + CP}|^2\ PM^2 = CF^2 + 2CF \times CP + CP^2 + PM^2$, and in the right angled triangle FMP, FM^2 or $CA^2 - 2CA \times DM + DM^2 = FP^2 + PM^2 = \overline{CF - CP}|^2 + PM^2 = CF^2 - 2CF \times CP + CP^2 + PM^2$; and ſubtracting the latter equation from the former $SM^2 - FM^2 = 4CA \times DM = 4CF \times CP$, and $CF \times CP = CA \times DM$. But ſince $SM = CA + DM$, and $FM = CA - DM$; therefore $SM - FM = 2DM$, and conſequently $CF \times CP = CA \times \frac{SM - FM}{2}$.

Cor. I. If F, S, be the foci, MP an ordinate, then it is as $CA : CF :: CP : \overline{CA - MF}$ or $\overline{SM - CA}$.

Cor. II. If F, S, be the foci, MP an ordinate, then the difference of the ſquares of the lines SM and FM, viz. $SM^2 - FM^2 = 4CF \times CP$.

Cor. III. $CA \times \overline{SM - FM} = 2CF \times CP$.

For the ſake of enumerating the more propoſitions and properties of the ellipſis, in what follows the demonſtrations are ſuppreſſed.

Prop. VI. If an ordinate (MP) be drawn to the tranſverſe axis, (*fig.* 18.) it will be as the ſquare of the tranſverſe (BA^2) is to the ſquare of the conjugate (NE^2) ſo is the rectangle of the ſegments of the tranſverſe ($BP \times PA$) to the ſquare of the ordinate. (PM^2)

Cor. I. $CA^2 : CN^2 :: BF \times FA : PM^2$.

Cor. II. As the tranſverſe BA : to its latus rectum :: rectangle $BP \times PA$: the ſquare of the ordinate or PM^2.

Cor. III. The rectangles of the ſegments of the tranſverſe are as the ſquares of the ordinates.

Cor. IV. As the ſquare of the ſemitranſverſe (CA^2) rectangle of the focal diſtances from the vertex ($BF \times FA$) :: rectangle of the ſegments ($BP \times PA$) : ſquare of the ordinate (PM^2).

Prop. VII. If the ordinate MG (*fig.* 18) be drawn perpendicular to the conjugate NE, it will be as the ſquare of the ſemiconjugate : ſquare of the ſemitranſverſe :: rectangle of the ſegments of conjugate $NG \times GE$ to the ſquare of the ordinate MG; or MG^2.

Cor. The whole ordinate to the tranſverſe or conjugate axis is biſected by that axis, and equal ordinates are equally diſtant from the centre.

Prop. VIII. If MP be ordinate to the tranſverſe (*fig.* 18) F, S, the foci, and if CA be to CF as CP to CI, then the rectangle $SM \times MF = CA^2 - CI^2$.

Cor. I. If $CA : CF :: CP : CI$, then $FM = AI$ and $SM = BI$.

Cor. II. $CA : CF :: CP : CA - FM$ or $SM - CA$.

Prop. IX. If MP be an ordinate to the tranſverſe as before, then $CM^2 = CA^2 + CE^2 - SM \times MF$.

Cor. I. If $CA : CF :: CP : CI$, then $CM = EI$, and the rectangle $BP \times PA =$ rectangle $SI \times IF + PM^2$.

Prop. X. (*fig.* 18.) The lines SM and FM drawn from the foci to any point M in the curve, make equal angles with the curve in that point.

Cor. If a line MO be drawn perpendicular to the tanges MT in M, the angles FMO and SMO are equal.

Prop. XI. If MP be an ordinate to the tranſverſe (*fig.* 18) and MO perpendicular to the tangent at M, and S, F, the foci, then $CA^2 : CF^2 :: CP : CO$.

Cor. I. $CA^2 : CD^2 :: CP : PO$.

Cor. II. $2\,CA$: latus rectum $:: CP : PO$.

Cor. III. $CA : MF :: CF : OF$.

Prop. XII. MO, as before being perpendicular to the tangent in M, then $MO^2 = SM \times MF - SO \times OF$.

Cor. I. $MO = \frac{CD}{CA}\sqrt{SM \times MF}$; or $CA^2 : CD^2 :: SM \times MF : MO^2$.

Cor. II. $SM \times MF = MO^2 + BO \times OA - CD^2$.

Prop. XIII. If through any point M (*fig.* 19.) the line SG, equal to BA, be drawn from the focus F, and the line MD be drawn to the middle of FG, then MD will touch the curve in M.

Cor. I. The tangent at M biſects the external angle FMG made by two lines drawn from the focus.

Cor. II. The tangent at A and B are perpendicular to the tranſverſe axis AB; likewiſe a tangent at the end of the conjugate is perpendicular to the conjugate.

Prop. XIV. If PM (*fig.* 20.) be an ordinate, AD a line drawn from the ends of the tranſverſe and conjugate axes, and PQ parallel to AD then $PM^2 = CD^2 - CQ^2 = DQ \times QE$.

Prop. XV. If PM be an ordinate as before, and MH be drawn perpendicular to the curve at M, cutting the tranſverſe and conjugate axes at O and H, it will be as $OP : OC :: CD^2 : CF^3$, F being the focus.

Cor. I. $CD^2 : CF^2 :: MO : OH :: MP : CH :: PO : CO$.

Cor. II. If L be the latus rectum of AB, then as $L : AB - L :: MO : OH :: OP : OC :: MP : CH$.

Cor. III. $CA^2 : CD^2 :: CH + PM : PM :: CP : OP$.

Prop. XVI. If PM be an ordinate to the tranſverſe, MT a tangent at M, then CP, CA, and CT, are in continued proportion, C being the center.

Cor. I. If MO be perpendicular to MT, then OP, CD, and CT, are continually proportional.

Cor. II. $BP : PA :: BT : AT$, and conſequently BT is harmonically divided in the points P and A.

Prop. XVII. If MG be an ordinate to the conjugate, MV a tangent at M, C the center, then CG, CD, CV, are in continued proportion.

Cor. I. If MH be perpendicular to the tangent MV, then HG, CA, CV are continual proportionals.

Cor. II. $EG : GD :: EV : DV$; and EV is harmonically divided in the points G, D.

Prop. XVIII. If on the tranſverſe axis AB (*fig.* 21) as a diameter, a circle AKB be deſcribed, and the ordinate PM be drawn cutting the circle in N, then PN will always be to PM in the given ratio of the ſemitranſverſe CA to the ſemiconjugate CD.

Cor. If a circle be deſcribed on the conjugate axis DE, as a diameter, and an ordinate QR be drawn cutting the circle in I, then QI will always be to QR in the given ratio of the ſemiconjugate CD to the ſemitranſverſe CB.

Prop. XIX. (*fig.* 21.) If the line FD be drawn from the focus, perpendicular to any tangent MD, then the interſection D will be in the circumference of the circle ADB, deſcribed on the diameter BA, the tranſverſe axis.

Cor. I. If a circle be deſcribed on the tranſverſe AB, and a tangent be drawn at M cutting it in D, H, and the lines FD and SH be drawn from the foci; then FD, and SH, are perpendicular to the tangent HMD.

Cor. II. If FS, be the foci, C the center, MD a tangent at M, then if CD be drawn parallel to SM to cut the tangent in D, CD and CA will be equal to each other.

Cor. III. If a tangent HD interſects the circle AHB, in D and H, the perpendiculars to it, DF and HS will paſs through the foci F and S.

Cor. IV. If CI be drawn parallel to the tangent at M, then will $IM = CA$.

Prop. XX. The lines SH and FD being drawn perpendicular to the tangent MD as before, $SH \times FD$ will be equal to $BS \times SA$.

Cor. $SH \times FD =$ the ſquare of the ſemiconjugate.

Prop. XXI. The tangent being produced to T, and the reſt as before, $HM : MD :: HT : TD$.

Cor. $HM : MD :: TC + CS : TC - CF$.

Prop. XXII. The ſame things being ſuppoſed as before, $HM \times MD = SM \times MF =$ the ſquare of the ſemiconjugate.

Prop. XXIII. $SM : MF ::$ ſquare of the ſemiconjugate : FD^2; and $MF : MS ::$ ſquare of the ſemiconjugate : SH^2.

Prop. XXIV. (*fig.* 22) If MP be an ordinate to the tranſverſe HMT a tangent at M, C the center; AK, CG, BH, perpendicular to AB. Then it will be as $AK : PM :: CG : BH$.

Cor. $TA : TP :: TC : TB$.

Prop. XXV. The ſame things being ſuppoſed as before $AK \times BH = PM \times CG = CD^2$, or the ſquare of the ſemiconjugate.

Cor. I. $AK \times BH = PM \times CG = \frac{1}{4}BA \times$ latus rectum $= BS \times SA$.

Cor. II. Lines drawn from H and K to the focus, make a right angle HSK.

Cor. III. Hence a circle deſcribed on the diameter HK, will paſs through the foci, SF.

Prop. XXV. (*fig.* 21.) If S, F, be the foci, HMD a tangent at M, MO perpendicular to it, and OG perpendicular to SM, then MG is equal to half the latus rectum.

Cor. I. If $L =$ the latus rectum of the tranſverſe axis, then $AB - L : L :: SO \times OF : MO^2$.

Cor. II. If MH be perpendicular to the curve at M, cutting the two axes in O and H, then $SO \times OF = MO \times OH$.

Prop. XXVI. (*fig.* 23.) If two circles BDA, KLV, be deſcribed about the ſemitranſverſe and conjugate diameters; and CD be drawn, and form D, DP perpendicular to BA; and from L, LI perpendicular to DP, then the point I will be in the ellipſis.

Prop. XXVII. The ſum of the ſquares of any two diameters which are conjugate to each other is equal to the ſum of the ſquares of the tranſverſe and conjugate axes.

Prop. XXVIII. All circumſcribing parallelograms, whoſe ſides are parallel to two conjugate diameters, are equal to the rectangle of the two axes.

Prop. XXIX. (*fig.* 24.) If CK be the ſemiconjugate to MC, and LQ an ordinate thereto, then $CM^2 : CK^2 :: ML \times LV : LQ^2$.

Cor. I. MV : its latus rectum $:: ML \times LV : LQ^2$.

Cor. II. The rectangles of the ſegments of any diameter are as the ſquares of their ordinates.

Cor. III. The diameter biſects all its double ordinates, and the ordinates are equal at equal diſtances from the center.

Prop. XXX. (*fig.* 21.) If MT, a tangent in M, cut the diameter BA in T, and the ordinate MP be drawn, then CP, CA, and CT, are continually proportional.

Cor. I. $BP : PA :: TB : TA$; and therefore BT is harmonically divided in A and P.

Cor. II. $PC : PA :: PB : PT$.

Cor. III. $TA : TP :: TC : TP$.

Cor. IV. Two tangents drawn from equal ordinates on each ſide the curve meet in the diameter.

Prop. XXXI. (*fig.* 25.) If two lines TL, TM, touch the ellipſis in H and K, and HK be drawn, and alſo if there be drawn from T any line as TI cutting HK in D, and the curve in F and I, then $TF : TI :: DF : DI$.

Prop. XXXII. If TH and TK, be two tangents at H and K, and HK be drawn, and any line SR cut HK, and the curve in D, X and Y, then $DS^2 : DR^2 :: XS \times SY : YR \times RX$.

Prop. XXXIII. (*Fig.* 26.) If any line GP, be drawn through the focus F, then the rectangle $GF \times FP = \frac{1}{2}GP \times \frac{1}{2}$ latus rectum.

Prop. XXXIV. As the tranſverſe axis is to the conjugate, ſo is the area of a circle, whoſe diameter is tranſverſe to the area of the ellipſis.

Cor. I. The area of a circle deſcribed on the conjugate, is to the ellipſis, as the conjugate is to the tranſverſe.

Cor. II. The correſpondent ſegments of the circle and ellipſis, are in the ſame proportion as the wholes.

Cor. III. The ellipſis is a mean proportion between two circles, deſcribed on the tranſverſe and conjugate diameters.

Cor. IV. The ellipſis is equal to a circle, whoſe diameter is a mean proportion between the two axes.

Cor. V. An ellipſis is to the rectangle of the two axes, as any circle is to the ſquare of its diameter.

Cor. VI. The area of ellipſes, are to one another, as the rectangles of their tranſverſe and conjugate axes.

PROBLEMS RELATING TO THE ELLIPSIS.

Prob. I. To deſcribe an ellipſis by motion. This may be performed by Definition I.

Prob. II. (*fig.* 27.) To deſcribe an ellipſis, by finding ſeveral points in the curve. About the axes AB deſcribe the circle

AEB; divide CB, into any number of equal parts, CL, LL, LL, &c. and draw LF, LF, LF, &c. parallel to CE, draw DB and L*o*, L*o*, L*o*, &c. parallel thereto; or rather from L neareſt to C, draw L*o* parallel to DB, and divide CD into parts equal to C*o*; draw *or*, *or*, *or*, &c. parallel to AB, and each equal to its correſpondent LF; then *r*, *r*, *r*, &c. are in the curve of the ellipſis.

Prob. III. (*fig.* 28.) Any diameter AB, being given in an ellipſis to find its conjugate. Draw HI, parallel to AB. Biſect AB and HI, in C and G, and through C and G, draw the conjugate DE.

Prob. IV. (*fig.* 28.) Any diameter AB, being given to draw an ordinate to it, from a given point in the curve, as H. Through the centre C, draw HK; and let KL, be drawn parallel to AB; then join LH, and it will be the double ordinate required.

Prob. V. (*fig.* 29.) From any given point M, in an ellipſis to draw a tangent. From the given M, draw MC to the centre, and find its conjugate CB (by Prob. III.) then from M, draw MG, parallel to CR, for the tangent required.

Prob. VI. (*fig.* 30.) Given the focus F, and three points M, N, P, of an ellipſis, to deſcribe the ellipſis. Draw NMK through two of the points, and NPI alſo through two, and draw MF, NF, PF, to the focus. Then make $FN : FM :: NK : MK$. Alſo $FN : FP :: NI : PI$. Draw KI, and MH, perpendicular to it, and FT, perpendicular to it from the focus, and make $FA : AT :: FM : MH$. Then produce TF to B, ſo that BF may be to BT, in the ſame ratio. And AB will be the axis, and the middle point C, the centre. Alſo make $CS = CF$, and S will be the other focus, from whence the ellipſis may be deſcribed by Definition I.

SECT. III.

OF THE HYPERBOLA.

Definitions.

1. If the ends of two threads, SPQ, and FPQ, (Plate II. *fig.* 31.) be faſtened at the points S and F; and be made to paſs through a ſmall bead, or pin, P, and knotted together at Q, then by taking hold of Q, and drawing the threads tight, if the bead be moved along the threads, the point P will deſcribe the curve *mp*APM, named an hyperbola. 2. If the end of the long thread be fixed at F, and that of the ſhort one at S, and the curve NBR, be deſcribed after the ſame manner, ſuch curve is called the oppoſite hyperbola; and both thoſe curves, MA*m* and NBR are named oppoſite ſections, or oppoſite hyperbolas. 3. The two fixed points F, and S, are named the foci. 4. The line AB, which paſſes through the foci when continued, and which is contained between the two parts of the curve, is called the tranſverſe axis. 5. The middle point of AB, (that is C) is the centre of the hyperbola, or of the oppoſite ſections. 6. If VY be drawn through the centre C, perpendicular to AB, and with the radius CF, and centre A, an arc be deſcribed, cutting VY in V and Y, then VY is called the conjugate axis. 7. Any line TO (*fig.* 32.) drawn through the centre C, and terminated at the oppoſite ſections, is called a diameter, and the extremity T, (or O) is its vertex; and the line drawn through the centre, parallel to the tangent at the vertex, is called its conjugate diameter. 8. If any diameter OT (*fig.* 32.) is continued within the curve, the part within, TP, is named the abſciſſa. 9. Any line PM, drawn parallel to the tangent, at the vertex T, and terminated at the abſciſſa and curve, is called an ordinate to that diameter TO. If it go quite through the curve, it is called a double ordinate. 10. The line LI (*fig.* 31.) drawn through the focus F, perpendicular to the tranſverſe axis AB, and terminated at the curve, is named the parameter, or latus rectum. 11. If the ends of the two axes be joined by the lines BY and BV, and through the centre C, two lines CH, and CG, be drawn parallel to BY and BV; or if VY, be placed at A, perpendicular to BA, and the lines CH and CG be drawn from the centre C, through E and D, then thoſe lines CH and CG, are named the aſſymptotes of the hyperbolas, or of the oppoſite hyperbolas. 12. When the tranſverſe and conjugate axes are equal, the curve is called an equilateral hyperbolas, or right angled hyperbola. 13. A right line which touches the hyperbola in one point T, (*fig.* 32.) but does not cut it (as TH) is called a tangent to it, in that point (T). 14. If two oppoſite hyperbolas, KO and TW, be in like manner deſcribed to the tranſverſe VY ($= DE$), and conjugate AB; ſuch are conjugate hyperbolas, with regard to the former.

Prop. I. The difference of the lines SP and FP, (*fig.* 31.) drawn from the foci to any point P, of the curve, is equal to the tranſverſe axis AB. For by conſtruction, $PS - PF = AS - AF = AB + BS - AF = AB$, becauſe $BS = AF$.

Cor. The foci are equally diſtant from the centre.

Prop. II. The ſquare of the diſtance of the focus from the centre, is equal to the ſum of the ſquares of the ſemitranſverſe, and ſemiconjugate. For make AE (*fig.* 31.) equal and parallel to CY, then the radius $CE = CF$, and in the right angled triangle CAE, $CE^2 = CA^2 + AE^2$; that is $CF^2 = CA^2 + AE^2 = CA^2 + CY^2$.

Cor. $CF^2 - AE^2 = CA^2$; and $CF^2 - CA^2 = AE^2 = CY^2$.

Prop. III. The rectangle of the focal diſtances from either vertex, $=$ ſquare of the ſemiconjugate. For make $AE = CY$ (*fig.* 31.) by the property of the circle $FA \times AS = AE^2 = CY^2$.

Cor. The rectangle of the diſtances of either focus from the two vertices, is equal to the ſquare of the ſemiconjugate.

Prop. IV. As the tranſverſe axis is the conjugate, ſo is the conjugate to the latus rectum of the tranſverſe, viz. $AB : VY :: VY : LI$ (*fig.* 33.) For by Prop. I. $LL - LF = BA = 2CA$, and $SL = 2CA + LF$; alſo $SL^2 = 4CA^2 + 4CA \times LF + LF^2$; and in the right angled triangle, SLF, $SL^2 = SF^2 + LF^2$; and ſubtracting LF^2, from theſe two values of SL^2, we have $4CA^2 + 4CA \times LF = SF^2 = 4CF^2$; and $CF^2 = CA^2 + CA \times LF$. But by Prop. II. $CF^2 = CA^2 + CY^2 = CA^2 + CA \times LF$; therefore $CY^2 = CA \times LF$; and multiplying by 4, $VY^2 = BA \times LI$.

Cor. I. As the tranſverſe is to the ſemiconjugate, ſo is the ſemiconjugate to half the latus rectum.

Cor. II. As the ſemitranſverſe is to the diſtance of the focus from the centre, ſo is the ſame diſtance to the ſum of the tranſverſe and half the latus rectum.

Cor. III. The rectangle $BF \times TA = \frac{1}{2}$ tranſverſe $\times \frac{1}{2}$ latus rectum $= CA \times FL$.

N. B. The third proportional to any diameter and its conjugate, is called the latus rectum of that diameter, and therefore in any right angle hyperbola, every diameter is equal to its latus rectum.

Prop. V. From any point M, in the curve (*fig.* 34.) if the lines MF and MS, to the foci be drawn, and alſo the ordinate PM, perpendicular to the tranſverſe axis AB; then it will be as the ſemitranſverſe, CA, is to the diſtance of the focus from the centre CF, ſo is the diſtance of the ordinate from the center CP, to half the ſum of the lines MS and MF. For make $CD = AC$, then $SM = CA + DM$ and $FM = SM - 2CA = DM - CA$. Alſo in the right angled triangle, SMP, $SM^2 = CA^2 + 2CA \times DM + DM^2 = SP^2 + PM^2 = \overline{CF + CP}^2 + PM^2 = CF^2 + 2CF \times CP + CP^2 + PM^2$. And in the right angled triangle FMP, $FM^2 = DM^2 - 2DM \times CA + CA^2 = FP^2 + PM^2 = \overline{CP - CF}^2 + PM^2 = CP^2 - 2CF \times CP + CF^2 + PM^2$; and ſubtracting the latter equation from the former, $SM^2 - FM^2 = 4CA \times DM = 4CF \times CP$; and $CF \times CP = AC \times DM$. But ſince $SM = DM + CA$ and $FM = DM - CA$, therefore $SM + FM = 2DM$, and $DM =$ half the ſum of SM and FM; wherefore $CF \times CP = CA \times$ half the ſum of SM and FM.

Cor. I. If F and S are the foci, and MP be an ordinate, then is $CA : CF :: CP : SM - CA$, or $FM + CA$.

Cor. II. $SM^2 - FM^2 = 4CF \times CP$.

Cor. III. $CA \times \overline{SM + FM} = 2CF \times CP$.

Prop. VI. If MP be an ordinate on the tranſverſe axis (*fig.* 34.) it will be, as the ſquare of the tranſverſe (BA^2) : ſquare of the conjugate (NE^2) :: rectangle of the ſegments of the tranſverſe ($BA \times PA$) : ſquare of the ordinate (PM^2). Make $SD = CA$, then $DM = \frac{SM + FM}{2}$, and (by Propoſi. 5.) $CA : CF :: CP : DM$; and by compoſition $CA : CA + CF$, or $BF :: CP : CP + DM$; and alternately $CA : CP :: BF : CP + DM$; and again by compoſition $CA : CA + CP$ or $BP :: BF : BF + CP + DM$. But $BF = BC + CF = SD + CF$; and $BF + CP + DM = SD + CF + CP + DM = SM + SP$. Therefore $CA : BP :: BF : SM + SP$. Alſo ſince $CA : CF :: CP : DM$, (by Diviſion) $CA : CF - CA$ or $AF :: CP : DM - CP$, and alternately $CA : CP - CA$ or $AP :: AF : DM - CP - AF$; but $AF = CF - CA = SC - SD$; therefore $DM - CP - AF = DM - CP + SD - SC = SM - SP$, and conſequently, $CA : AP :: AF : SM - SP$, and CA being to $BP :: BF : SM + SP$; therefore (by Multiplication) $CA^2 : AP \times BP :: AF \times BF : SM^2 - SP^2$. Now make CN or CE perpendicular to AB and equal to half the conjugate; then by Prop. 3, $AF \times BF = CN^2$; and $SM^2 - SP^2 = PM^2$, whence $CA^2 : AP \times PB :: CN^2 : PM^2$ or $BA^2 : NE^2 :: BP \times PA : PM^2$.

Cor. I. The ſquare of the conjugate : ſquare of the ſemitranſverſe :: rectangle of the diſtances of the ordinate from the vertices : ſquare of the ordinate, viz. $CA^2 : CN^2 :: BP \times PA : PM^2$.

Cor. II. As the tranſverſe axis : latus rectum :: rectangle of the ordinates diſtances from the vertice : ſquare of the ordinate, viz. BA : latus rectum :: $BP \times PA : PM^2$.

Cor. III. The rectangle of the abſciſſas or diſtances of the ordinates from the vertices, of the figure, are as the ſquares of the ordinates.

Cor. IV. As the ſquare of the ſemi-tranſverſe : rectangle of the focal diſtances from the vertex :: rectangle of the ordinates diſtances from the vertices : ſquare of the ordinate.

Cor. V. The whole ordinates to the tranſverſe are biſected by the axis, and equal ordinates are equally diſtant from the centre.

If the reader has acquired perfect knowledge of the plain geometry, and qualified himſelf in the preceding ſections of conics, he will be enabled to demonſtrate for himſelf, the remaining propoſitions concerning the hyperbola, and as it is the propoſitions alone that can be of uſe in practical caſes; and were we to enlarge in demonſtrations, we muſt ſuppreſs many uſeful theorems, therefore in the remaining part of this ſection, the propoſitions, with their dependent corollaries will be given without the demonſtrations; at the ſame time we are perſuaded that there is not a work of this kind ſo ample on the ſubject.

Prop. VII. If MP be an ordinate to the tranſverſe axis (*fig.* 34.) C the center; F, S, the foci; and if CA be taken to $CF :: CP : CI$, then the rectangle $SM \times MF = CI^2 - CA^2$.

Cor. I. If $CA : CF :: CP : CI$, then $SM = BI$, and $FM = AL$.

Cor. II. The rectangle $SM \times MF = BI \times AI$.

Cor. III. $CA : CF :: CP : CA + FM :: CP : SM - CA$.

Prop. VIII. The ſame things be ſupported as in the laſt Prop. $CM^2 = CA^2 - CE^2 + SM \times MF$.

Cor. IV. If $CA : CF :: CP : CI$, then the rectangle $BPA =$ rectangle $SIF - MP^2$.

Prop. VIII. If two lines SM and FM (*fig.* 34.) be drawn from the foci to any point M in the curve, they will make equal angles with the curve in that point.

Cor. I. If KMO be drawn perpendicular to the tangent at M, then the angle $KMS = FMO$.

Cor. II. If MO be drawn perpendicular to the tangent at M, and SMD and FM be drawn from the foci, the angle $FMO = DMO$.

Prop. X. If MP (*fig.* 36.) be an ordinate to the tranſverſe axis, and MO perpendicular to the tangent at M, and S, F, the foci, then $CA^2 : CF^2 :: CP : CO$.

Prop. XI. The ſame things being ſuppoſed, $MO^2 = SO \times OF - SM \times MF$.

Cor. If MQ biſects the angle SMF, and MO be perpendicular to MQ, then $SQ : QF :: SO : OF$.

Prop. XII. If SM and MF be drawn from the foci to any point M in the curve (*fig.* 34), and SG be made equal to BA and FG be drawn, and if MD be drawn to the middle of FG, then MD will touch the curve in M.

Cor. I. The tangent at M biſects the angle SMF made by two lines drawn from M to the focus.

Cor. II. The tangents at the ends of the tranſverſe axis are perpendicular to that axis.

Prop. XIII. If MP be an ordinate (*fig.* 35.) DCE the conjugate axis, then if AD be drawn to the ends of the tranſverſe and conjugate axes, and PQ parallel to it, then $PM^2 = CQ^2 - CD^2 =$ rectangle $DQ \times QE$.

Prop. XIV. If MP be an ordinate (*fig.* 36.) F the focus and HMO be drawn perpendicular to the curve at M cutting the conjugate CD in H, and the tranſverſe in O, then will $OP : OC :: CD^2 : CF^2$.

Cor. I. $CD^2 : CF^3 :: MO : OH :: MP : CH :: PO : CO$.

Cor. II. If L be the latus rectum of AB, then $L : L + AB :: MO : OH :: OP : OC :: MP : CH$.

Cor. III. $CA^2 : CD^2 :: CH - PM : PM :: CP : PO :: HM : MO$.

Prop. XV. If PM be an ordinate to the tranſverſes (*fig.* 36) MQ a tangent at M, C a centre; then CQ, CA, and CP are in continued proportion.

Cor. I. $BQ : AQ :: BP : AP$.

Cor. II. If CE be the ſemi-conjugate, MO perpendicular to MQ, and the reſt as before, then CQ, CE, and PO are in geometrical progreſſion.

Cor. III. All hyperbolas deſcribed on the ſame tranſverſe axis, AB will have their tangents to interſect at the ſame point of the axis Q, when the abſciſſa AP is the ſame.

Cor. IV. All tangents to the curve AM interſect the axis CA, between the centre, C, and vertex, A.

Prop. XVI. All hyperbolas on the ſame tranſverſe axis, will have their ordinates ſtanding on the ſame abſciſſa in a given ratio to one another; that is, as their reſpective conjugates.

Prop. XVII. If MT be a tangent at M (*fig.* 37.) and the line FD be drawn perpendicular to it from either, the interſection D will be in the circumference of a circle ADB deſcribed on the tranſverſe axis BA as a diameter.

Cor. I. If a circle be deſcribed on the tranſverſe axis AB, and a tangent at M cuts it in the points D and H, and FD, SH, be drawn from the foci to D and H, then FD, SH, are perpendicular to the tangent HMD.

Cor. II. If F, S, be the foci, C the centre, MD a tangent at M, and if CD be drawn parallel to SM to cut the tangent in D, then $CD = CA$, half the tranſverſe.

Cor. III. If a tangent MH interſects the circle $DAHB$ deſcribed on the tranſverſe, in D and H, the perpendiculars DF and SH being drawn to it, will paſs through the foci, FS.

Cor. IV. If CI be drawn parallel to the tangent at M to interſect SM, then will $IM =$ ſemi-tranſverſe CA.

Prop. XVIII. If FS be the foci (*fig.* 37.) C the centre, MH a tangent at M; and if SH and FD be drawn perpendicular to the tangent MH, then $SH \times FD = BS \times SA =$ ſquare of the ſemi-conjugate axis.

Prop. XIX. (*fig.* 37.) If FD and SH be perpendiculars to the tangent MH drawn from the foci, then $HM : MD :: HT : TD$.

Cor. $HM : MD :: CF + CT : CF - CF :: TS : TF$.

Prop. XX. If MH be a tangent at M (*fig.* 38), SH and FD perpendiculars on it from the foci, and CE the ſemi-conjugate axis, then the rectangle $HM \times MD =$ rectangle $SM \times FM - CE^2$.

Prop. XXI. The ſame things being ſuppoſed, $SM : MF :: SH^2 : CE^2 :: CE^2 : FD^2$.

Prop. XXII. (*Fig.* 39). If MP be an ordinate to the tranſverſe axis, MH a tangent at M, C the centre; AK, CG and BN perpendicular to AB, then $AK : PM :: CG : BN$.

Cor. Hence $TA : TP :: TC : TB$.

Prop. XXIII. If CE be the ſemi-conjugate and the reſt as before, then $AK \times BN = PM \times CG = CE^2 = BS \times SA = \frac{1}{4} BA \times$ latus rectum.

Cor. I. $FD \times SH = AK \times BN = CE^2$, &c.

Cor. II. The lines NS, KS, drawn to the focus, make a right angle NSK.

Cor. III. Hence a circle deſcribed on the diameter NK will paſs through the foci S and F.

Prop. XXIV. If S, F, be the foci (*fig.* 38.) MH a tangent at M, MO perpendicular to it, and OG perpendicular to SM, then MG is half the latus rectum.

Cor. If L be the latus rectum, then $AB + L : L ::$ rectangle $SO \times OF : MO^2$.

Prop. XXV. Any diameter as MN (*fig.* 40.) is biſected in the centre C.

Prop. XXVI. The difference of the ſquares of two conjugate diameters, is equal to the difference of the ſquares of the two axes.

Cor. In any equilateral hyperbola, every diameter is equal to its conjugate.

Prop. XXVII. All inſcribed parallelograms, whoſe ſides are parallel to two conjugate diameters, are equal to the rectangle of the two axes.

Prop. XXVIII. In an equilateral hyperbola, the ſquare of the ſemi-conjugate is equal to the rectangle of the diſtances of either vertex from the foci.

Prop. XXIX. In an equilateral hyperbola, the rectangle of the diſtances of the ordinate from the two vertices, is equal to the ſquare of the ordinate.

Prop. XXX. If CA (*fig.* 41.) be the ſemi-tranſverſe axis, CF and CH, the aſſymptotes, AD the ſemi-conjugate, PM an ordinate continued to F, then the rectangle $HM \times MF = AD^2$.

Cor. I. If the ordinates be continued to the aſſymptotes, the parts between the curve and aſſymptotes are equal, viz. $FM = GH$.

Cor. II. If more ordinates be drawn to cut the aſſymptotes, their rectangles are all equal.

Prop. XXXI. If from the point M of the curve, MK be drawn parallel to the tranſverſe axis AB, (*fig.* 41) cutting the aſſymptotes in I and K, then the rectangle $KMI = CA^2$.

Cor. I. The rectangle $IM \times MH = KM \times MF$.

Cor. II. If more lines be drawn parallel to CA all their rectangles are equal to one another.

Prop. XXXII. All inſcribed parallelograms between the aſſymptotes and the curve are equal.

Cor. I. The hyperbola continually approaches to the aſſymptote, but can never touch it, though continued ad infinitum.

Cor. II. If a line be drawn parallel to one aſſymptote, it will interſect the oppoſite hyperbolas in one point, and no more.

Prop. XXXIII. If two hyperbolas QE and FD, (*fig.* 42) have the ſame aſſymptotes CP, and CH, and if HDE be drawn parallel to the aſſymptote CP, then HD is to HE every where in the given ratio of CN to CP.

Cor. I. The area $FGHD$: area $QGHE$ :: ordinate GF : ordinate GQ, or as the inſcribed parallelogram CF to the inſcribed parallelogram CQ.

Cor. II. If $CG = GS = 1$, and $GF = .43429448$, then the area $FGHD$ is the common logarithm of the number GH.

PROBLEMS RELATING TO THE HYPERBOLA.

Prob. I. To deſcribe an hyperbola by continued motion. This may be done by Definitions 1 and 2.

Prob. II. To deſcribe an hyperbola by finding ſeveral points in the curve. Let BA (*fig* 43) be the axis, S, F, the foci. Take any point N beyond F, and with the extent AN, and one foot in F, deſcribe an arc M; then with the extent NB, and one foot in S, croſs the former arc at M. Thus find as many points as neceſſary and draw the hyperbola through them.

Prob. III. Any diameter AB (*fig.* 44) in an hyperbola, being given to find its conjugate. Draw any line KI parallel to AB and biſect it in L; through L and the centre C draw LC for the conjugate, which will be terminated by the conjugate hyperbolas.

Prob. IV. Any diameter AB (*fig* 45) being given to draw an ordinate to it. From a given point H in the curve, through the centre C draw the diameter HK; and from K draw KL parallel to AB; then from L draw LH for the double ordinate.

Prob. V. To draw a tangent to any point in the hyperbolas. This is done by drawing the ſemidiameter, and finding its conjugate (by Prob. 3) and then from the given point draw a line parallel to ſuch conjugate, and it will be the tangent required.

Prob. VI. The focus F (*fig.* 46) being given, as alſo three points in the curve to deſcribe the hyperbola through the two points NM, draw NMK, and alſo, through NP, draw NIP; likewiſe draw MF, NF, PF to the focus; and make $FN : FM :: NK : MK$; and $FN : FP :: NI : PI$. Then through K and I draw

KG, and FT and MH perpendicular to it. Take the points AB, ſo that FM : MH :: FA : AT :: BF : BT; ſo will BA be the axis, and C (the middle point) the centre; make BS = AF, and S will be the other focus; whence the hyperbola may be deſcribed (by Prob. 2.)

PART III.

CURVE LINES.

Having laid down the elements of thoſe curves named the conic ſections, it will be proper that nothing may be deficient in this ſyſtem, to mention the chief properties of ſuch other curves as have been inveſtigated by geometricians, and are in frequent uſe in matters of ſcience, namely the conchoid, ciſſoid, cycloid, quadratrix, logarithmic curve, ſpirals, &c. of which I ſhall treat ſeverally in theii due order.

SECT. I.

OF THE CONCHOID.

Definitions. 1. Suppoſe AQ (*fig.* 47) to be a ſtreight ruler in which the points A and B are fixed; then if this ruler be ſo moved that it always paſſes through the fixed point P, whilſt the point B ſlides along the right line CD, the curve NAFM deſcribed by the point A is called a *conchoid*, or the *conchoid of Nichomedes*. 2. If B be between A and P, the curve AFM is named the *ſuperior conchoid*. 3. If *a* is between PB, the curve *afg* is called the inferior conchoid. 4. If PT (*fig.* 48) is perpendicular to CD, and if B*a* in the inferior conchoid be greater than TP, the curve *a*P*f*ZP*g*, is called the nodated conchoid. 5. The fixed point P (*fig.* 47) is named the pole or centre of the conchoid. 6. The line CD (*fig.* 47) is called the directrix of the conchoid.

The chief properties of the conchoid are as under: — 1. All lines as AB (*fig.* 47) which paſs through the pole P, and which are comprehended between the curve and directrix, are equal. 2. The directrix of the conchoid (CD) is an aſſymptote to the curve, or approaches infinitely near, but never touches it. 3. If from any point A of the curve (*Fig.* 47) AH, and FTP be drawn perpendicular to the directrix HT, and AL parallel to it; and if the quadrant FGK be deſcribed cutting AL parallel in G; then PL × LG = TL × LA. Alſo AG = BT, and GL = HB; and this holds good likewiſe in the inferior conchoid. 4. In the ſuperior conchoid; if PTF and AH be perpendicular to the directrix HT, and AL parallel to it, then $\mathrm{TL}^2 : \mathrm{TF}^2 - \mathrm{AH}^2 :: \mathrm{PL}^2 : \mathrm{AL}^2$. Alſo putting FT = *a*PT = *b*, and axis TH = *x*, the ordinate HA = *y*, then the equation of the ſuperior conchoid is $\frac{\overline{b+y}\,\sqrt{aa-yy}}{y} = x = \mathrm{AL}$. 5. In the inferior conchoid, if P*f*T (*Fig.* 47) and *ab* be perpendicular to the directrix BT, and *al* parallel to it, then $\mathrm{T}l^2 : \mathrm{T}f^2 - a\mathrm{B}^2 :: \mathrm{P}l^2 : al^2$; alſo putting T*f* = *a*, TP = *b*, axis T*b* = *x* ordinate *ha* = *y*, the equation of the inferior conchoid will be $\frac{\overline{b-y}\,\sqrt{aa-yy}}{y} = x = al$. The ſame holds for the nodated conchoid, all the difference being, that there *a* is greater than *b*.

SECT. II.

OF THE CISSOID.

Definitions. 1, Let ABG (*Fig.* 49) be a circle, C the centre, QED a ſquare; and let P and F be two fixed points in the lines AP, and ED, ſo that GP = radius CG = EF = FD; and let CD, produced ad infinitum be perpendicular to CP; then if the ſquare QED be ſo moved that the ſide EQ may always paſs through the point P, whilſt the end D ſlides along the right line CD, the point F (in the middle of ED) will deſcribe the curve GFB, called the *ciſſord*, or the *ciſſord* of *Diocles*. 2. The circle ABG is called the generating circle. 3. The line CD is called the directrix. This curve has the following properties. 1. If AB and BG be quadrants, the ciſſoid paſſes through the point B. 2. If from any point F of the curve, FL be drawn parallel to the directrix CD, cutting the circle in M, then LM, LG, and LF are in geometrical progreſſion. Alſo if FOH be perpendicular to the directrix CD, then OD = LM, the ordinate of the circle, and putting GH = *x*, HF = *y*, and CG = *a*, the equation of the curve is $2axx - yxx = y^3$. Moreover the four lines AL, LM, LG, and LF, are in continued proportion, and if FL be produced to N, and NC be drawn, CD will be equal to FN. Likewiſe $\mathrm{FH} : \mathrm{AL} :: \mathrm{GH}^2 : \mathrm{FH}^2$. 3. If AE be perpendicular to AG, then AE is an aſſymptote to the curve. 4. Through any point X of the curve draw GY cutting the circle in M and the aſſymptote in Y, then GX = MY. 5. If GS (*Fig.* 50) be perpendicular to the diameter AG, and from any point F in the curve FN be drawn parallel to GS cutting the circle in N, and ASN be drawn, then NF = GS; the line IZ = LF; and NF being made perpendicular to AG, and GF being drawn, NF, GF, and LF are in continued proportion, as are alſo GS, GF, and LF. 6. Through any point F, NF being as before perpendicular to AG, and GS parallel to it, and ANS being drawn, then GN : GF :: GL : LF :: AG : GS. — Alſo AN : NG :: NG : GF :: GL : LF. 7. If the ſame things being ſuppoſed, $\mathrm{GA} : \mathrm{GL} :: \mathrm{GS}^2 : \mathrm{GF}^2$. 8. All ciſſoids are ſimilar figures; for the abſciſſas and ordinates of ſeveral ciſſoids will be in the ſame ratio when either of them is in a given ratio to the diameter of its generating circle.

SECT. III.

OF THE CYCLOID.

Definitions. 1. If a circle DEBL (*fig.* 51) be made to roll along the right line AF until the fixed point D, which at firſt touched the line at A, comes to touch it again at F, the point D will deſcribe the curve ADGF called a cycloid or trochoid. 2. The circle DEBL is called the generating circle. 3. The line DB perpendicular to the middle AF is the axis of the cycloid.

The cycloid has the following properties: — 1. The baſe of the cycloid AF (*fig.* 51) is equal to the circumference DEBL of the generating circle. 2. If PM be drawn parallel to the baſe BF, it will be equal to the arc DP. Alſo the ordinate of the cycloid is equal to the ſum of its arc and its ſine, viz. AM = DP + AP. 3. If AM be an ordinate cutting the circle in P; MT a tangent at M, then MT is parallel to the chord PD. Alſo if ME be parallel to PB then ME is perpendicular to the curve in M; likewiſe AP : AD :: AM : AT. 4. If the ordinate APM be drawn, then the arc of the cycloid DM is double the correſpondent chord DP, in the generating circle. Hence the length of the ſemicycloid DMF is double the diameter AB; and the length of the whole cycloidal curve is four times the diameter of the generating circle. Alſo DA, the arc DM, and 4 AB, are in continued proportion; and DA, arc DM, and 2DF, are in continued proportion. 5. If AM be an ordinate, and DA the abſciſſa, then $\mathrm{DB} : \mathrm{DA} :: \mathrm{DF}^2 : \mathrm{DM}^2$. And the abſciſſa DA is directly as the ſquare of the arc DM. 6. If MS be perpendicular to the baſe BF, then $\mathrm{DB} \times \mathrm{MS} = \mathrm{DB} \times \mathrm{MF} - \frac{1}{4}\mathrm{MF}^2$. 7. If MS be perpendicular to the baſe as before, and MA parallel to it, then SF = arc BP — ſine AP. 8. If APM be an ordinate, DN parallel to it, and NM parallel to AB, then the external cycloidal ſpace DNM is equal to the circular ſegment DAP. Alſo the area of internal cycloidal ſpace is equal to the rectangle DA × AM — the circular area AGD; and the area of the whole cycloidal ſpace DMFB is equal to thrice the area of the ſemicircle ADB = alſo to $\frac{3}{4}$ of the circumſcribing parallelogram; likewiſe the whole cycloidal ſpace without the circle DPBFM is double the ſemicircle DPB.

SECT. IV.

OF THE QUADRATRIX.

Definitions. 1. If ACBL (*Fig.* 52.) be the quadrant of a circle, and ſuppoſe the radius CL to move uniformly round the center C from A to B, and at the ſame time the line FG to move uniformly along AC, from A to C, and in a parallel poſition to CB, ſo that both motions may begin and end together. Then the point of interſection N, of the lines CL and FG, during the motion, will deſcribe the curve AND, named the *quadratrix*, or the *quadratrix* of *Dinoſtratus*. 2. The circle ALB is called the generating circle. 3. The radius AC is called the axis, and CD the baſe.

The following are the properties of this curve: 1. If through any point N of the curve the radius CNL be drawn, and NF be parallel to CB, then AF : AC :: angle ACN : angle ACD; and as AF : FC :: angle ACN : angle NCD. Alſo the abſciſſas AF are as the angles at the center ACN. 2. The baſe is a third proportional to the quadrant and the axis, viz. ALGB : AC :: AC : CD. 3. If with the radius equal to the baſe CD, the quadrantal arc DPH be deſcribed, the ſame will be equal to the axis AC. 4. If through any point N of the curve, the radius CL be drawn and FN be parallel to the baſe, then CD : CA :: AF : arc AL. 5. Upon the baſe CD, if the quadrant DPH be deſcribed as before, and if through any point N of the curve NF be drawn perpendicular to AC, and CN, be drawn cutting the inſcribed quadrant in P, then AF will be equal to the arc HP; and FC = arc PD. 6. If the radius CA (*Fig.* 53) be continued to Q, ſo that AQ = AC, and the ſemicircle BAK be deſcribed; and if it be made AQ : AF :: AK : AL, and CL be drawn, and FN be parallel to CK, cutting CL in N, then will N be in the curve of the quadratrix continued without the circle, where the quadratrix DAN may be continued ad infinitum, by finding a ſufficient number of points N, *n*, &c.

N. B. The line QX, erected perpendicular to the line QAC, is an aſſymptote to the curve.

SECT. V.

OF THE LOGARITHMIC CURVE.

Definitions. 1. If in the line AE (*fig.* 54.) the parts AB, AC, AD, AE, &c. be taken in arithmetic progreſſion from the fixed point A, and at the points A, B, C, D, E, &c. the ordinates AF, BG, CH, DI, and EK, &c. be drawn parallel to one another, and in geometrical progreſſion; and if theſe ordinates are ſuppoſed infinite in number, or infinitely near to each other, then the curve line FGHIK, deſcribed through the extremities of all the ordinates is called the logarithmic curve. 2. The line AE is named the axis of the curve. The chief properties of this curve are the following: 1. The axis AE is an aſſymptote to the curve. 2. If TI is a tangent to the curve at I and DI an ordinate, then the ſubtangent TD is every where the ſame, in whatever place the point I be taken. 3. The ſpace (BDIG) comprehended between any two ordinates (BG and DI) is equal to the rectangle of the ſubtangent, and the difference of the ordinate, viz. $=$ TD $\times$ SI. Alſo the area of the whole curve infinitely produced towards A is equal to the rectangle of the ſubtangent and ordinate, viz $=$ ID$\times$TD, likewiſe the ſpace between any two ordinates is to the ſpace between any other two, as the difference of the firſt two, to the difference of the laſt two. 4. The ſolid made by the infinitely long ſpace FKEA revolving about the axis AE is equal to half a cylinder of the ſame baſe, and height equal to the ſubtangent, viz. $= \frac{1}{2}$TD $\times$ circle DI. Therefore the ſaid infinitely long ſolid is to a cone of the ſame baſe, and whoſe height is equal to the ſubtangent in the proportion of 3 to 2. 5. If AF $= 1$, BG $= a$AE $= x \times$ AB, EK $= y$, then the equation of the curve is $y = a^x$. 6. If the ordinates AF, BG, CH, &c. repreſent numbers in geometrical progreſſion, and be placed at equal diſtances, the abſciſſas AB, AC, AD, &c. being in arithmetical progreſſion, will repreſent the logarithms of theſe numbers. Hence logarithms may be of as many different ſorts as we pleaſe, but as a multiplicity of ways would be uſeleſs, mathematicians confine themſelves to two ſorts only, 1. When AF, BG, CH, DI, &c. are 1, 10, 100, 1000, &c. and AD, AC, AD, AE, &c. are 1, 2, 3, 4, &c. which are named the common or Briggs's Logarithms, the ſubtangent being .43429448. 2. In Napier's or the Hyperbolic Logarithm, the ſubtangent is 1. 7. If DI, EK, be two ordinates, then DE $=$ Log. $\frac{\text{EK}}{\text{DI}}$.

SECT. VI.

OF THE SPIRAL OF ARCHIMEDES.

Definitions. 1. If the radius CA (*fig.* 55.) be moved uniformly round the centre C, deſcribing the circle ABDA, and at the ſame time a point is ſuppoſed to move uniformly along that radius, from C to A, ſo that both motions begin and end together, the curve CFGA, deſcribed by that point, is called the *ſpiral of Archimedes*; and if the radius produced, moved round a ſecond time, while the deſcribing point continues its motion, the curve deſcribed is the *ſecond ſpiral*, and ſo on. 2. The circle ABDA, is called the generating circle; the properties of this ſpiral, are, 1. That if F be any point in the curve, then will CF : radius CA : : arc AB : circumference ABDA. Therefore, if the angles about C, be taken in arithmetical progreſſion, the diſtances of the moving point from C, will alſo be in arithmetical progreſſion; alſo the angles about the centre, are as the diſtances of the moving point from the centre. Likewiſe, if the radius CA $= r$; the circumference ABDA $= c$; any arc ABD $= z$, and its ordinate CP $= y$ then the equation of the curve, is $y = \frac{rz}{c}$. 2. If to any point P of the cu:ve, CPD be drawn from the centre, and CT perpendicular to it; and if there be made the radius CA : arc ABD : : CP : CT, and PT be drawn, then will it be a tangent to or touch the curve in P. 3. If F be any point in the curve, and if with radius CF, the arc FS be deſcribed, then AC^2 : CF^2 : : circumference ABD : arc FG. 4. The ſpiral ſpace CFPC is equal $\frac{1}{3}$ the ſector CPQL, whoſe radius is CP, and arc PQL. Alſo the whoſe ſpiral ſpace CFPA $= \frac{1}{3}$ of the generating circle ABDA. 5. If the firſt circle be A, the firſt, ſecond, third, or fourth, &c. ſpiral ſpace will be $\frac{1}{3}$ A, $\frac{7}{3}$ A, $\frac{19}{3}$ A, A, &c. Alſo if *a*, *b*, *c*, *d*, &c. be the firſt, ſecond, third, fourth, &c. ſpiral ſpace, and AB, CD, &c. the correſpondent circles, then will *a*, *b*, *c*, *d*, &c. be reſpectively equal to $\frac{1}{3}$ A, $\frac{7}{12}$ B, $\frac{19}{27}$ C, $\frac{37}{48}$ D, &c. And the area of the n^{th} ſphiral will be $\frac{1}{3}$ A $\times 3n \times \overline{n-1}+1$. Likewiſe the ſpiral ſpaces contained between every two ſucceeding circles are 2A, 4A, 6A, 8A, &c.

SECT. VII.

LOGARITHMIC SPIRAL.

Definitions. 1. If the curve FGDA (*fig.* 56.) be drawn about the centre C, ſo that it may every where cut the radii CF, CD, CG, CA, &c. in one and the ſame angle, that curve is called the *logarithmic or proportional ſpiral*. 2. The lines CF, CD, CG, &c. are called ordinates; to this ſpiral belongs the following properties. 1. If any number of ordinates CF, CK, CD, CA, &c. be drawn (*fig.* 57.) making equal angles at the centre C, then thoſe ordinates are in continued proportion. 2. If the angles at the centre, are in arithmetic progreſſion, the ordinates will be in geometrical progreſſion. 3. The ſpiral makes an infinite number of revolutions, before it comes to the centre C. 4. Let any radius CA, cut the ſpiral in its ſeveral revolutions, then the diſtances of the ſeveral points of interſection from the centre, will be in geometric progreſſion, and that in the ratio of CA to CB. 5. If CD, CE, CF, CA, &c. (*fig.* 58.) be in geometric progreſſion, and CD $= 1$, then will the angles DCE, DCF, DCA, &c. be the logarithms of CE, CF, CA, &c.

6. If CF is an ordinate and CT perpendicular to it, and if the angle CFT be made equal to the angle of the ſpiral, then FT is a tangent at F. Hence TF is to CF every where in the ſame given ratio. 7. If FT be a tangent at F, and CT perpendicular to the ordinate CF, then will the length of the whole ſpiral FEDC be equal to the tangent TF. 8. If FS be a tangent at F, and CS perpendicular to FS; CA, CF ordinates, then FS : CF : : AC—FC : AF, the length of the ſpiral contained between the ordinates. 9. If CF be an ordinate and FT a tangent, CT perpendicular to CF, then the area of the ſpiral ſpace FDC deſcribed by a radius making an infinite number of revolutions is equal to half the triangle TCF. But the area here mentioned is that made by an infinite number of revolutions of the radius, where every ſucceeding revolution covers a part of the former, and ſo the ſame parts of the area are deſcribed over and over. The real area of the ſpiral ſpace FEDGF, comprehended between the part of the ordinate GF, and the curve FEDG is equal $\frac{\text{TC}}{4\text{FC}} \times \overline{\text{FC}^2 - \text{GC}^2}$. 10. In the ſpiral CAB (*fig.* 59.) if the ordinate CA $= 1$, and the circle ADE be deſcribed with the radius CA, and any other ordinate CB be drawn, then the arc A$=$log. CB. Alſo from the point A where it cuts the circle if the tangent AT be drawn, and CT be perpendicular to CA; and if the ſubtangent C be .43429448, then AD is Brig's logarithm of the number denoted by CB. If the ſubtangent CF be 1, then AD is Napier's Logarithm of CB.

SECT. VIII.

OF THE HYPERBOLIC SPIRAL.

Definitions. Draw any line CG (*fig.* 60,) and C as a centre, deſcribe as many arcs of circles as you pleaſe from CG, to wit, VE, GF, *gf*, &c. all equal to one another, then the curve paſſing through all the points, which terminate theſe arcs, as FE*fd*C is called the hyperbolic or reciprocal ſpiral. 2. Any right line drawn from the centre to the curve, as CF is called an ordinate. 3. The line CG is named the axis. This ſpiral contains theſe properties, viz. 1. If CA be perpendicular to the axis GC, and equal to any of the arcs VE, GF, &c. and if AB be parallel to CG, then AB is an aſſymptote to the curve. Alſo the diſtance of the aſſymptote from the axis is equal to any arc GF between the axis and the curve. 2. Through any point F of the curve, draw the arc GF and the ordinate CF, and draw any other ordinate as CE, cutting the arc GF in L, then will CF$\times$GF$=$CE$\times$arc GL. 3. If HT be a tangent at any point H, (*fig.* 61) and CT be drawn perpendicular to CH, then the ſubtangent CT $=$ arc IH, $=$ alſo CA, the diſtance of the aſſymptote from the curve. The angle CHT continually encreaſes in approaching the center; and conſequently the curve makes an infinite number of revolutions about the center. If CF and CE (*fig.* 60) be any two ordinates, theſe ordinates are reciprocally as the angles they make with the axis CG, viz. CF : CE : : $\angle$GCE : $\angle$GCF. 5. The length of the ſpiral between any two ordinates is equal to the length of the logarithmic curve, between two ordinates of equal lengths with the former, when the ſubtangents of both curves are the ſame.

6. The ſpiral ſpace F*f*RF (*fig.* 62.) continued between the curve and part of the ordinate RF $= \frac{1}{2}$ CT$\times$RF. Alſo any part of a ſpiral ſpace contained between two ordinates CF, C*f* $= \frac{1}{2}$ CF $\times$CF — C*f*, FT being a tangent to the curve at the point F. 7. The ſpiral ſpace contained between any two ordinates is equal to half the ſpace in the logarithmic curve contained betwyeen two ordinates equal to the former, when the ſubtangents of both curves are the ſame.

SECT. IX.

OF THE CATENARY.

Definition. If a ſlack heavy line or rope, equally flexable, be ſuſpended at the ends on two fixed points, then the curve which the line by its own gravity would form itſelf into, is named the catenary; or, if upon the perpendicular AB (*fig.* 63.) as an axis, and the vertex A, an equilateral hyperbola AH be deſcribed whoſe ſemi-axis AC $= a$; and alſo upon the ſame axis and vertex a parabola AP whoſe parameter is quadruple, the axis of the hyperbola and the ordinate of the hyperbola HB be always produced till HF be equal to the curve AP, then making BD and BF equal, the curve FAD, in which the points FD are poſited, is the catenage. The following are ſome of the properties of this curve. 1. The ordinate BF $=$ parabolic curve AP — correſpondent ordinate BH. 2. The curve of the catenary AF is equal to BH, the correſpondent ordinate of the conterminal equilateral hyperbola. 3. All catenaries are ſimilar to one another. 4. Two right lines ſimilarly inclined to the horizon and carried through the vertices of catenarian curves will cut off ſimilar figures. 5. If the catenary QAD be ſuſpended on the points Q and D, which are *unequally* high, the part FAD of the curve remains the ſame as if it were ſuſpended by the points F and D, which are *equally high*. 6. If the force of the cartenary drawing in the direction dD, be divided into the force $d\delta$ acting with an horizontal direction, and the force δD with a perpendicular direction, then the force, in the end of the catenary of approaching directly to the axis, is to the force of deſcending perpendicularly in the ſame, (viz. that part of the ſuſtaining force that acts in the direction BD, is to that part which acts in the direction D) as the ſemi-axis of the conterminal hyperbola AH, to DA (the length of the catenary) to the vertex, whence the catenary being given, this ratio is alſo given and in the ſame catenary, ſuſpended with different degrees of laxity, that horizontal force is as the axis of the conterminal hyperbola.

7. If a tangent to the catenary in any point D, be produced to meet the axis in F (*fig.* 63.) then will D : BT : : ($d\delta$: δD : :) a : curve DA. 8. In the catenary the fluxion of the ordinate BF, is to the fluxion of the abſciſſa AB, as the conſtant force exerted perpendicularly on the correſpondent parts of the catenary to the curve AF, or, putting AB $= x$, and the conſtant force $= a$, then $\frac{a\dot{x}}{\sqrt{2ax+xx}} : \dot{x} :: a$: curve AF, and therefore its length will be determined. Or, if AD (*fig.* 64.) be the catenarya, AB $=$ X, BD $= y$, curve line AD $= v$, and a, as before, then the equation of the curve is $vv = 2ay + yy$; and the area $= \overline{v-x} \times a$.

It muſt however, be obſerved that the catenary, though here introduced, is not a geometrical curve, and that the above expreſſion exhibiting the area thereof, though true upon mechanical and fluxional principles,' can be of little uſe in practical matters, as the quantity a, though conſtant, is not given. Wherefore the areas of curves of this kind are beſt determined by the method of equidiſtant ordinates; which method will be given in the Syſtem of Menſuration and Gauging.

SECT. X.

OF THE EPICYCLOID.

DEFINITIONS.

The epicycloid is a curve generated by the revolution of the periphery of a circle along the convex, or concave part of another circle, which part of this other circle is named the baſe of the epicycloid, as in (*fig.* 65.) DB is the baſe of the epicycloid, V, its vertex, VB its axis, DPV half of the exterior epicycloid, made by the revolution of the ſemi-circle VLB (which is called the generant) along the convex ſide of the baſe DB; in like manner, as DPu in the anterior epicycloid is formed by the generant's revolving along the concave ſide of the baſes.

The quadrature of a portion of the epicycloid is given by Mr. Caſwell in the Philoſophical Tranſactions, N° 217, as follows: Biſect the arc of the ſemicircle VB in L, and on the center C through L, draw a circle cutting the epicycloid in P, then the ſquare of the ſemidiameter of the generant circle will be to the curve linear triangle VLP, as CB, the ſemi-diameter of the baſe to CE, which CE in the exterior epicycloid is the ſum of the ſemidiameters of the baſe and generant, but in the interior epicycloid Dpu it is the difference of the ſaid diameters. Mr. Caſwell ſays he deduced his concluſion from the following propoſition, viz. the ſegments of the generant circle are to the correſpondent ſegments of the cycloid, as CB to 2CE+CB, and the whole epicycloid is to the whole generant in the ſame proportion.

It would be endleſs to enumerate the different ſpecies of curves, as they are infinitely various; but if the reader has qualified himſelf in plain geometry and the conic ſections, and made himſelf maſter of the analytic art, he will be enabled by a careful attention to the nature and geneſis of any curve, and a due application of fluxions, to inveſtigate its properties, length, quadrature, &c. let it be of what order or kind it may. I ſhall therefore conclude the Syſtem with a few uſeful remarks upon curve lines in general.

1. If the abſciſſa of a curve be repreſented by x, and the ordinate by y; and the nature of the curve be expreſſed by an equation, between x and y, then if any particular value be aſſigned to x, there will be as many values for y as is the index of its higheſt power in the equation, and no more.

2. In like manner for any particular value of y, there are as many values of x, as the higheſt power of it has dimenſions in the equation.

3. Among the ſeveral values of y for any determinate value of x, thoſe that are affirmative are drawn on the upper ſide of the abſciſſa to the curve, and thoſe that are negative, are drawn from the abſciſſa downwards to the curve; alſo among the values of x, for any particular value of y, if thoſe that are affirmative lie from the origin of the abſciſſa to the ordinates on the right, then thoſe that are negative will lie from the origin of abſciſſa to the ordinate on the left hand.

4. When ſuch a value of x is aſſigned that in the reſulting equation ſome of the roots are impoſſible, it denotes that ſuch ordinates as are repreſented by thoſe impoſſible roots do not reach the curve, and in that caſe there is in reality no ſuch ordinate. Therefore by aſſigning ſeveral values of x, you may determine as many values of y as you pleaſe, and by that means find as many points of the curve as are neceſſary, and a line being drawn through all theſe points will be the locus of that equation.

5. In aſſigning any particular value for x of one root, or value of y be 0, then the curve cuts the abſciſſa in that point; but if y be infinite, the ordinate to that point is an aſſymptote to the curve, which runs out ad infinitum.

6. If x be infinite, and ſome value of y is 0, it ſhews that x, or the abſciſſa, is an aſſymptote to ſome branch of the curve which runs on infinitely.

7. If a curve is defined by an equation ſhewing the relation of the abſciſſa (x) and ordinate (y) a right line may cut that curve in as many points as the higheſt power of x has dimenſions in that equation, and not in more points. Hence one root alone cannot vaniſh out of the equation, or one ordinate vaniſh out of the curve; but two muſt vaniſh together.

8. In a line of a third, fifth, &c. or of any order whoſe dimenſion is an odd number, the abſciſſa, or any right line not parallel to an aſſymptote, will cut the curve at leaſt in one point. Hence if a right line touch a curve line of the third order, it will neceſſarily cut the curve in ſome point. Alſo if the right line touch ſuch a curve in the point of contrary flexure, it will cut the curve in that point, and no where elſe. But if a right line cut a curve in a double point of the curve, this muſt be eſteemed as two points, and a line that touches one arch of the curve in that point, will alſo cut the other in the like point.

9. An aſſymptote may interſect the curve in ſo many points, abating two, as the equation of the curve has dimenſions, and in no more.

10. Lines of the third, fifth, ſeventh, &c. order, have at leaſt two infinite legs or branches running contrary ways.

11. In lines of the ſecond, fourth, ſixth, or any even number of dimenſions, the roots of the equation may be all impoſſible, and then the figure may return into itſelf, and be contained within certain bounds.

12. In any curve, if tangents be drawn to all points of the curve, and if they always cut the abſciſſa at a finite diſtance from the beginning of it, that curve has an aſſymptote, otherwiſe not.

13. A line of any order may have as many aſſymptotes as it has dimenſions, and not more.

14. Any geometrical curve, being continued, either returns into itſelf or goes on to an infinite diſtance; for ſuch curve may be conſidered as deſcribed by the motion of a point, and this being effected by ſome certain law, the motion muſt neceſſarily continue ad infinitum; and therefore the ſpace run through (to wit, the line itſelf,) muſt either return back or proceed on infinitely, by reaſon of the regular motion of the deſcribing point; and therefore, if any curve has two infinite branches, or legs, they join one another, either at a finite or at leaſt at an infinite diſtance.

15. The ſhadow of any given curve line, projected from a lucid point, upon an infinite plane, will be a curve of the ſame gender with the given one. Hence the ſhadow of a circle or conic ſection, will be a conic ſection. The ſhadows of lines of the third order, will be lines of the third order, and ſo on ad infinitum.

16. If any part of the curve be higher (or further from the plane) than the light is, that part of the curve can caſt no ſhadow upon the plane, and the ſhadow of the curve will run on infinitely towards that hand, and therefore whatever there is in that part of the curve above the light will be quite loſt in the ſhadow, and be no where found.

The firſt part of this Syſtem, which treats of Plain Geometry, I have ſelected principally from that excellent treatiſe written by the late Thomas Simpſon, F.R.S. Profeſſor of Mathematics at the Royal Academy at Woolwich, and member of the Royal Academy of Sciences at Stockholm; judging that a proper extract from a work of ſuch eſtabliſhed reputation, would be more acceptable to the reader than any thing I could offer of my own.

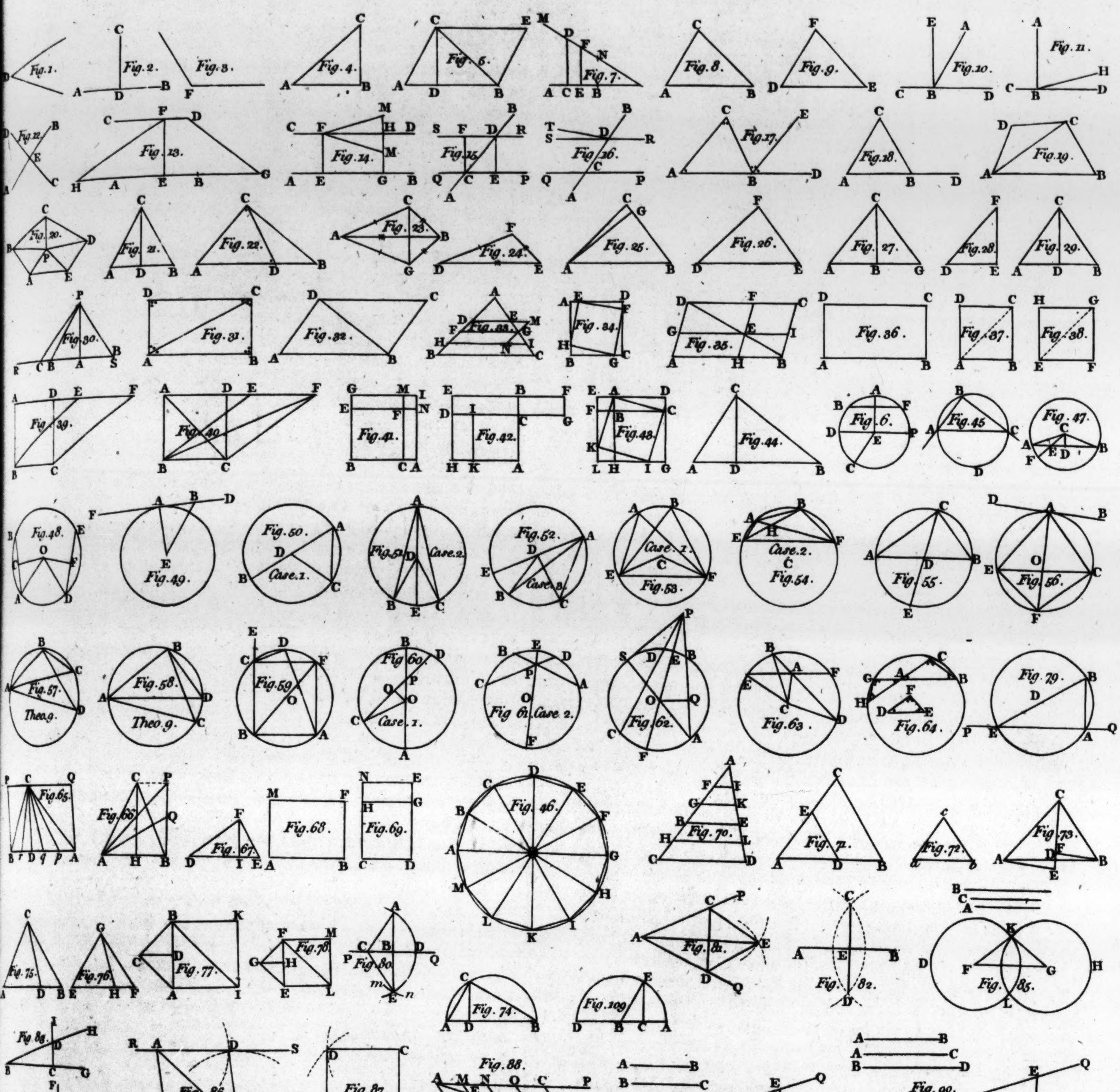
Mr. Simpſon ſays that his deſign in writing upon Geometry, was to open an eaſy way for young beginners to arrive at a proficiency in that uſeful Science, without being either obliged to go through a number of unneceſſary propoſitions, or having recourſe to the ungeometrical methods of demonſtration, that abound in moſt modern compoſitions; *that he has ſpared no pains to render the work uſeful, and he believes that the ſpirit and rigour of demonſtration, ſo eſſential to the ſubject, are alſo tolerably well preſerved, though he ſuggeſts that he has not been ſo intent to guard againſt the attack of critics, as to loſe ſight of his main deſign of furniſhing a plain and eaſy inſtitution for learners.*

For the ſecond and third parts of this Syſtem, which contain the Elements of the Conic Sections and Curve Lines, I am chiefly indebted to Mr. Emerſon's Treatiſe, a work not leſs valuable than the former: and as the Editor of this undertaking is anxious, in every department of the work, to present the public with nothing but what is truly good and valuable in itſelf, ſo I hope that this brief Syſtem will merit a place in the New Royal Encyclopædia.

T. MARQUOIS.

PARLIAMENT STREET,
WESTMINSTER.

Elementary Principles of Plain Geometry.
See the System.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St. **GEORGE**, a name whereby ſeveral orders, both military and religious, are denominated. It took its riſe from a Saint famous throughout all the Eaſt, called by the Greeks Μεγαλομαρτυρ, q. d. *great martyr.*

St. George is particularly uſed for an Engliſh order of knights, more commonly now called the *order of the Garter*, which ſee.

GEORGIC, ſomething that relates to the culture or tilling of the ground.

GERANIUM, *cranes bill*, in botany, a genus of the decandria order belonging to the monodelphia claſs of plants. It ſtands recommended as one of the greateſt vulneraries and abſtergents of the vegetable world, and is highly extolled for its power of ſtopping profluvia of the menſes, and hæmorrhages of all kinds. Experience confirms the truth of this, eſpecially among the poor people in the country; and it were to be wiſhed that the plant could be brought into more eſteem in the ſhops, where at preſent it is diſregarded.

GERMAN, in genealogy, denotes *entire* or *whole:* thus, a brother-german is one by the father's and mother's ſide; and couſins-german are the children of brothers or ſiſters.

GERMEN, the ſeed-bud; defined by Linnæus to be the baſe of the piſtillum, which contains the rudiments of the ſeed; and, in progreſs of vegetation, ſwells and becomes a ſeed-veſſel. In aſſimilating the vegetable and animal kingdoms, Linnæus denominates the ſeed-bud the *ovarium* or *uterus* of plants; and affirms its exiſtence to be chiefly at the time of the diſperſion of the male-duſt by the antheræ; as after its impregnation, it becomes a ſeed-veſſel.

GERMINATION, the act of germinating; that is, of a plant's ſprouting, or ſhooting in the ground. Some uſe the word in a more extenſive ſenſe, ſo as likewiſe to include the firſt ſhooting out of leaves, bloſſoms, branches, flowers, roots, and ſeeds.

GERUND, in grammar, a verbal noun of the neuter gender, partaking of the nature of a participle, declinable only in the ſingular number, through all the caſes except the vocative; as nom. *amandum*, gen. *amandi*, dat. *amando*, accuſ. *amandum*, abl. *amando*. The word is formed of the Latin *gerundivus*, and that from the verb *gerere*, to bear. The *gerund* expreſſes not only the *time*, but alſo the *manner*, of an action; as, "he fell in running poſt." It differs from the participle, in that it expreſſes the *time*, which the participle does not; and from the tenſe properly ſo called, in that it expreſſes the *manner*, which the tenſe does not.

GESTATION, the time of a woman's going with child, or the interval between *Conception* and *Delivery*. See FOETUS and PREGNANCY.

GESTICULATION, the making of affected, indecent, or unſuitable geſtures, or even of proper ones in too great number. *Geſticulation* is a great fault in an orator.

GESTURE, a motion of the body, intended to ſignify ſome idea or paſſion of the mind. *Geſtures* are a kind of natural language, which ſupplies the uſe of ſpeech in thoſe naturally dumb. The mimes and pantomimes were very great proficients in the ſtyle of *geſture*. *Geſture* conſiſts principally in the action of the hands and face; and may be defined, a ſuitable conformity of the motions of the countenance, and ſeveral parts of the body, in ſpeaking of the ſubject matter of the diſcourſe. See Treatiſe on the Art of ORATORY.

GIALLOLINO, in natural hiſtory, a ſpecies of yellow ochre uſed in painting, and called in the colour-ſhops, Naples yellow. It is both uſed as an oil and water-colour, and likewiſe in enamelling, encauſtic painting, and the colouring of china-ware.

GIANT, a perſon of extraordinary bulk and ſtature. The romances of all ages have furniſhed us with ſo many extravagant accounts of giants of incredible bulk and ſtrength, that the exiſtence of ſuch people is now generally diſbelieved. It is commonly thought, that the ſtature of man hath been the ſame in all ages. In the Scripture we are told of giants, who were produced from the marriages of the ſons of God with the daughters of men. But of this paſſage no ſufficient explanation hath yet been found: nor can we be ſure that the word tranſlated *giants* does there imply any extraordinary ſtature; ſeeing in other places it is explained by *falling away*, *revolting*, or *tranſgreſſing*. In other places of Scripture, however, giants, with their dimenſions, are mentioned in ſuch a manner that we connot poſſibly doubt; as in the caſe of Og king of Baſhan, and Goliath. Profane hiſtorians have given ſeven feet of height to Hercules their firſt hero; and in our days we have ſeen men eight feet high. The giant who was ſhewn in Rouen, in 1735, meaſured eight feet ſome inches. The emperor Maximin was of that ſize; Skenkius and Platerus, phyſicians of the laſt century, ſaw ſeveral of that ſtature; and Goropius ſaw a girl who was ten feet high. The body of Oreſtes, according to the Greeks, was eleven feet and a half; the giant Galbara, brought from Arabia to Rome under Claudius Cæſar, was near ten feet; and the bones of Secondilla and Puſio, keepers of the gardens of Salluſt, were but ſix inches ſhorter. Funnam, a Scotſman, who lived in the time of Eugene II. king of Scotland, meaſured eleven feet and a half: and Jacob le Maire, in his voyage to the ſtreights of Magellan, reports, that, on the 17th of December 1615, they found at Port Deſire ſeveral graves covered with ſtones; and having the curioſity to remove the ſtones, they diſcovered human ſkeletons of ten and eleven feet long. The chevalier Scory, in his voyage to the Pike of Teneriffe, ſays, that they found in one of the ſepulchre caverns of that mountain the head of a Guanche which had 80 teeth, and that the body was not leſs than 15 feet long. The giant Ferragus, ſlain by Orlando nephew of Charlemagne, was 18 feet high. Rioland, a celebrated anatomiſt, who wrote in 1614, ſays, that ſome years before there was to be ſeen in the ſuburbs of St. Germain the tomb of the giant Iſoret, who was 20 feet high. In Rouen, in 1509, in digging in the ditches near the Dominicans, they found a ſtone-tomb containing a ſkeleton whoſe ſkull held a buſhel of corn, and whoſe ſhin-bone reached up to the girdle of the talleſt man there, being about four feet long, and conſequently the body muſt have been 17 or 18 feet high. Upon the tomb was a plate of copper, whereon was engraved, "In this tomb lies the noble and puiſſant lord, the chevalier Ricon de Vallemont, and his bones." Platerus, a famous phyſician, declares, that he ſaw at Lucerne the true human bones of a ſubject which muſt have been at leaſt 19 feet high.

"At Totu, in Bohemia, in 758, was found a ſkeleton, the head of which could ſcarce be encompaſſed by the arms of two men together, and whoſe legs, which they ſtill keep in the caſtle of that city, were 26 feet long. The ſkull of the giant found in Macedonia, September 1691, held 210 pounds of corn. The celebrated Sir Hans Sloane, who treated this matter very learnedly, does not doubt theſe facts; but thinks the bones were thoſe of elephants, whales, or other enormous animals. Elephants bones may be ſhewn for thoſe of giants; but they can never impoſe on connoiſſeurs. Whales, which, by their immenſe bulk, are more proper to be ſubſtituted for the largeſt giants, have neither arms nor legs; and the head of that animal hath not the leaſt reſemblance to that of man. If it be true, therefore, that a great number of the gigantic bones which we have mentioned have been ſeen by anatomiſts, and by them have been reputed real human bones; the exiſtence of giants is proved."

With regard to the credibility of all, or any of theſe accounts, it is difficult to determine any thing. If, in any caſtle of Bohemia, the bones of a man's leg 26 feet in length are preſerved, we have indeed a deciſive proof of the exiſtence of a giant, in compariſon of whom moſt others would be but pigmies. Nor indeed could theſe bones be ſuppoſed to belong to an elephant; for an elephant itſelf would be but a dwarf in compariſon to ſuch an enormous monſter. But if theſe bones were really kept in any part of Bohemia, it ſeems ſtrange that they have not been frequently viſited, and particular deſcriptions of them given by the learned who have travelled into that country. It is certain, however, that there have been nations of men conſiderably exceeding the common ſtature. Thus, all the Roman hiſtorians inform us, that the Gauls and Germans exceed the Italians in ſize, and it appears that the Italians in thoſe days were of much the ſame ſtature with the people of the preſent age. Among theſe northern nations, it is alſo probable, that there would be as great differences in ſtature, as there are among the preſent race of men. If that can be allowed, we may eaſily believe that ſome of theſe barbarians might be called *giants*, without any great impropriety. Of this ſuperiority of ſize, indeed, the hiſtorian Florus gives us a notable inſtance in Teutobochus, king of the Teutones; who being defeated and taken priſoner by Marius, was carried in triumph before him at Rome, when his head reached above the trophies that were carried in the ſame proceſſion. But whether theſe accounts are credited or not, we are very certain, that the ſtature of the human body is by no means abſolutely fixed. We are ourſelves a kind of giants in compariſon of the Laplander; nor are theſe the moſt diminutive people to be found upon the earth. The abbe la Chappe, in his journey into Siberia, in order to obſerve the laſt tranſit of Venus, paſſed through a village inhabited by people called *Wotiacks*, neither men nor women, of whom were above four feet high. The accounts of the Patagonians alſo, which cannot be entirely diſcredited, render it very probable, that ſome where in South America there is a race of people very conſiderably exceeding the common ſize of mankind, and conſequently that we cannot altogether diſcredit the relations of giants handed down to us by ancient authors; though what degree of credit we ought to give them, is not eaſy to be determined.

GIANTS *Cauſeway*, a name given by the common people of the county of Antrim, in Ireland, to a vaſt quantity of that kind of black marble, called *Baſaltes*, which ſtands in columns, and is natural to that marble, and runs out a great way into the ſea. For a particular deſcription, ſee CAUSEWAY.

GIBBOUS, in ſurgery, is uſed to denote a perſon bunched or hump-backed.

GIBBOSITY is a preternatural incurvation of the ſpina dorſi, either backward, or on one ſide. Infants are more ſubject to this diſorder than adults, and it oftner proceeds from external, than internal cauſes. A fall, blow, or the like violence frequently thus diſtorts the tender bones of infants. When it proceeds from an internal cauſe, it is generally from a relaxation of the ligaments that ſuſtain the ſpine, or a caries of its vertebræ; though the ſpine may be inflected forward, and the back thrown out, by a too ſtrong and repeated action of the abdominal muſcles; and this, if not timely redreſſed, uſually grows up and fixes as the bones harden, till in adults it is totally irretrievable: but when the diſorder is recent, and the perſon young, there are ſome hopes of a cure. The common method is by a machine of paſte-board, wood, or ſteel, which is made to preſs principally upon the *gibbous* part, and this by long wearing may ſet all right. The ſurgeons, however, have a different inſtrument which they call a croſs, much more efficacious though not quite ſo convenient in the wearing; by the uſe of this, the parts are always prevented from growing any worſe, and are often cured. During the application of theſe aſſiſtances, the parts ſhould be at times rubbed with hungary-water, ſpirit of lavender, and the like, and defended with a ſtrengthening plaſter, oxycroceum, opodeldoc, or the like. The part of the liver, out of which the vena cava ariſes, is alſo called the *gibbous* part.

GIDDINESS, a name for the diſtemper, called by phyſicians VERTIGO. *Giddineſs* in horſes; for the cauſes and methods of treatment, ſee Syſtem of FARRIERY; Part II. Claſs 8. Sect. 25.

GIFT, *donum*, in law, is a conveyance which paſſeth either lands or goods, and is of a larger extent than a grant, being applied to things moveable and immoveable; yet as to things immoveable, when taken ſtrictly, it is applicable only to lands and tenements given in tail; but *gift* and *grant* are often confounded.

GILDING, the art of ſpreading or covering a thing over with gold, either in leaf or liquid. The art of gilding was not unknown among the ancients, though it never arrived among them at the perfection to which the moderns have carried it. Pliny aſſures us, that the firſt gilding ſeen at Rome, was after the deſtruction of Carthage, under the cenſorſhip of Lucius Mumminus, when they began to gild the ceilings of their temples and palaces; the Capitol being the firſt place on which this enrichment was beſtowed. But he adds, that luxury advanced on them ſo haſtily, that in a little time you might ſee all, even private or poor perſons, gild the very walls, vaults, &c. of their houſes.

The modern gilders alſo make uſe of gold-leaves of divers thickneſſes; but there are ſome ſo fine, that a thouſand do not weigh above four or five drachms. The thickeſt are uſed for gilding on iron, and other metals; and the thinneſt, on wood. But we have another advantage over the ancients, in the manner of uſing or applying the gold: the ſecret of painting in oil, diſcovered of late ages, furniſhes us with means of gilding works that ſhall endure all the injuries of time and weather, which to the ancients was impracticable. The luſtre and beauty of gold have occaſioned ſeveral enquiries and diſcoveries concerning the different methods of applying it to different ſubſtances. Hence the art of gilding is very extenſive, and contains many particular operations and various management. A colour of gold is given by painting and by varniſhes, without employing gold; but this is a falſe kind of gilding. Thus a very fine golden colour is given to braſs and to ſilver, by applying upon theſe metals a gold-coloured varniſh, which, being tranſparent, ſhews all the brilliancy of the metals beneath. Many ornaments of braſs are varniſhed in this manner, which is called *gold lacquering*, to diſtinguiſh them from thoſe which are really gilt. Silver-leaves thus varniſhed are put upon leather, which is then called *gilt leather*. See LACQUER.

Amongſt the falſe gilding may alſo be reckoned thoſe which are made with thin leaves of copper or braſs, called *Dutch-leaf*. In this manner are made all the kinds of what is called *gilt paper*. In the true gilding, gold is applied to the ſurface of bodies. The gold intended for this purpoſe ought in general to be beat into thin leaves, or otherwiſe divided into very fine parts. As metals cannot adhere well merely by contact to any but to other metallic ſubſtances, when gold is to be applied to the ſurface of ſome unmetallic body, that ſurface muſt be previouſly covered with ſome gluey and tenacious ſubſtance, by which the gold ſhall be made to adhere. Theſe ſubſtances are in general called *ſizes*. Some of theſe are made of vegetable and animal glues, and others of oily, gluey, and drying matters. Upon them the leaves of gold are applied, and preſſed down with a little cotton or a hare's foot; and when the whole is dry, the work is to be finiſhed and poliſhed with a hard inſtrument, called a *dogs-tooth*, to give luſtre.

When the work is required to be capable of reſiſting rain or moiſture, it ought to be previouſly covered with a compoſition of drying oil and yellow ochre ground together; otherwiſe a water-ſize may be uſed, which is prepared by boiling cuttings of parchment or white leather in water, and by mixing this with ſome chalk or whiting: ſeveral layers of this ſize muſt be laid upon the wood, and over theſe a layer of the ſame ſize mixed with yellow ochre. Laſtly, another mixture, called *gold ſize*, is to be applied above theſe; upon which the gold leaves are to be fixed. This gold ſize, the uſe of which is to make the gold-leaf capable of being burniſhed, is compoſed of tobacco-pipe clay, ground with ſome ruddle or black lead, and tempered with a little tallow or oil of olives. The edges of glaſſes may be gilt by applying, firſt, a very thin coat of varniſh, upon which the gold-leaf is to be fixed; and when the varniſh is hardened, may be burniſhed. This varniſh is prepared by boiling powdered amber with linſeed oil in a braſs veſſel to which a valve is fitted, and by diluting the above ſolution with four or five times its quantity of oil of turpentine; and that it may dry ſooner, it may be ground with ſome white lead.

The method of applying gold upon metals is entirely different. The ſurface of the metal to be gilt is firſt to be cleaned; and then leaves are to be applied to it, which, by means of rubbing with a poliſhed blood-ſtone, and a certain degree of heat, are made to adhere perfectly well. In this manner ſilver-leaf is fixed and burniſhed upon braſs in the making of what is called *French plate*, and ſometimes alſo gold-leaf is burniſhed upon copper and upon iron. Gold is applied to metals in ſeveral other manners. One of theſe is by previouſly forming the gold into a paſte or amalgam with mercury. In order to obtain a ſmall amalgam of gold and mercury, the gold is firſt to be reduced into thin plates or grains, which are heated red-hot, and thrown into mercury previouſly heated, till it begins to ſmoke. Upon ſtirring the mercury with an iron rod, the gold totally diſappears. The proportion of mercury to gold is generally as ſix or eight to one. With this amalgam the ſurface of the metal to be gilded is to be covered; than a ſufficient heat is to be applied to evaporate the mercury; and the gold is laſtly to be burniſhed with a blood-ſtone.

Some metals, particularly ſilver, may be gilt in the following manner. Let gold be reſolved into aqua-regia. In this ſolution pieces of linen are to be dipt, and burnt to black aſhes. Theſe aſhes being rubbed on the ſurface of the ſilver by means of a wet linen rag, apply the particles of gold which they contain, and which by this method adhere very well. The remaining part of the aſhes is to be waſhed off; and the ſurface of the ſilver, which in this ſtate does not ſeem to be gilt, is to be burniſhed with a blood-ſtone till it acquire a fine colour of gold. This method of gilding is very eaſy, and conſumes a very ſmall quantity of gold. Moſt gilt ornaments upon fans, ſnuff-boxes, and other toys of much ſhow and little value, are nothing but ſilver gilt in this manner.

Gold may alſo be appplied to glaſs, porcelain, and other vitrified matters. As the ſurface of theſe matters is very ſmooth, and conſequently is capable of a very perfect contact with gold leaves, theſe leaves adhere to them with ſome force, although they are not of metallic nature. This gilding is ſo much more perfect, as the gold is more exactly applied to the ſurface of the glaſs. The pieces are then to be expoſed to a certain degree of heat, and burniſhed ſlightly to give them luſtre. A more ſubſtantial gilding is fixed upon glaſs, enamel, and porcelain, by applying to theſe ſubſtances powder of gold mixed with a ſolution of gum arabic, or with ſome eſſential oil, and a ſmall quantity of borax; after which a ſufficient heat is to be applied to ſoften the glaſs and the gold, which is then to be burniſhed. With this mixture any figures may be drawn. The powders for this purpoſe may be made, 1. By grinding gold-leaf with honey, which is afterwards to be waſhed away with water. 2. By diſtilling to dryneſs a ſolution of gold in aqua-regia. 3. By evaporating the mercury from an amalgam of gold, taking care to ſtir well the maſs near the end of the proceſs. 4. By precipitating gold from its ſolution in aqua-regia by applying to it a ſolution of green vitriol in water, or ſome copper, and perhaps ſome other metallic ſubſtances.

GILL, a meaſure of capacity, containing a quarter of an Engliſh pint.

GILLS, or *Branchiæ*, in itchthyology. See the Syſtem.

GIN See GENEVA.

GINGER, in botany. See AMOMUM.

GINGIDIUM, in botany. See ARTEDIA.

GINGIVA, in anatomy, the *gum*; a hard ſort of fleſh, inveſting the alveoli, or ſockets, of the teeth. The *gingivæ* are formed of the union of two membranes; one of which is a production of the perioſteum, and the other of the external membrane of the mouth.

GINGLYMUS, Γιγυμος, in anatomy, one of the ſpecies of articulation. See Syſtem of ANATOMY, Part I. Sect. 12.

GIN-SENG, or NIN-SENG, panax, in botany; for the characters and qualities of this plant, ſee PANAX.

GIRDLE, *Cingulus*, or *Zona*, a belt or band of leather, or other matter tied about the reins, to keep that part more firm and tight. It was anciently the cuſtom for bankrupts, and other inſolvent debtors, to put off and ſurrender their *girdle* in open court. The reaſon hereof was, that our anceſtors uſed to carry all the neceſſary utenſils, as purſe, keys, &c. tied to the *girdle*; whence the *girdle* became a ſymbol of the eſtate.

GIRDLE, in architecture. See CINCTURE.

GIRRONNE, GIRONY, in heraldry, is when a ſhield or coat is divided into ſeveral girons, which are alternately colour and metal.

GIRT, in architecture, the ſame with fillet. See FILLET.

GIVEN, *datum*, a term very frequently uſed in mathematics, ſignifying a thing which is ſuppoſed to be known. Thus, if a magnitude be known, or we can find another equal to it, we ſay it is a *given* magnitude, or that ſuch a thing is *given* in magnitude.

GLACIS, in building, an eaſy inſenſible ſlope or declivity. The *glacis* of the cornich is an eaſy imperceptible ſlope in the cymatium of the cornich, to promote the deſcent and draining off of the rain-water.

GLACIS, in fortification, is particularly uſed for that of the counterſcarp, being a ſloping bank, which reaches from the parapet of the counterſcarp, or covert-way, to the level ſide of the field, at the diſtance of about twenty fathom. See Syſtem of FORTIFICATION.

GLADIATORS, in antiquity, perſons who were retained to fight ordinarily in the arena, for the entertainment of the people. The *gladiators* were uſually ſlaves, and fought out of neceſſity, though, ſometimes, freemen made profeſſion thereof, like our prize-fighters, for a livelihood. After a *ſlave* had ſerved on the arena three years, he was diſmiſſed. The Romans borrowed this cruel diverſion from the Aſiatics: ſome ſuppoſe that there was policy in this practice, the frequent combats of *gladiators* tending to accuſtom the people to deſpiſe danger and death. The origin of ſuch combats ſeems to be as follows: from the earlieſt times with which we have any acquaintance, in prophane hiſtory, it had been the cuſtom to ſacrifice captives, or priſoners of war, to the manes of the great men who had died in the engagement: thus Achilles, in the Iliad, lib. xxiii. ſacrifices twelve young Trojans to the manes of Patroclus; and in Virgil, lib. xi. ver. 81. Æneas ſends captives to Evander, to be ſacrificed to the funeral of his ſon Pallas. In courſe of time they came alſo to ſacrifice ſlaves at the funerals of all perſons of condition; this was even eſteemed a neceſſary part of the ceremony; but, as it would have appeared barbarous to have maſſacred them like beaſts, they were appointed to fight with each other, and endeavour to ſave their own lives by killing their adverſary. This ſeemed ſomewhat leſs inhuman, becauſe there was a poſſibility of avoiding death, by an exertion of ſkill and courage. This occaſioned a profeſſion of *gladiator* to become an art: hence aroſe maſter of arms, and men learned to fight and and exerciſe this art. Theſe maſters, whom the latins called *laniſtæ*, bought them ſlaves to be trained up to this cruel trade, whom they afterwards ſold to ſuch as had occaſion to preſent the people with ſo horrible a ſhew. They were at firſt performed near the ſepulchre of the deceaſed, or about the funeral pile; but were afterwards removed to the circus and amphitheatres, and became ordinary amuſements.

The firſt ſhew of gladiators, called *manus gladiatorum*, was exhibited at Rome, according to Valerius Maximus, by M. and D. Brutus, upon the death of their father, in the year of the city 490. On this occaſion there were probably only three pair of *gladiators*; in the year of Rome 537, the three ſons of M. Æmilius Lepidus the augur, who had been three times conſul, entertained the people with the cruel pleaſure of ſeeing twenty-two gladiators fight in the forum. In the year of Rome 547, the firſt Africanus diverted his army at New-Carthage with a ſhew of gladiators, which he exhibited in honour of his father and uncle, who had begun the reduction of Spain. In proceſs of time, the Romans became ſo fond of theſe bloody entertainments, that not only the heir of any great and rich citizen lately deceaſed, but all the principal magiſtrates, preſented the people with ſhews of this nature, to procure their affection. The ædiles, pretors, conſuls, and, above all, the candidates for offices, made their court to the people, by entertaining them frequently with theſe fights: and the prieſts were ſometimes the exhibitors of the barbarous ſhews; for we meet with the *ludi pontificales* in Suetonius, Auguſt. cap. 44, and with the *ludi ſacerdotales*, in Pliny. Epiſt. lib. vii. As for the emperors, it was ſo much their intereſt to ingratiate themſelves with the populace, that they obliged them with combats of *gladiators* almoſt upon all occaſions; and as theſe increaſed, the number of combatants increaſed likewiſe. Accordingly, Julius Cæſar, in his ædileſhip, diverted the people with three hundred and twenty couple. Titus exhibited a ſhew of *gladiators*, wild beaſts, and repreſentations of ſea-fights, which laſted a hundred days; and Trajan continued a ſolemnity of this nature for a hundred and twenty-three days, during which time he brought out a thouſand pair of gladiators. Before this time, under the republic, the number of gladiators was ſo great, that when the conſpiracy of Catiline broke out, the ſenate ordered them to be diſperſed into the garriſon and ſecured, leſt they ſhould have joined the diſaffected party. Theſe ſpots were become ſo common, and their conſequences, in a variety of reſpects, ſo dangerous, that Cicero preferred a law, that no perſon ſhould exhibit a ſhew of *gladiators* within two years before he appeared candidate for any office. Julius Cæſar ordered, that only a certain number of men of this profeſſion ſhould be in Rome at a time. Auguſtus decreed, that only two ſhews of *gladiators* ſhould be preſented in a year, and never above ſixty couple of combatants in a ſhew. And Tiberius provided by an order of ſenate, that no perſon ſhould have the privilege of gratifying the people with ſuch a ſolemnity, unleſs he was worth four hundred thouſand ſeſterces. They were alſo conſiderably regulated by Nerva. The emperor Claudius reſtrained them to certain occaſions; but he ſoon afterwards annulled what he decreed, and private perſons began to exhibit them at pleaſure, as uſual; and ſome carried the brutal ſatisfaction ſo far, as to have them at their ordinary feaſts. And not ſlaves only, but other perſons would hire themſelves to this infamous office. The maſter of the *gladiators* made them all firſt ſwear, that they would fight to death; and if they failed, they were put to death, either by fire, or ſwords, clubs, whips, or the like. It was a crime for the wretches to complain when they were wounded, or aſk for death, or ſeek to avoid it, when overcome; but it was uſual for the emperor, or the people to grant them life, when they gave no ſigns of fear, but waited the fatal ſtroke with courage and intrepidity: Auguſtus even decreed, that it ſhould always be granted them. From ſlaves and freedmen, the inhuman ſport at length ſpread to people of rank and condition; ſo that Auguſtus was obliged to iſſue a public edict, that none of the ſenatorian order ſhould become *gladiators*; and ſoon after he laid the ſame reſtraint on the knights: nevertheleſs, Nero is related to have brought upwards of four hundred ſenators, and ſix hundred Roman knights upon the arena; though Lipſius takes both thoſe numbers to be falſified, and, not without reaſon, reduced them to forty ſenators, and ſixty knights: yet Domitian, that other monſter of cruelty, refined upon Nero, exhibiting combats of women in the night time.

Conſtantine the Great is ſaid to have firſt prohibited the combats of *gladiators* in the Eaſt; at leaſt, he forbad thoſe who were condemned to death for their crimes, to be employed; there being an order ſtill extant to the præfectus prætorii, rather to ſend them to work in the mines in lieu thereof: it is dated at Berytus, in Phœnicia, the firſt of October, 325. The emperor Honorius forbad them at Rome, on occaſion of the death of Telemachus, who coming out of the Eaſt into Rome, at the time of one of theſe ſpectacles, went down into the arena, and uſed all his endeavour to prevent the *gladiators* from continuing the ſport, upon which the ſpectators of that carnage, fired with anger, ſtoned him to death. It muſt be obſerved, however, that the practice was not entirely aboliſhed in the Weſt before Theodoric, king of the Oſtrogoths. Honorius, on the occaſion firſt mentioned, had prohibited them; but the prohibition does not ſeem to have been executed. Theodoric, in the year 500 aboliſhed them finally. Some time before the day of battle, the perſon who preſented the people with the ſhews, gave them notice thereof, by programmas, or bills, containing the names of the *gladiators*, and the marks whereby they were to be diſtinguiſhed; for each had his ſeveral badge, which was, moſt commonly, a peacock's feather, as appears, from the ſcholiaſt of Juvenal, on the 158th verſe of the third ſatire, and Turnebus Adverſ. lib. ii. cap. 8. They alſo gave notice what time the ſhews would laſt, and how many couples of *gladiators* there were; and it even appears, from the 52d verſe of the ſeventh Satire of the ſecond book of Horace, that they ſometimes made repreſentations of theſe things in painting, as is practiſed among us by thoſe who have any thing to ſhew at fairs. The day being come, they began the entertainments by bringing two kinds of weapons; the firſt were ſtaves, or wooden files, called *rudes*; and the ſecond were effective weapons, as ſwords, poniards, &c.

The firſt were called *arma luſoria*, or, *exercitoria*; the ſecond *decretoria*, as being given by decree or ſentence of the prætor, or of him at whoſe expence the ſpectacle was exhibited. They began to fence or ſkirmiſh with the firſt, which was to be the prelude to the battle; and from theſe, when well warmed, they advanced to the ſecond, at the ſound of the trumpets, with which they fought naked. Then they were ſaid *vertere arma*; the terms of ſtriking were *petere & repetere*; of avoiding a blow, *exire*; and when one of the combatants received a remarkable wound, his adverſary or the people cried out, *habet*, or *hoc habet*. The firſt part of the engagement was called, *ventilare, præludere:* and the ſecond, *dimicare ad certum*, or *verſis armis pugnare*: and ſome authors think, with much probability, that it is to theſe two kinds of combat that St. Paul alludes, in the paſſage 1 Cor. ix. 26, 27. "I fight, not as one that beateth the air; but I keep my body, and bring it into ſubjection." If the vanquiſhed ſurrendered his arms, it was not in the victor's power to grant him life; it was the people, during the time of the republic, and the prince or people, during the time of the empire, that were alone impowered to grant the boon. The *gladiators* challenged or defied each other, by ſhewing the little finger; and by extending this or ſome other, during the combat, they owned themſelves vanquiſhed, and begged mercy from the people.

Dying **GLADIATOR**, is a moſt valuable ancient ſculpture, which is now preſerved in the palace of Chighi. This man, when he had received the mortal ſtroke, is particularly careful, *ut procumbat honeſte*, that he might fall honourably; he is ſeated in a reclining poſture on the ground, and has juſt ſtrength ſufficient to ſupport himſelf on his right arm; and in his expiring moments it is plainly ſeen that he does not abandon himſelf to grief and dejection, but is ſolicitous, to maintain that firmneſs of aſpect, which the *gladiators* valued themſelves on preſerving in this ſeaſon of diſtreſs, and that attitude which they had learnt of the maſters of defence. He fears not death, nor ſeems to betray any tokens of fear by his countenance, nor to ſhed one tear: *quis mediocris* gladiator *ingemuit, quis vultum mutavit unquam, quis non modo ſtetit, verum etiam decubuit turpiter*, ſays Cicero, in that part of his Tuſculan, where he is deſcribing the aſtoniſhing firmneſs of theſe perſons. We ſee, in this inſtance, notwithſtanding his remaining ſtrength, that he has but a moment to live, and we view him with attention, that we may ſee him expire and fall: thus the ancients knew how to animate marble, and to give it almoſt every expreſſion of life. Encyclopedie Françoiſe.

GLAIR *of Eggs*, is the ſame as the white of eggs, and is uſed as a varniſh for preſerving paintings. For this purpoſe it is beat to an unctuous conſiſtence, and commonly mixed with a little brandy or ſpirit of wine, to make it work more freely, and with a lump of ſugar to give it body and prevent its cracking; and then ſpread over the picture or painting with a bruſh.

GLAMA, in zoology, for a particular deſcription of which, ſee the article CAMEL.

GLAND, GLANDULA, in anatomy, a ſoft, ſpongy, lax kind of body; ſerving to ſeparate ſome particular *humour* from the maſs of *blood*. For a particular deſcription, ſee Syſtem of ANATOMY, Part I. Sect. 6.

GLANDERS, a filthy diſeaſe in a horſe, conſiſting in a corrupt ſlimy matter, running from the noſe, of a different colour according to the degree of the malignity, or as the infection has been of a ſhorter or longer continuance; being white, yellow, green, or black, ſometimes tinged with blood. For the cauſes and methods of cure, ſee Syſtem of FARRIERY, Claſs 8. Sect. 24.

GLANS, in anatomy, the tip or button of the *penis*, or that part covered with the prepuce, called alſo *balanus*. See Syſtem of ANATOMY, Part III. Sect. 24, Plate X, *fig*. 1. letter L.

GLANS is alſo uſed to denote the tip or extremity of the *clitoris*, from its reſemblance, both in form and uſe, to that of the penis. See Syſtem of ANATOMY, Part V. Sect. 12, and Plate X. lower diviſion, *fig*. 1. letter K.

GLASS, a tranſparent, brittle, factitious body produced from ſand melted in a ſtrong fire with fixed alkaline ſalts, lead, ſlags, &c. till the whole becomes perfectly clear and fine. The word is formed of the latin *glaſtum*, a plant called by the Greeks *iſatis*, by the Romans *vitrum*, by the ancient Britons *guadum*, and by the Engliſh *woad*. We find frequent mention of this plant in ancient writers, particularly Cæſar, Vitruvius, Pliny, &c. who relate, that the ancient Britons painted or dyed their bodies with glaſtum, guadum, vitrum, &c. i. e. with the blue colour procured from this plant. And hence, the factitious matter we are ſpeaking of came to be called *glaſs*; as having always ſomewhat of this bluiſhneſs in it. At what time the art of glaſs-making was firſt invented, is altogether uncertain. Some imagine it to have been invented before the flood; but of this we have no direct proof, though there is no improbability in the ſuppoſition; for we know, that it is almoſt impoſſible to excite a very violent fire, ſuch as is neceſſary in metallurgic operations, without vitrifying part of the bricks or ſtones wherewith the furnace is built. This indeed might furniſh the firſt hints of glaſs-making; though it is alſo very probable, that ſuch imperfect vitrifications would be obſerved a long time before people thought of making any uſe of them. Neri traces the antiquity of glaſs as far back as the time of Job. That writer, ſpeaking of the value of wiſdom, chap. xxviii. verſe 17. ſays, that gold and *cryſtal* cannot equal it. But this word, which Neri will have to ſignify factitious glaſs, is capable of a great many different interpretations, and properly ſignifies only whatever is beautiful or tranſparent. Dr. Merret will have the art to be as ancient as that of pottery, or the making of bricks, for the reaſons already given, viz. that by all vehement heats ſome imperfect vitrifications are produced. Of this kind undoubtedly was the foſſile glaſs mentioned by Ferant. Imperator. to have been found under-ground where great fires had been. But it is evident, that ſuch imperfect vitrifications might have paſſed unnoticed for ages; and conſequently we have no reaſon to conclude from thence, that the art of glaſs-making is of ſuch high antiquity.

The Egyptians boaſt, that this art was taught them by their great Hermes. Ariſtophanes, Ariſtotle, Alexander, Aphrodiſeus, Lucretius, and St. John the divine, put it out of all doubt that glaſs was uſed in their days. Pliny relates, that it was firſt diſcovered accidentally in Syria, at the mouth of the river Belus, by certain merchants driven thither by a ſtorm at ſea; who being obliged to continue there, and dreſs their victuals by making a fire on the ground, where there was great plenty of the herb kali; that plant, burning to aſhes, its ſalts mixed and incorporated with the ſand, or ſtones fit for vitrification, and thus produced glaſs; and that this accident, being known, the people of Sidon, in that neighbourhood, eſſayed the work, and brought glaſs into uſe; ſince which time the art has been continually improving. Be this as it will, however, the firſt glaſs-houſes mentioned in hiſtory were erected in the city of Tyre, and here was the only ſtaple of the manufactory for many ages. The ſand, which lay on the ſhore for about half a mile round the mouth of the river Belus was peculiarly adapted to the making of glaſs, as being neat and glittering; and the wide range of the Tyrian commerce gave an ample vent for the productions of the furnace. It appears, however, that before the conqueſt of Britain by the Romans, glaſs-houſes had been erected in this iſland, as well as in Gaul, Spain, and Italy. Hence, in many parts of the country are to be found annulets of glaſs, having a narrow perforation and thick rim, denominated by the remaining Britons *gleineu naidreedh*, or *glaſs adders*, and which were probably in former times uſed as amulets by the druids. It can ſcarcely be queſtioned that the Britons were ſufficiently well verſed in the manufacture of glaſs, to form out of it many more uſeful inſtruments than the glaſs-beads. Hiſtory indeed aſſures us, that they did manufacture a conſiderable quantity of glaſs veſſels. Theſe, like their annulets, were moſt probably green, blue, yellow, or black, and many of them curiouſly ſtreaked with other colours. The proceſs in the manufacture would be nearly the ſame with that of the Gauls or Spaniards. The ſand of their ſhores being reduced to a ſufficient degree of fineneſs by art, was mixed with three fourths of its weight of their nitre (much the ſame with our kelp), and both were melted together. The metal was then poured into other veſſels, where it was left to harden into a maſs, and afterwards replaced in the furnace, where it became tranſparent in the boiling, and was afterwards figured by blowing, or modelling in the lath, into ſuch veſſels as they wanted.

It is not probable that the arrival of the Romans would improve the glaſs manufacture among the Britons. The taſte of the Romans at that time was juſt the reverſe of that of the inhabitants of this iſland. The former preferred ſilver and gold to glaſs, for the compoſition of their drinking veſſels. They made indeed great improvements in their own at Rome, during the government of Nero. The veſſels then formed of this metal rivalled the bowls of porcelain in their dearneſs, and equalled the cups of cryſtal in their tranſparency. But theſe were by far too coſtly for common uſe; and therefore, in all probability, were never attempted in Britain. The glaſs commonly made uſe of by the Romans was of a quality greatly inferior; and, from the fragments which have been diſcovered at the ſtations or towns of either, appears to have conſiſted of a thick, ſometimes white, but moſtly blue-green, metal. With regard to the theory of vitrification, we are almoſt totally in the dark. In general, it ſeems to be that ſtate, in which ſolid bodies are, by the vehement action of fire, fitted for being diſſipated, or carried off in vapour. In all vitrifications, there is a plentiful evaporation; and if any ſolid ſubſtance is carried off in vapour by the intenſe heat of a burning ſpeculum, a vitrification is always obſerved previouſly to take place. The difference, then, between the ſtate of fuſion and vitrification of a ſolid body we may conceive to be, that in the former the element of fire acts upon the parts of the ſolid in ſuch a manner as only to disjoin them, and render the ſubſtance fluid; but, in vitrification, the fire not only disjoins the particles, but combines with them in a latent ſtate, into a third ſubſtance; which, having now as much fire as it can contain, can receive no further change from that element, except being carried off in vapour.

But, though except we are unable to effect this change upon ſolid bodies without a very violent heat, it is otherwiſe in the natural proceſſes. By what we call *cryſtalization*, nature produces more perfect glaſſes than we can make with our furnaces. Theſe are called *precious ſtones*; but in all trials they diſcover the eſſential properties of glaſs, and not of ſtones. The moſt diſtinguiſhing property of glaſs is its reſiſting the force of fire, ſo that this element cannot calcine or change it as it does other bodies, but can only melt it, and then carry it off in vapours. To this laſt all the precious ſtones are ſubject. The diamond (the hardeſt and moſt ponderous of them all) is diſſipable in a leſs degree of heat than what would diſſipate common glaſs. Nor can it be any objection to this idea, that ſome kinds of glaſs are capable of being converted into a kind of porcelain by a long-continued cementation with certain materials. This change happens only to thoſe kinds of glaſs which are made of alkaline ſalt and ſand; and Dr. Lewis hath ſhewn that this change is produced by the diſſipation of the ſaline principle, which is the leaſt fixed of the two. Glaſs, therefore, we may ſtill conſider as a ſubſtance upon which the fire has no other effect than either to melt, or diſſipate it in vapour. The other properties of glaſs are very remarkable, ſome of which follow: 1. It is one of the moſt elaſtic bodies in nature. If the force with which glaſs-balls ſtrike each other be reckoned 16, that wherewith they recede by virtue of their elaſticity will be nearly 15. 2. When glaſs is ſuddenly cooled, it becomes exceedingly brittle; and this brittleneſs is ſometimes attended with very ſurpriſing phenomena: Hollow bells made of unnealed glaſs, with a ſmall hole in them, will fly to pieces by the heat of the hand only, if the hole by which the internal and external air communicate be ſtopped with a finger. Lately, however, ſome veſſels made of ſuch unnealed glaſs have been diſcovered, which have the remarkable property of reſiſting very hard ſtrokes given from without, though they ſhiver to pieces by the ſhocks received from the fall of very light and minute bodies dropped into their cavities. Thoſe glaſſes may be made of any ſhape; all that needs be obſerved in making them is, that their bottoms be thicker than their ſides. The thicker the bottom is, the eaſier do the glaſſes break. One whoſe bottom is three fingers breadth in thickneſs, flies with as much eaſe at leaſt as the thinneſt glaſs. Some of theſe veſſels have been tried with ſtrokes of a mallet ſufficient to drive a nail into wood tolerably hard, and have held good without breaking. They have alſo reſiſted the ſhock of ſeveral heavy bodies let fall into their cavities, from the height of two or three feet; as muſket-balls, pieces of iron, or other metal, pyrites, jaſper, wood, bone, &c. But this is not ſurpriſing, as other glaſſes of the ſame ſhape and ſize will do the ſame: but the wonder is, that taking a ſhiver of flint of the ſize of a ſmall pea, and letting it fall into the glaſs only from the height of three inches, in about two ſeconds the glaſs flies, and ſometimes at the very moment of the ſhock; nay, a bit of flint no larger than a grain, dropped into ſeveral glaſſes ſucceſſively, though it did not immediately break them, yet when ſet by, they all flew in leſs than three quarters of an hour. Some other bodies produce the ſame effect with flint; as ſapphire, diamond, porcelain, hard tempered ſteel; alſo marbles ſuch as children play with, and likewiſe pearls.

Theſe experiments were made before the Royal Society; and ſucceeded equally when the glaſſes were held in the hand, when they were reſted on a pillow, put in water, or filled with water. It is alſo remarkable, that the glaſſes broke upon having their bottoms ſlightly rubbed with the finger, though ſome of them did not fly till half an hour after the rubbing. If the glaſſes are every where extremely thin, they do not break in theſe circumſtances.

Some have pretended to account for theſe phenomena, by ſaying, that the bodies dropped into the veſſels cauſe a concuſſion which is ſtronger than the coheſive force of the glaſs, and conſequently that a rupture muſt enſue. But why does not a ball of iron, gold, ſilver, or copper, which are perhaps a thouſand times heavier than the flint, produce the ſame effect? Is it becauſe they are not elaſtic? But ſurely iron is more elaſtic than the end of one's finger. Mr. Euler has endeavoured to account for theſe appearances from his principles of percuſſion. He thinks that this experiment entirely overthrows the opinion of thoſe who meaſure the force of percuſſion by the *vis viva*, or abſolute apparent ſtrength of the ſtroke. According to his principles, the great hardneſs and angular figure of the flint, which makes the ſpace of contact with the glaſs extremely ſmall, ought to cauſe an impreſſion on the glaſs vaſtly greater than lead, or any other metal; and this may account for the flint's breaking the veſſel, though the bullet, even falling from a conſiderable height, does no damage. Hollow cups made of green bottle glaſs, ſome of them three inches thick at the bottom, were inſtantly broken by a ſhiver of flint, weighing about two grains, though they had reſiſted the ſhock of a muſket-ball from the height of three feet.

That Mr. Euler's theory cannot be concluſive more than the other, muſt appear evident from a very ſlight conſideration. It is not by angular bodies alone that the glaſſes are broken. The marbles with which children play are round, and yet they have the ſame effect with the angular flint. Beſides, if it was the mere force of percuſſion which broke the glaſſes, undoubtedly the fracture would always take place at the very inſtant of the ſtroke; but we have ſeen, that this did not happen ſometimes till a very conſiderable ſpace of time had elapſed. It is evident, therefore, that this effect is occaſioned by the putting in motion ſome ſubtile fluid with which the ſubſtance of the glaſs is filled; and that the motions of this fluid, when once excited in a particular part of the glaſs, ſoon propagate themſelves through the whole or greateſt part of it, by which means the coheſive power becomes at laſt too weak to reſiſt them. There can be little doubt that the fluid juſt now mentioned is that of electricity. It is known to exiſt in glaſs, in very great quantity; and it alſo is known to be capable of breaking glaſſes, even when annealed with the greateſt care, if put into too violent a motion. Probably the cooling of glaſs haſtily may make it more electric than is conſiſtent with its coheſive power, ſo that it is broken by the leaſt increaſe of motion in the electric fluid by friction or otherwiſe. This is evidently the caſe when it is broken by rubbing with the finger; but why it ſhould alſo break by the mere contact of flint and the other bodies abovementioned, has not yet been ſatisfactorily accounted for. A moſt remarkable phenomenon alſo is produced in glaſs tubes placed in certain circumſtances. When theſe are laid before a fire in an horizontal poſition, having their extremities properly ſupported, they acquire a rotatory motion round their axis, and alſo a progreſſive motion towards the fire, even when their ſupports are declining from the fire, ſo that the tubes will move a little way up-hill towards the fire. When the progreſſive motion of the tubes towards the fire is ſtopped by any obſtacle, their rotation ſtill continues. When the tubes are placed in a nearly upright poſture, leaning to the right hand, the motion will be from eaſt to weſt; but if they lean to the left hand, their motion will be from weſt to eaſt; and the nearer they are placed to the perfectly upright poſture, the leſs will the motion be either way.

If the tube is placed horizontally on a glaſs plane, the fragment, for inſtance, of coach window-glaſs, inſtead of moving towards the fire, it will move from it, and about its axis in a contrary direction to what it had done before; nay, it will recede from the fire, and move a little up-hill when the plane inclines towards the fire. Theſe experiments are recorded in the philoſophical tranſactions. They ſucceeded beſt with tubes about 20 or 22 inches long, which had in each end a pretty ſtrong pin fixed in cork for an axis. The reaſon given for theſe phenomena, is the ſwelling of the tubes towards the fire by the heat, which is known to expand all bodies. For, ſay the adopters of this hypotheſis, granting the exiſtence of ſuch a ſwelling, gravity muſt pull the tube down when ſupported near its extremities, and a freſh part being expoſed to the fire, it muſt alſo ſwell out and fall down, and ſo on. But, without going farther in the explanation of this hypotheſis, it may be here remarked, that the fundamental principle on which it proceeds is falſe: for though fire indeed makes bodies expand, it does not increaſe them in weight; and therefore the ſides of the tube, though one of them is expanded by the fire, muſt ſtill remain *in equilibrio*; and hence we muſt conclude, that the cauſes of theſe phenomena remain yet to be diſcovered. 4. Glaſs is leſs dilatable by heat than metalline ſubſtances, and ſolid glaſs-ſticks are leſs dilatable than tubes. This was firſt diſcovered by Col. Roy, in making experiments in order to reduce barometers to a greater degree of exactneſs than hath hitherto been found practicable; and ſince his experiments were made, one of the tubes 18 inches long, being compared with a ſolid glaſs rod of the ſame length, the former was found by a pyrometer, to expand four times as much as the other, in a heat approaching to that of boiling oil. On account of the general quality which glaſs has of expanding leſs than metal, M. de Luc recommends it to be uſed in pendulums: and he ſays it has alſo this good quality, that its expanſions are always equable, and proportioned to the degrees of heat; a quality which is not to found in any other ſubſtance yet known. 5. Glaſs appears to be more fit for the condenſation of vapours than metallic ſubſtances. An open glaſs filled with water, in the ſummer time, will gather drops of water on the outſide, juſt as far as the water in the inſide reaches; and a perſon's breath, blown on it, manifeſtly moiſtens it. Glaſs alſo becomes moiſt with dew, when metals do not. See Dew. 6. A drinking-glaſs partly filled with water, and rubbed on the brim with a wet finger, yields muſical notes, higher or lower as the glaſs is more or leſs full; and will make the liquor friſk and leap. 7. Glaſs is poſſeſſed of very great electrical virtues. See Electricity.

Materials for Making of Glass. The materials whereof glaſs is made, we have already mentioned to be ſalt and ſand or ſtones. The ſalt here uſed, is procured from a ſort of aſhes, brought from the Levant, called *polverine*, or *rochetta*; which aſhes are thoſe of a ſort of water-plant called *kali*, cut down in ſummer, dried in the ſun, and burnt in heaps, either on the ground, or on iron gates; the aſhes falling into a pit, grow into a hard maſs, or ſtone, fit for uſe. It may alſo be procured from common kelp, or the aſhes of the *fucus veſiculoſus*. To extract the ſalt, theſe aſhes, or polverine, are powdered and ſifted, then put into boiling water, and there kept till one third of the water be conſumed; the whole being ſtirred up from time to time, that the aſhes may incorporate with the fluid, and all its ſalts be extracted: then the veſſel is filled up with new water, and boiled over again, till one half be conſumed; what remains is a ſort of lee, ſtrongly impregnated with ſalt. This lee, boiled over again in freſh coppers, thickens in about twenty-four hours, and ſhoots its ſalt; which is to be ladled out, as it ſhoots, into earthen pans, and thence into wooden vats to drain and dry. This done, it is groſly pounded, and thus put in a ſort of oven, called *calcar*, to dry. It may be added, that there are other plants, beſides kali, and fucus, which yield a ſalt fit for glaſs: ſuch are the common way-thiſtle, bramble, hops, wormwood, woad, tobacco, fern, and the whole leguminous tribe, as peaſe, beans, &c. In ſome kinds of glaſs, however, litharge, common pearl-aſhes, and nitre, are uſed in great quantities. The ſand or ſtone, called by the artiſts *tarſo*, is the ſecond ingredient in glaſs, and that which gives it the body and firmneſs. Theſe ſtones, Agricola obſerves, muſt be ſuch as will fuſe; and of theſe ſuch as are white and tranſparent are beſt; ſo that cryſtal challenges the precedency of all others.

At Venice they chiefly uſe a ſort of pebble, found in the river Teſino, reſembling white marble, and called *cuogolo*. Indeed Ant. Neri, aſſures us, that all ſtones which will ſtrike fire with ſteel, are fit to vitrify: but Dr. Merret ſhews, that there are ſome exceptions from this rule. Flints are admirable; and when calcined, powdered, and ſearched, make a pure white cryſtalline metal: but the expence of preparing them makes the maſters of our glaſs-houſes ſparing of their uſe. Where proper ſtones cannot be ſo conveniently had, ſand is uſed; which ſhould be white, and ſmall, and well waſhed, before it be applied; ſuch is uſually found in the mouths and ſides of rivers. Our glaſs-houſes are furniſhed with a fine ſand for cryſtal, from Maidſtone; the ſame with that uſed for ſand-boxes, and in ſcouring; and with a coarſer for green glaſs, from Woolwich. For cryſtal glaſs, to 200 lb. of tarſo, pounded fine, they put 130 lb. of ſalt of polverine; then mix them together, and put them into the calcar, a ſort of reverberatory furnace, being firſt well heated. Here they remain baking, frying, and calcining, for five hours, during which the workman keeps mixing them with a rake, to make them incorporate; when taken out, the mixture is called *frit*, or *bollito*. It may be further obſerved, that glaſs might be made by immediately melting the materials without thus calcining, and making them frit; but the operation would be much more tedious.

A glaſs much harder than any prepared in the common way may be made by means of borax, in the following manner. Take four ounces of borax, and an ounce of fine white ſand, reduced to powder, and melt them together in a large cloſe crucible ſet in a wind-furnace, keeping a ſtrong fire for half an hour; then take out the crucible, and, when cold, break it; and there will be found at the bottom, a hard, pure glaſs, capable of cutting common glaſs almoſt like a diamond. This experiment duly varied, ſays Dr. Shaw, may lead to ſome conſiderable improvements in the art of making glaſs, enamels, and artificial gems. It ſhews us an expeditious method of making glaſs without the uſe of fixed ſalts, which has generally been thought an eſſential ingredient in glaſs, and which is the ingredient that gives common glaſs its ſoftneſs; and it is not yet known, whether calcined cryſtal, or other ſubſtances being added to this ſalt, inſtead of ſand, it might not make a glaſs approaching to the nature of a diamond.

Kinds of Glass. There are many ſorts of glaſs made, which may principally be diſtinguiſhed according to their beauty: as the cryſtal flint-glaſs, the cryſtal white-glaſs, the green-glaſs, and the bottle-glaſs. Again, theſe ſeveral ſorts are diſtinguiſhed by their ſeveral uſes: as plate or coach glaſſes, looking-glaſſes, optic-glaſſes, &c. which are made of the firſt ſort. The ſecond ſort includes crown-glaſs, toys, phials, drinking glaſſes, &c. The third ſort is well known by its colour, and the ſecond by its form.

Balas-coloured Glass is made thus: Put into a pot cryſtal frit, thrice waſhed in water; tinge this with manganeſe prepared into a clear purple: to this add alumen cativum ſifted fine in ſmall quantities, and at ſeveral times; this will make the glaſs grow yellowiſh, and a little reddiſh, but not blackiſh, and always diſſipates the manganeſe. The laſt time you add manganeſe, give no more of the alumen cativum, unleſs the colour be too full. Thus will the glaſs be exactly of the colour of the balas-ruby.

Red Glass. A blood-red glaſs may be made in the following manner: Put ſix pounds of glaſs of lead, and ten pounds of common glaſs, into a pot glazed with white glaſs: when the whole is boiled and refined, add, by ſmall quantities, and at ſmall diſtances of time, copper calcined to a redneſs, as much as, on repeated proofs, is found ſufficient: then add tartar in powder by ſmall quantities at a time, till the glaſs is become as red as blood; and continue adding one or other of the ingredients till the colour is quite perfect.

Yellow Glass. It is neceſſary to remark in glaſs-making, that the cryſtal glaſs made with ſalt that has an admixture of tartar will never receive the true gold yellow, though it will all other colours: for yellow glaſs, therefore, a ſalt muſt be prepared from polverine, or pot-aſhes alone, to make the glaſs.

Furnace for the Making of Glass. In this manufacture, there are three ſorts of furnaces; one, called *calcar*, is for the frit; the ſecond is for working the glaſs; the third ſerves to anneal the glaſs, and is called the *leer*. The calcar reſembles an oven ten feet long, ſeven feet broad, and two deep: the fuel, which in Britain is ſea-coal, is put into a trench on one ſide of the furnace; and the flame reverberating from the roof upon the frit calcines it. The *glaſs-furnace*, or working furnace, is round, of three yards diameter, and two high; or thus proportioned. It is divided into three parts, each of which is vaulted. The lower part is properly called the *crown*, and is made in that form. Its uſe is to keep a briſk fire, which is never put out. The mouth is called *bocca*. There are ſeveral holes in the arch of this crown, through which the flame paſſes into the ſecond vault or partition, and reverberates into the ports filled with the ingredients above-mentioned. Round the inſides are eight or more pots placed, and piling pots on them. The number of pots is always double that of the boccas or mouths, or of the number of workmen, that each may have one pot refined to work out of, and another for metal to refine in while he works out of the other. Through the working holes the metal is taken out of the pots, and the pots are put into the furnace; and theſe holes are ſtopped with moveable covers made of lute and brick, to ſcreen the workmens eyes from the ſcorching flames. On each ſide of the bocca, or mouth, is a bocarella, or little hole, out of which coloured glaſs, or finer metal, is taking from the piling pot. Above this oven, there is the third oven, or *leer*, about five or ſix yards long, where the veſſels, or glaſs, are annealed, or cooled: this part conſiſts of a tower, beſides the leer, into which the flame aſcends from the furnace. The tower has two mouths, through which the glaſſes are put in with a fork, and ſet on the floor or bottom: but they are drawn out on iron pans, called *fraches*, through the leer, to cool by degrees; ſo that they are quite cold by the time they reach the mouth of the leer, which enters the ſaroſel, or room, where the glaſſes are to be ſtowed.

But the green glaſs-furnace is ſquare; and at each angle it has an arch for annealing or cooling glaſſes. The metal is wrought on two oppoſite ſides, and on the other two they have their colours, into which are made linnet holes, for the fire to come from the furnace to break the frit, and to diſcharge the ſmoke. Fires are made in the arches to anneal the work, ſo that the whole proceſs is done in one furnace. Theſe furnaces muſt not be of brick, but of hard ſandy ſtones. In France they build the outſide of brick; and the inner part, to bear the fire, is made of a ſort of a fuller's earth, or tobacco-pipe clay, of which earth they alſo make their melting-pots. In Britain the pots are made of Sturbridge clay. Mr. Blancourt obſerves, that the worſt and rougheſt work in this art, is the changing the pots when they are worn out and cracked. In this caſe, the great working hole muſt be uncovered; the faulty pot muſt be taken out with iron hooks and forks, and a new one muſt be ſpeedily put in its place, through the flames, by the hands only. For this work, the man guards himſelf with a garment made of ſkins, in the ſhape of a pantaloon, that covers him all but his eyes, and is made as wet as poſſible; they eyes are defended with a proper ſort of glaſs.

Inſtruments for making of Glass. The inſtruments made uſe of in this work, may be reduced to theſe that follow. A blowing pipe, made of iron, about two feet and a half long, with a wooden handle. An iron rod to take up the glaſs, after it is blown, and to cut off the former. Sciſſars to cut the glaſs when it comes off from the firſt hollow iron. Shears to cut and ſhape great glaſſes, &c. An iron ladle, with the end of the handle caſed with wood, to take the metal out of the refining pot, to put it into the workmens pots. A ſmall iron ladle, caſed in the ſame manner, to ſkim the alkalic ſalt that ſwims at top. Shovels, one like a peel, to take up the great glaſſes; another, like a fire-ſhovel, to feed the furnace with coals. A hooked iron fork, to ſtir the matter in the pots. An iron rake for the ſame purpoſe, and to ſtir the frit. An iron fork, to change or pull the pots out of the furnace, &c.

Working or Blowing Round Glass. The tools thus provided, the workman dips his blowing pipe into the melting-pot; and by turning it about, the metal ſticks to the iron more firmly than turpentine. This he repeats four times, at each time rolling the end of his inſtrument, with the hot metal thereon, on a piece of plate-iron; over which is a veſſel of water which helps to cool, and ſo to conſolidate and to diſpoſe that matter to bind more firmly with what is to be taken next out of the melting-pot. But after he has dipt a fourth time, and the workman perceives there is metal enough on the pipe, he claps his mouth immediately to the other end of it, and blows gently through the iron tube, till the metal lengthens like a bladder about a foot. Then he rolls it on a marble ſtone, a little while, to poliſh it; and blows a ſecond time, by which he brings it to the ſhape of a globe of about 18 or 20 inches diameter. Every time he blows into the pipe, he removes it quickly to his cheek; otherwiſe he would be in danger, by often blowing, of drawing the flame into his mouth: and this globe may be flattened by returning it to the fire; and brought into any form by ſtamp-irons, which are always ready. When the glaſs is thus blown, it is cut off at the collet, or neck; which is the narrow part that ſtuck to the iron. The method of performing this is as follows: the pipe is reſted on an iron bar, cloſe by the collet; then a drop of cold water being laid on the collet, it will crack about a quarter of an inch, which, with a ſlight blow, or cut of the ſhears, will immediately ſeparate the collet.

After this is done, the operator dips the iron rod into the melting-pot, by which he extracts as much metal as ſerves to attract the glaſs he has made, to which he now fixes this rod at the bottom of his work, oppoſite to the opening made by the breaking of the collet. In this poſition the glaſs is carried to the great bocca, or mouth of the oven, to be heated and ſcalded; by which means it is again put into ſuch a ſoft ſtate, that, by the help of an iron inſtrument, it can be pierced, opened, and widened without breaking. But the veſſel is not finiſhed till it is returned to the great bocca; where being again heated thoroughly, and turned quickly about with a circular motion, it will open to any ſize, by the means of the heat and motion. If there remain any ſuperfluities, they are cut off with the ſhears; for till the glaſs is cool, it remains in a ſoft, flexible ſtate. It is therefore taken from the bocca, and carried to an earthern bench, covered with brands, which are coals extinguiſhed, keeping it turning; becauſe that motion prevents any ſettling, and preſerves an evenneſs in the face of the glaſs, where, as it cools, it comes to its conſiſtency; being firſt cleared from the iron rod by a ſlight ſtroke by the hand of the workman. If the veſſel conceived in the workman's mind, and whoſe body is already made, requires a foot, or a handle, or any other member or decoration, he makes them ſeparately: and now eſſays to join them with the help of hot metal, which he takes out of the pots with his iron rod: but the glaſs is not brought to its true hardneſs, till it has paſſed the leer, or annealing oven, deſcribed before.

Working or Blowing of Window or Table Glass. The method of working round glaſs, or veſſels of any ſort, is in every particular applicable to the working of window or table glaſs, till the blowing iron has been dipt the fourth time. But then, inſtead of rounding it, the workman blows, and ſo manages the metal upon the iron plate, that it extends two or three feet in the form of a cylinder. This cylinder is put again to the fire, and blown a ſecond time, and is thus repeated till it is extended to the dimenſions required, the ſide to which the pipe is fixed diminiſhing gradually till it ends in a pyramidal form; ſo that, to bring both ends nearly to the ſame diameter, while the glaſs is thus flexible, he adds a little hot metal to the end oppoſite the pipe, and draws it out with a pair of iron pincers, and immediately cuts off the ſame end with the help of a little cold water, as before. The cylinder being now open at one end, is carried back to the bocca; and there, by the help of cold water, it is cut about eight or ten inches from the iron pipe or rod; and the whole length at another place, by which alſo it is cut off from the iron rod. Then it is heated gradually on an earthen table, by which it opens in length; while the workman, with an iron tool, alternately lowers and raiſes the two halves of the cylinder; which at laſt will open like a ſheet of paper, and fall into the ſame flat form in which it ſerves for uſe; in which it is preſerved by heating it over again, cooling it on a table of copper, and hardening it 24 hours in the annealing furnace, to which it is carried upon forks. In this furnace an hundred tables of glaſs may lie at a time, without injury to each other, by ſeparating them into tens, with an iron ſhiver between, which diminiſhes the weight by dividing it, and keeps the tables flat and even. This was the method formerly made uſe of for blowing plate-glaſs, looking-glaſſes, &c. but the workmen, by this method, could never exceed 50 inches in length, and a proportional breadth, becauſe what were larger were always found to warp, which prevented them from reflecting the objects regularly, and wanted ſubſtance to bear the neceſſary grinding. Theſe imperfections have been remedied by an invention of the Sieur Abraham Thevart, in France, about the year 1688, of caſting or running large plates of glaſs in the following manner.

Caſting or Running of Large Looking Glass *Plates.* The furnace is of a very large dimenſion, environed with ſeveral ovens, or annealing furnaces, called *carquaſſes*, beſides others for making of frit and calcining old pieces of glaſs. This furnace, before it is fit to run glaſs, coſts an enormous ſum. It ſeldom laſts above three years, and even in that time it muſt be refitted every ſix months. It takes ſix months to rebuild it; and three months to refit it. The melting pots are as big as large hogſheads, and contain about 2000 weight of metal. If one of them burſts in the furnace, the loſs of the matter and time amounts to 250l. The heat of this furnace is ſo intenſe, that a bar of iron laid at the mouth thereof becomes red hot in leſs than half a minute. The materials in theſe pots are the ſame as deſcribed before. When the furnace is red hot, theſe materials are put in at three different times, becauſe that helps the fuſion; and in twenty-four hours they are vitrified, refined, ſettled, and fit for caſting.

Grinding and Poliſhing of Plate GLASS. Glaſs is made tranſparent by fire; but it receives its luſtre by the ſkill and labour of the grinder and poliſher, the former of whom takes it rough out of the hands of the maker. In order to grind plate glaſs, they lay it horizontally upon a flat ſtone table, made of a very fine grained free ſtone: and for its greater ſecurity they plaſter it down with lime or ſtucco; for otherwiſe the force of the workmen, or the motion of the wheel with which they grind it, would move it about. This ſtone table is ſupported by a ſtrong frame, made of wood, with a ledge quite round its edges, riſing about two inches higher than the glaſs. Upon this glaſs to be ground, is laid another rough glaſs not above half ſo big, and ſo looſe as to ſlide upon it; but cemented to a wooden plank, to guard it from the injury it muſt otherwiſe receive from the ſcraping of the wheel to which this plank is faſtened, and from the weights laid upon it to promote the grinding or triture of the glaſſes. The whole is covered with a wheel, made of hard light wood, about ſix inches in diameter; by pulling of which backwards and forwards alternately, and ſometimes turning it round, the workmen, who always ſtand oppoſite to each other, produce a conſtant attrition between the two glaſſes, and bring them to what degree of ſmoothneſs they pleaſe, by firſt pouring in water and coarſe ſand; after that, a finer ſort of ſand, as the work advanceth, till at laſt they muſt pour in the powder of ſmalt. As the upper or incumbent glaſs poliſhes and grows ſmoother, it muſt be taken away, and another from time to time put in its place. This engine is called a *mill* by the artiſts, and is uſed only in the largeſt ſized glaſſes; for in the grinding of the leſſer glaſſes, they are content to work without a wheel, and to have only four wooden handles faſtened to the four corners of the ſtone which loads the upper plank, by which they work it about. When the grinder has done his part, who finds it very difficult to bring the glaſs to an exact plainneſs, it is turned over to the poliſher; who with the fine powder of tripoli ſtone, or emery, brings it to a perfect evenneſs and luſtre. The inſtrument made uſe of in this branch is a board, furniſhed with a felt, and a ſmall roller, which the workman moves by means of a double handle at both ends. The artiſt in working this roller, is aſſiſted with a wooden hoop or ſpring, to the end of which it is fixed: for the ſpring, by conſtantly bringing the roller back to the ſame points, facilitates the action of the workman's arm.

Painting in GLASS. The ancient manner of painting in glaſs was very ſimple: it conſiſts in the mere arrangement of pieces of glaſs of different colours in ſome ſort of ſymmetry, and conſtituted what is now called *Moſaic work*. See MOSAIC.

In proceſs of time they came to attempt more regular deſigns, and alſo to repreſent figures heightened with all their ſhades: yet they proceeded no farther than the contours of the figures in black with water-colours, and hatching the draperies after the ſame manner on glaſſes of the colour of the object they deſigned to paint. For the carnation, they uſed glaſs of a bright red colour; and upon this they drew the principal lineaments of the face, &c. with black.

But in time, the taſte for this ſort of painting improving conſiderably, and the art being found applicable to the adorning of churches, baſilics, &c. they found out means of incorporating the colours in the glaſs itſelf, by heating them in the fire to a proper degree; having firſt laid on the colours. This art, however, has frequently met with much interruption, and ſometimes been almoſt totally loſt; of which Mr. Walpole gives us the following account, in his Anecdotes of Painting in England.

" The firſt interruption given to it was by the reformation, which baniſhed the art out of churches; yet it was in ſome meaſure kept up in the eſcutcheons of the nobility and gentry, in the windows of their ſeats. Towards the end of queen Elizabeth's reign it was omitted even there; yet the practice did not entirely ceaſe. The chapel of our Lady at Warwick was ornamented anew by Robert Dudley earl of Leiceſter, and his counteſs, and the cipher of the glaſs painter's name yet remains, with the date 1574: and in ſome of the chapels at Oxford the art again appears, dating itſelf in 1622, by the hand of no contemptible maſter. I could ſupply even this gap of 48 years by many dates on Flemiſh glaſs; but nobody ever ſuppoſed that the ſecret was loſt ſo early as the reign of James I. and that it has not periſhed ſince, will be evident from the following ſeries reaching to the preſent hour. The portraits in the windows of the library at All Souls, Oxford. In the chapel at Queen's college there are twelve windows dated 1518. P.C. a cipher on the painted glaſs in the chapel at Warwick, 1574. The windows at Wadham college; the drawing pretty good, and the colours fine, by Bernard Van Linge, 1622. In the chapel at Lincoln's-Inn, a window, with the name of *Bernard*, 1623. This was probably the preceding Van Linge. In the church of St. Leonard, Shoreditch, two windows by Baptiſta Sutton, 1634. The windows in the chapel at Univerſity-college, Hen. Giles *pinxit*, 1687. At Chriſt-church, Iſaac Oliver, aged 84, 1700. Window in Merton chapel, William Price, 1700. Windows at Queen's New-college, and Maudlin, by Wm. Price, the ſon, now living, whoſe colours are fine, whoſe drawing is good, and whoſe taſte in ornaments and moſaic is far ſuperior to any of his predeceſſors; is equal to the antique, to the good Italian maſters, and only ſurpaſſed by his own ſingular modeſty.

" It may not be unwelcome to the curious reader to ſee ſome anecdotes of the revival of taſte for painted glaſs in England. Price, as we have ſaid, was the only painter in that ſtyle for many years in England. Afterwards one Rowel, a plumber at Reading, did ſome things, particularly for the laſe Henry earl of Pembroke; but Rowel's colours ſoon vaniſhed. At laſt he found out a very durable and beautiful red; but he died in a year or two, and the ſecret with him. A man at Birmingham began the ſame art in 1756 or 1757, and fitted up a window for lord Lyttleton, in the church of Hagley; but ſoon broke. A little after him, one Peckitt at York began the ſame buſineſs, and has made good proficiency. A few lovers of that art collected ſome diſperſed panes from ancient buildings, particularly the late lord Cobham, who erected a a Gothic temple at Stowe, and filled it with arms of the old nobility, &c. About the year 1753, one Aſciotti, an Italian, who had married a Flemiſh woman, brought a parcel of painted glaſs from Flanders, and ſold it for a few guineas, to the honourable Mr. Bateman, of Old Windſor. Upon that I ſent Aſciotti again to Flanders, who brought me 450 pieces, for which, including the expence of his journey, I paid him 36 guineas. His wife made more journeys for the ſame purpoſe; and ſold her cargoes to one Palmer, a glazier in St. Martin's-lane, who immediately raiſed the prize to one, two, or five guineas for a ſingle piece, and fitted up entire windows with them, and the moſaics of plain glaſs of different colours. In 1761, Paterſon, an auctioneer, at Eſſex-houſe in the Strand, exhibited the two firſt auctions of painted glaſs, imported in like manner from Flanders. All this manufacture conſiſted in rounds of ſcripture-ſtories, ſtained in black and yellow, or in ſmall figures of black and white; birds and flowers in colours, and Flemiſh coats of arms."

The moſt modern as well as highly finiſhed production in glaſs painting is on one of the windows of Saliſbury cathedral, executed at the expence of the preſent Lord Rawdon, by Mortimer, a proficient of unrivalled merit in the art. The ſubject is Moſes uplifting the ſerpent. The figures in this piece are ten feet high: the joining of the glaſs is ſo judiciouſly contrived as to connect the reſpective pieces in the dark ſhadows, by which means it has the appearance of being painted upon one large ſheet of glaſs. From the elegance of the deſign, the accuracy of the drawing, the brilliancy of the colouring, and the effect of the *toute enſemble*, it ſurpaſſes all productions both of the ancients or moderns.

The colours uſed in painting or ſtaining of glaſs are very different from thoſe uſed in painting either in water or oil colours. For black, take ſcales of iron, one ounce; ſcales of copper, one ounce; jet, half an ounce: reduce them to powder, and mix them. For blue, take powder of blue, one pound; ſal nitre, half a pound; mix them and grind them well together. For carnation, take red chalk, eight ounces; iron ſcales, and litharge of ſilver, of each two ounces; gum arabic, half an ounce; diſſolve in water; grind all together for half an hour as ſtiff as you can; then put it in a glaſs and ſtir it well, and let it ſtand to ſettle fourteen days. For green, take red-lead, one pound; ſcales of copper, one pound; and flint, five pounds: divide them into three parts; and add to them as much ſal nitre; put them into a crucible, and melt them with a ſtrong fire; and when it is cold, powder it, and grind it on a porphyry. For gold colour, take ſilver an ounce; antimony, half an ounce; melt them in a crucible; then pound the maſs to powder; and grind it on a copper plate; add to it yellow ochre, or brick-duſt calcined again, fifteen ounces; and grind them well together with water. For purple, take minium, one pound; brown ſtone, one pound; white flint, five pounds: divide them into three parts, and add to them as much ſal nitre as one of the parts; calcine, melt, and grind it as you did the green. For red, take jet, four ounces; litharge of ſilver, two ounces; red chalk, one ounce; powder them fine, and mix them. For white, take jet, two parts; white flint, ground on a glaſs very fine, one part; mix them. For yellow, take Spaniſh brown, ten parts; leaf-ſilver, one part; antimony, half a part; put all into a crucible, and calcine them well.

In the windows of ancient churches, &c. there are to be ſeen the moſt beautiful and vivid colours imaginable, which far exceed any of thoſe in general uſed by the moderns, not ſo much becauſe the ſecret of making thoſe colours is entirely loſt, as that the moderns will not go to the charge of them, nor be at the neceſſary pains, by reaſon that this ſort of painting is not now ſo much in eſteem as formerly. Thoſe beautiful works which were made in the glaſs-houſes were of two kinds. In ſome, the colour was diffuſed

fuſed through the whole ſubſtance of the glaſs. In others, which were the more common, the colour was only on one ſide, ſcarce penetrating within the ſubſtance above one third of a line; though this was more or leſs according to the nature of the colour, the yellow being always found to enter the deepeſt. Theſe laſt, though not ſo ſtrong, and beautiful as the former, were of more advantage to the workmen, by reaſon that on the ſame glaſs, though already coloured, they could ſhew other kinds of colours where there was occaſion to embroider draperies, enrich them with foliages, or repreſent other ornaments of gold, ſilver, &c.

In order to this, they made uſe of emery, grinding or wearing down the ſurface of the glaſs, till ſuch time as they were got through the colour to the clear glaſs. This done, they applied the proper colours on the other ſide of the glaſs. By theſe means, the new colours were hindered from running and mixing with the former, when they expoſed the glaſſes to the fire, as will appear hereafter. When indeed the ornaments were to appear white, the glaſs was only bared of its colour with emery, without tinging the place with any colour at all; and this was the manner by which they wrought their lights, aud heightnings, on all kinds of colour. The firſt thing to be done, in order to paint and ſtain glaſs, in the modern way, is to deſign, and even colour the whole ſubject on paper. Then they chooſe ſuch pieces of glaſs as are clear, even, and ſmooth, and proper to receive the ſeveral parts; and proceed to diſtribute the deſign itſelf, or papers it is drawn on, into pieces ſuitable to thoſe of the glaſs; always taking care that the glaſſes may join in the contours of the figures and the folds of the draperies; that the carnations, and other finer parts, may not be impaired by the lead with which the pieces are to be joined together. The diſtribution being made, they mark all the glaſſes as well as papers, that they may be known again: which done, applying every part of the deſign upon the glaſs intended for it, they copy, or transfer, the deſign upon this glaſs with the black colour, diluted in gum-water, by tracing and following all the lines and ſtrokes as they appear through the glaſs with the point of a pencil. When theſe ſtrokes are well dried, which will happen in about two days, the work being only in black and white, they give a ſlight waſh over with urine, gum arabic, and a little black; and repeat it ſeveral times, according as the ſhades are deſired to be heightened; with this precaution, never to apply a new waſh till the former is ſufficiently dried.

This done, the lights and riſings are given by rubbing of the colour in the reſpective places with a wooden point, or a handle of the pencil. As to the other colours above-mentioned, they are uſed with gum-water, much as in painting in miniature; taking care to apply them lightly, for fear of effacing the outlines of the deſign; or even, for the greater ſecurity, to apply them on the other ſide; eſpecially yellow, which is very pernicious to the other colours, by blending therewith. And here too, as in pieces of black and white, particular regard muſt always be had not to lay colour on colour, or lay on a new lay, till ſuch time as the former are well dried. It may be added, that the yellow is the only colour that penetrates through the glaſs, and incorporates therewith by the fire; the reſt, and particularly the blue, which is very difficult to uſe, remaining on the ſurface, or at leaſt entering very little. When the painting of all the pieces is finiſhed, they are carried to the furnace, or oven, to anneal, or bake the colours. The furnace here uſed is ſmall, built of brick, from 18 to 30 inches ſquare. At ſix inches from the bottom is an aperture to put in the fuel, and maintain the fire. Over this aperture is a grate, made of three ſquare bars of iron, which traverſe the furnace, and divide it into two parts. Two inches above this partition, is another little aperture, through which they take out pieces to examine how the coction goes forward. On the grate is placed a ſquare earthen pan, ſix or ſeven inches deep, and five or ſix inches leſs every way than the perimeter of the furnace. On the one ſide hereof is a little aperture, through which to make trials, placed directly oppoſite to that of the furnaces deſtined for the ſame end. In this pan are the pieces of glaſs to be placed, in the following manner: firſt, the bottom of the pan is covered with three ſtrata, or layers, of quicklime pulveriſed; thoſe ſtrata being ſeparated by two others of old broken glaſs, the deſign whereof is to ſecure the painted glaſs from the too intenſe heat of the fire. This done, the glaſſes are laid horizontally on the laſt or uppermoſt layer of lime. The firſt row of glaſs they cover over with a layer of the ſame powder, an inch deep; and over this they lay another range of glaſſes, and thus alternately till the pan is quite full; taking care that the whole heap always end with a layer of the lime-powder. The pan being thus prepared, they cover up the furnace with tiles, on a ſquare table of earthen ware, cloſely luted all round; only leaving five little apertures, one at each corner, and another in the middle, to ſerve as chimneys. Things thus diſpoſed, there remains nothing but to give the fire to the work. The fire for the firſt two hours muſt be very moderate, and muſt be increaſed in proportion as the coction advances, for the ſpace of ten or twelve hours; in which time it is uſually compleated. At laſt the fire, which at firſt was charcoal, is to be of dry wood, ſo that the flame covers the whole pan, and even iſſues out at the chimneys.

During the laſt hours, they make eſſays, from time to time, by taking out pieces laid for the purpoſe through the little aperture of the furnace and pan, to ſee whether the yellow be perfect, and the other colours in good order. When the annealing is thought ſufficient, they proceed with great haſte to extinguiſh the fire, which otherwiſe would ſoon burn the colours, and break the glaſſes.

GLAZING, the cruſting over earthen ware by a vitreous ſubſtance, the baſis of which is lead. For making a pure glaſs of lead, the following receipt will be found to anſwer: put a large quantity of lead into a potter's kiln, and keep it in a ſtate of fuſion with a moderate fire, till it is calcined to a grey looſe powder; then ſpread it in the kiln, and give it a greater heat, continually ſtirring it to keep it from running into lumps. Continue this for ſeveral hours, till the powder becomes of a fair yellow; then take it out and ſift it fine. This is called *calcined lead.* Take of this calcined lead, 15 pounds; and cryſtalline or other fritt, 12 pounds: mix theſe as well as poſſible together; put them into a pot, and ſet them in a furnace for 10 hours; then caſt the whole, which will now be perfectly melted, into water; ſeparate the looſe lead from it, and return the metal into it; and after ſtanding in fuſion 12 hours more, it will be fit for uſe. The workers of common earthen ware, however, are not at the trouble of thus previouſly making a pure glaſs of lead. Their uſual compoſition for glazing their ware is formed of ſand, wood-aſhes, lead-aſhes, and ſalt. The ware, after being turned on the wheel, and dried in the open air, is covered over with this compoſition by means of a bruſh; and when ſet in the furnace the violent heat ſoon reduces it to a perfect glaſs, covering the whole internal and external ſurface of the veſſel. The various colours for glazing are the ſame with thoſe for tinging glaſs, which we have already deſcribed. A black colour is given with manganeſe or iron. The proportions, however, are not exactly aſcertained, nor are there any receipts publiſhed concerning theſe things on which we can much depend. In the Philoſophical Tranſactions we have the following receipt for a fine gold coloured glazing, communicated to the Royal Society by Mr. Heinſius of Peterſburg. Take of litharge three parts, of ſand or calcined flint one part; mix theſe very well together, then run them into a yellow glaſs with a ſtrong fire. Pound this glaſs, and moiſten it when in ſubtile powder with a well-ſaturated ſolution of ſilver, which make into a paſte. Put this paſte into a crucible, and cover it. Give at firſt a gentle degree of fire, then increaſe and continue it till you have a perfect glaſs which will be green. Pound this glaſs again, and reduce it to a fine powder: moiſten this powder with ſome beer, ſo that by means of an hair-pencil you may apply it upon the veſſels. Thoſe that are painted or covered over with this glazing muſt be firſt well heated, then put under a muffle; and as ſoon as the glaſs runs you muſt ſmoke them, and take out the veſſels. This preparation owes its colour to the ſilver in it; the precipitates of which, ſpread upon a glaſs plate, have the property of ſtaining it yellow by ignition, without fuſion. When uſed in glazing veſſels, however, they muſt be held over the ſmoke of burning vegetables, in order to call forth the beautiful colour. A red or green tinge may be given to glazings by means of copper. The red colour appears firſt; but by a continuation of the fire, it is changed into a green. The fineſt red colour, however, that can be given to glazings, is that prepared from the ſolution of gold in aqua regia, as mentioned under the article GLASS. The fineſt blue is always given by means of zaffre or ſmalt. A purpliſh colour, as well as a brown or black, may alſo be given by manganeſe; but a mixture of the materials for red and blue will undoubtedly produce the fineſt colour. The colouring materials for glazings, therefore, in ſhort, are the following: *Red*—Gold or copper. *Yellow*—Silver, iron. *Green*—Copper. *Blue*—Zaffre or ſmalt. *Black*—Manganeſe. *White*—Calx of tin.

Each of theſe materials mixed up in a proper quantity with any compoſition that readily vitrifies, will form a glazing of the deſired colour upon any kind of earthen ware. The proportions in which they are to be uſed may eaſily be determined by a few trials. Stone ware is glazed by another method, viz. the vitrification of a ſmall part of the ſubſtance of the ware itſelf, by the fumes of ſalt thrown into the furnace when the veſſels are intenſely heaten. See STONE WARE. The application of different colours to it, however, is equally eaſy with the former. The Romans had a method of glazing their earthen veſſels, which in many reſpects appears to have been ſuperior to ours. The common brown glazing eaſily ſcales off, cracks, and in a ſhort time becomes diſagreeable to the eye. Beſides, it is very eaſily deſtroyed by acids; nor can veſſels glazed in this manner be even employed to hold water, without part of it oozing through their pores. Lead is alſo very deſtructive to the human body; and if acids are unwarily put into veſſels glazed with lead, the liquors will receive a very dangerous impregnation from the metal. The Roman glazing, which is yet to be ſeen upon urns dug up in ſeveral places, appears to have been made of ſome kind of varniſh; and Pliny gives us a hint that it was made of bitumen. He tells us that it never loſt its beauty, and that at length it became cuſtomary to glaze over ſtatues in this manner. As this varniſh ſunk deep into the ſubſtance of the ware, it was not ſubject to thoſe cracks and flaws which diſfigure our veſſels; and as it was not liable to be corroded by acids, it could not be liable to any of the accidents which may enſue from the uſe of veſſels glazed with lead.

GLEBE, among miners, ſignifies a piece of earth in which is contained ſome mineral ore.

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Spheres and Globes _ See System of Geography

Fig. 1. Copernican Armillary Sphere.

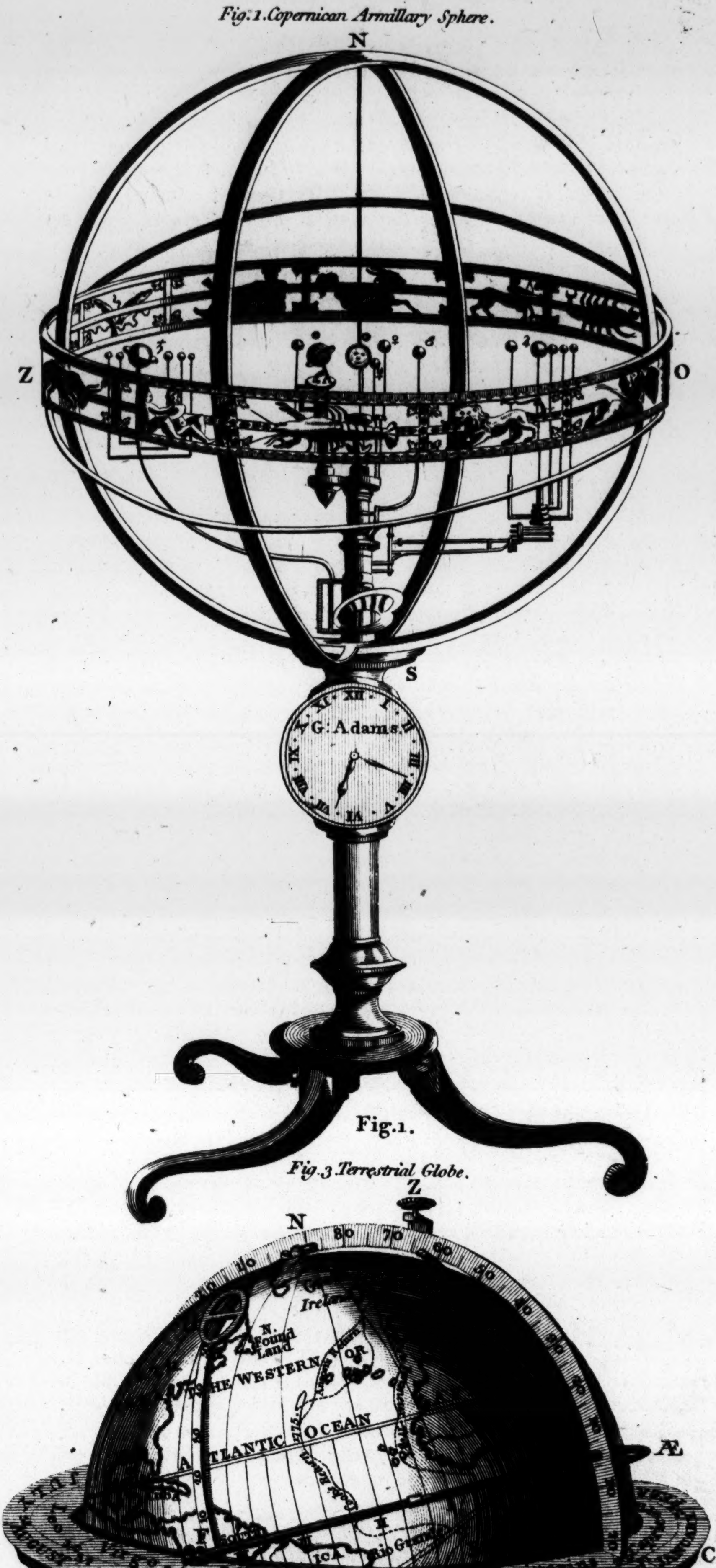
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Fig. 1.

Fig. 2. Newly Improved Armillary Sphere.

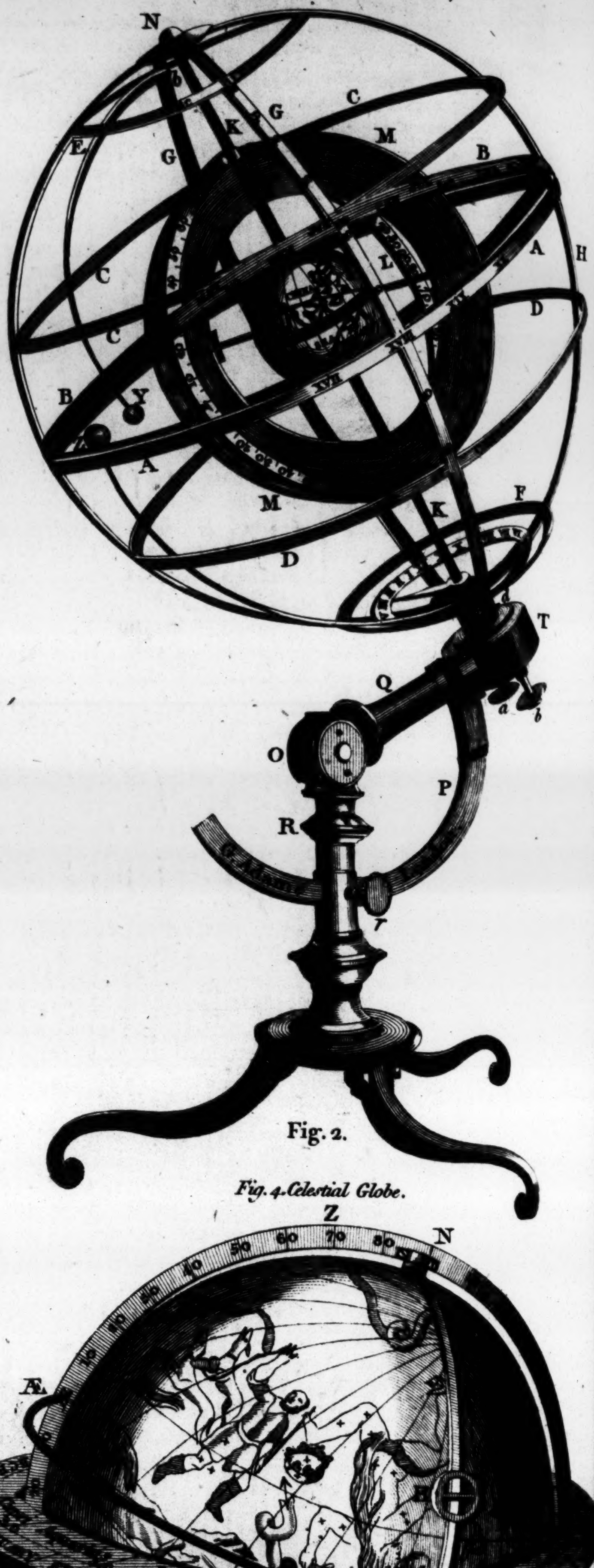
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Fig. 2.

Fig. 3. Terrestrial Globe.

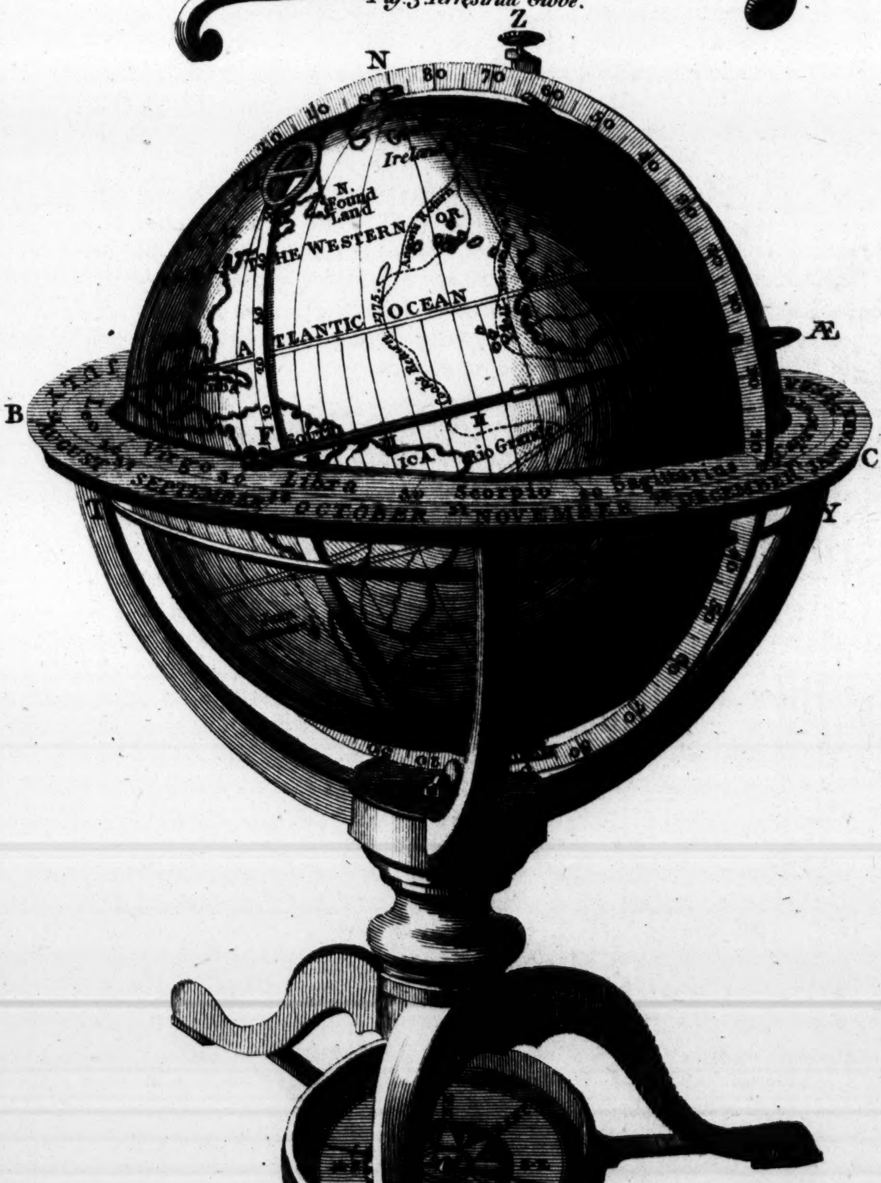
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Fig. 3.

Fig. 4. Celestial Globe.

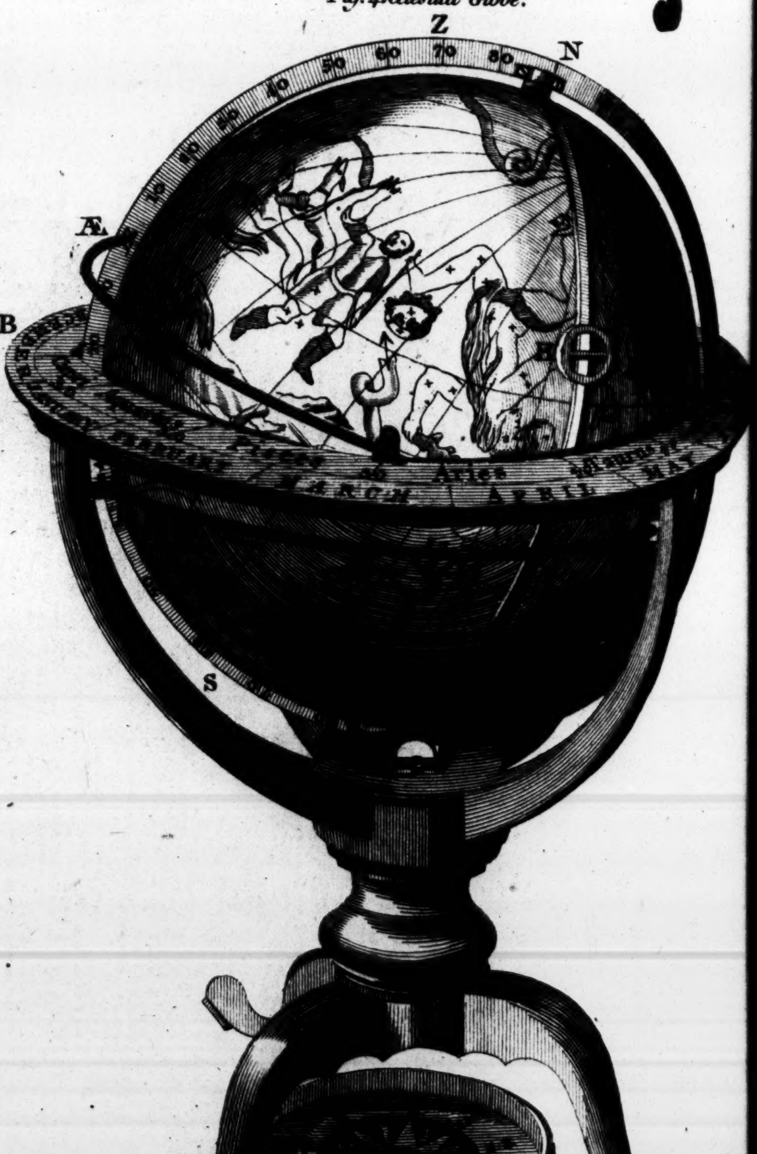
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Fig. 4.

Milne del.

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Lodge

TREATISE ON THE GLOBES.

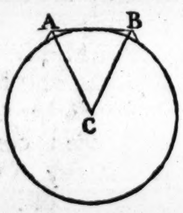
THE globes are artificial repreſentations of the earth and heavens, after a moſt natural and agreeable manner, and are infinitely preferable to any projected repreſentations in plano; beſides, to underſtand the nature of the projection of either ſphere in plano, requires more knowledge of geometry than is generally poſſeſſed by beginners, its principles are more recluſe, and the ſolution of problems by them more obſcure. The motion of the earth upon its axis is one of the moſt important principles both in geography and aſtronomy; on it the greater part of the phænomena of the viſible world depend; there is no invention that can communicate ſo natural a repreſentation of this motion, as that of a terreſtrial globe about its axis. By a celeſtial globe, the apparent motion of the heavens is alſo repreſented in a natural and ſatisfactory manner. In order to convey clear ideas of the *various diviſions* of the earth, of the ſituation of different places, and to obtain an eaſier ſolution of *problems in geography*, it is neceſſary to conceive many imaginary circles to be delineated on its ſurface, and to underſtand their relation to each other. Now on a globe theſe circles have their true form; their interſections and relative poſitions are viſible upon the moſt curſory inſpection. But in projections of the ſphere in plano, the form of theſe circles is varied, and their nature changed; they are conſequently but ill adapted to convey to young minds the elementary principles of geography. While the globe exhibits every thing in true proportion, both of figure and ſize.

The beſt conſtructed globes are thoſe made by Mr. George Adams of Fleet Street, Mathematical Inſtrument Maker to his Majeſty, and Optician to his Royal Highneſs the Prince of Wales; for they contain many new and uſeful improvements, which render them greatly ſuperior to the common or ordinary globes made by others. By the globes of Mr. Adams's conſtruction, many operations may be performed which cannot be ſolved by the common globes; while all that they can ſolve, may be performed by his, and that with a far greater degree of perſpicuity; for many problems may be performed by them at one view, which on the other globes require ſucceſſive operations; adding to this, the ſuperior neatneſs of workmanſhip, and elegant ſtile in which they are mounted, we ſhould not do juſtice to Mr. Adams, did we not recommend them in preference of thoſe made by other artiſts. The following deſcriptions and precepts are therefore all adapted to Mr. Adams's globes, but if the reader knows how to uſe thoſe globes rightly, he will not be at a loſs in uſing any other that he may happen to meet with. Previous, however, to entering into their deſcription and uſe, I ſhall advance a few mathematical problems relative to the earth, which will help to facilitate the uſe of the terreſtrial globe, in the reſolution of ſundry geographical enquiries.

GEOGRAPHICAL PROBLEMS.

Prob. I. To find the length of a degree on the earth's ſurface. Chuſe two places on the earth, ſituate under the ſame meridian, in a level and even country, and as far off as poſſible, and at each place on the ſame day, let the meridian altitude of the ſun or ſome noted ſtar be taken; or let the latitude of thoſe places be taken, as has been ſhewn in the aſtronomy; then the difference of thoſe altitudes or latitudes, will give the difference of latitude, or the diſtance of the two places in degrees. Then if the neareſt diſtance between the two places be actually meaſured, it will be the diſtance anſwerable to ſuch degrees, and conſequently the length of a degree will be had by diviſion.

But the length of a degree on the earth's ſurface, ſuppoſing the earth to be a ſphere, may be found in a more general manner as follows. Chuſe two ſtations as A and B on the tops of two mountains, and as far diſtant as poſſible, ſo as to be ſeen from one another through a teleſcopic ſight. Then being ſtationed at A, with a proper inſtrument take the angle BAC, contained between the perpendicular AC, and the viſual ray AB. Alſo in like manner at the other ſtation B, take the angle ABC, contained between the perpendicular BC, and the viſual ray, BA. Then the ſum of theſe two angles taken from 180°, gives the angle ACB. Laſtly, meaſure the line AB, leading directly from one ſtation to the other, and it will give the number of miles correſponding to the degrees of the angle ACB; and hence the length of one degree will be had.



N. B. If any part the line AB be impaſſible, it may be meaſured trigonometrically by taking off ſtations, as is uſual in meaſuring inacceſſible diſtances.

In the year 1635, Mr. Norwood meaſured the diſtance between London and York, and found the length of a degree to be 367196 feet, or 69.54 Engliſh miles, but at a medium the length of a degree is only about 69.31 miles.

Cor. I. The length of a degree being obtained, the circumference of the earth is had by multiplying it by 360; and dividing the circumference by 3.1416, will give the diameter nearly. By which means the earth's circumference is found to be 24951.6 Engliſh miles, and its diameter 7942 miles.

The earth, however, is not a perfect ſphere, but is of the form of an oblate ſpheroid, the equatorial diameter being longer than the axis, from pole to pole, by about $\frac{1}{230}$ part thereof, as has been demonſtrated by Sir Iſaac Newton, from the principles of gravitation, and been ſince confirmed by actual meaſuring the different lengths of a degree of latitude in different parts of the earth.

The following table ſhews the length of a degree on the meridian to every 5th. degree of latitude.

Deg. Lat.	Miles in a Deg.	Lat.	Miles in a Deg.	Lat.	Miles in a Deg.	Lat.	Miles in a Deg.	Lat.	Miles in a Deg.
0	68.723	20	68.830	40	69.097	60	69.401	80	69.601
5	68.730	25	68.882	45	69.176	65	69.467	85	69.620
10	68.750	30	68.950	50	69.256	70	69.522	90	69.628
15	68.783	35	69.020	55	69.330	75	69.568		

Prob. II. Having the longitudes of two places in one parallel, (or which is the ſame, their difference of longitude) to find their diſtance on that parallel, ſuppoſing the earth a ſphere. Since the circumference of circles are to one another, as their reſpective radii, and like parts areas their wholes; and ſince the radii of all parallels of latitude, are as the coſines of the latitudes; we have this proportion; as radius : coſine of latitude : : difference of longitude in degrees, to the diſtance in degrees of the equinoctial, which multiplied by 69.31 gives the diſtance in miles Engliſh, or multiplied by 60, gives the diſtance in geographical miles; for a geographical mile is the 60th part of a degree on the earth's ſurface. Or, the difference of longitude may be brought into miles on the equator at once, and then the proportion will give the anſwer. Or, from the following table, take the length of a degree, anſwering to the given latitude, which, multiplied by the difference of longitude in degrees, will give the diſtance in that parallel in geographical miles.

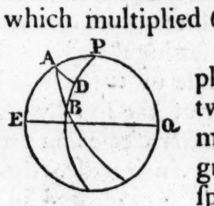
A TABLE Shewing the Number of Miles contained in a Degree of Longitude, in each Parallel of Latitude from the Equator.

Degrees of Latitude.	Miles.	100th Parts of a Mile.	Degrees of Latitude.	Miles.	100th Parts of a Mile.	Degrees of Latitude.	Miles.	100th Parts of a Mile.	Degrees of Latitude.	Miles.	100th Parts of a Mile.	Degrees of Latitude.	Miles.	100th Parts of a Mile.	Degrees of Latitude.	Miles.	100th Parts of a Mile.
1	59	99	16	57	67	31	51	43	46	41	68	61	29	09	76	14	51
2	59	96	17	57	38	32	50	88	47	40	92	62	28	17	77	13	50
3	59	91	18	57	06	33	50	32	48	40	14	63	27	24	78	12	47
4	59	85	19	56	73	34	49	74	49	39	36	64	26	30	79	11	45
5	59	77	20	56	39	35	49	15	50	38	57	65	25	35	80	10	42
6	59	67	21	56	01	36	48	54	51	37	76	66	24	40	81	09	38
7	59	55	22	55	63	37	47	92	52	36	94	67	23	44	82	08	34
8	59	41	23	55	23	38	47	28	53	36	11	68	22	47	83	07	31
9	59	26	24	54	81	39	46	62	54	35	27	69	21	50	84	06	27
10	59	09	25	54	38	40	45	96	55	34	41	70	20	52	85	05	22
11	58	89	26	53	93	41	45	28	56	33	55	71	19	53	86	04	18
12	58	68	27	53	46	42	44	58	57	32	68	72	18	54	87	03	14
13	58	46	28	52	97	43	43	88	58	31	79	73	17	54	88	02	09
11	58	22	29	52	47	44	43	16	59	30	90	74	16	53	89	01	05
15	57	95	30	51	96	45	42	42	60	30	00	75	15	53	90	00	00

Prob. III. To find the proper diſtance of any two places upon the earth, whoſe latitudes and longitudes are known.

1ſt. If the places be under the ſame meridian, ſubtract one latitude from the other, when they are both on one ſide of the equator, but add them together, if on the contrary ſides, and you will have the diſtance in degrees, then with the *mean latitude* enter table belonging to Problem I, and take out the number of miles to a degree, by which multiply the ſaid diſtance, and you will have the diſtance in Engliſh miles.

2d. If the places be in one parallel of latitude, ſay as Radius : coſine of latitude : : ſine half the difference of longitude : ſine of half the diſtance in degrees; then the double is the diſtance ſought; which multiplied 69.31 gives the Engliſh miles.



3d. In general let EPQ be the meridian of one place, EQ the equator, P the pole, A and D the two places whoſe diſtance is required, PB the meridian of B. Through A and B draw the great circle AB. Then in the oblique angled ſpherical triangle APB, there is given the angle APB == the difference of longitude, and the containing ſides AP and BP == to the colatitudes, to find the ſide AB, the diſtance ſought. Now by ſpherical trigonometry (the perpendicular AD being drawn) we have as radius : coſine APB : : tangent of AP : tangent of DP; and DP being taken from BP, when the angle ABP is leſs than a right angle, or added to it when greater, gives the ſegment BD. And as coſine PD : coſine PA : : coſine BD : coſine BA, the diſtance required in degrees, which multiplied by the miles in a degree, as correſponding to the middle latitude in table to Prob. I. will give the diſtance in Engliſh miles.

In like manner if the latitudes and diſtance were given, the difference of longitudes would be found by finding the angle APB, having the three ſides PA, PB, and AB given, for the ſolution of which the reader is referred to Spherical Trigonometry.

DESCRIPTION OF THE GLOBES.

There are two artificial globes. On the ſurface of one of them the heavens are delineated; this is called the celeſtial globe. The other, on which the ſurface of the earth is deſcribed, is called the terreſtrial globe. In Plate of the Spheres and Globes, (*fig.* 3.) repreſents the terreſtrial, and (*fig.* 4.) the celeſtial globe.

In uſing the terreſtrial globe, we are to ſuppoſe ourſelves on ſome point of its ſurface. In uſing the celeſtial globe, we are to conſider ourſelves as at the center. The motion of the terreſtrial globe repreſents the real motion of the earth; the motion of the celeſtial globe repreſents the apparent motion of the heavens. The motion therefore of the terreſtrial globe is a motion from weſt to eaſt. But the motion of the celeſtial globe is a motion from eaſt to weſt. On the ſurface of each globe ſeveral circles are deſcribed. The center of ſome of theſe circles is the ſame with the center of the globe; and ſuch circles are, by way of diſtinction called great circles; and of theſe great circles, ſome are graduated. The graduated circles divided into 360 degrees, or equal parts, 90 of which make a quarter of a circle, or a quadrant. Thoſe circles whoſe centers do not paſs through the center, are called leſſer circles. The globes are each of them ſuſpended at the poles in a ſtrong braſs circle N Z ÆS, and turn therein upon two iron pins, which are the axis of the globe; they have each a thin braſs ſemicircle N H S, moveable about theſe poles, with a ſmall thin circle H ſliding thereon; it is quadrated each way, to 90 degrees from the equator to either pole. On the terreſtrial globe this ſemicircle is a moveable meridian. Its ſmall ſliding circle, which is divided into a few of the points of the mariner's compaſs, is called a terreſtrial or viſible horzion. On the celeſtial globe, this ſemicircle is a moveable circle of declination, and its ſmall braſs circle an artificial ſun, or planet. Each globe has a braſs wire circle T W Y, placed at the limits of the crepuſculum, or twilight, which, together with the globe, is mounted in a wooden frame; the upper part B C is covered with a broad paper circle, whoſe plane divides the globe into two hemiſpheres, and the whole is ſupported by a neat pillar and claw, with a magnetic needle in a compaſs box marked M.

DESCRIPTION OF THE CIRCLES DELINEATED ON THE BROAD BAPER CIRCLE BC; TOGETHFR WITH A GENERAL ACCOUNT OF ITS USES.

It contains four concentric circular ſpaces, the innermoſt of which is divided into 360 degrees, and numbered into four quadrants, beginning at the eaſt and weſt points, and proceeding each way to 90 degrees at the north and ſouth points; theſe are the four cardinal points of the horizon. The ſecond circular ſpace contains, at equal diſtances, the thirty-two points of the mariner's compaſs. Another circular ſpace is divided into twelve equal parts, repreſenting the twelve ſigns of the zodiac; theſe are again ſubdivided into 30 degrees each, between which are engraved their names and characters. This ſpace is connected with a fourth, which contains the calendar of months and days, each day (on the 18 inch globes) being divided into four parts, expreſſing the four cardinal points of the day, according to the Julian reckoning; by which means the ſun's place is very nearly obtained for the common years after biſſextile, and the intercalary day is inſerted without confuſion. In all poſitions of the celeſtial globe, this broad paper circle repreſents the plane of the horizon, and diſtinguiſhes the viſible from the inviſible part of the heavens; but in the terreſtrial globe it is applied to three different uſes. 1. To diſtinguiſh the points of the horizon; in this caſe it repreſents the rational horizon of any place. 2. It is uſed to repreſent the circle of illumination, or that circle which ſeparates day from night. 3. It occaſionally repreſents the ecliptic.

THE STRONG BRASS CIRCLE. NÆZS.

One ſide of this ſtrong braſs circle is graduated into four quadrants, each containing 90 degrees. The numbers on two of theſe quadrants increaſe from the equator towards the poles; the other two increaſe from the pole towards the equator. Two of the quadrants are numbered from the equator, to ſhew the diſtance of any point on the globe from the equator. The other two are numbered from the poles, for the more ready ſetting the globe to the latitude of any place. The ſtrong braſs circle of the celeſtial globe is called the meridian, becauſe the center of the ſun comes directly under it at noon. But as there are other circles on the terreſtrial globe, which are called meridians, we chuſe to denominate this the ſtrong braſs circle, or meridian. The graduated ſide of the ſtrong braſs circle that belongs to the terreſtrial globe, ſhould face the weſt. The graduated ſide of the ſtrong brazen meridian of the celeſtial globe ſhould face the eaſt. On the ſtrong braſs circle of the terreſtrial globe, and at about 23½ degrees on each ſide of the north pole, the days of each month are laid down according to the declination of the ſun.

THE HORARY CIRCLES, AND THEIR INDICES.

When the globes are mounted after Mr. Adams's manner, the equator is uſed as the hour circle; becauſe it is not only the moſt natural, but alſo the largeſt circle that can be applied for that purpoſe. To make this circle anſwer the purpoſe, a ſemi-circular wire is placed over it, carrying two indices, one on the eaſt, the other on the weſt ſide of the ſtrong braſs circle. The indices ſhew in what ſpace of time any part of ſuch revolution is made among the hours which are graduated below the degrees of the equator on either globe. As the motion of the terreſtrial globe is from weſt to eaſt, the horary numbers increaſe according to the direction of that motion; on the celeſtial globe they increaſe from the eaſt to the weſt.

THE QUADRANT OF ALTITUDE, Z A.

It is a thin, narrow, flexible ſlip of braſs, that will bend to the ſurface of the globe; it has a nut, with a fiducial line upon it, which may be readily applied to the diviſions on the ſtrong braſs meridian of either globe. One edge of the quadrant is divided into 90 degrees, and the diviſions are continued to 18 degrees below the horizon.

SOME OF THE CIRCLES THAT ARE DESCRIBED UPON THE SURFACE OF EACH GLOBE.

We may ſuppoſe as many circles to be deſcribed on the ſurface of the earth as we pleaſe, and conceive them to be extended to the ſphere of the heavens, marking thereon concentric circles. For as we are obliged, in order to diſtinguiſh one place from another, and to appropriate names to them, ſo are we obliged to uſe different circles on the globes, to diſtinguiſh the parts, and their ſeveral relations to each other.

THE EQUATOR, OR EQUINOCTIAL.

It goes round the globe exactly in the middle, between the two poles, from which it always keeps at the ſame diſtance; or in other words, it is every where 90 degrees diſtant from each pole, and is therefore a boundary, ſeparating the northern from the ſouthern hemiſphere; hence it is frequently called the line (by ſailors) and when they ſail over it, they are ſaid to croſe the line.

It is graduated into 360 degrees. Upon the terreſtrial globe the numbers increaſe from the meridian of London weſtward, and proceed quite round to 360. They are alſo numbered from the ſame meridian eaſtward, by an upper row of figures, to accommodate thoſe who uſe the Engliſh tables of latitude and longitude. On the celeſtial globe, the equatorial degrees are numbered from the firſt point of Aries eaſtward, to 360 degrees. Under the degrees on either globe is graduated a circle of hours and minutes. On the celeſtial globe the hours increaſe eaſtward, from Aries to XII at Libra, where they begin again in the ſame direction, and proceed to XII at Aries. But on the terreſtrial globe, the horary numbers increaſe by twice twelve hours weſtward from the meridian of London to the ſame again.

THE ECLIPTIC.

The graduated circle, which croſſes the equator obliquely, forming with it an angle of about 23½ degrees, is called the ecliptic. This circle is divided into 12 equal parts, each of which contains 30 degrees. The beginning of each of theſe 30 degrees is marked with the characters of the 12 ſigns of the zodiac. The ſun appears always in this circle; he advances therein every day, nearly a degree, and goes through it exactly in a year. The points where this circle croſſes the equator are called the *equinoctial points*. The one is at the beginning of Aries, the other at the beginning of Libra. The commencement of Cancer and Capricorn are called the *ſolſtitial points*. The twelve ſigns, and their degrees, are laid down on the terreſtrial globe; but upon the celeſtial globe, the days of each month are graduated juſt under the ecliptic. The ecliptic belongs principally to the celeſtial globe.

Definitions. For the definitions of other technical terms and circles of the ſphere, &c. mentioned in this treatiſe, the reader will do well to conſult the Syſtem of Aſtronomy, in which they are all fully defined.

THE USE OF THE TERRESTRIAL GLOBE.

Prob. I. To find the longitude of any place on the globe. Set the moveable meridian to the place, or bring the place under the ſtrong braſs meridian, and that degree of the equator, which is cut by either of theſe brazen meridians, is the longitude in degrees and minutes, or the hour and minute of its longitude, expreſſed in time. As the given place may lie either eaſt or weſt of the firſt meridian, the longitude may be expreſſed accordingly. It appears moſt natural to reckon the longitude always weſtward from the firſt meridian; but it is cuſtomary to reckon one half round the globe eaſtward, and the other half weſtward from the firſt meridian. To accommodate thoſe who may prefer either of theſe plans, there are in Mr. Adams's globes two ſets of numbers, thoſe neareſt the equator increaſe weſtward, from the meridian of London quite round the globe to 360°, over which another ſet of numbers is engraved, which increaſe the contrary way; by which means, the longitude may be reckoned upon the equator, either eaſt or weſt.

Prob. II. To find the difference of longitude between any two places. Bring the moveable meridian to one of the places, and the other place under the ſtrong braſs circle, and the angle of longitude is contained between theſe two meridians, the meaſure or quantity of which is to be counted on the equator, and is the difference of longitude required. If one place is eaſt, and the other weſt of the firſt meridian, either find the longitude of both places weſtward, by that ſet of numbers which increaſe weſtward from the meridian of London to 360 degrees, and the difference between the number thus found is the anſwer to the queſtion; or, add together the eaſt and weſt longitudes, and the ſum is the difference of longitude; thus the longitude of Rome is 12 deg. 30 min. eaſt, of Charles-Town 79 deg. 50 min. weſt; 91 deg. 20 min. is the difference required. It may be proper to obſerve here, that the difference in time is the ſame with the difference of longitude, allowing 15° to an hour.

Prob. III. To find what places have the ſun upon their meridian, at any given hour of the day, in another propoſed place. As the diurnal motion of the earth, repreſented by the terreſtrial globe, is from weſt to eaſt, it is plain that all places which are to the eaſt of any particular meridian, muſt neceſſarily paſs by the ſun, before a meridian which is to the weſt of them can arrive at it. This Problem is divided into three Caſes.

Case I. *When the given hour is at London.* As the firſt meridian on Mr. Adams's globes paſſes through London, bring the given hour to the eaſt of London, (if it be in the morning,) to the ſtrong braſs meridian, and all thoſe places which are under it will have noon at the given hour; but bring the given hour weſt of London, if it is in the afternoon.

Case II. *If the given hour be in the afternoon, but not at London.* Bring the given place to the ſtrong braſs meridian, and ſet one of the hour indexes to that XII which is moſt elevated; then turn the globe from weſt to eaſt, till the index points to the given hour, and the ſtrong braſs meridian will paſs over thoſe places which have noon at the given hour in the propoſed place.

Case III. *If the given hour be in the morning, but not at London.* Bring the place to the ſtrong braſs meridian; ſet the hour index to the uppermoſt XII, and turn the globe from Eaſt to Weſt, until the hour index points to the given hour; then the required places are all under the ſtrong braſs meridian.

Prob. IV. When it is noon at any place, to find what hour of the day it is at any other place. Bring the place at which it is noon, to the ſtrong braſs meridian, and ſet the hour index to the uppermoſt XII, and then turn the globe about till the other place comes under the ſtrong braſs meridian, and the hour index will ſhew upon the equator the required hour. If to the eaſtward of the place where it is noon, the hour found will be in the afternoon; if to the weſtward, it will be in the forenoon.

Prob. V. The hour where you are, being given, to tell what hour it is in any other part of the world. Bring the propoſed place under the ſtrong braſs meridian, ſet the hour index to the given time; then turn the globe, till the place where you are is under the braſs meridian, and the horary index will point to the hour required.

Prob. VI. To find the latitude of any place. Bring the place to the gratuated ſide of the ſtrong braſs meridian, and the degree which is over it, is its latitude.

Prob. VII. To find the difference of latitude between two places. If the places be in the ſame hemiſphere, bring each of them to the meridian, and ſubtract the latitude of one from the other. If they are in different hemiſpheres, add the latitude of one to that of the other.

Prob. VIII. The latitude and longitude of any place being known, to find that place upon the globe; or if the place be not inſerted on the globe, to find where it ought to be placed, and fix the center of the artificial horizon thereto. Seek for the given longitude in the equator, and bring the moveable meridian to that point; then count from the equator on the meridian, the degree of latitude either towards the north or ſouth pole, and bring the artificial horizon to that degree, and the interſection of its edge with the meridian is the ſituation required.

Prob. IX. Any place being given, to find the diſtance of that place from another, in a great circle of the earth. This problem I ſhall divide into three caſes.

Case I. If the places lie under the ſame meridian; bring them up to the meridian, and mark the number of degrees intercepted between them. Multiply the number of degrees thus found by 60, and they will give the number of geographical miles between the two places. But if we would have the number of Engliſh miles, the degree before found muſt be multiplied by 69.31, as ſhewn in Prob. (1) at the beginning of this Treatiſe, or out of the table (belonging to that Prob.) with the middle latitude, take out the number of miles anſwering to a degree, by which multiply as before, which will be more accurate.

Case II. If the places lie under the equator. Find their difference of longitude in degrees, and multiply as in the preceding caſe, by 60, for geographical miles; or by 68.723, for Engliſh miles.

Case III. If the places lie neither under the ſame meridian, nor under the equator. Then lay the quadrant of altitude over the two places, and mark the number of degrees intercepted between them. Theſe degrees multiplied by 69.31, or more accurately by the number anſwering to the middle latitude, will give the required diſtance.

Prob. X. *To rectify the Terreſtrial Globe.* To rectify the terreſtrial globe, is to place it in the ſame poſition in which our earth ſtands to the ſun, at all or any given times. To rectify then the terreſtrial globe, is to bring it into ſuch a poſition, as that the enlightened half of the earth's ſurface may be all above the broad paper circle. Bring the day of the month that is graduated, on the back ſide of the ſtrong braſs meridian, to coincide with the broad paper circle, and the globe is rectified.

Prob. XI. To place the globe in the ſame ſituation, with reſpect to the ſun, as our earth is in at the time of the ſummer ſolſtice. Rectify the globe to the extremity of the diviſions for the month of June, or 23½ degrees north declination; that is, bring theſe diviſions on the ſtrong braſs meridian to coincide with the plane of the broad paper circle. Then that part of the earth's ſurface, which is within the northern polar circle, will be above the broad paper circle, and will be in the light, and the inhabitants thereof will have no night. But all that ſpace which is contained within the ſouthern polar circle, will continue in the ſhade: that is, it will there be continual night. If any place be brought under the ſtrong braſs meridian, and the horary index is ſet to that XII which is moſt elevated, and the place be afterwards brought to the weſtern ſide of the broad paper circle, the hour index will ſhew the time of ſun-riſing; and when the place is moved to the eaſtern edge, the index points to the time of ſun-ſetting. The length of the day is obtained by the time ſhewn by the horary index, while the globe moves from the weſt to the eaſt ſide of the broad paper circle.

Prob. XII. To explain the ſituation of the earth, with reſpect to the ſun, at the time of the winter ſolſtice. Rectify the globe to the extremity of the diviſions for the month of December, or to 23½ degrees ſouth declination. When it will be apparent that the whole ſpace within the ſouthern polar circle is in the ſun's light, and enjoys continual day; whilſt that of the northern polar circle is in the ſhade, and has continual night. If the globe be turned round, as before, the horary index will ſhew, that at the ſeveral places before-mentioned their days will be reſpectively equal to what their nights were at the time of the ſummer ſolſtice. It will appear farther, that it is now ſun-ſetting at the ſame time in thoſe places, in which it was ſun-riſing at the ſame time at the ſummer ſolſtice. And on the contrary, ſun-riſing at the time it then appeared to ſet.

Prob. XIII. To place the globe in the ſituation of the earth, at the times of the equinox. The ſun having no declination at the times of the equinox, conſequently there is no elevation of the pole. Bring the day of the month when the ſun enters the firſt point of Aries, or day of the month when the ſun enters the firſt point of Libra, to the plane of the broad paper circle; then the two poles of the globe will be in that plane alſo, and the globe will be in the poſition which is called a *right ſphere*. If the globe be now turned from weſt to eaſt, it will appear, that all places upon it's ſurface are twelve hours above the broad paper circle, and twelve hours below it; that is, the days are twelve hours long all over the earth, and that the nights are equal to the days, whence theſe times are called the times of equinox.

THE ARTIFICIAL, OR TERRESTRIAL HORIZON.

The braſs circle, which may be ſlipped from pole to pole on the moveable meridian, has been already deſcribed. The circumference of it is divided into eight parts, to which are affixed the initial letters of the mariner's compaſs. When the center of it is ſet to any particular place, the ſituation of any other place is ſeen, with reſpect to that place; that is, whether they be eaſt, weſt, north, or ſouth of it. It will therefore repreſent the horizon of that place. We ſhall here uſe this artificial horizon, to ſhew why the ſun, although he be always in one and the ſame place, appears to the inhabitants of the earth at different altitudes, and in different azimuths.

Prob. XIV. To exemplify the ſun's altitude, as obſerved with an artificial horizon. Let the moveable circle be applied to any place, as London, then will the horizon of London be thereby repreſented. The ſun is ſuppoſed to be in the zenith, that is, directly over the terreſtrial globe. If then from London a line go vertically upwards, the ſun will be ſeen at London in that line. At ſun-riſing, when London is brought to the weſt edge of the broad paper circle, the ſuppoſed line will be parallel to the artificial horizon, and the ſun will then be ſeen in the horizon. As the globe is gradually turned from the weſt towards the eaſt, the horizon will recede from that line which goes from London vertically upwards; ſo that the line in which the ſun is ſeen, gets further and further from the horizon, that is, the ſun's altitude increaſes gradually. When the horizon, and the line which goes from London vertically upwards, are arrived at the ſtrong braſs meridian, the ſun is then at his greateſt or meridian altitude for that day, and the line and horizon are at the largeſt angle they can make with each other. After this, the motion of the globe being continued, the angle between the artificial horizon, and the line which goes from London vertically upwards, continually decreaſes, until London arrives at the eaſtern edge of the broad paper circle; it's horizon then becomes vertical again, and parallel to the line which goes vertically upwards. The ſun will again appear in the horizon, and will ſet.

Prob. XV. Of the ſun's meridian altitude, at the three different ſeaſons at London. Rectify the globe to the time of winter ſolſtice, (by problem xii.) and place the center of the viſible horizon on London. When London is at the graduated edge of the ſtrong braſs meridian, the line which goes vertically upwards makes an angle of about 15 degrees; this is the ſun's meridian altitude at that ſeaſon, to the inhabitants of London. If the globe be rectified to the times of the equinox, (by problem xii.) the horizon will be farther ſeparated from the line which goes vertically upwards, and makes a greater angle therewith, it being about 38½ degrees; this is the ſun's meridian altitude, at the time of equinox at London. Again, rectify to the ſummer ſolſtice (by problem xi.) and you will find the artificial horizon recede farther from the line which goes from London vertically upwards, and the angle it then makes is about 62 degrees, which ſhews the ſun's meridian altitude at the time of the ſummer ſolſtice.

Prob. XVI. Of the Antœci, Periœci, and Antipodes. Theſe terms being often mentioned by geographical writers, it will be neceſſary to take ſome notice of them. The Antœci are two nations which are near the ſame meridian, but the one in north, the other in ſouth latitude. They have the ſame longitude, and equal latitudes; but of oppoſite conditions, viz. the one is north and the other ſouth. They have conſequently oppoſite ſeaſons of the year, but the ſame hour of the day; the days of the one being equal to the nights of the other, and vice verſa; when the days of the one are at the longeſt, they are ſhorteſt at the other. When they look towards each other, the ſun ſeems to riſe on the right hand of the one, but on the left of the other. They have different poles elevated, and the ſtars that never ſet to the one, are never ſeen by the other. Perioeci are alſo two oppoſite nations, ſituated on the ſame parallel of latitude. They have, the ſame latitude, but differ 180 degrees in longitude; the ſame ſeaſons of the year, but oppoſite hours of the day: for when it is twelve at night to the one, it is twelve at noon with the other. On the equinoctial days, the ſun is riſing to one, when it is ſetting to the other. Antipodes are two nations diametrically oppoſite, which have oppoſite ſeaſons and latitude, oppoſite hours and longitude. The ſun and ſtars riſe to the one, when they ſet to the other. The day of the one, is the night of the other, and when the day is longeſt with the one, the other has it's ſhorteſt day. They have contrary ſeaſons at the ſame time; different poles, but equally elevated; and thoſe ſtars that are always above the horizon of one, are always under the horizon of the other. To exemplify theſe particulars, bring the given place to the ſtrong braſs meridian; then in the oppoſite hemiſphere, and under the ſame degree of latitude with the given place, you will find the *antœci*. The given place remaining under the meridian, ſet the horary index to XII; then turn the globe, till the other XII is under the index, then will you find the *periœci* under the ſame degree of latitude with the given place. Thus the inhabitants of the ſouth part of Chili are *antœci* to the people of New England, whoſe *periœci* are thoſe Tartars who dwell in the north borders of China, which Tartars have the ſaid inhabitants of Chili for their *antipodes*.

Prob. XVII. The day of the month being given, to find all thoſe places on the globe, over whoſe zenith the ſun will paſs on that day. Bring the given day of the month on the back ſide of the ſtrong braſs meridian, to coincide with the plane of the broad paper circle; obſerve the number of degrees of the braſs meridian which correſponds to the given day of the month. This number, counted from the equator on the ſtrong braſs meridian towards the elevated pole, is the point over which the ſun is vertical; and all thoſe places which paſs under this point, have the ſun directly vertical on the given day.

Prob. XVIII. To find the ſun's declination, and thence the parallel of latitude correſponding thereto. Find the ſun's place for the given day in the broad paper circle, and ſeek that place in the ecliptic line upon the globe; this will ſhew the parallel of the ſun's declination among the above-mentioned dotted lines, which is alſo the correſponding parallel of latitude; therefore, all thoſe places through which this parallel paſſes, have the ſun in their zenith at noon on the given day.

Prob. XIX. The day and hour at any place being given, to find where the ſun is vertical at that time. Rectify the globe to the day of the month, and you have the ſun's declination; bring the given place to the meridian, and ſet the hour index to XII: turn the globe, till the index points to the given hour on the equator; then will the place be under the degree of the declination previouſly found.

Prob. XX. The time of the day at any one place being given, to find all thoſe places where at the ſame inſtant the ſun is riſing, ſetting, and on the meridian, and where he is vertical; likewiſe, thoſe places where it is midnight, twilight, and dark night; as well as thoſe places in which the twilight is beginning and ending; and alſo to find the ſun's altitude at any hour in the illuminated hemiſphere, and his depreſſion in the obſcure hemiſphere. Rectify the globe to the day of the month, on the back ſide of the ſtrong braſs meridian, and the ſun's declination for that day; bring the given place to the ſtrong braſs meridian, and ſet the horary index to XII upon the equator; turn the globe from weſt to eaſt, until the horary index points to the given time. Then all thoſe places which lie in the plane of the weſtern ſide of the broad paper circle, ſee the ſun riſing, and at the ſame time thoſe on the eaſtern ſide of it ſee him ſetting. It is noon to all the inhabitants of thoſe places under the upper half of the graduated ſide of the ſtrong braſs meridian, whilſt at the ſame time thoſe under the lower half have midnight. All thoſe places which are between the upper ſurface of the broad paper circle, and the wire circle under it, are in the twilight, which begins to all thoſe places on the weſtern ſide that are immediately under the wire circle; it ends at all thoſe which are in the plane of the paper circle. The contrary happens on the eaſtern ſide; the twilight is juſt beginning to thoſe places in which the ſun is ſetting, and his end is at the place juſt under the wire circle. And thoſe places which are under the twilight wire circle have dark night, unleſs the moon is favourable to them. All places in the illuminated hemiſphere have the ſun's altitude equal to their diſtance from the edge of the enlightened diſk, which is known by fixing the quadrant of altitude to the zenith, and laying its graduated edge over any particular place. The ſun's depreſſion is obtained in the ſame manner, by fixing the center of the quadrant as the nadir.

Prob. XXI. To rectify either globe to the latitude and horizon of any place. If the place be in north latitude, raiſe the north pole; if in ſouth latitude, raiſe the ſouth pole, until the degree of the given latitude, reckoned on the braſs meridian under the elevated pole, cuts the plane of the broad paper circle; then this circle will repreſent the horizon of that place.

Prob. XXII. To rectify for the ſun's place. After the former rectification, bring the degrees of the ſun's place in the ecliptic line upon the globe to the ſtrong braſs meridian, and ſet the horary index to that XIIth hour upon the equator which is moſt elevated. Or, if the ſun's place is to be retained, to anſwer various concluſions, bring the graduated edge of the moveable meridian to the degree of the ſun's place in the ecliptic, and ſlide the wire which croſſes the center of the artificial horizon thereto; then bring its center, which is the interſection of the aforeſaid wire, and graduated edge of the moveable meridian, under the ſtrong braſs meridian as before, and ſet the horary index to that XII on the equator which is moſt elevated.

Prob. XXIII. To rectify for the zenith of any place. After the firſt rectification, ſcrew the nut of the quadrant of altitude ſo many degrees from the equator, reckoned on the ſtrong braſs meridian towards the elevated pole, as that pole is raiſed above the plane of the broad paper circle, and that point will repreſent the zenith of the place.

Prob. XXIV. To ſhew at *one view* upon the terreſtrial globe for any given place, the ſun's meridian altitude, his amplitude, or point of the compaſs, on which he riſes and ſets every day in the year. Rectify the globe to the latitude of the given place, bring that place to the ſtrong braſs meridian, and ſet the horary index to XII; ſcrew the quadrant of altitude to the zenith of the horizon, and bring it to the braſs meridian. You will then at *one view* ſee the ſun's meridian altitude on every degree of the ſun's declination for the whole year, cut by the graduated edge of the quadrant of altitude, on the dotted parallels. Theſe dotted parallels at the ſame inſtant alſo cut the edge of the broad paper circle, now repreſenting the horizon, in the point of the compaſs, or amplitude, on which the ſun is ſeen to riſe on the eaſt, or to ſet on the weſt ſide of the horizon, for every degree of declination throughout the year. If you trace any of thoſe parallels to the ecliptic line, you have the ſun's place when he is upon that declination, and thence the day and month upon the horizon.

Prob. XXV. To ſhew at *one view* upon the terreſtrial globe the length of the days and nights at any particular place, for all times of the year. Rectify the globe to the latitude of the place, and the broad paper circle will repreſent the horizon; and the upper part of the dotted parallels of declination, which are here alſo parallels of latitude, will repreſent the diurnal arches, and the number of hours in each is the length of the day required.

Prob. XXVI. To find the angle of poſition of places. The angle of poſition is that formed between the meridian of one of the places, and a great circle paſſing through the other place. Rectify the globe to the latitude and zenith of one of the places; bring that place to the ſtrong braſs meridian; ſet the graduated edge of the quadrant to the other place, and the number of degrees contained between it and the ſtrong braſs meridian is the meaſure of the angle ſought.

Prob. XXVII. To obſerve the ſun's altitude (by the terreſtrial globe) when he ſhines bright, or when he can but juſt be diſcerned through a cloud. Elevate the north pole of the globe to 66½ degrees; bring that meridian, or hour circle, which paſſes through the IXth hour upon the equator, under the graduated ſide of the ſtrong braſs meridian; the globe being now ſet upon the horizontal plane, turn it about thereon, frame and all, that the ſhadow of the ſtrong braſs meridian may fall directly under itſelf; or in other words, that the ſhade of it's graduated face may fall exactly upon the aforeſaid hour circle; at that inſtant the ſhade of extuberancy will touch the true degree of the ſun's altitude upon that meridian, which paſſes through the IXth hour upon the equator, reckoned from the polar circle, the moſt elevated part of which will then be in the zenith of the place where this operation is performed, and is the ſame whether it ſhould happen to be either in north or ſouth latitude.

Prob. XXVIII. To place the terreſtrial globe in the ſun's rays, that it may repreſent the natural poſition of the earth, either by a meridian line, or without it. Having a meridian line, ſet the north and ſouth points of the broad paper circle directly over it, the north pole of the globe being elevated to the latitude of the place, and ſtanding upon a level plane, bring the place you are in under the graduated ſide of the ſtrong braſs meridian, then the poles and parallel circles upon the globe will, without ſenſible error, correſpond with thoſe in the heavens, and each point, kingdom, and ſtate, will be turned towards the real one which it repreſents.

Prob. XXIX. To obſerve the hour of the day in the moſt natural manner, when the terreſtrial globe is properly placed in the ſun-ſhine. Having rectified the globe as before directed, and placed it upon an horizontal plane over your meridian line, hold a long pin upon the illuminated pole, in the direction of the polar axis, and its ſhadow will ſhew the hour of the day amongſt the polar parallels.

THE USE OF THE CELESTIAL GLOBE.

Prob. I. *To rectify the Celeſtial Globe.* To rectify the celeſtial globe, is to put it in that poſition in which it may repreſent exactly the apparent motion of the heavens. Therefore, to rectify for any particular place, find firſt, by the terreſtrial globe, the latitude of that place. The latitude of the place being found in degrees, elevate the pole of the celeſtial globe the ſame number of degrees and minutes above the plane of the horizon, for this is the name given to the broad paper circle, in the uſe of the celeſtial globe. Thus the latitude of London being 51½ degrees, let the globe be moved till the plane of the horizon cuts the meridian in that point. The next rectification is for the ſun's place, which may be performed as directed in Prob. xxii; or look for the day of the month cloſe under the ecliptic line, againſt which is the ſun's place; place the artificial ſun over that point, then bring the ſun's place to the graduated edge of the ſtrong brazen meridian, and ſet the hour index to the moſt elevated twelve. Laſtly, ſet the meridian of the globe north and ſouth, by the compaſs. And the globe will be rectified, or put into a ſimilar poſition, to the concave ſurface of the heavens, for the given latitude.

Prob. II. To find the declination of the ſun for any given day in the year. Seek the day of the month cloſe under the ecliptic line, againſt which is the ſun's place; bring that point under the ſtrong braſs meridian, and the degree that ſtands over it is the ſun's declination for that day. Thus on the 23d of May the ſun's declination will be about 23 deg. 10 min. and upon the 23d of Auguſt it will be 11 deg. 13 min.

Prob. III. To find the ſun's right aſcenſion. Bring the ſun's place to the meridian, and that point of the equinoctial which is under the meridian will ſhew the ſun's right aſcenſion. Thus on the 11th of May the right aſcenſion will be found to be 47 deg. 10 min.

Prob. IV. The latitude of the place and the ſun's place being given, to find the ſun's amplitude. Rectify the globe to the latitude of the place, and bring the ſun's place to the eaſtern ſide of the meridian, and the arc of the horizon intercepted between that point and the eaſtern point, will be the ſun's amplitude at riſing. If the ſame point be brought to the weſtern ſide of the horizon, the arc of the horizon intercepted between that point and the weſtern point, will be the ſun's amplitude at ſetting.

Prob. V. To find the ſun's altitude at any given time of the day. Set the center of the artificial ſun to his place in the ecliptic upon the globe, and rectify it to the latitude and zenith; bring the center of the artificial ſun under the ſtrong braſs meridian, and ſet the hour index to that XII which is moſt elevated; turn the globe to the given hour, and move the graduated edge of the quadrant to the center of the artificial ſun; and that degree on the quadrant which is cut by the ſun's center, is the ſun's height at that time. The artificial ſun being brought under the ſtrong braſs meridian, and the quadrant laid upon its center, will ſhew its meridian, or greateſt altitude, for that day.

Prob. VI. The latitude, the ſun's place, and his altitude, being given; to find the hour of the day, and the ſun's azimuth from the meridian. Having rectified the globe for the latitude, the zenith, and the ſun's place, turn the globe and the quadrant of altitude, ſo that the ſun's place may cut the given degree of altitude: then the index will ſhew the hour, and the quadrant will cut the azimuth in the horizon. Thus, if at London, on the 21ſt of Auguſt, the ſun's altitude be 36 deg. in the forenoon, the hour of the day will be IX, and the ſun's azimuth about 58 deg. from the ſouth part of the meridian.

Prob. VII. The latitude hour of the day, and the ſun's place being given, to find the ſun's altitude and azimuth. Rectify the globe for the latitude, the zenith, and the ſun's place, then the number of degrees contained betwixt the ſun's place and the vertex, is the ſun's meridional zenith diſtance; the complement of which to 90 deg. is the ſun's meridian altitude. If you turn the globe about until the index points to any other given hour, then bringing the quadrant of altitude to cut the ſun's place, you will have the ſun's altitude at that hour; and where the quadrant cuts the horizon, is the ſun's azimuth at the ſame time.

Prob. VIII. The latitude, the ſun's place, and his azimuth being given, to find his altitude, and the hour. Rectify the globe for the latitude, the zenith, and the ſun's place; then put the quadrant of altitude to the ſun's azimuth in the horizon, and turn the globe till the ſun's place meets the edge of the quadrant, then the ſaid edge will ſhew the altitude, and the index point to the hour.

Prob. IX. The latitude, the ſun's altitude, and his azimuth being given, to find his place in the ecliptic, and the hour. Rectify the globe for the latitude and zenith, and ſet the edge of the quadrant to the giving azimuth; then turning the globe about, that point of the ecliptic which cuts the altitude, will be the ſun's place. Keep the quadrant of altitude in the ſame poſition, and having brought the ſun's place to the meridian, and the hour index to 12 at noon, turn the globe about till the ſun's place cuts the quadrant of altitude, and then the index will point the hour of the day.

Prob. X. The declination and meridian altitude of the ſun, or any ſtar being given, to find the latitude of the place. Mark the point of declination upon the meridian, according as it is either north or ſouth from the equator; then ſlide the meridian up or down in the notches, till the point of declination be ſo far diſtant from the horizon, as is the given meridian altitude; that elevation of the pole will be the latitude.

Prob. XI. To find the length of any day in the year, in any latitude, not exceeding 66½ degrees. Elevate the celeſtial globe to the latitude, and ſet the centre of the artificial ſun to his place upon the ecliptic line on the globe for the given day, and bring its centre to the ſtrong braſs meridian, placing the horary index to that XII which is moſt elevated; then turn the globe till the artificial ſun cuts the eaſtern edge of the horizon, and the horary index will ſhew the time of ſun-riſing; turn it to the weſtern ſide, and you obtain the hour of ſun-ſetting. The length of the day and night is obtained, by dobling the time of ſun-riſing and ſetting reſpectively.

Prob. XII. To find the latitude of a place, in which its longeſt day may be of any given length between twelve and twenty four hours. Set the artificial ſun to the firſt point of Cancer; bring its centre to the ſtrong braſs meridian, and ſet the horary index to XII; turn the globe till it points to half the number of the given hours and minutes; then elevate or depreſs the pole, till the artificial ſun coincides with the horizon, and that elevation of the pole is the latitude required.

Prob. XIII. To find the place of any planet upon the globe, and by that means to find its place in the heavens; alſo, to find at what hour any planet will riſe or ſet, or be on the meridian, on any day in the year. Rectify the globe to the latitude and ſun's place, then find the planet's longitude and latitude in an ephemeris, and ſet the graduated edge of the moveable meridian to the given longitude in the ecliptic, and counting ſo many degrees amongſt the parallels in the zodiac, either above or below the ecliptic, as her latitude is north or ſouth; and ſet the center artificial ſun to that point, and the centre will repreſent the place of the planet for that time. While the globe moves about its axis, this point moving along with it will repreſent the planet's motion in the heavens. If the planet be brought to the eaſtern ſide of the horizon, the horary index will ſhew the time of its riſing. If the artificial ſun is above the horizon, the planet will not be viſible: when the planet is under the ſtrong brazen meridian, the hour index ſhews the time it will be on that circle in the heavens: when it is at the weſtern edge, the time of its ſetting will be obtained.

Prob. XIV. To find the right aſcenſion, declination, amplitude, azimuth, altitude, hour of the night, &c. of any given planet, for a day of a month and latitude given. Rectify the globe for the given latitude and day of the month; then find the planet's place, and then the right aſcenſion, declination, amplitude, azimuth, altitude, hour, &c. are all found, as directed in the problems for the ſun.

Prob. XV. To find the right aſcenſion and declination of any given ſtar. Bring the given ſtar to the meridian, and the degree under which it lies is it's declination; and the point in which the meridian interſects the equinoctial is it's right aſcenſion. For inſtance, let Arcturus be the given ſtar; this brought to the meridian will be ſeen under the 20 deg. 20 min. which is therefore it's declination, north; and it's right aſcenſion is, at the ſame time, ſhewn in the equinoctial to be 211 deg.

Prob. XVI. To find the latitude and longitude of a given ſtar. Bring the pole of the ecliptic to the meridian, over which fix the quadrant of altitude, and holding the globe very ſteady, move the quadrant to lie over the given ſtar, and it will cut that degree in the edge, as will ſhew it's latitude from the ecliptic, and in the ecliptic the quadrant will cut that degree which is called its place *reduced to the ecliptic*, or longitude, from the beginning of Aries.

Prob. XVII. The right aſcenſion and declination of a ſtar being given, to find its place on the globe. Turn the globe till the meridian cuts the equinoctial in the degree of right aſcenſion. Thus, for example, ſuppoſe the right aſcenſion of Aldebaran to be 65 deg. 30 m. and its declination to be 16 deg. north, then turn the globe about till the meridian cuts the equinoctial in 65 deg. 30 min. and under the 16 deg. of the meridian, on the northern part, you will obſerve the ſtar Aldebaran, or the bull's eye.

Prob. XVIII. To find the time of the riſing, ſouthing, ſetting, amplitude, &c. of any ſtar, in a given latitude and day of the year. The precept is the ſame as in the problems for the ſun.

Prob. XIX. To find at what hour any known ſtar paſſes the meridian on any day in the year. Rectify the globe to the latitude, and ſet the artificial ſun to his place in the ecliptic; bring its center under the ſtrong braſs meridian, and ſet the horary index to XII; then turn the globe till the ſtar comes to the meridian, and the horary index will point upon the equator to the hour on which that ſtar will be upon the ſouth part of the meridian. If you turn the globe on till the center of the artificial ſun is under that graduated ſide of the braſs meridian, which is below that elevated pole, all thoſe ſtars, which are then cut by that ſide of the meridian above the ſaid pole, will paſs the meridian at midnight.

Prob. XX. To find on what day of the year any ſtar paſſes the meridian at any propoſed hour of the night. Bring the ſtar to the ſtrong braſs meridian, and ſet the horary index to the propoſed hour; then turn the globe till the index points to XII, and that degree on the ecliptic, which is cut by the meridian, is the ſun's place, againſt which, in the calender upon the broad paper circle, is the day of the month.

Prob. XXI. To repreſent the face of the heavens on the globe for a given hour on any day of the year. Rectify the globe to the given latitude of the place and day of the month, ſetting it due north and ſouth by the needle; then turn the globe on it's axis till the index points to the given hour of the night; then all the upper hemiſphere of the globe will repreſent the viſible face of the heavens for that time, by which it will be eaſily ſeen what conſtellations and ſtars of note are then above our horizon, and what poſition they have with reſpect to the points of the compaſs. In this caſe, ſuppoſing the eye was placed in the center of the globe, and holes were pierced through the centers of the ſtars on it's ſurface, the eye would perceive through thoſe holes the various correſponding ſtars in the firmament; and hence it would be eaſy to know the various conſtellations at ſight, and to be able to call all the ſtars by their names.

Prob. XXII. The latitude of the place, the ſun's place, and the hour of the night being given, to find the azimuth and altitude of any known fixed ſtar. Rectify the globe for the latitude of the place, and the ſun's place; turn the globe till the hour index points to the given hour; then fix the quadrant of altitude in the zenith, and lay it over the ſtar, and it will ſhew the altitude and azimuth of it.

Prob. XXIII. The latitude of the place, the ſun's place, and the azimuth of any known ſtar being given, to find the hour of the night. Having rectified the globe for the latitude of the place and the ſun's place, if the given ſtar be due north or ſouth, bring it to the meridian, and the index will ſhew the hour of the night. If the ſtar be in any other direction, fix the quadrant of altitude in the zenith, and ſet it to the ſtar's azimuth in the horizon; turn the globe about until the quadrant cuts the center of the ſtar, and then the horary index will ſhew the hour of the night.

Prob. XXIV. The latitude of the place, the ſun's place, the hour of the night, and the altitude and azimuth of any ſtar being given, to find the ſtar, or the place on the globe where ſuch ſtar ought to be inſerted. Rectify the globe for the latitude of the place, and the ſun's place; fix the quadrant of altitude in the zenith, and turn the globe till the hour index points to the given hour, and ſet the quadrant of altitude to the given azimuth; then the ſtar that cuts the quadrant in the given altitude, will be the ſtar ſought.

Prob. XXV. The latitude of the place being given, to find by the globe, the time of the year when a given ſtar riſes or ſets coſmically: that is when it riſes or ſets at the time of the ſun's-riſing. Let the given place be Rome, whoſe lattitude is 42 deg. 8 min. north; and let the given ſtar be the Lucida Pleiadum. Rectify the globe for the latitude of the place; bring the ſtar to the edge of the eaſtern horizon, and mark the point of the ecliptic riſing along with it, that will be found to be Taurus, 18 deg. oppoſite to which, on the horizon, will be found May the 8th. The Lucida Pleiadum, therefore, riſes coſmically May the 8th. If the globe continues rectified as before, and the Lucida Pleiadum be brought to the edge of the weſtern horizon, the point of the ecliptic, which is the ſun's place, then riſing on the eaſtern ſide of the horizon, will be Scorpio, 29 deg. oppoſite to which, on the horizon, will be found November the 21ſt. The Lucida Pleiadum, therefore, ſets coſmically November the 21ſt.

Prob. XXVI. The latitude of the place being given, to find the time of the year when a given ſtar will riſe or ſet achronically, viz. when it riſes or ſets at the time of ſun ſetting. Let the given place be Athens, whoſe latitude is 37 deg. north, and let the given ſtar be Arcturus. Rectify the globe for the latitude of the place, and bringing Arcturus to the eaſtern ſide of the horizon, mark the point of the ecliptic then ſetting on the weſtern ſide; that will be found Aries, 12 deg. oppoſite to which, on the horizon, will be found April the 2d. Therefore, Arcturus riſes at Athens achronically April the 2d. If the globe continues rectified to the latitude of the place, as before, and Arcturus be brought to the weſtern ſide of the horizon, the point of the ecliptic ſetting along with it will be Sagittary, 7 deg. oppoſite to which, on the horizon, will be found November the 29th. At Athens, therefore, Arcturus ſets achronically November the 29th.

Prob. XXVII. The latitude of the place being given, to find the time of the year when a given ſtar will riſe heliacally, viz. when it becomes viſible in the morning after having been hid by the ſun's rays. Let the given place be rome, whoſe latitude is 42 deg. north, and let the given ſtar be the bright ſtar in the bull's horn. Rectify the globe for the latitude of the place, ſcrew on the the braſs quadrant of altitude in it's zenith, and turn it to the weſtern ſide of the horizon. Bring the ſtar to the eaſtern ſide of the horizon, and mark what degree of the ecliptic is cut by 12 deg. marked on the quadrant of altitude; that will be found to be Capricorn, 3 deg. the point oppoſite to which is Cancer, 3 deg. and oppoſite to this will be found, on the horizon, June the 25th. The bright ſtar, therefore, in the bull's horn, in the latitude of Rome, riſes heliacally, June the 25th.

Prob. XXVII. The latitude of the place being given, to find the time of the year when a given ſtar ſets heliacally, viz. when it is firſt hid by the ſun's rays in the evening, after having been ſome time viſible. Let the given place be Rome, in latitude 42 deg. north, and let the given ſtar be the bright ſtar in the bull's horn. Rectify the globe for the latitude of the place, and bring the ſtar to the edge of the weſtern horizon; turn the quadrant of altitude, till 12 deg. cut the ecliptic on the eaſtern ſide of the meridian. This will be found to be 7 deg. of Sagittary, the point oppoſite to which, in the ecliptic, is 7 deg. of Gemini; and oppoſite to that, on the horizon, is May the 28th, the time of the year when that ſets heliacally in the latitude of Rome.

ARMILLARY SPHERES.

Figures 1 and 2, in the Plate of Spheres and Globes, are repreſentations of two Armillary Spheres, that of fig. 2, is of an improved conſtruction, and made by Mr. Adams, the deſcription of which is as follows:

The exterior parts of this machine repreſent the principal circles of the heaven, viz. 1. The equinoctial, which is divided into 360°. 2. The ecliptic B B, which is divided into 12 ſigns, and each ſign into 30 degrees, &c. 3. The tropic of Cancer C C. 4. The arctic circle E, and the antarctic circle F, each 23½ degrees from its reſpective pole at N and S. 5. The equinoctial colure G G paſſing through the north and ſouth poles of the heaven at N and S, and through the equinoctial points Aries and Libra, in the ecliptic. 6. The ſolſtitial colure H H paſſing through the poles of the heaven, and through the ſolſtitial points Cancer and Capricorn, in the ecliptic. In the north pole of the ecliptic is a nut *b*, to which is fixed one end of a quadrantal wire, and to the other end a ſmall ſun Y, which is carried round the ecliptic B B, by turning the nut; and in the ſouth pole of the ecliptic is a pin at *d*, on which is another quadrantal wire, with a ſmall moon Z upon it, which may be moved round by the hand. Within the circular rings is a ſmall terreſtrial globe I, fixed on an axis K K, which extends from the north and ſouth poles of the globe, to thoſe of the celeſtial ſphere at N and S; on this axis is fixed the flat celeſtial meridian L, which may be ſet directly over the meridian of any place on the globe, and then turned round with the globe, ſo as to keep over the ſame meridian upon it. To this globe is fitted the moveable horizon M M, ſo as to turn upon two ſtrong wires proceeding from its eaſt and weſt points to the globe, and entering the globe at oppoſite points of its equator, which is a moveable braſs ring let into the globe in a groove all around its equator; the globe may be turned by hand within this ring, ſo as to place any given meridian upon it, directly under the celeſtial meridian L. The horizon is divided into 360 degrees all around its outermoſt edge, within which are the points of the compaſs, for ſhewing the amplitude of the ſun and moon, both in degrees and points. The celeſtial meridian LL paſſes through two notches in the north and ſouth points of the horizon. And if the globe be turned round, the horizon and meridian turn with it. At the ſouth pole of the ſphere is a circle of 24 hours, fixed to the rings, and on the axis is an index which goes round that circle, if the globe be turned round its axis.

The whole fabric is ſupported on three feet, and may be elevated or depreſſed upon the joint O, to any number of degrees from *0* to *90*, by means of the arc P, which is fixed into the ſtrong braſs arm Q, and ſlides in the upright piece R, in which is a ſcrew at *r* to fix it at any proper elevation. In the box T are two wheels and two pinions, whoſe axes comes out at *a* and *b*; either of which may be turned by the milled nuts affixed to them. When the nut *b* is turned, the terreſtrial globe, with its horizon and celeſtial meridian, keep at reſt; and the whole ſphere of circles turns round from eaſt, by ſouth, to weſt, carrying the ſun Y, and moon Z, round the ſame way, and cauſing them to riſe above and ſet below the horizon; but when the nut *a* is turned forward, the ſphere, with the ſun and moon, keep at reſt; and the earth, with its horizon and meridian, turn round from weſt, by ſouth, to eaſt; and bring the ſame points of the horizon to the ſun and moon, to which theſe bodies came when the earth kept at reſt, and they were carried round it, ſhewing that they riſe and ſet in the ſame points of the horizon, and at the ſame times in the hour circle, whether the motion be in the earth, or in the heaven. If the earthly globe be turned, the hour index goes round its hour circle; but if the ſphere be turned, the hour circle goes round below the index. To rectify the ſphere for uſe, firſt ſlacken the ſcrew *r* in the upright ſtem R, and taking hold of the arm Q, move it up or down until the given degree of latitude for any place be at the ſide of the ſtem R, and then the axis of the ſphere will be properly elevated, ſo as to ſtand parallel to the axis of the world, if the machine be ſet north and ſouth by a ſmall compaſs: this done, count the latitude from the north pole, upon the celeſtial meridian L, down towards the north notch of the horizon, and ſet the horizon to that latitude; then turn the nut *b*, until the ſun Y comes to the given day to the year in the ecliptic, and the ſun will be at its proper place for that day: find the place of the moon's aſcending node, and alſo the place of the moon, by an ephemeris, and ſet them right accordingly. Laſtly, turn the nut *b* until either the ſun comes to the meridian L, or until the meridian comes to the ſun, (according as you want the ſphere or earth to move) and ſet the hour index to the XII marked noon, and the whole machine will be rectified. Then turn the nut *a*, and obſerve when the ſun or moon riſe and ſet in the horizon, and the hour index will ſhew the times thereof for the given day. Thoſe who underſtand the uſe of the globes will be at no loſs to work many other problems by this ſphere.

I have already ſignified that the precepts in this Syſtem, are adapted to the Globes conſtructed by Mr. George Adams of Fleet Street, which Globes, on many Accounts, are preferable to any other. I have only therefore to add, that I hope this ſhort Treatiſe will be an uſeful and inſtructing Appendage to the Syſtems of Aſtronomy and Geography.

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GLOBULAR *Chart*, a repreſentation of the ſurface, or ſome part of the ſurface, of the terraqueous globe upon a plane; wherein the parallels of latitude are circles nearly concentric; the meridians, curves bending towards the poles; and the rhumb-lines alſo curves. See CHART.

GLOBULE, GLOBULUS, a little *globe*; otherwiſe called a *ſpherule*. Thus the red particles of the *blood* are called *globules* of the blood, on account of their redneſs and ſmallneſs. See BLOOD.

GLORIA *Patri*, in the Liturgy, a formula of words, repeated at the end of each Pſalm, and on other occaſions, to give glory to the Trinity, called the *Doxology*. See DOXOLOGY.

GLOSS, GLOSSA, a comment on the text of any author, to explain his ſenſe more fully and at large, whether in the ſame language, or in any other. See COMMENTARY.

GLOSS is alſo uſed in matters of *commerce*, &c. for the luſtre of ſilk, ſtuff, or the like.

GLOSSARY, GLOSSARIUM, a kind of dictionary for explaining the obſcure, ancient, and barbarous words and phraſes of an altered, corrupted, or refined language.

Spelman's *Gloſſary*, intitled Archaiologicum, is an excellent work; though that author did not begin to ſtudy in this way till fifty years of age. M. Du-Cange's Latin *Gloſſary* in three volumes, and his Greek *Gloſſary* in two volumes folio, are excellent performances, full of uncommon erudition. Lindenbroek has a *Gloſſary* on the laws of Charlemagne, &c.

GLOTTIS, in anatomy, a cleft or chink in the larynx, ſerving for the formation of the voice. The *glottis* is in form of a little tongue, whence its name, from *γλωττα*, *tongue*. For the ſame reaſon, the Latins call it *lingula*, i. e. *little tongue*.

GLOVE, a habit of covering for the hand and wriſt. *To throw the* GLOVE was a practice or ceremony very uſual among our forefathers, being the challenge whereby another was deſired to ſingle combat. It is ſtill retained at the coronation of our kings, when the king's champion caſts his *glove* in Weſtminſter-hall.

GLOW *Worm*, *cicindela*, in entomology, a genus of inſects, of the *coleoptera* order; the antennæ of which are cetaceous, the jaws prominent, and dentated, the eyes in a ſmall degree prominent, the thorax of a roundiſh marginated figure. For the claſſification, ſee the SYSTEM, Part II. Order I.

Cantharis and *Cicindela* have been often uſed, indiſcriminately, for the *glow-worm*; but they form two diſtinct genera of the ſame order, comprehending ſeveral ſpecies, in the Linnæan ſyſtem. The ſpecies of the *cantharis* have ſetaceous antennæ; the thorax is marginated and ſhorter than the head, the exterior wings are flexile, and the ſides of the abdomen are plicated and papilloſe. In moſt ſpecies the thorax is flatted, but in ſome roundiſh. Of this genus Linnæus reckons twenty-ſix ſpecies. Of the *cicindela* he enumerates fourteen ſpecies, diſtinguiſhed by their colour and the ſpots on their exterior wings; thus, the field or green *glow-worm* hath five ſpots on theſe wings: the black *glow-worm*, that frequents woody places, two: the braſſy *glow-worm*, common in moiſt places, has broad excavated ſpots on the wings; the black *glow-worm*, with a round thorax, common in rocky places, has two ferrugineous ſpots, &c.

GLUE, GLUTEN, a viſcid, tenacious matter, ſerving as a cement to bind or connect divers things together. There are divers kinds of *glues* made uſe of in the divers arts; as the *common glue*, *glove glue*, *parchment glue*: but the two laſt are more properly called ſize.

Method of making GLUE. To make *glue* of parings, they firſt ſteep them two or three days in water; then waſhing them well out, they boil them to the conſiſtence of a thick jelly; this done, they paſs the jelly, while yet hot, through oſier baſkets, to ſeparate from it any impurities; and, in order to purify it ſtill farther, they let it reſt ſome time. When the ordures, or foreign matters, are precipitated to the bottom of the veſſel, they melt and boil it a ſecond time. This done, they pour it into flat frames, or moulds; whence it is taken out, when pretty hard and ſolid, and then cut into ſquare pieces or cakes. Nothing now remains but to dry it in the wind, on a ſort of coarſe net, and afterwards to ſtring it to finiſh the drying. The *glue* made of feet, ſinews, &c. is managed after the ſame manner, with this only difference, that they bone and ſcour the feet, and do not lay them to ſteep. The beſt *glue* is that which is oldeſt: the ſureſt teſt of its goodneſs is, to lay a piece to ſteep three or four days in water; if it ſwells conſiderably without melting, and, when taken out, reſumes its former dryneſs, it is very excellent.

GLUTÆUS, in anatomy, is a name common to three muſcles, whoſe office it is to extend the thigh. They are called Glutæus major, medius, and minimus. For their origin, inſertion, and uſe, ſee Syſtem of ANATOMY, Part III. Sect. XIII. For repreſentation ſee Plate III. Letter *a*, *Fig*. 2.

GLYPHE, or GLYPHIS, in ſculpture and architecture, a general name for a cavity or canal, whether round, or terminating in an angle; uſed as an ornament in any part. The Greek word is γλυφη, which literally ſignifies *graving*, *nitching*.

GNAT, in entomology. See CULEX. For the claſſification, ſee the Syſtem, Part II. Order VI.

GNOMON, in dialling, the ſtyle, pin, or cock of a dial; which, by its ſhadow, ſhews the hour of the day. The gnomon of every dial repreſents the axis of the world. The word is Greek, *γνωμὼν*, which literally implies ſomething that makes a thing known; by reaſon that the ſtyle or pin indicates or makes the hour known.

GNOMONIC *Polyhedron*. See POLYHEDRON.

GNOMONIC, or GNOMONICAL *Projection*, that which repreſents the circles of a hemiſphere, upon a plane touching it in the vertex, by lines or rays from the centre of the hemiſphere to all the points of the circles to be projected. See Treatiſe on DIALLING, Part I. Sect. II.

GOAT, *Capra*. See MAMMALIA.

GOBLET, or GOBELET, a kind of drinking cup, or bowl, ordinarily of a round figure, and without either foot or handle.

GOBONE′, or GOBONY, in heraldry, the ſame as COMPONE′.

GOD, one of the many names of the immaterial, intelligent, and free being; of perfect goodneſs, wiſdom, and power; who made the univerſe, and continues to ſupport it, as well as to govern and direct it by his providence.

The Rabbins and Hebraiſts, particularly St. Jerom, and the interpreters, reckon up ten different names of *God* in Scripture; which are אל, *El*, אלהים, *Elohim*, אלחי, *Elohi*, or in the ſingular, אלה *Eloah*, צבאות, *Tſebaoth*, עליון, *Elion*, אהיה, *Ehjeh*, ארוני, *Adonai*, יה, *Jah*, שרי, *Shaddai*, יהוה, *Jehovah*: but it is wrong to divide אלחי, from צבאות; they ſhould be but one name אלהיצבאות, *Elohetſeboath*, i. e. *God of hoſts*. Of theſe names there are three which expreſs the eſſence of *God*, and are proper names; viz. אהיה, *Ehjeh*, יה, *Jah*, and יחות, *Jehovah*: the others are only names of attributes. St. Jerom gives a particular explanation of theſe ten names, in his epiſtle to Marcella; and Buxtorf the younger has an expreſs diſſertation on the ſame, Diſſertatio de Nominibus Dei. The Jeſuit Souciet has three ſeveral diſcourſes on the three names, *El*, *Shaddai*, and *Jehovah*, printed at Paris, 1715. The Hebrews call the name of God כוארנע אותיות, and the Greeks, after this example Τετϱαγϱαμματον; as conſiſting of four letters, which it is obſerved to do in moſt languages; thus, in the Hebrew *God* is called יתוה; *Jehovah*; in the Greek, Θεος; in Latin, *Deus*; in Spaniſh, *Dios*, in Italian, *Idio*; in French, *Dieu*; in the ancient Gauliſh, *Diex*; in ancient German, *Diet*; in the Sclavonic, *Buch*; in Arabic, *Alla*; in the Poliſh, *Bung*; in the Pannonian, *Iſtu*; in the Egyptian, *Tenu*; in the Perſian, *Sire*; in the language of the Magi, *Orſi*. But a diſtinction ought here to be made between the name *God*, and the name of *God*; it being the latter, not the former, that in the Hebrew conſiſts of four letters. The word *God*, in the Hebrew, is אלה, *Eloah*, which conſiſts but of three letters; or in the plural, אלהים, *Elohim*, which conſiſts of five. The name of God is יהוה *Jehovah*; which is the true *τετραγραμματον*, or the name of four letters among the Hebrews and Greeks. But it is not this name that anſwers to the Greek Θεος, Latin *Deus*, Engliſh *God*, &c. In reality, none of theſe languages have any proper name of *God*, as יהוה, *Jehovah*, is in the Hebrew.

By his immateriality, intelligence, and freedom, *God* is diſtinguiſhed from *fate*, *nature*, *deſtiny*, *neceſſity*, *chance*, *anima mundi*, and from all the other fictitious beings, acknowledged by the Stoics, Pantheiſts, Spinoſiſts, and other ſorts of atheiſts. The knowledge of *God*, his nature, attributes, word, and works, with the relations between him and his creatures, make the ſubject of the extenſive ſcience called *theology*. In Scripture, *God* is defined by, I am that I am; Alpha and Omega; the Beginning and End of all things. Among philoſophers, he is defined a being of infinite perfection; or in whom there is no defect of any thing which we conceive may raiſe, improve, or exalt his nature. Among men, he is chiefly conſidered as the firſt cauſe, the firſt being, who has exiſted from the beginning, has created the world, or who ſubſiſts neceſſarily, or of himſelf. Sir Iſaac Newton chooſes to conſider and define *God*, not as is uſually done, from his perfection, his nature, exiſtence, or the like; but from his dominion. "The word *God*, according to him, is a relative term, and has a regard to ſervants: it is true, it denotes a being eternal, infinite, and abſolutely perfect; but a being, however eternal, infinite, and abſolutely perfect, without dominion, would not be *God*. The word *God*, the ſame author obſerves, frequently ſignifies *Lord*; but every lord is not *God*: it is the dominion of a ſpiritual being or lord, that conſtitutes *God*; true dominion, true *God*; ſupreme, the ſupreme; feigned, the falſe god.

"From ſuch true dominion it follows, that the true *God* is living, intelligent, and powerful; and from his other perfections, that he is ſupreme, or ſupremely perfect: he is eternal, and infinite: omnipotent and omniſcient; that is, he endures from eternity to eternity, and is preſent from infinity to infinity. He governs all things that exiſt, and knows all things that are to be known: he is not eternity, or infinity, but eternal and infinite: he is not duration or ſpace, but he endures, and is preſent: he endures always, and is preſent every where; and by exiſting always, and every where, he conſtitutes the very thing, duration and ſpace, eternity and infinity. Since every particle of ſpace is always, and every indiviſible moment of duration every where, the Creator and Lord of all things can never be *nunquam* or *nuſquam*. He is omnipreſent, not only virtually, but alſo ſubſtantially; for power without ſubſtance cannot ſubſiſt. All things are contained, and move, in him; but without any mutual paſſion; he ſuffers nothing from the motions of bodies; nor do they undergo any reſiſtance from his omnipreſence.

It is confeſſed, that *God* exiſts neceſſarily; and by the ſame neceſſity he exiſts always, and every where. Hence, alſo, he muſt be perfectly ſimilar; all eye, all ear, all brain, all arm, the power of perceiving, underſtanding, and acting; but after a manner not at all corporeal, after a manner not like that of men, after a manner wholly to us unknown. He is deſtitute of all body, and all bodily ſhape; and therefore cannot be ſeen, heard, nor touched; nor ought to be worſhipped under the repreſentation of any thing corporeal.

"We have ideas of the attributes of *God*, but do not know the ſubſtance even of any thing: we ſee only the figures and colours of bodies, hear only ſounds, touch only the outward ſurfaces, ſmell only odours, and taſte taſtes; and do not, cannot, by any ſenſe, or any reflex act, know their inward ſubſtances; and much leſs can we have any notion of the ſubſtance of *God*. We know him by his properties and attributes; by the moſt wiſe and excellent ſtructure of things, and by final cauſes; but we adore and worſhip him only on account of his dominion; for *God* ſetting aſide dominion, providence, and final cauſes, is nothing elſe but fate and nature." Newt. Philoſ. Nat. Princip. Math. in calce.

An ingenious divine has wrought theſe thoughts or that admirable philoſopher into form, and ripened them into a more expreſs ſyſtem, in a diſcourſe on this ſubject. Maxwell's Diſc. concerning God.

Beſides, the origin and progreſs of learning, and the moſt uſeful arts, confirm the notion of the world's beginning, and of the common æra of its creation: to which alſo may be added, that the world itſelf, being material and corruptible, muſt have had a beginning; and many phenomena occur to the obſervation of the aſtronomer and natural hiſtorian, which furniſh a ſtrong preſumption, that it could have had no long duration, and that it gradually tends to diſſolution. For a further illuſtration of this important ſubject, ſee Metaphysics.

God, is uſed in ſpeaking of the falſe deities of the heathens, many of which were only creatures to which divine honours and worſhip were ſuperſtitiouſly paid. The great variety of attributes in *God*, that is, the number of relations, capacities, and circumſtances, wherein they had occaſion to conſider him, put theſe poets, &c. under a neceſſity of making a partition, and of ſeparating the divine attributes into ſeveral perſons; becauſe the weakneſs of the human mind could not conceive ſo much power and action in the ſimplicity of one ſingle divine nature. Thus the omnipotence of *God* came to be repreſented under the perſon and appellation of Jupiter; the wiſdom of *God*, under that of Minerva; the juſtice of *God*, under that of Juno. The firſt idols, or falſe gods, that are ſaid to have been adored, were the ſtars, ſun, moon, &c. on account of the light, heat, and other benefits, which we derive from them. Afterwards, the earth came to be deified, for furniſhing fruits neceſſary for the ſubſiſtence of men and animals; then fire and water became objects of divine worſhip, for their uſefulneſs to human life. In proceſs of time, and by degrees, gods became multiplied to infinity; and there was ſcarce any thing but the weakneſs, or caprice, of ſome devotee or other elevated into the rank of deity; things uſeleſs, or even deſtructive, not excepted. The principal of the ancient gods, whom the Romans called *dii majorum gentium*, and which Cicero calls *celeſtial gods*, Varro *ſelect gods*, Ovid *nobiles deos*, others *conſentes deos*, were, Jupiter, Juno, Veſta, Minerva, Ceres, Diana, Venus, Mars, Mercury, Neptune, Vulcan, and Apollo. Jupiter is conſidered as the *god* of heaven; Neptune as *god* of the ſea, Mars as the *god* of war; Apollo of eloquence, poetry, and phyſic; Mercury of thieves; Bacchus of wine; Cupid of love, &c. A ſecond ſort of gods, called *demi gods*, *ſemi dii*, *dii minorum gentium*, *indigetes*, or gods adopted; were men canonized and deified. As the greater gods had poſſeſſion of heaven by their own right; theſe ſecondary deities had it by right and donation; being tranſlated into heaven becauſe they had lived as gods upon earth. The heathen gods may be all reduced to the following claſſes. 1. Created ſpirits, angels, or dæmons: whence good and evil gods; Genii, Lares, Lemures, Typhones, guardian gods, infernal gods, &c. 2. Heavenly bodies; as the ſun, moon, and other planets: alſo the fixed ſtars, conſtellations, &c. 3. Elements; as air, earth, ocean, Ops, Veſta: the rivers, fountains, &c. 4. Meteors. Thus the Perſians adored the wind; thunder and lightning were honoured under the name of Geryon; and ſeveral nations, of India and America, have made themſelves gods of the ſame. Caſtor, Pollux, Helena, and Iris, have alſo been preferred from meteors to be gods: and the like has been practiſed in regard to comets; witneſs that which appeared at the murder of Cæſar. Socrates deified the clouds, if we may give credit to Ariſtophanes; and the primitive Chriſtians, Tertullian aſſures us, were reproached with the ſame thing. 5. They erected minerals, or foſſils, into deities. Such was the Bætylus; the Finlanders adored ſtones; the Scythians iron; and many nations ſilver and gold. 6. Plants have been made gods. Thus leeks and onions were deities in Egypt; the Sclavi, Lithuanians, Celtæ, Vandals, and Peruvians, adored trees and foreſts; the ancient Gauls, Britons, Druids, bore a particular devotion to the oak: and it was no other than wheat, corn, ſeed, &c. that the ancients adored under the names of Ceres and Proſerpina. 7. They took themſelves gods from among the waters. The Syrians and Egyptians adored fiſhes; and the Tritons, Nereids, Syrens, &c. what were they but fiſhes? Several nations have adored ſerpents; particularly the Egyptians, Pruſſians, Lithuanians, Samogitians, &c. 8. Inſects, as flies, and ants, had their prieſts, and votaries: theſe among the Theſſalians, and thoſe in Acarnania, where bullocks were offered to them. 9. Among birds, the ſtork, raven, the ſpharhawk, ibis, eagle, griffon, and lapwing, have had divine honours; the laſt in Mexico, the reſt in Egypt, and at Thebes. 10. Four-footed beaſts have had their altars; as the bull, dog, cat, wolf, baboon, lion, and crocodile, in Egypt, and elſewhere; the hog in the iſland of Crete; rats and mice in the Troas, and at Tenedos; weaſels at Thebes, and the porcupine throughout all Zoroaſter's ſchool. 11. Nothing was more common than to place men among the number of deities: and from Belus or Baal, to the Roman emperors before Conſtantine, the inſtances of this kind are innumerable; frequently they did not wait ſo long as their deaths for the apotheoſis. Nebuchadnezzar procured his ſtatue to be worſhipped while living; and Virgil ſhews that Auguſtus had altars and ſacrifices offered to him, Eclog. i. 6. 7. As we learn, from other hands, that he had prieſts called *Auguſtales*, and temples, at Lyons, Narbona, and ſeveral other places: and he muſt be allowed the firſt of the Romans, in whoſe behalf idolatry was carried to ſuch a pitch. The Ethiopians deemed all their kings gods; the Velleda of the Germans; the Janus of the Hungarians; and the Thaut, Woden, and Aſſa, of the northern nations, were indiſputably men. 12. Not men only, but every thing that relates to man, has alſo been deified; as labour, reſt, ſleep, youth, age, death, virtues, vices, occaſion, time, place, numbers, among the Pythagoreans; the generative power, under the name of Priapus. Infancy, alone, had a cloud of deities; as Vagetanus, Levana, Rumina, Eduſa, Potina, Cuba, Cumina, Carna, Oſſilago, Statulinus, Fabulinus, &c.

They alſo adored the gods health, fever, fear, love, pain, indignation, ſhame, impudence, opinion, renown, prudence, ſcience, art, fidelity, felicity, calumny, liberty, money, war, peace, victory, triumph, &c. Laſtly, nature, the univerſe, or το ϖαν, was reputed a great god. Heſiod has a poem under the title of Θεογονια, i. e. the generation of the gods; wherein he explains their genealogy and deſcent; ſets forth who was the firſt, and principal; who next deſcended from him, and what iſſue each had; the whole making a ſort of ſyſtem of heathen theology. Beſide this popular theology, each philoſopher had his ſyſtem; as may be ſeen from the Timæus of Plato, and Cicero De Natura Deorum. Juſtin Martyr, Tertullian in his Apologetics, and in his book Contra Gentes; Arnobius, Minutius Felix, Lactantius, Euſebius, Præpar. and Demonſt. Evangel. St. Auguſtine De Civit. Dei, and Theodoret Adverſ. Gentes, ſhew the vanity of the heathen gods. It is very difficult to diſcover the real ſentiments of the heathens, with reſpect to their gods; they are exceedingly intricate and confuſed, and even frequently contradictory. They admitted ſo many ſuperior and inferior gods, who ſhared the empire, that all was full of gods. Varro reckons up no leſs than 30,000, adored within a ſmall extent of ground, and yet their number was every day growing. The way to heaven was ſo eaſy for the great men of thoſe days, that Juvenal brings in Atlas complaining he was ready to ſink under the load of ſuch a number of new gods as were daily placed in the heavens: yet father Mourgues ſeems to have proved that all the philoſophers of antiquity have acknowledged that there was but one god. Plan. Theol. des Sect. Scavant. de la Grece.

GODDESS, *dea, diva*, a heathen deity, to whom they attributed the female ſex. The ancients had almoſt as many goddeſſes as gods. Such were Juno, the goddeſs of air; Diana, the goddeſs of woods and chaſtity; Proſerpina, the goddeſs of hell; Venus, of beauty; Thetis, of the ſea; ſuch alſo were victory, fortune, &c.

GODFATHERS, and **Godmothers**, perſons who, at the baptiſm of infants, anſwer for their future conduct, and ſolemnly promiſe that they will renounce the devil and all his works, and follow a life of piety and virtue; and by this means lay themſelves under an indiſpenſable obligation to inſtruct them, and watch over their conduct. This cuſtom is of great antiquity in the Chriſtian church; and was probably inſtituted to prevent children being brought up in idolatry, in caſe their parents died before they arrived at years of diſcretion. The number of godfathers and godmothers is reduced to two, in the church of Rome; and three, in the church of England; but formerly they had as many as they pleaſed.

GOLD, the moſt precious of all the metals. For an account of the places where gold is found in greateſt quantities; the methods of extracting it from the ore, and afterwards purifying it; with an account of its different phenomena in combination with other metals; ſee the article Metallurgy. For its chymical properties, ſee Chymistry. For its effects on glaſs, ſee the articles Glass and Vitrification.

Gold is the moſt fixed of all the metals; and it hath been generally believed, till very lately, that it was abſolutely fixed in every degree of fire which could be excited by human art. Some chymiſts indeed pretended to have evaporated, calcined, and even vitrified gold, by expoſing it to the focus of a good burning-glaſs; but as their experiments did not appear to have all the authenticity that was neceſſary, the opinion fell into diſcredit; and this the more readily that gold is found to reſiſt the moſt violent furnace fires without any loſs. Mr. Macquer, however, in the laſt additions to his

Chymical Dictionary, hath found, that this metal, when expoſed to the heat of a good burning-glaſs, loſes in weight conſiderably, and that even in a very ſhort time. He held ſome very fine gold in the focus of a large burning-glaſs, at ſeveral times, at half an hour each time, ſometimes in a hollow piece of charcoal, or in veſſels made of earthern ware and porcelain; and whenever the air was very clear, and the ſun bright, a very ſenſible ſmoke aroſe to the height of three or four inches. To know the nature of this ſmoke, a cold ſilver plate was expoſed to it; by which means, ſome of the vapour appeared on the ſilver like a tarniſh a little leſs white, but not ſenſibly yellow. But when this part of the ſilver was rubbed with a burniſher, it appeared ſo evidently to be gilded, that none could doubt the evaporation of the metal. At this experiment ſeveral members of the Academy of Sciences were preſent. The experiments with regard to the calcination and vitrification of gold were alſo tried by Mr. Macquer, in preſence of Meſſrs. Montigy, Cadet, Lavoiſier, and Briſſon. The glaſs employed was that of Tnſchirnhauſen, the ſame which had formerly been employed by Mr Homberg. Gold of 24 carats fine was expoſed to the focus of this glaſs ſeveral times, by half an hour at a time, on veſſels made of a very refractory porcelain earth. When the gold was melted, which happened in the ſpace of a few ſeconds, it took a ſpherical form as nearly as its gravity would permit, and had nearly the conſiſtence of quickſilver. The melted maſs ſoon acquired a rotatory motion round its axis, ſometimes in one direction, and ſometimes in another, according to the direction of the focus upon the metal; which, is a very curious appearance, and ſeems difficult to be accounted for. A ſmoke aroſe as in the former experiments. On the ſurface of the melted gold, ſpots evidently vitrified were formed, which ſeparated from the metal. Theſe afterwards united into a dark violet-coloured maſs, of a greater curvature than the melted gold, in which they were found to be ſet, as jewels in a ring; and produced nearly the ſame appearance that the tranſparent cornea has on the globe of the eye; that is, as the ſegment of a ſmall ſphere joined to the ſurface of a large one. On a maſs of liquid gold, of about half an inch diameter, he obtained, after four hours calcination, a button of this violet glaſs, whoſe diameter exceeded two lines; and this glaſs was obſerved gradually to increaſe as the gold diminiſhed. Yet, though this very much reſembles the vitrification of the gold, Mr. Macquer doth not take upon him to aſſert that it certainly is ſo; ſeeing it may ariſe from the veſſels on which the gold is ſupported, and which were coloured purple to a conſiderable diſtance, and beſides were ſprinkled with many ſmall particles of gold undecompoſed, eaſily diſtinguiſhable by a microſcope; and in the violet glaſs alſo, many ſimilar particles were obſervable. To determine the matter accurately, the experiment ought to be continued till all the particles of the metal be certainly either vitrified or evaporated. Though this experiment, however, is hitherto equivocal when the heat of burning-glaſſes is made uſe of, it certainly ſucceeds with a ſtrong flaſh of electric fire. See ELECTRICITY.

GOLD *Wire*, a cylindrical ingot of ſilver, ſuperficially gilt or covered with gold at the fire, and afterwards drawn ſucceſſively through a great number of little round holes, of a wire-drawing iron, each leſs than the other, till it be ſometimes no bigger than a hair of the head. See WIRE *Drawing*.

It may be obſerved, that, before the wire be reduced to this exceſſive fineneſs, it is drawn through above an hundred and forty different holes; and that each time they draw it, it is rubbed afreſh over with new wax, both to facilitate its paſſage, and to prevent the ſilver's appearing through it.

GOLD *Wire flatted*, is the former wire flatted between two rollers of poliſhed ſteel, to fit it to be ſpun on a ſtick, or to be uſed flat, as it is, without ſpinning, in certain ſtuffs, laces, embroideries, &c. See STUFF, &c.

GOLD *Thread*, or *Spun Gold*, is flatted gold, wrapped or laid over a thread of ſilk, by twiſting it with wheel and iron bobbins. To diſpoſe the wire to be ſpun on ſilk, they paſs it between two rollers of a little mill: theſe rollers are of nicely poliſhed ſteel, and about three inches in diameter. They are ſet very cloſe to each other, and turned by means of a handle faſtened to one of them, which gives motion to the other. The gold wire in paſſing between the two, is rendered quite flat, but without loſing any thing of its gilding; and is rendered ſo exceedingly thin and flexible, that it is eaſily ſpun on ſilk thread, by means of a hand wheel, and ſo wound on a ſpool or bobbin. See WIRE-*Drawing*.

GOLD-*Leaf*, or *Beaten Gold*, is gold beaten with a hammer into exceeding thin leaves, ſo that it is computed, that an ounce may be beaten into ſixteen hundred leaves, each three inches ſquare, in which ſtate it takes up more than 159,052 times its former ſurface. It muſt be obſerved, however, that gold is beaten more or leſs, according to the kind or quality of the work it is intended for; that for the gold-wire drawers to gild their ingots withal, is left much thicker than that for gilding the frames of pictures, &c.

Shell-GOLD, that uſed by the illuminers, and, wherewith we write gold letters. It is made of the parings of leaf-gold, and even of the leaves themſelves, reduced into an impalpable powder, by grinding on a marble with honey. After leaving it to infuſe ſome time in aqua fortis, they put it in ſhells, where it ſticks. To uſe it, they dilute it with gum-water, or ſoap-water.

GOLD-*Finch*, in ornithology. See FRINGILLA.

Theſe are ſeed-birds of very curious colours, and which, were they not ſo common in this country, would probably be very much eſteemed. They are uſually taken about Michaelmas, and ſoon become tame; but they differ very much in their ſong. They frequently breed in the upper part of plum-trees, making their neſts of the moſs that grows upon apple-trees, and of wool; quilting the inſide with all ſorts of hairs they find upon the ground.

GOLDEN, ſomething that has a relation to gold, or conſiſts of gold.

GOLDEN *Calf*, was a figure of a calf, which the Iſraelites caſt in that metal, and ſet up in the wilderneſs, to worſhip, during Moſes's abſence into the mount; and which that legiſlator, at his return, burnt, grinded to powder, and mixed with the water the people were to drink of; as related in Exod. xxxii. The commentators have been divided on this article; the pulverizing of gold, and rendering it potable, is a very difficult operation in chymiſtry. Many, therefore, ſuppoſe it done by a miracle; and the reſt, who allow of nothing ſupernatural in it, advance nothing but conjectures as to the manner of the proceſs. Moſes could not have done it by ſimple calcination, nor amalgamation, nor antimony, nor calcination; nor is there one of thoſe operations that quadrates with the text. M. Stahl has endeavoured to remove this difficulty. The method Moſes made uſe of, according to this author, was by diſſolving the metal with hepar ſulphuris; only, inſtead of the vegetable alkali, he made uſe of the Egyptian natron, which is common enough throughout the Eaſt.

GOLDEN *Fleece*, in the ancient mythology, was the ſkin, or fleece of the ram, upon which Phryxus and Hella are ſuppoſed to have ſwam over the ſea to Colchis; and which being ſacrificed to Jupiter, was hung upon a tree in the grove of Mars, guarded by two brazen-hoofed bulls, and a monſtrous dragon that never ſlept; but was taken and carried off by Jaſon and the Argonauts. Many authors have endeavoured to ſhew that this fable is an allegorical repreſentation of ſome real hiſtory, particularly of the philoſopher's ſtone. Others have explained it, by the profit of the wool-trade to Colchis, or the gold which they commonly gathered there with fleeces in the rivers.

Order of the GOLDEN FLEECE, is a military order inſtituted by Philip the Good, duke of Burgundy, in 1429. It took its denomination from a repreſentation of the golden fleece, borne by the knights on their collars, which conſiſted of flints, and ſteels. The king of Spain is now grand maſter of the order, in quality of duke of Burgundy; the number of knights is fixed to thirty-one.

GOLDEN *Number*, in chronology, a number ſhewing what year of the moon's cycle any given year is. See ASTRONOMY.

GOLDEN *Roſe*. The pope annually conſecrates a golden-roſe on the fourth Sunday in Lent, which is ſent to princeſſes, or to ſome church, as a mark of his peculiar affection.

GOLDEN *Rule*, in arithmetic, a rule or praxis, of great uſe and extent in the art of numbers; whereby we find a fourth proportional to three quantities given. The *golden rule* is alſo called the *Rule of Three*, and *Rule of Proportion*. See its nature and uſe under ARITHMETIC.

GOLDSMITH, or, as ſome chooſe to expreſs it, *ſilver ſmith*, an artiſt who makes veſſels, utenſils, and ornaments, in gold and ſilver. The goldſmith's work is either performed in the mould, or beat out with the hammer or other engine. All works that have raiſed figures, are caſt in a mould, and afterwards poliſhed and finiſhed: plates, or diſhes, of ſilver or gold, are beat out from thin flat plates; and tankards, and other veſſels of that kind, are formed of plates ſoldered together, and their mouldings are beat, not caſt. The buſineſs of the goldſmiths formerly required much more labour than it does at preſent; for they were obliged to hammer the metal from the ingot to the thinneſs they wanted: but there are now invented flatting mills, which reduce metals to the thinneſs that is required, at a very ſmall expence. The goldſmith is to make his own moulds; and for that reaſon ought to be a good deſigner, and have a taſte in ſculpture: he alſo ought to know enough of metallurgy, to be able to aſſay mixed metals, and to mix the alloy. The goldſmiths in London employ ſeveral hands under them for the various articles of their trade: ſuch are the jeweller, the ſnuff-box and toy maker, the ſilver-turner, the gilder, the burniſher, the chaſer, the refiner, and the gold-beater.

Goldſmiths are ſuperior tradeſmen: their wares muſt be aſſayed by the wardens of the company of this name in London, and marked; and gold is to be of a certain touch. No goldſmith may take above one ſhilling the ounce of gold, beſides what he has for the faſhioning more than the buyer may be allowed for it at the king's exchange; and here any falſe metal ſhall be ſeized and forfeited to the king. The cities of York, Exeter, Briſtol, &c. are likewiſe places appointed for the aſſaying wrought-plate of goldſmiths; alſo a duty is granted on ſilver plate of ſix-pence an ounce, &c. Plate made by goldſmiths ſhall be of a particular fineneſs, on pain of forfeiting 10l. and if any parcel of plate ſent to the aſſayers is diſcovered to be of a coarſer alloy than the reſpective ſtandards, it may be broken and defaced; and the fees for aſſaying are particularly limited.

GONDOLA, a little flat boat, very long and narrow, chiefly uſed at Venice to row on the canals.

Gondola is alſo the name of a paſſage-boat of ſix or eight oars, uſed in other parts of the coaſt of Italy.

GONIOMETRICAL *lines*, derived from *γονια*, *angle*, and *μετρω*, *I meaſure*, in geometry, lines uſed for meaſuring or determining the quantity of angles. Such are ſines, tangents, ſecants, verſed ſines, &c. We have a paper by Mr. Jones, in the Philoſophical Tranſactions, containing a commodious diſpoſition of equations for exhibiting the relations of *goniometrical* lines: from whence a multitude of curious theorems may be derived. See Phil. Tranſ. N° 483. ſect. 26.

GONORRHŒA, Γονοῤῥοια, in medicine, an involuntary flux or dripping of ſeed, or other humour, by the penis, without erection or titillation. The word is formed of the Greek *γονος*, *genitura*, *ſeed*, and *ῥεω*, *fluo*, *I flow*. The *gonorrhœa* is of two kinds; the one *ſimple* or *benign*, the other *virulent* or *venereal*. See the Syſtem.

GOOD, in general, whatever is apt to increaſe pleaſure, or diminiſh pain in us; or, which amounts to the ſame, whatever is able to procure or preſerve to us the poſſeſſion of agreeable ſenſations, and remove thoſe of an oppoſite nature.

Moral Good denotes the right conduct of the ſeveral ſenſes and paſſions, or their juſt proportion and accommodation to their reſpective objects and relations. See Morals.

Philoſophers are divided as to what the chief *good* of man conſiſts in; whether in the *goods* of fortune, of body, or of mind. Some hold riches and honours the ſupreme *goods*; others, as Ariſtippus, and the Cyrenaic ſchool, bodily pleaſures; and others, as Zeno and the Stoics, virtue, or living according to nature. The Peripatetics agreed with the Stoics in maintaining that virtue is the *ſummum bonum*; but the Stoics aſſerted farther, that virtue was the *only good*; whilſt the Peripatetics denied, with reaſon, that virtue was not ſufficient, and therefore, required ſeveral other things as auxiliaries, ſuch as health, proſperity, friends, &c. which are to the virtuous man in the nature of inſtruments or ornaments to his felicity.

Virtue rightly underſtood is the perfection of human nature; it is the inſtrument of obtaining happineſs: but this alone will not make a man happy; it is farther neceſſary that he be perfect as to life, or happy in the circumſtances of his being: and, therefore, natural reaſon demonſtrates, that the favour of God, ſecured by virtue, is properly man's *ſupreme good*. Grove's Syſtem of Moral Philoſophy, vol. i. part I. paſſim. See Epicureans, Peripatetics, and Stoics.

Good *Behaviour*, in law, an exact carriage and behaviour to the king and his people. A juſtice of the peace may, at the requeſt of another, or where he himſelf ſees cauſe, demand ſurety for the good behaviour; and to that end the juſtice may iſſue out his warrant againſt any perſons whatſoever, under the degree of nobility; but when it is a nobleman, complaint is to be made in the court of chancery, or king's-bench, where ſuch nobleman may be bound to keep the peace. Infants and feme-coverts, who ought to find ſurety by their friends, may be bound over to their good behaviour; as alſo lunatics, that have ſometimes lucid intervals, and all others who break the peace, or being ſuſpected to do it, by affrays, aſſaults, battery, wounding, fighting, quarreling, threatening, &c. A perſon may be likewiſe bound to his good behaviour for a ſcandalous way of living, keeping bawdy-houſes, gaming-houſes, &c. and ſo may common drunkards, whoremongers, common whores, cheats, libellers, &c. He who demands ſurety for the peace, on any violence offered, muſt take an oath before the juſtice, that he goes in fear of his life, or ſome bodily harm, &c. and that it is not out of malice, but from a regard to his own ſafety.

Good-*Friday*, a faſt of the Chriſtian church, in memory of the ſufferings and death of Jeſus Chriſt. It is obſerved on the Friday in *holy* or *paſſion week*: and it is called by way of eminence, *good*, becauſe of the bleſſed effects of our Saviour's ſufferings, which were a propitiatory or expiating ſacrifice for the ſins of the world. The commemoration of our Saviour's ſufferings has been kept from the very firſt ages of Chriſtianity, and was always obſerved as a day of the ſtricteſt faſting and humiliation. Among the Saxons it was called *Long-Friday*: but for what reaſon, except on account of the long faſtings and offices then uſed, is uncertain. On Good-Friday the Pope ſits on a plain form; and, after ſervice is ended, when the cardinals wait on him back to his chamber, they are obliged to keep a deep ſilence, as a teſtimony of their ſorrow. In the night of Good-Friday, the Greeks perform the obſequies of our Saviour round a great crucifix, laid on a bed of ſtate, adorned with flowers: theſe the biſhops diſtribute among the aſſiſtants, when the office is ended. The Armenians, on this day, ſet open a holy ſepulchre, in imitation of that mount of Calvary.

GOOSE, in ornithology, ſee Anas. For the claſſification, ſee the System.

GOOSEBERRY. See Ribes.

GORE, in heraldry, denotes one of the regular *abatements*, uſed, according to Guillim, to denote a coward. It conſiſts of two arches or curve lines, drawn, one from the ſiniſter chief, the other from the ſiniſter baſe, and meeting in an acute angle in the middle of the feſſe-point.

GORGE is ſometimes alſo uſed for a moulding that is concave in the upper part, and convex at bottom; more properly called *gula* and *cymatium*. See Syſtem of Architecture, Plate VI.

Gorge, in fortification, the entrance of a *baſtion*, or of a *ravelin* or other *out-work*.

The Gorge *of a Baſtion* is what remains of the ſides of the polygon of a place, after retrenching the curtins; in which caſe it makes an angle in the center of the baſtion.

GORGED, in heraldry, is when the crown, coronet, or the like thing, is borne about the neck of a lion, a ſwan, &c. In that caſe they ſay, the lion or cygnet is *gorged* with a ducal coronet, &c.

GORGONEI *Fontes*, an affected term, uſed by ſome of the writers in chymiſtry, to expreſs thoſe ſprings or waters which turn things into ſtone. We have ſeveral ſprings in England, which cover over things with a ſtony matter, without introducing it into their inner ſtructure; but there are very few certain inſtances of waters, which at this day abſolutely petrify wood, that is, fill its pores with true ſtony matter. The famous water of Lough Neagh, in Ireland, is much diſputed by ſome as to its having this quality, and many fruitleſs experiments have been made in attempting to prove that it has.

GOSPEL, the hiſtory of the life, actions, death, reſurrection, aſcenſion, and doctrine of Jeſus Chriſt. The word is Saxon, and of the ſame import with the Latin term *evangelium*, or the Greek *ευαγγέλιον*, which ſignifies *glad tidings*, or *good news*; the hiſtory of our Saviour being the beſt hiſtory ever publiſhed to mankind. This hiſtory is contained in the writings of St. Matthew, St. Mark, St. Luke, and St. John; who from thence are called Evangeliſts. The Chriſtian church never acknowledged any more than theſe four Goſpels as canonical; notwithſtanding which, ſeveral apocryphal goſpels are handed down to us, and others are entirely loſt.

GOSSAMER, is the name of a fine filmy ſubſtance, like cobwebs, which is ſeen to float in the air, in clear days in autumn, and is more obſervable in ſtubble-fields, and upon furze and other low buſhes. This is probably formed by the flying ſpider, which, in tranſverſing the air for food, ſhoots out theſe threads from its anus, which are borne down by the dew, &c.

GOSSYPIUM, or Cotton, a genus of the polyandria order, belonging to the monodelphia claſs of plants. There are four ſpecies, all of them natives of warm climates. The firſt three ſpecies are annual, but the fourth is perennial both in root and ſtalk. In warm countries theſe plants are cultivated in great quantities in the fields for the ſake of the cotton they produce; but the ſpecies called herbaceous, is generally cultivated. The pods are ſometimes as large as middling-ſized apples, cloſely filled with the cotton ſurrounding the ſeed. When theſe plants are raiſed in this country, they muſt be continually kept in a warm ſtove, where they will produce ſeeds and cotton. They are propagated by ſeeds. See Cotton.

The American Iſlands produce cotton ſhrubs of various ſizes, which riſe and grow up without any culture; eſpecially in low and marſhy grounds. Their produce is of a pale red; ſome paler than others; but ſo ſhort that it cannot be ſpun. None of this is brought to Europe, tho' it might be uſefully employed in making of hats. The little that is picked up, ſerves to make mattraſſes and pillows. The cotton-ſhrub that ſupplies our manufactures, requires a dry and ſtony ſoil, and thrives beſt in grounds that have already been tilled. Not but that the plant appears more flouriſhing in freſh lands than in thoſe which are exhauſted; but, while it produces more wood, it bears leſs fruit. A weſtern expoſure is beſt for it. The culture of it begins in March and April, and continues during the firſt ſpring-rains. Holes are made at ſeven or eight feet diſtance from each other, and a few ſeeds thrown in. When they are grown to the height of five or ſix inches, all the ſtems are pulled up, except two or three of the ſtrongeſt. Theſe are cropped twice before the end of Auguſt. This precaution is the more neceſſary, as the wood bears no fruit till after the ſecond pruning; and, if the ſhrub was ſuffered to grow more than four feet high, the crop would not be the greater, nor the fruit ſo eaſily gathered. The ſame method is purſued for three years; for ſo long the ſhrub may continue, if it cannot conveniently be renewed oftener with the proſpect of an advantage that will compenſate the trouble. This uſeful plant will not thrive if great attention is not paid to pluck up the weeds that grow about it. Frequent rains will promote its growth; but they muſt not be inceſſant. Dry weather is particularly neceſſary in the months of March and April, which is the time of gathering the cotton, to prevent its being diſcoloured and ſpotted. When it is all gathered in, the ſeeds muſt be pricked out from the wool with which they are naturally mixed. This is done by means of a cotton-mill; which is an engine, compoſed of two rods of hard wood, about 18 feet long, 18 lines in circumference, and fluted two lines deep. They are confined at both ends, ſo as to leave no more diſtance between them than is neceſſary for the ſeed to ſlip through. At one end is a kind of little millſtone, which, being put in motion with the foot, turns the rods in contrary directions. They ſeparate the cotton, and throw out the ſeed contained in it.

GOTHIC, ſomething that has a relation to the Goths, an ancient people, originally inhabiting that part of Sweden called Gothland; whence they ſpread themſelves over Greece, Dalmatia, Bulgaria, Italy, Spain, &c. We ſay, the *Gothic* manner; *Gothic* ignorance; the tyrant Maximian was of *Gothic* race.

It has been a general opinion, ſtrenuouſly maintained by Cluverius and Pelloutier, and adopted by Mallet in his Northern Antiquities, that the *Gothic* and Celtic nations were the ſame; but the ingenious Engliſh tranſlator of Mr. Mallet's work, has produced a variety of teſtimonies from ancient authors, to prove that the Celtic and Teutonic or *Gothic* nations were, *ab origine,* diſtinct, and that they differed conſiderably in perſon, manners, laws, religion, and language. The former were the anceſtors of the Gauls, Britons, and Iriſh; and the Germans, Saxons, and Scandinavians, derived their origin from the latter. The Celtic tribes were probably the firſt that travelled weſtward; and the *Goths,* or Getæ of the ancients, who emigrated at different times from the eaſtern countries after them, might borrow ſome of their opinions and practices, which will account for the reſemblance that has been obſerved between them, without admitting that they were deſcended from them, or that they ſhould be conſidered as the ſame people. In the ſame way we may account for thoſe reliques both of Celtic and *Gothic* ſuperſtitions, which are diſcernible in Gaul and Britain, and many other countries, the inhabitants of which derive their deſcent equally from the Celts and *Goths,* who were at different times maſters of theſe kingdoms, and whoſe deſcendants are now blended together: thus, the firſt inhabitants of Gaul and Britain, being of Celtic race, followed the Druidical ſuperſtition.

The ancient Germans, Scandinavians, &c. being of *Gothic* race, profeſſed that ſyſtem of polytheiſm which was afterwards delivered in the EDDA: and the Franks and Saxons, who afterwards ſettled in Gaul and Britain, being of *Gothic* race, introduced the polytheiſm of their own nation, which was in general the ſame that prevailed among all the other *Gothic* or Teutonic people. With regard to the *Gothic* and Celtic languages, they are radically different from each other; and from theſe two mother-tongues the following particular languages are ſeverally derived: from the *Gothic* are derived the old Saxon or Anglo-Saxon, the Francic or Fronco-theotiſc, and the Cimbric or old Icelandic; of the old Saxon are formed the Engliſh, the broad or Lowland Scotch, the Belgic, or Low Dutch and the Friſic or Friezeland tongue; from the Francic proceed the German or high Dutch, the German of Swabia, and the Swiſs; and the Cimbric is the immediate ſource of the Icelandic, Norwegian or Norſe, Daniſh, and Swediſh. From the Celtic language are derived the ancient Gauliſh, the ancient Britiſh, from which proceeded the Welch, Armorican or Bas-Bretagne, and Corniſh; and the ancient Iriſh, from which ſprung the Iriſh, Erſe or Highland Scotch, and the Manks or language of the Iſle of Man. See the preface and notes to the Engliſh edition of Mallet's Northern Antiquities, 1770.

GOTHIC *Bible.* The *Gothic* verſion of the four Goſpels, firſt printed at Dort in 1665, was publiſhed at Oxford in 1750, by Mr. Lye: this edition was deſigned and prepared by Benzelius, archbiſhop of Upſal, with a Latin tranſlation and notes, in which the editor introduced ſome ſmall variations, and added a *Gothic* grammar. The ancient manuſcript of the *Gothic* verſion is preſerved in the library of the univerſity of Upſal, in Sweden, under the name of the *Codex Argenteus,* or *ſilver book,* becauſe the letters, which ſeem to have been ſtamped on the vellum leaves with hot metal types, are of ſilver, except the initials, which are gold. Another fragment of this curious verſion, containing part of the Epiſtle to the Romans, has been ſince diſcovered in the library at Wolfenbuttle, and publiſhed a few years ago in a ſplendid volume in quarto, by the Rev. F. A. Knitell, archdeacon of Wolfenbuttle.

GOTHIC *Architecture* is that which deviates from the proportions, characters, &c. of the antique. See Syſtem on the Origin, &c. of ARCHITECTURE.

The *Gothic* architecture is frequently very ſolid, heavy, and maſſive; and ſometimes, on the contrary, exceedingly light, delicate, and rich. An abundance of little whimſical ornaments are its moſt uſual character. Thoſe of the *modern Gothic,* or, as it ſhould rather be called, the Arabeſc, was introduced about the tenth century, and ran into the other extreme, being light, delicate, and rich to a fault; witneſs Weſtminſter-abby, the cathedral of Litchfield, the croſs of Coventry, &c. The laſt kind continued long in uſe, eſpecially in Italy; viz. from the thirteenth century to the reſtauration of the antique building in the ſixteenth. All the ancient cathedrals are in this kind. The marks which conſtitute the character of modern *Gothic* or Saracenical architecture, are its numerous and prominent buttreſſes, its lofty ſpires and pinnacles, its large and ramified windows, its ornamental niches or canopies, its ſculptured ſaints, the delicate lace-work of its fretted roofs, and the profuſion of ornaments laviſhed indiſcriminately over the whole building: but its peculiar diſtinguiſhing characteriſtics are, the ſmall cluſtered pillars and pointed arches, formed by the ſegments of two interſecting circles; which arches, though laſt brought into uſe, are evidently of a more ſimple and obvious conſtruction than the ſemi-circular arches. The firſt appearance of this ſtyle of building in our country was towards the latter end of the reign of Henry II. In the reign of Henry III. it ſeems to have gained a complete footing: the preſent cathedral church of Saliſbury, which is entirely in this ſtyle, was begun early in this reign, and finiſhed in the year 1258. From the reign of Henry VIII. or the cloſe of that of Henry VII. the *Gothic* architecture began to decline, and was ſoon after ſupplanted by a mixed ſtyle, wherein the Grecian and *Gothic* are blended together. The Roman or Grecian architecture did not prevail in England till the time of Inigo Jones; yet there were ſome earlier ſpecimens of this ſtyle, particularly Somerſet-houſe in the Strand, built in 1549, but lately pulled down, and rebuilt. Moſt of the great buildings of queen Elizabeth's reign have a ſtyle peculiar to themſelves; in which, though much of the old *Gothic* is retained, and great part of the new taſte is adopted, yet neither predominates; while both thus indiſtinctly blended, compoſe a fantaſtic ſpecies, hardly reduceable to any claſs or name. See Syſtem of ARCHITECTURE, on the Origin of the Science.

GOTHIC *Column,* is any round pillar in a Gothic building, either too thick or too ſmall for its height. There are ſome found even twenty diameters high, without either diminution or ſwelling.

GOTHS, a warlike nation, and above all others famous in the Roman hiſtory, came originally out of Scandinavia, (the name by which the ancients diſtinguiſhed the preſent countries of Sweden, Norway, Lapland, and Finmark.) According to the moſt probable accounts, they were the firſt inhabitants of thoſe countries; and from thence ſent colonies into the iſlands of the Baltic, the Cimbrian Cherſoneſus, and the adjacent places yet deſtitute of inhabitants. The time of their firſt ſettling in Scandinavia, and the time when they firſt peopled with their colonies the abovementioned iſlands and Cherſoneſus, are equally uncertain; though the Gothic annals ſuppoſe the latter to have happened in the time of Serug the great grandfather of Abraham. This firſt migration of the Goths is ſaid to have been conducted by their king Eric; in which all the ancient Gothic chronicles, as well as the Daniſh and Swediſh ones, agree. Their ſecond migration is ſuppoſed to have happened many ages after; when, the abovementioned countries being overſtocked with people, Berig, at that time king of the Goths, went out with a fleet in queſt of new ſettlements. He landed in the country of the Ulmerugians, now Pomerania, drove out the ancient inhabitants, and divided their lands among his followers. He fell next upon the Vandals, whoſe country bordered on that of the Ulmerugians, and overcame them; but inſtead of forcing them to abandon their country, he only made them ſhare their poſſeſſions with the Goths. The Goths were famous for their hoſpitality and kindneſs to ſtrangers, even before they embraced the Chriſtian religion. Nay, it is ſaid, that from their being eminently good, they were called *Goths* by the neighbouring nations; that name, according to Grotius and moſt other writers being derived from the German word *goten,* which ſignifies *good.* They encouraged, ſays Dio, the ſtudy of philoſophy above all other barbarous or foreign nations, and often choſe kings from among their philoſophers. Polygamy was not only allowed but countenanced among them; every one being valued or reſpected according to the number of his wives. By ſo many wives they had an incredible number of children, of whom they kept but one at home, ſending out the reſt in queſt of new ſettlements; and hence thoſe ſwarms of people which over-ran ſo many countries. With them adultery was a capital crime, and irremiſſibly puniſhed with death. This ſeverity, and likewiſe polygamy, prevailed among them when they were known to the Romans only by the name of *Getes,* (their moſt ancient name); as appears from the poet Menander, who was himſelf one of that nation; and from Horace, who greatly commends the chaſtity of their women. Their laws fell little ſhort of thoſe of the ancient Romans. Their government was monarchical; their religion much the ſame with that of the ancient Germans or Celtes.

GOVERNMENT, a quality or office which gives a man power or right to command or rule over a place, a city, a province, a kingdom, or the like, either ſupremely or by deputation. *Government* is either *general* and ſupreme, as that of a whole kingdom, empire, ſovereign ſtate, &c. or *particular* and ſubordinate; which, again, is ſubdivided into *civil, military,* and *eccleſiaſtical.* Our cities, corporations, and boroughs, are uſually governed by mayors, with aldermen and common-council-men.

GOVERNMENT is alſo uſed for the country, city, or place, to which the power of governing or commanding is extended.

GOVERNMENT, again, is uſed for the manner or form of *governing,* i. e. for the policy of a country, ſtate, &c. In this ſenſe *governments* are divided into MONARCHIES, ARISTOCRACIES, and DEMOCRACIES.

The *government* of France was *monarchic*; that of Venice, is *ariſtocratic*; and that of the United Provinces, *democratic:* the *government* of England is *mixt*; being monarchical, ariſtocratic, and democratic, all in one. Civil *government* and ſociety originate in the wants and fears of individuals, who, being naturally free, equal, and independent, aſſociate together, either by expreſs or tacit conſent, for the mutual preſervation of their lives, liberties, and eſtates, on this fundamental principle, that the whole ſhould protect all its parts, and that every part ſhould pay obedience to the will of the whole. However the ſeveral forms of *government,* that now ſubſiſt, actually began; there is and muſt be in all of them a ſupreme, irreſiſtible, abſolute, uncontrolled authority, in which the *jura ſummi imperii,* or the rights of ſovereignty, reſide: and this authority is placed in thoſe hands, wherein, according to the opinion of the founders of ſuch reſpective ſtates, either expreſly given, or collected from their tacit approbation, the qualities requiſite for ſupremacy, viz. wiſdom, goodneſs, and power, are the moſt likely to be found. Individuals unite for mutual protection and benefit; and, therefore, the legiſlative and executive authority of *government* originally derived from themſelves, ſhould be invariably directed to no other end but their ſafety and welfare; and that form of *government* is moſt eligible, which is beſt adapted to theſe purpoſes. Cicero declares himſelf of opinion, in his fragments De Rep. lib. ii. "*eſſe optiman conſtitutam rempublicam, quæ ex tribus generi-*" "*bus illis, regali, optimo & populari, ſit modieē confuſa.*" Of this kind is the Britiſh conſtitution, which lodges the executive power of the laws in a ſingle perſon, and the legiſlative in three diſtinct powers, entirely independent of each other; viz. the king; the lords ſpiritual and temporal, forming an ariſtocratical aſſembly; and the houſe of commons, freely choſen by the people, which renders it a kind of democracy: and each branch of this aggregate body, actuated by different views, and attentive to different intereſts, is armed with a negative power, ſufficient to repel any innovation which it ſhall think inexpedient or dangerous. Nothing can endanger or hurt the conſtitutional *government* of Britain, but deſtroying the equilibrium of power between one branch of the legiſlature and the reſt: for if ever it ſhould happen that the independence of any one of the three ſhould be loſt, or that it ſhould become ſubſervient to the views of the other two, there would ſoon be an end of our conſtitution: the legiſlature would be changed from that which was originally ſet up by the general conſent and fundamental act of the ſociety; and ſuch a change, however effected, is, according to Mr. Locke, at once an entire diſſolution of the bands of *government*, and the people are thereby reduced to a ſtate of anarchy, with liberty to conſtitute to themſelves a new legiſlative power. Locke on Government, book ii. chap. 19. Blackſt. Com. vol. i. Introd. See LAW, LIBERTY, PARLIAMENT, &c.

On this ſubject we ſhall give the opinion of the Rev. Dr. Price, as delivered in his ſermon before the Revolution Society, November the 5th 1789, but as his ideas may be deemed extravagant, to avoid the imputation of partiality, we ſhall ſubjoin the oppoſite opinion of the Rev. Mr. De Coetlogon, as delivered in his ſermon, on the 30th of January, 1790; it being the invariable plan of this Work, to give the ſentiments of the learned on all ſubjects of importance, leaving our readers to draw their own concluſions.

Extract from Dr. Price's Sermon before the Revolution Society.

"Civil government is an inſtitution of human prudence for guarding our perſons, our property, and our good name, againſt invaſion; and for ſecuring to the members of a community that liberty to which all have an equal right, as far as they do not, by any overt act, uſe it to injure the liberty of others. Civil laws are regulations agreed upon by the community for gaining theſe ends; and civil magiſtrates are officers appointed by the community for executing theſe laws. Obedience, therefore, to the laws and to magiſtrates, are neceſſary expreſſions of our regard to the community; and without this obedience the ends of government cannot be obtained, or a community avoid falling into a ſtate of anarchy that will deſtroy thoſe rights and ſubvert that liberty, which government is inſtituted to protect.

"I wiſh it was in my power to give you a juſt account of the importance of this obſervation. It ſhews the ground on which the duty of obeying civil governors ſtands, and that there are two extremes in this caſe which ought to be avoided. Theſe extremes are adulation and ſervility on one hand; and a proud and licentious contempt on the other. The former is the extreme to which mankind in general have been moſt prone; for it has oftener happened that men have been too paſſive than too unruly; and the rebellion of kings againſt their people has been more common, and done more miſchief, than the rebellion of people againſt their kings.

"Adulation is always odious, and when offered to men in power it corrupts them, by giving them improper ideas of their ſituation; and it debaſes thoſe who offer it, by manifeſting an abjectneſs founded on improper ideas of themſelves. I have lately obſerved in this kingdom too near approaches to this abjectneſs. In our late addreſſes to the king, on his recovery from the ſevere illneſs with which God had been pleaſed to afflict him we have appeared more like a herd crawling at the feet of a maſter, than like enlightened and manly citizens rejoicing with a beloved ſovereign, but at the ſame time conſcious that he derives all his conſequence from themſelves. But, perhaps, the ſervilities in the language of our late addreſſes ſhould be pardoned, as only forms of civility and expreſſions of an overflow of good-nature. They have, however, a dangerous tendency. The potentates of this world are ſufficiently apt to conſider themſelves as poſſeſſed of an inherent ſuperiority, which gives them a right to govern, and makes mankind their own: and this infatuation is almoſt every where foſtered in them by the creeping ſycophants about them, and the language of flattery which they are continually hearing.

"Civil governors are properly the ſervants of the public; and a king is no more than the firſt ſervant of the public, created by it, maintained by it, and reſponſible to it: and all the homage paid him, is due to him on no other account than his relation to the public. His ſacredneſs is the ſacredneſs of the community. His authority is the authority of the community; and the term Majeſty, which it is uſual to apply to him, is by no means his own majeſty, but the majeſty of the people. For this reaſon, whatever he may be in his private capacity; and though, in reſpect of perſonal qualities, not equal to, or even far below many among ourſelves. For this reaſon, I ſay, (that is, as repreſenting the community and its firſt magiſtrate,) he is entitled to our reverence and obedience. The words *moſt excellent majeſty* are rightly applied to him; and there is a reſpect which it would be criminal to withhold from him.

"You cannot be too attentive to this obſervation. The improvement of the world depends on the attention to it: nor will mankind be ever as virtuous and happy as they are capable of being, till the attention to it becomes univerſal and efficacious. If we forget it, we ſhall be in danger of an idolatry as groſs and ſtupid as that of the ancient heathens, who, after fabricating blocks of wood or ſtone, fell down and worſhipped them. The diſpoſition in mankind to this kind of idolatry is indeed a very mortifying ſubject of reflexion. In Turkey, millions of human beings adore a ſilly mortal, and are ready to throw themſelves at his feet, and to ſubmit their lives to his diſcretion. In Ruſſia, the common people are only a ſtock on the lands of grandees, or appendages to their eſtates, which, like the fixtures in a houſe, are bought and ſold with the eſtates. In Spain, in Germany, and under moſt of the governments of the world, mankind are in a ſimilar ſtate of humiliation. Who, that has a juſt ſenſe of the dignity of his nature, can avoid execrating ſuch a debaſement of it?

"Had I been to addreſs the king on a late occaſion, I ſhould have been inclined to do it in a ſtyle very different from that of moſt of the addreſſers, and to uſe ſome ſuch language as the following:—'I rejoice, ſir, in your recovery. I thank God for his goodneſs to you. I honour you not only as my king, but as almoſt the only lawful king in the world, becauſe the only one who owes his crown to the choice of his people. May you enjoy all poſſible happineſs, may God ſhew you the folly of theſe effuſions of adulation which you are now receiving, and guard you againſt their effects. May you be led to ſuch a juſt ſenſe of the nature of your ſituation, and endowed with ſuch wiſdom, as ſhall render your reſtoration to the government of theſe kingdoms a bleſſing to it, and engage you to conſider yourſelf as more properly the ſervant than the ſovereign of your people.'

"But I muſt not forget the oppoſite extreme to that now taken notice of; that is, a diſdainful pride, derived from a conſciouſneſs of equality, or, perhaps, ſuperiority, in reſpect of all that gives true dignity to men in power, and producing a contempt of them, and a diſpoſition to treat them with rudeneſs and inſult. It is a trite obſervation, that extremes generally beget one another. This is particularly true in the preſent caſe. Perſons juſtly informed on the ſubject of government, when they ſee men dazzled by looking up to high ſtations, and obſerve loyalty carried to a length that implies ignorance and ſervility: ſuch perſons, in ſuch circumſtances, are in danger of ſpurning at all public authority, and throwing off that reſpectful demeanour to perſons inveſted with it which the order of ſociety requires. There is undoubtedly a particular deference and homage due to civil magiſtrates, on account of their ſtations and offices; nor can that man be either truly wiſe or truly virtuous, who deſpiſes governments, and wantonly ſpeaks evil of his rulers; or who does not, by all the means in his power, endeavour to ſtrengthen their hands, and to give weight to their exertions in the diſcharge of their duty."

Extract from the Rev. Mr. De Coetlogon's Sermon, on the 30th of January, at St. Paul's Cathedral.

"With regard to KINGS—it ſhould never be forgotten, that, they are *men*; and men, of like paſſions with ourſelves. And, it has been obſerved, I think, with perfect approbation of good ſenſe, ſound judgment, and a thorough acquaintance with human nature, to ſay nothing of the more amiable principles of our religion, whoſe very line of life is benevolence and charity; that, "inſtead of wondering there are ſo many kings, *unfit* and *unworthy* to be truſted with the government of mankind, appear in the world, we ought rather to wonder there are any *tolerable*; when we conſider the flattery, with which they are moſt commonly ſurrounded from their very cradle; and the tendency of all thoſe falſe notions, which are inſtilled into them by precept, and by example, by the habits of courts, and by the intereſted, ſelfiſh views of courtiers. They are bred up to eſteem themſelves of a *diſtinct* and *ſuperior ſpecies* among *men*; as men are, amongſt animals." A king, is an office of the higheſt *rank*, *authority*, and *reſpectability*, a *ſupreme* ruler and governor; whoſe buſineſs, and whoſe honour it is, to execute the power, with which he is inveſted, according to law, juſtice, and right, for the general good. For, if a king ſhould ceaſe to rule according to law and juſtice, he deſtroys the very being of that government, which it is his office to *ſecure* and to *defend*; and, ſo far, he ceaſes to *be* a king. If the *fountain* of juſtice be diſorderly and corrupt, what muſt the *ſtreams* be! If the *head* of the body politic be regardleſs of right and wrong, what can the *members* be! A magiſtrate, who is elevated to ſuch a dignity, and who is a depiſer of that, which ought to be his delight and his ſupport, is only elevated there, to be at once the *ſcourge*, and the *ſcorn* of mankind!

"From the general hiſtory of the church and ſtate of theſe kingdoms, we may learn, how very much the *uſe* and the *abuſe* of *certain terms* and *certain things* affect the peace and felicity of ſociety, ſuch, for inſtance, as the *divine right* of kings—*paſſive obedience*, and *non-*

reſiſtence — the *liberty of the Subject* — *toleration* — *conſcience* — *Patriotiſm* — and the like. To ſuppoſe, that any king can have a *divine right* to act wrong: to be a tyrant: a monſter: to bid defiance to all the laws of juſtice, of humanity, and his country, is very well underſtood to be a contradiction to *nature*, to *reaſon*, to *religion*, and to *God*. It is no leſs a contradiction, perhaps, to nature, to reaſon, to religion, and to God, under the too plauſible pretences, of a right to reſiſt, in *particular* caſes: of the liberty of the ſubject: of toleration; and patriotiſm: to diſturb the royal peace: to interrupt the tranquility of the ſtate; to obtrude upon the frame of the conſtitution: or, to attempt an improvement, where the *attempt* may be unneceſſary; the *improvement*, utopian; and the *iſſue*, not only uncertain, in point of *ſucceſs*, but even alarming, in point of *danger*. To *prevent*, as much as human foreſight, and the wiſdom of imperfect beings can be ſuppoſed to prevent, a *repetition* of thoſe evils, which have ariſen, and which might ariſe, from each of theſe extremes, a civil and eccleſiaſtical conſtitution has been formed, in which the reſpective rights, of the ſovereign, and of the people, are very nicely aſcertained, and very ſuitably adjuſted.

"Still however there are ſome among us, who are forever pleading, what they think fit to call, the rights of man; the rights of the citizen; and the rights of conſcience, in *oppoſition* to this conſtitution! Far be it from us, to pretend to any uncommon ſuperiority of merit, of patriotiſm, or of influence! But, if we cannot improve the underſtandings, correct the judgments, and liberalize the ſouls of the vulgar: for ſuch, it ſeems, are they, who preſume to differ from the philoſophical and political prodigies of our times: let us be allowed the indulgence of thinking and ſpeaking for ourſelves: let us be permitted the favour, of partiality and attachment to our preſent happy conſtitution, both in church and ſtate; and though, for want of that *ſuperlative* capacity, with which the great author of our being may have diſtinguiſhed [in their own conceit at leaſt] ſome modern innovators, their favourite ſpeculations may excite our *ſurprize*, much more than our *approval*; ſtill let us be granted the toleration of ſuppoſing, that our breaſts may alſo glow with *one ſpark* of that patriotic ſpirit, with which the breaſts of others *profeſs* to be ſo *much* inſpired, ſo *much* inflamed! For, have the *oppoſers* of our inimitable conſtitution a right to *think?* So have we; have they a right to *ſpeak?* So have we; have they a right to *petition?* So have we. But, in *them*, it is *privilege*; in us, *perſecution*. In *them*, it is *toleration*; in us, *bigotry*. In *them*, *liberality* of *ſentiment*; in us, the *prejudices* of *education*, the *abſurdity* of *cuſtom*, and an ignoble *ſubmiſſion* to *antiquity*, to *eccleſiaſtical authority*, and to *civil power!* Unequal to the taſk of contending with ſuch decided advantages, on the part of our accuſers, *themſelves* being *judges*, we have no refuge, no protection, no plea, but what we can derive from the amiableneſs of candour, the dictates of moderation, the glories of the reformation, and the genius of that religion, which we both avow. Under the genius of whoſe tuition we have perhaps been miſled to imagine, that, to ruffle the peace of a well-formed ſociety, is no *good* evidence of a benevolent heart; or, of an enlarged underſtanding: to introduce confuſion and diſorder into a legitimate conſtitution, is no *ſatisfactory* proof of our patriotiſm; and, to make a ſacrifice of the ſpirit of chriſtianity upon the altar of non-eſſential diſtinctions, is but a poor recommendation of that piety, or that conſcience, whoſe righteous claims we would be underſtood to maintain, and ſecure.

"But how are theſe rights to be maintained and ſecured? For, firſt of all, we are told, by perſons of a particular deſcription, of a kind of excluſive *right*, which they ſeem to claim, to a *compleat toleration*; a ſort of thing, which is a contradiction both in *terms*, and in *law*. Then, you are very modeſtly aſſured, of an *equal right* they have, to the poſſeſſion of certain offices of truſt, influence, and emolument, which are appropriated by the legiſlature itſelf to members of the *eſtabliſhment* only. And, to crown all, they inform you, in the true ſpirit of *toleration*, that *you* have no right to *creeds*, *articles*, or *any eſtabliſhment* yourſelves; nor *ſhall* you have them whenever it is in their power to prevent it. If there be any thing more aſtoniſhing than this, it is, the almoſt faulty exceſs of patient indifference with which ſuch ſentiments are permitted to paſs. Had I the piety of an Apoſtle, and the thunder of a Demoſthenes, I would knock at the pillow of ſuch lethargic compoſure, and endeavour to awaken it to that degree of indignant ſenſibility, which would by no means degrade the chriſtian, the miniſter, or the man. If the little zeal, I have been ambitious to ſhew on this occaſion, be *illiterate* or *intemperate*, and demand an *apology*, I muſt beg leave to refer you for *that*, to the *cauſe* by which it has been animated; the intereſts of religion, the quiet of the ſtate, and the ſafety of the church. We have been accuſtomed to think, by all the laws of nations and of God, that the perſon of the ſovereign is to be treated as *ſacred*, on account of his office. To inſult the *office*, is an act of treaſon; treaſon againſt the *conſtitution!* For, is it neceſſary to remind ſome wilful novices in the knowledge of our government, that it is a *monarchy?* And, that a *king* is an *eſſential branch*, not the "*ſervant*," of the conſtitution!

"But, perhaps, this indecency of expreſſion may not be levelled againſt the *Office*, but againſt the *Man*; If ſo, we ſhall not ſcruple to aſſert, that, againſt *ſuch* a man, and *ſuch* a character, it is as inhuman, as it is illiberal, and ungrateful! Burdened, as *The ſovereign* muſt neceſſarily be, with all the cares, which are unavoidably connected with his peculiar ſphere of action; poſſeſſed, of all the various ſenſibilities, which belong to the moſt endearing, and the moſt honourable relations of life; and affected, by all the numberleſs ſolicitudes, which attach to ſuch a ſphere, and ſuch relations; to be inſulted with the idea of his being *the Servant*, inſtead of being treated with the veneration, the reſpect, the gratitude ſo juſtly due to him, as the FATHER; the FRIEND; and the GUARDIAN of a loyal and affectionate people; it is an imagination! No! it is a *ſcandalous Reality*, at which we *bluſh!* which makes our very nature *ſhudder!* and, which it were diſgraceful to *mention*, if it were not more ſo, to leave in *ſilence!!*

"After all; much as we may eſtimate ourſelves, in the ſeveral characters, of *Men*; of *Citizens*; and of *Patriots*; the moſt ſublime and exalted point of light, in which we *can* be conſidered, is, as *faithful Subjects* of the Kingdom of the Son of God. And, in *that* caſe, however puſillanimous it may ſeem, and whatever may be the vehemence of our animal, or out intellectual, temperature; in the ſober moments of ſolitude and conſideration, if there be *any extreme*, in which it would moſt become us to *err*, it ſhould be that, of *paſſive ſubmiſſion*. It is much more in uniſon with the *genius* of the religion, we profeſs, to *ſuffer*, than to *rebel*. It was the character of our bleſſed Saviour himſelf; the greateſt philoſopher, the greateſt hero, and the greateſt king, that ever did, or ever will, ſuſtain the human form. Nor is it ſuppoſed, that men of ſenſe and morals will ever be induced to judge favourably of *that* ſpecies of chriſtianity, which breathes the very fire of political inflammation."

GOVERNMENT, in grammar, is underſtood of that conſtruction of nouns and verbs, wherein they require ſome alteration to be made in others joined or conſtructed with them. See Syſtem of GRAMMAR, Part II. Chap. IV.

GOVERNOR, an officer veſted by a king, or ſovereign prince with the command and adminiſtration of a province, place, &c. A *governor* repreſents the king; and not only commands the garriſon, troops, &c. but the citizens, &c.

GOVERNOR is alſo frequently uſed for a preſident, or ſuperintendant. Thus we ſay, the *governor* of the bank; the *governor* and directors of the South Sea company; the *governor* of an hoſpital.

GOUGE, an inſtrument uſed by divers artificers; being a ſort of round, hollow chiſſel; ſerving to cut holes, channels, grooves, &c. in wood, ſtone, &c.

GOWN, *robe*, a long upper garment, worn by lawyers, divines, and other graduates, who are hence called *gentlemen of the gown*, or *gown-men*.

GRACE, GRATIA, in theology, any gift which God confers on men, of his own free liberality, and without their having deſerved it at his hands; whether ſuch gift regard the preſent or future life. *Grace* is uſually divided into *natural* and *ſupernatural*.

Natural GRACE, includes the gift of being, of life, of ſuch and ſuch faculties, of preſervation, &c.

Supernatural GRACE, is a gift from above, conferred on intelligent beings, in order to their ſalvation.

Art of GRACE, properly denotes an act of amneſty, or oblivion; for the pardon of all offenders who are qualified, or come within the conditions of it. The term is alſo extended to an act made for relief of inſolvent debtors in ſeveral priſons; by ſetting thoſe who are qualified, at liberty from their debts and confinement.

Days of GRACE, three days immediately following the term of payment of a bill, within which the creditor muſt proteſt it if payment is not obtained, in order to entitle him to recourſe againſt the drawer.

GRACE, in law, is ſometimes uſed for a faculty, licence or diſpenſation; but this ſeems to be only in a caſe where the matter proceedeth, as it were, *ex-gratia*, of *grace* and favour; and not where the licence or diſpenſation is granted of courſe, or of neceſſity. *Grace* is alſo a term in the formula of all patents, &c. which begin, George, by the *grace* of God, king of Great Britain, &c. The Romiſh biſhops frequently began their mandates in the like manner: ſuch a one, by the *grace* of God, and the holy ſee, biſhop of, &c. The Engliſh archbiſhops ſay, by divine *grace*, or divine providence. All ſovereigns uſe the phraſe *grace* of God; as emperors, kings, princes, &c. Anciently dukes, counts, and even lords, talked in the ſame ſtyle. In the new collection of Fath. Martene, we meet with a mere ſeigneur, or lord, qualified by the *grace* of God ſeigneur de Comborn. Louis XI. forbad the duke of Britany to ſtile himſelf by the *grace* of God. GRACE is alſo a title of dignity, attributed to princes of inferior rank, and who are not qualified for that of highneſs. In former times the kings of England were addreſſed under the title of *grace*, as they now are under that of majeſty. Our Engliſh dukes and archbiſhops are ſtill addreſſed under the title of *grace*.

GRACES, in heathen mythology, three goddeſſes, whoſe names were *Aglia*, *Thalia*, and *Euphroſyne*; that is, *ſhining*, *flouriſhing*, and *gay*; or, according to ſome authors, *Paſithea*, *Euphroſyne*, and *Ægiale*. Some make them the daughters of Jupiter, and Eurynome, or Eunomia, the daughter of Oceanus; but the moſt common opinion is, that they were the daughters of Bacchus and Venus. They are ſometimes repreſented dreſſed; but more frequently naked, to ſhew, perhaps, that whatever is truly graceful, is ſo in itſelf, without the aid of exterior ornaments. They preſided over mutual kindneſs and acknowledgment; beſtowed liberality, eloquence, and wiſdom, together with a good grace, gaiety of diſpoſition, and eaſineſs of manners.

GRACE, *Graceſulneſs*, in the human character; an agreeable attribute, inſeparable from motion as oppoſed to reſt, and as comprehending ſpeech, looks, geſture, and loco-motion. As ſome motions are homely, the oppoſite to *graceful*; it is to be inquired, With what motions is this attribute connected? No man appears graceful in a maſk; and therefore, laying aſide the expreſſions of the countenance, the other motions may be genteel, may be elegant, but of themſelves never are graceful. A motion adjuſted in the moſt perfect manner to anſwer its end, is elegant; but ſtill ſomewhat more is required to complete our idea of grace or gracefulneſs. What this unknown *more* may be, is the nice point. One thing is clear from what is ſaid, that this *more* muſt ariſe from the expreſſions of the countenance: and from what expreſſions ſo naturally as from thoſe which indicate mental qualities, ſuch as ſweetneſs, benevolence, elevation, dignity? This promiſes to be a fair analyſis; becauſe of all objects mental qualities affect us the moſt; and the impreſſion made by graceful appearance upon every ſpectator of taſte, is too deep for any cauſe purely corporeal. The next ſtep is, to examine what are the mental qualities, that, in conjunction with elegance of motion, produce a graceful appearance. Sweetneſs, cheerfulneſs, affability, are not ſeparately ſufficient, nor even in conjunction. Dignity alone with elegant motion, produces a graceful appearance; but ſtill more graceful with the aid of other qualities, thoſe eſpecially that are the moſt exalted. See DIGNITY.

But this is not all. The moſt exalted virtues may be the lot of a perſon whoſe countenance has little expreſſion: ſuch a perſon cannot be graceful. Therefore to produces this appearance, we muſt add another circumſtance, viz. an expreſſive countenance, diſplaying to every ſpectator of taſte, with life and energy, every thing that paſſes in the mind. Collecting theſe circumſtances together, grace may be defined, "that agreeable appearance which ariſes from elegance of motion and from a countenance expreſſive of dignity." Expreſſions of other mental qualities are not eſſential to that appearance, but they heighten it greatly. Of all external objects, a graceful perſon is the moſt agreeable. Dancing affords great opportunity for diſplaying grace, and haranguing ſtill more. See DANCING, DECLAMATION, and ORATORY. But in vain will a perſou attempt to be graceful, who is deficient in amiable qualities. A man, it is true, may form an idea of qualities he is deſtitute of; and, by means of that idea, may endeavour to expreſs theſe qualities by looks and geſtures: but ſuch ſtudied expreſſion will be too faint and obſcure to be graceful.

GRADATION, in general, the aſcending ſtep by ſtep, or in a regular and uniform manner.

GRADATION, in painting, a gradual and inſenſible change of colour, by the diminution of the teints and ſhades.

GRADATION, in rhetoric, the ſame with *climax*, which ſee.

GRADUATE, a perſon who has the degrees of any faculty. A *graduate* in phyſic, in divinity, &c. See DEGREE, DOCTOR, &c.

GRADUATION is uſed, in mathematics, for the act of *graduating*, or dividing any thing into degrees.

GRAFT, or GRAFF, in agriculture and gardening, a little ſhoot, cion, bud, or eye of a tree, inſerted into another tree to make it yield fruit of the ſame nature and kind as thoſe of the tree whence the graft is taken.

GRAFTING, or GRAFFING, or INGRAFTING, in gardening. For full directions reſpecting the various methods, ſee Treatiſe on GARDENING, Article *Fruit Garden*, month of *February*.

GRAIN, GRANUM, primarily denotes a fruit, or ſeed, growing in a ſpica, or ear. In this ſenſe, *grain* comprehends all ſorts of corn; as *Wheat*, *Rye*, *Barley*, *Oats*, &c.

Structure of GRAIN. There are three particulars obſervable in every *grain*, whether it be wheat, barley, oat, or whatever elſe of that kind. Theſe are, 1. The outer coat or pellicle, which contains all the reſt. This in the ſame ſpecies of *grain* is found to be very different in thickneſs in different ears, and as it has grown in different ſoils. 2. The germ or bud; this is always hid within the ſeed or *grain*, and is the plant in miniature that is to ariſe from it. And, 3. The meal, or that farinaceous matter which is incloſed in the ſkin, and which ſurrounds the germ, and ſerves to give it nouriſhment when firſt put into the earth, before it is capable of drawing it from the earth itſelf. Dr. Grew, in his Anatomy of Plants, has treated of this at large. See VEGETATION, &c. The whole ſtructure of the plant which produces theſe ſeeds is equally admirable. The chaffy huſk is admirably adapted to ſhield and defend the ſeed as long as that is neceſſary, and then to let it fall; and the ſtalk formed hollow and round, is neceſſarily at once light and ſtrong, capable of ſuſtaining the ear, without abſorbing too much of the juices deſtined to its nouriſhment; and the beards of many kinds are a defence againſt the birds, that would otherwiſe deſtroy the ſeed before its ripening. The covering of the ſeed is formed of two membranes, which meeting in a line on one part of the ſeed, form together that furrow we ſee on it. This is the place at which the ſeed is to burſt open on being moiſtened. Had not nature provided this means of the germ's coming out, the toughneſs neceſſary to the coat of the ſeed, as a defence from injuries, would have ſuffered the farinaceous matter and the germ to rot together, within it, before it would have given them way to come out, and for the germ to grow. Nor is this the only uſe of this place of opening. The great Creator of all things has provided theſe ſeeds, not only for a ſupply of the ſame ſpecies of plant, but for our food, and for that of birds, &c. We have art enough to erect machines for the reducing the farina to powder, and the freeing it from its covering membrane; birds eat it as it is, and it would paſs through them whole, and without doing them any good, were it not that the juices of the ſtomach ſwelling it up, it burſts open at this furrow, and all the nutritive matter pours itſelf out. Des Landes, Trait. Phyſ. p. 62. This farinaceous matter is compoſed of an infinite number of white and tranſparent bodies, of a globular figure: theſe every way ſurround and incloſe the young plant, and by their figure being eaſily put in motion, as ſoon as the heat and humidity of the earth act upon them, they, by degrees, force themſelves into the veſſels of the plant, and give it increaſe from time to time till they are received into it; and they then have ſo far given it ſtrength, that it is in a condition to feed on the juices in the earth. The ſame proceſs of nature is obſervable in the caſe when *grains* of corn grown out of time, on being thrown too careleſly together in a moiſt place.

When the corn is ground into powder, theſe farinaceous globules make what we call the flour. The germs are always leſs white, and leſs tranſparent than they, but they are of great uſe; ſince it is principally to them that we owe the agreeable flavour of bread, and almoſt wholly to them, that the fermentation of dough is owing, their little parts being, of all others of the *grain*, the moſt eaſily put in motion. And it is alſo to theſe, that the rotting of wheat, preſerved in damp granaries, is to be attributed, their natural tendency being to motion and to corruption, if that motion be given without the neceſſary accidents. That the obſervation of the fermentation of dough, and the lightneſs of bread, being owing to theſe germs, may not ſeem advanced at random, it may be proper to confirm it, by the obſervations of the people employed in making bread for the army. Theſe people always find, that fine flour, if well dried, and put up in dry barrels, will keep good a long time; but that after it has been thus kept long, though it will make biſcuit, and ſerve for many other neceſſary uſes, it will never make the fine light bread eaten at table; and this they attribute to the life of the flour being ſpent; that is, to theſe germs being deſtroyed, as to their vegetative power, by having been a long time broken to pieces. For the laws relating to the importation and exportation of ſeveral ſorts of *grain*, as wheat, barley, &c. ſee WHEAT.

GRAIN is alſo applied to the fruits or ſeeds of divers plants, as a *grain* of millet, of pepper, &c.

GRAIN is alſo extended to a minute body, or parcel of a body pulverized. In which ſenſe we ſay, a *grain* of ſand, a *grain* of ſalt, a *grain* of gunpowder, &c.

GRAIN denotes alſo a ſmall weight, uſed in eſtimating divers ſubſtances. The *grain* is the ſmalleſt of all weights known in England.

GRAIN *of Iron*. Even iron has its *grain*, as well as wood, and that not the ſame in all iron, though all iron is very evidently the ſame ſpecies of body. The common caſt iron has a *grain* very different from that which has been hammered, or wrought, the granules which compoſe the maſs being in this laſt ſtate forced as it were into combinations, with one another, by the repeated blows of the hammer: the tempering of iron into ſteel alſo alters its *grain*, partly by means of the ſalts and ſulphurs, which are by that operation introduced into it, and partly by the ſtopping the effect of the fiery particles received into it at a certain time.

But beſides theſe differences, the common wrought iron has in it ſeveral pieces, or ſometimes in the ſeveral parts of the ſame piece, different *grains*. Firſt a laminated one, ſecondly a granulated one, and thirdly a fibroſe or ſtringy one. Theſe, however, are not ſo different, in reality, as they appear to be; for the laminæ, as they become ſmaller, become granules: and arrangements of theſe granules, in long lines, make the fibres of the thready kind. The artificers, however, know by theſe marks of the *grain* what iron is beſt for tempering into ſteel; and they find the laminated pieces to be the worſt of all, and the granulated ones the beſt. Mem. Acad. Scien. Par. 1722.

GRALLÆ, in ornithology, an order of birds analogous to the *bruta* in the claſs of *mammalia*, in the Linnæan ſyſtem; the characters of which are, that the beak is ſubcylindric and ſomewhat obtuſe; the tongue is entire and fleſhy; and the thighs above the knees are bare. For the claſſification, ſee the SYSTEM.

GRAMINA, GRASSES; one of the ſeven tribes or natural families, into which all vegetables are diſtributed by Linnæus in his *Philoſophia Botanica*. They are defined to be plants which have very ſimple leaves, a jointed ſtem, a huſky calix termed *gluma*, and a ſingle ſeed. This deſcription includes the ſeveral ſorts of corn as well as graſſes. In Linnæus's ſexual method, they are moſtly contained in the ſecond order of the third claſs, called *triandria digynia*. This numerous and natural family of the graſſes, has engaged the attention and reſearches of ſeveral eminent botaniſts.

GRAMMAR, the art of ſpeaking or writing any language with propriety; or as it is more extenſively defined, the art of expreſſing the relations of things in conſtruction, with due quantity in ſpeaking, and orthography in writing, according to the cuſtom of thoſe whoſe language we learn. The word Grammar is derived from *γραμμα*, *littera*, letter.

SYSTEM OF GRAMMAR.

INTRODUCTION.

GRAMMAR is the ſame in all languages as to its general principles and notions, which it borrows from philoſophy to explain the order and manner wherein we expreſs our ideas by words; but as each language has its particular turns, its ſeveral characters and genius, different from the genius and characters of other languages; hence ariſe as many grammars as languages. The following example will ſave to ſhew this. We ſay in Engliſh, *draw a ſtrait line*, not, *a line ſtrait*: in French they ſay, *tirer ligne droit, a line ſtrait*, not *droit ligne* a ſtrait line. In Latin they have liberty to ſay, *rectam lineam* or *lineam rectam ducere:* And if there be a language which in the phraſe abovementioned, follows the ſame analogy as the Engliſh, it differs from it in many other inſtances.

GRAMMAR, is either *univerſal* or *particular*.

Univerſal, called alſo with great propriety *philoſophical* grammar, conſidered as a ſcience, is that which without regarding the ſeveral idioms of particular languages, only reſpects thoſe principles that are eſſential to them all. One of this kind was propoſed by lord Bacon; not upon the analogy of words, but ſuch as ſhould diligently examine the analogy or relation between words and things. He diſapproves too curious an enquiry about the original impoſition and etymology of names. This he thinks an elegant, and as it were, a waxen ſubject, that may be handſomely wrought and twiſted, but is attended with little truth and advantage. But, ſays he, it would be a noble kind of *grammar*, if any one well verſed in languages, both the learned and the vulgar, ſhould treat of their various properties, ſhewing wherein each of them excel and fall ſhort: for thus languages might be enriched, by mutual commerce, and one beautiful image of ſpeech, or one grand model of language, for juſtly expreſſing the ſenſe of mankind, be formed like the Venus of Apelles, from the excellencies of ſeveral. And thus at the ſame time we ſhould have ſome conſiderable marks of the genius and manners of people and nations, from their reſpective languages. See Bacon's Doctrine of Delivery, § 7. and De Augm. Scient. vi. 1.

The object of philoſophical or univerſal *grammar* is ſpeech or language, as divided into its conſtituent parts, as a ſtatue may be divided into its ſeveral limbs; or elſe, as reſolved into its matter and form, as the ſame ſtatue may reſolve into its marble and figure: and thus it is diſtinguiſhed from the art of LOGIC, which conſiders ſpeech as combined or compounded; ſo that by this ſyntheſis, ſimple terms are combined to produce a truth, and two truths are combined to produce a third, &c. In this kind of *grammar*, the deſign is to point out the ſeveral powers and modes of expreſſion which ſounds are capable of, to trace their connections with, or relation to the ideas they repreſent; and to ſhew the actual variety of the external expreſſions of the ſame mental conceptions which different languages exhibit. By this compariſon we ſhall be enabled to judge which is the moſt adequate and convenient method of expreſſion, what is defective, and what is redundant in the ſtructure of any particular language, and directed to the moſt proper method of ſupplying the defect, or leſſening the inconveniencies ariſing from the ſuperfluity.

Particular GRAMMAR, conſidered as an *art*, neceſſarily ſuppoſes the previous exiſtence of language; and as its deſign is to teach any language to thoſe who are ignorant of it, it muſt be adapted to the genius of that particular language of which it treats. A juſt method of grammar, therefore, ſuppoſing a language introduced by cuſtom, without attempting any alterations in it, furniſhes certain obſervations called *rules*, to which the methods of ſpeaking uſed in this language may be reduced; this collection of rules is what is called a *grammar* of any particular language. By this we are enabled to expreſs ourſelves with propriety in that language, and to judge of every phraſe and form of conſtruction, whether it be right or not. Beſides, there is a ſecondary uſe to which it may be applied; viz. the facilitating of the acquiſition of other languages, whether ancient or modern. Having thus briefly defined the two ſpecies of grammar, we ſhall treat of them as divided into two parts.

PART I.

UNIVERSAL GRAMMAR.

It is not neceſſary here to enquire how language was originally invented, to trace the various changes it may have undergone, or to examine whether any language may be conſidered as the original from which all others have been derived; it is ſufficient for our purpoſe to obſerve, that all mankind, however diverſified in other reſpects, agree in the common uſe of language; from which it appears, that language is not merely accidental and arbitrary, but founded in the nature of things, and within the reach of all mankind. It is therefore an object worthy of a philoſophic inquiry, to diſcover the foundations upon which this univerſal fabric has been raiſed.

The deſign of ſpeech is to publiſh to others the thoughts and perceptions of our mind. The moſt acute feelings of man, as well as of every other animal, are expreſſed by ſimple inarticulate ſounds, which, as they tend to the preſervation of the individual, are univerſally underſtood. Theſe inarticulate but ſignificant ſounds, therefore, conſtitute a natural and univerſal language, which man, as a mere ſenſitive being, partakes in common with the other animals. But as man is not only endowed with ſenſation, but with the faculty of reaſoning, ſimple inarticulate ſounds are inſufficient for expreſſing all the various modifications of thought, or for communicating to others a chain of argumentation: it was therefore neceſſary to call in the aid of *articulation*; which by modifying theſe ſimple ſounds, and by fixing a particular meaning to theſe modifications, forms the language peculiar to man, and which diſtinguiſhes him from all other animals, and enables him to communicate with facility all that diverſity of ideas with which his mind is ſtored. Theſe ſounds, thus modified, and having a determinate meaning, are called WORDS; and as all language is compoſed of ſignificant words variouſly combined, a knowledge of them is neceſſary previous to our acquiring an adequate idea of language. But, as it is by words that we expreſs the various ideas which occur to the mind, it is neceſſary to examine how ideas themſelves are ſuggeſted, before we can aſcertain the various claſſes into which words may be diſtributed. With this view, therefore, let us ſuppoſe a reaſonable being, devoid of every prepoſſeſſion whatever, placed upon this globe. His attention would, in the firſt place, be directed to the various objects which he ſaw exiſting around him: theſe he would naturally endeavour to diſtinguiſhed from one another, and give them names, by means of which the idea of them might be recalled when the objects themſelves were abſent. This is one copious ſource of words; and forms a natural claſs which muſt be common to every language, and which is diſtinguiſhed by the name of NOUNS. And as theſe nouns are the names of the ſeveral ſubſtances which exiſt, they have likewiſe been called SUBSTANTIVES. It would likewiſe be early diſcovered, that every one of theſe ſubſtances was endowed with certain qualities or attributes, to expreſs which another claſs of words would be requiſite. Thus, *to be weighty*, is a quality of matter; *to think*, is an attribute of man. Therefore, in every language, words have been invented to expreſs the various qualities of the ſeveral objects which exiſt. Theſe may all be comprehended under the general denomination of ATTRIBUTIVES. Theſe two claſſes of words muſt comprehend all things that exiſt: for whatever exiſts, muſt of neceſſity be either a ſubſtance, or the attribute of ſome ſubſtance; and hence theſe two claſſes muſt comprehend all thoſe words which are ſignificant of themſelves, and may be called WORDS SIGNIFICANT OF THEMSELVES. If any other words occur, they can only be ſignificant ſo far as they tend to explain or connect the words of the two former claſſes. But, although theſe words form the baſis or matter of a language, in the ſame manner as ſtones form the matter of a building; yet, as ſtones cannot be arranged into a regular ſtructure without a cement to bind and connect them, ſo theſe original words ſtand in need of others to connect them, before they can be made to expreſs all the variety of our ideas. Another order of words, therefore, was neceſſary, which although not of themſelves ſignificant, yet, when joined with others, might acquire a meaning. Theſe form a ſecond general claſs of words, that may be called WORDS NOT OF THEMSELVES SIGNIFICANT, and which cannot acquire any meaning but ſo far as they ſerve either to EXPLAIN or CONNECT the others. Hence, therefore, all words which can poſſibly be invented, may be divided into two general claſſes; thoſe that are SIGNIFICANT OF THEMSELVES, and thoſe that are NOT. Words which are ſignificant of themſelves, are either expreſſive of the names of ſubſtances, and therefore called SUBSTANTIVES; or, of qualities, which we call ATTRIBUTIVES. Words which are not ſignificant of themſelves, muſt acquire a meaning either as defining or connecting others, which we ſhall arrange under the two claſſes of DEFINITIVES and CONNECTIVES, each of which ſhall be examined in their order.

CHAP. I. OF SUBSTANTIVES.

SUBSTANTIVES may be divided into two claſſes, viz. thoſe which are primary, commonly called NOUNS; and thoſe of a ſecondary order, which are often ſubſtituted for nouns, and are hence called PRONOUNS; each of which we ſhall conſider ſeparately.

SECT. I. OF SUBSTANTIVES OF THE FIRST ORDER, CALLED NOUNS.

NOUNS are *all thoſe words by which objects or ſubſtances are denominated, and which diſtinguiſh them from one another, by names applicable to each, without marking either quantity, quality, action, or relation*. And as all the objects which exiſt muſt be either in the ſame ſtate that they were produced by *nature*, or changed from their original ſtate by *art*, or *abſtracted* from ſubſtances by the powers of imagination, this naturally ſuggeſts a diviſion of nouns into NATURAL, as *man*, *vegetable*, *tree*, &c.; ARTIFICIAL, as *houſe*, *ſhip*, *watch*, &c.; or ABSTRACT, as *whiteneſs*, *temperance*, &c. But the diverſity of objects being ſo great as to render it impoſſible for any perſon to know the diſtinct names of every individual, therefore it has been found expedient to arrange them under certain general claſſes, the names of which may be more eaſily acquired, ſo that by referring any unknown object to the claſs to which it belongs, we in ſome meaſure ſupply the want of proper names. Hence, therefore, each of the above ſpecies of nouns are divided into thoſe which denote genera, ſpecies, and individuals. Thus, into natural ſubſtances, *animal*, *vegetable*, and *mineral*, denote genera; *man*, *dog*, *tree*, *metal*, are ſpecies; and *Alexander*, *Cæſar*, *oak*, *gold*, are individuals. In artificial ſubſtances, *edifice* is a genus; *houſe*, *tower*, *church*, are ſpecies; and the *Vatican*, *St. John's* *church*, and *St. Thomas's hoſpital*, individuals. In *abſtract* ſubſtances, *motion* is a genus; *flight* and *courſe* are ſpecies; *the flight of Mahomet*, the *courſe of a grey-hound*, are individuals. Each of theſe general claſſes might be ſubdivided into many ſmaller; but as theſe leſſer diviſions can only relate to the particular genius of different languages, it does not fall within our plan to conſider them. We therefore proceed to take notice of the accidents which accompany nouns. Of which kind may be reckoned *number* and *gender*.

As *nouns* are the names of *ſubſtances*, and as there may be many ſubſtances of the ſame kind, therefore nouns muſt be adapted to expreſs whether there is one or more of thoſe objects of which we ſpeak. Nouns, therefore, in every language, admit of a certain variation to denote this circumſtance, which is called *number*. Thus, in the Engliſh language, when we ſpeak of a ſingle place of habitation, we call it *a houſe*; but if of more, we call them *houſes*. In the firſt of theſe caſes the noun is ſaid to be in the *ſingular*, and in the laſt caſe the *plural* number: nor does the Engliſh, or any other language except the Greek, admit of any other variation but theſe two: and although the Greek language admits of a particular variation of the noun called the *dual* number, which is a plural limited to two objects; yet this cannot be conſidered as eſſential to language; and it is perhaps doubtful whether this variation ought to be conſidered as an elegance or a defect in that language. But although number be a natural accident of nouns, it can only be conſidered as eſſential to thoſe which denote genera or ſpecies, as it does not deſcend to individuals. Thus we ſay, *animal*, or *animals*, *vegetables*, and *foſſils*; as alſo *man*, or *men*, *dogs*, *trees*, &c. But we only ſay, *Xenophon*, *Cæſar*, *Bucephalus*, &c. in the ſingular. Nor do theſe admit of a plural, excepting when we conſider any proper name as a general appellative under which many others are arranged, when it is no longer the name of an individual, but that of a ſpecies, and as ſuch admits of a plural; as the *Alexanders*, the *Ptolemies*, the *Howards*, the *Pelhams*, the *Montagues*, &c. The reaſon of all which will be obvious, if we conſider, that every genus may be found whole and entire in each of its *ſpecies*; for *man*, *horſe*, and *dog*, are each of them an entire and complete *animal*: and every ſpecies may be found whole and entire in each of its individuals; for *Socrates*, *Plato*, and *Xenophon*, are each of them completely and entirely a *man*. Hence it is, that every *genus*, though ONE, is multiplied into MANY; and every *ſpecies*; though ONE, is alſo multiplied into MANY, *by reference to thoſe beings which are their ſubordinates*. But as *no individual has any ſuch ſubordinates*, it can never in ſtrictneſs be conſidered as MANY, and ſo is truly an INDIVIDUAL as well in *nature* as in *name*, and therefore cannot admit of number.

Another accident of nouns is *gender*, the nature of which may be thus explained: As nouns are the names of the various objects in nature; and as the diſtinction of ſex is perceptible among all thoſe objects which are animated; and as thoſe which are inanimate cannot admit of any ſex at all; therefore all the beings which can become the objects of our ſpeculation, may be conſidered as either *males* or *femules*, or ſuch as admit of *no* ſex, and therefore may be ſaid to be neuter, or of *neither* ſex. Hence, therefore, grammarians have made a threefold diſtinction of nouns, into *maſculine genders*, or thoſe which denote *males*; *feminine*, or thoſe which denote *females*; and *neuters*, which denote thoſe ſubſtances that admit of no ſex. Although the origin of genders is ſo clear and obvious; yet every language that we know of, except the Engliſh, deviates from the order of nature, and often attributes ſex to thoſe ſubſtances which are totally incapable of any; nay, ſome languages are ſo particularly defective in this reſpect, as to claſs every object inanimate as well as animate under either the *maſculine* or *feminine gender*, as they admit of no gender for thoſe that are of neither ſex. This is the caſe with the French, Italian, and Spaniſh. But the Engliſh, ſtrictly following the order of nature, puts every noun which denotes a male animal, and no others, in the *maſculine* gender; every name of a female animal, in the *feminine*; and every animal whoſe ſex is not obvious, or known, as well as every inanimate object whatever, in the *neuter* gender. Nor does this rule admit of any exceptions; although poets take the liberty of perſoniſying any objects they think proper, and endowing them with whatever ſex ſuits their purpoſe beſt; and ſerves admirably to diſtinguiſh between the cool language of philoſophy, and the enthuſiaſm of poetry.

Although *caſes* are not neceſſary accidents of nouns; yet as they have been often conſidered as ſuch, it will perhaps be deemed proper to take ſome notice of them. As natural objects remain the ſame, although obſerved from many different points of view, they are not in their own nature altered, though they may be connected with others in many different ways; their names therefore ought to remain unchanged, although their relations to other words may be varied. However, there are certain circumſtances in which nouns may be conſidered with reſpect of their relation *to*, and connection *with*, other words, which occur more frequently than others. Some languages (particularly the Greek and Latin) expreſs *ſome* of theſe circumſtances by a variation of the original noun, which variations are called CASES. But the Engliſh, and almoſt all the modern languages of Europe, have followed the order of nature, and allow the noun to remain the ſame, expreſſing its relation and connection with other words by the help of diſtinct words called *prepoſitions*. Which of theſe methods is beſt, it is not our preſent purpoſe to inquire.

It has been ſuppoſed the Engliſh nouns admit of one variation which anſwers to the genitive caſe of the Latins. Thus the word *Alexander* is an Engliſh noun in its proper form, and in that caſe which in Latin would be called the *nominative*. The variation which they called the *genitive* caſe, is expreſſed in Engliſh by adding the prepoſition OF before the noun; thus, OF *Alexander*. But the ſame meaning may be conveyed by means of apoſtrophe; as in the word *Alexander*'s: for the meaning is the ſame, if I ſay the houſe *of Alexander*, or *Alexander*'s houſe. This, therefore, has been called a true inflexion of the original noun. However, though this opinion has been adopted by all grammarians, it appears to have been adopted without ſufficient examination, as will be evident from the following conſiderations. There are certain circumſtances in which this ſuppoſed genitive cannot be ſubſtituted inſtead of the other; for I may ſay, I ſpeak OF *Alexander*, I write OF *Cæſar*, I think OF *Pompey:* but I cannot ſay, I ſpeak *Alexander*'s, I write *Cæſar*'s, or I think *Pompey*'s. Hence theſe two are not in all caſes ſynonymous terms; and therefore one of them muſt be conſidered as only accidentally coinciding with the other in particular circumſtances. Again, every one of theſe ſuppoſed genitives can with propriety aſſume all the various ſigns of the different *caſes* in the Engliſh language: for we may ſay ſimply, as in the nominative caſe, *Alexander*'s houſe; but we can alſo ſay, OF *Alexander*'s *houſe*, TO, WITH, FROM, IN, BY, or FOR *Alexander*'s *houſe*, &c. If this then be a real genitive, it requires the ſign of genitive, as well as of the other caſes, to explain it; which would be an abſurdity too great to be admitted.

SECT. II. *Of* Subſtantives *of the Second Order called* PRONOUNS.

All converſation paſſes between individuals. When theſe individuals are unknown to each other, how ſhall the one ſpeaker addreſs the other when he knows not his name; or how explain himelf by his own name, of which the other is wholly ignorant? This might perhaps have been at firſt effected by pointing; but as this method would be extremely inconvenient and defective, it was neceſſary that a particular claſs of words ſhould be invented for this purpoſe; and as theſe words always ſupply the place of a noun, they have been called pronouns; the nature of which may be explained as follows. Suppoſe the parties converſing to be wholly unacquainted, and the ſubject of the converſation to be the ſpeaker himſelf: here, to ſupply the place of pointing, the inventors of language have furniſhed the ſpeaker with the pronoun *I: I write, I deſire:* and as the ſpeaker is always principal with reſpect to his own diſcourſe, they have therefore called this the *pronoun* of the firſt perſon.

Again, ſuppoſe the ſubject of the converſation to be the party addreſſed; here, for ſimilar reaſons, they invented the pronoun THOU; THOU *writeſt*, THOU *walkeſt:* and as the party addreſſed is next in dignity to the ſpeaker, or at leaſt comes next with reference to the diſcourſe, they therefore called this the *pronoun* of the ſecond perſon. But as the ſubject of the converſation may be ſome third object different from either the ſpeaker or the party addreſſed, another pronoun was neceſſary; and as this object might be either a *male* or a *female*, or a *neuter*, it was neceſſary to have one pronoun for each of the genders, HE for the *maſculine*, SHE for the *feminine*, and IT for the *neuter:* and this, in diſtinction to the former, was called the *pronoun* of the third perſon. Hence the diſtribution of pronouns into *perſons*. We have already ſeen that nouns admit of number; pronouns, which are their ſubſtitutes, likewiſe admit of number. There may be many ſpeakers of the ſame ſentiment, as well as one who including himſelf ſpeaks the ſame ſentiment with *many:* ſpeech may likewiſe be addreſſed to *many* at a time as well to as *one:* and the ſubject of the diſcourſe may likewiſe be *many:* therefore the pronoun of every one of the *perſons* muſt admit of number, to expreſs this ſingularity or plurality. Hence, therefore, the pronoun of the firſt perſon *I*, has the plural WE; that of the ſecond perſon *thou*, has the plural YOU; and that of the third perſon *he*, *ſhe*, or *it*, has the plural THEY, which is equally applied to all the three genders.

With regard to gender, we do not find in any language that the pronouns of the *Firſt* or *Second* perſons admit of any diſtinction in this reſpect; nor was it neceſſary that they ſhould; as the ſpeaker and party addreſſed are uſually preſent with one another, this diſtinction is generally obvious from dreſs and external appearance. But this is not the caſe with regard to the pronoun of the *Third* perſon; of whoſe character and diſtinctions we often know no more than what we learn from the diſcourſe itſelf; and hence it is, that in almoſt all languages the pronoun of the third perſon admits of genders, as we have already ſeen the Engliſh admits of the triple diſtinction of maſculine, feminine, and neuter. The utility of which threefold diſtinction will be beſt ſhewn by an example. Suppoſing there was no ſuch diſtinction, and that we ſhould read in any hiſtory HE cauſed HIM to deſtroy HIM, and were told that the pronoun which is here thrice repeated ſtood each time for ſomething different; that is to ſay, for a man, for a woman, and for a city, whoſe names were *Alexander*, *Thais*, and *Perſepolis*. Taking the pronoun thus diveſted of its genders, it does not appear which of the three was deſtroyed, which the deſtroyer, or which the cauſe that moved to the deſtruction. But there is no ambiguity when we hear the genders diſtinguiſhed; and when, inſtead of the ambiguous ſentence, *he* cauſed *him* to deſtroy *him*, we are told with the proper diſtinctions that SHE cauſed HIM to deſtroy IT. Then we know with certainty, that the promoter was the *woman*, that her inſtrument was the *hero*, and that the ſubject of her cruelty was the unfortunate *city*. From this example we may be ſurpriſed how the *Italian*, *French*, and *Spaniſh*, could expreſs themſelves with preciſion or elegance, with no more than two variations of this perſon. From the ſame cauſes, as a diſtinction of gender is unneceſſary in the pronouns of the firſt and ſecond perſons, we ſee the reaſon why a ſingle pronoun to each perſon, an *I* for the firſt, and a THOU for the ſecond, are ſufficient for all the purpoſes of language, as theſe are always ſuppoſed preſent and obvious. But it is not ſo with reſpect to the third perſon, as the various relations of different objects made it neceſſary to have not *one*, but *many:* ſuch as, HE, SHE, IT, THIS, THAT, OTHER, SOME, ALL, ANY, &c. Theſe are all that can be properly called *perſonal pronouns*; but beſides theſe, there are pronouns *relative*, *poſſeſſive*, *demonſtrative*, and *indefinite*, which will be ſeverally defined.

Pronouns *relative*, called alſo *modificative*, or *determinative*, are thoſe placed after nouns, or other pronouns, with which they have ſuch affinity, that without them they ſignify nothing; ſuch are *qui*, *who*, *that*, &c. frequently the noun or pronoun with which the relative is joined, is underſtood. Pronouns *poſſeſſive*, are thoſe which denote the enjoyment or poſſeſſion of any thing, either in particular, or in common: as *mine*, *thine*, *his*, &c. Theſe come within the denomination of adjectives, and only differ from the reſt by the relation they bear to pronouns whence they are derived, and by ſome particular inflections which they have in ſome languages. Pronouns *demonſtrative*, are thoſe which ſerve to indicate or point out the ſubject ſpoken of; as *this*, *thoſe*, &c. Pronouns *indefinite*, are thoſe which expreſs their ſubject indeterminately; as *whoever*, *any*, &c. A Grammarian of the firſt eminence diſtinguiſhes pronouns, which he ſays are words invented to ſupply pointing or indication by the finger or hand, called δειξις, into prepoſitive and ſubjunctive. *Prepoſitive* pronouns, are thoſe which are capable of introducing, or leading a ſentence, without having reference to any thing previous, and are divided into three orders, called the firſt, the ſecond, and the third perſon. *Subjunctive* pronouns, are thoſe which ſerve to ſubjoin one ſentence to ſome other which is previous; as *who*, *which*, *that*, &c. and may be diſtinguiſhed from other pronouns, as they are not only ſubſtitutes, but alſo *connectives*. They include the powers of the three orders, into which the *prepoſitive* are diſtinguiſhed, having ſuper-added the peculiar force of *connective*. Pronouns, like *nouns*, have three caſes, the *nominative*, the *genitive*, or *poſſeſſive*; moreover, a caſe which following the verb *active*, or the *prepoſition*, expreſſing the object of an action, or of a relation, ſome grammarians have callled the *objective caſe*.

CHAP. II.

OF ATTRIBUTIVES.

As all attributives muſt either be expreſſive of the attributes of SUBSTANCES, or of other ATTRIBUTES, we divide this claſs into two kinds; calling thoſe of the firſt kind, ATTRIBUTIVES of the FIRST ORDER; and thoſe of the ſecond kind, ATTRIBUTIVES of the SECOND ORDER.

SECT. I. Attributives *of the Firſt Order.*

ATTRIBUTIVES are all thoſe *principal* words that denote *attributes* conſidered as attributes. Such, for example, are the words, *black*, *white*, *great*, *little*, *wiſe*, *eloquent*, *to write*, *to walk*, *to ſpeak*, &c. all of which are the *attributes of ſubſtances*. Thus *black* is an attribute of *jet*, *white* of *ſnow*; *wiſe* and *eloquent*, as alſo, to *write* and *ſpeak*, are attributes of *men*. In examining the different attributes of ſubſtances, we readily perceive that ſome of them have their eſſence in *motion*; ſuch are, *to walk*, *to fly*, *to ſtrike*, *to live*, &c. Others have it in the *privation* of *motion*; as, *to ſtop*, *to reſt*, *to ceaſe*, *to die*, &c. And others have it in ſubjects that have *nothing to do* with either *motion* or its *privation*; ſuch are the attributes of *great* and *little*, *wiſe* and *fooliſh*, *white* and *black*, and, in a word, the ſeveral *quantities* and *qualities* of all things. This therefore furniſhes a natural diviſion of attributives of this order; and grammarians have called all thoſe, whoſe eſſence conſiſts in *motion* or its *privation*, VERBS; and all the others have been called ADJECTIVES; each of which we ſhall conſider ſeparately.

I. *Of* VERBS.

VERBS are all thoſe principal words which denote *attributes*, whoſe eſſence conſiſts in *motion*, or *energies*, (for we chooſe to make uſe of this laſt term, as it implies the exertions of the mind as well as thoſe of the body), or their *privation*. This order of attributives differs from the order called *adjectives*; not only in the particular above-mentioned, but alſo becauſe adjectives denote only qualities or quantities, which do not admit of any change of ſtate: whereas the verbal attributives may be conſidered as in ſeveral different ſtates, and therefore admit of ſeveral variations in the term employed to expreſs theſe. It may, in the firſt place, be conſidered as a ſimple attribute or energy, without particularizing any circumſtance relating to the ſtate it may be in; as in the word to WRITE. Or, in the ſecond place, as theſe are all attributes which denote motions or energies, they may be repreſented as in the ſtate of actual motion or exertion; as in the word WRITING. Or, laſtly, the motion or energy may be finiſhed, and its effect compleated; as in the word WRITTEN. Hence, therefore, every verb admits of a threefold variation in every language, in each of which languages they are diſtinguiſhed by ſome particular names. Our grammarians have given the name of the INFINITIVE MODE to the original verb itſelf, and the other two variations of it are both diſtinguiſhed by the name of PARTICIPLES; that variation which exhibits the verb in its ſtate of energy being called the PARTICIPLE PRESENT or ACTIVE, and the other variation is called the PARTICIPLE PERFECT OR PAST. Theſe variations of the verb are founded in the nature of things, and therefore muſt be found in every language under ſome form or other.

In the natural world, no attribute can poſſibly exiſt without a ſubſtance to which it belongs, nor any ſubſtance without poſſeſſing certain attributes. So neceſſary and intimate is the connection between theſe, that it is as impoſſible to ſeparate them, as to create or annihilate, the ſeveral ſubſtances that poſſeſs theſe attributes. But although we are thus circumſcribed as to our bodily powers, the mind admits not of ſuch limitation; but can, with the utmoſt facility, ſeparate every quality from every object whatever, and conſider them apart; as, *colour* without *ſuperficies*, *ſuperficies* without *ſolidity*, or *weight* without *matter*, &c. and, when thus ſeparated, apply them to what objects, and in what manner, it pleaſes. In this manner the mind abſtracts thoſe attributes which denote *motions* or *energies* from their *agents* or *energizers*, in the ſame way as it abſtracts *qualities* from their *ſubſtances*. And it is theſe energies thus abſtracted, which form that ſpecies of words called *verbs*; in the ſame manner as thoſe attributes which denote *quantities* and *qualities* abſtracted from their neceſſary ſubſtances, form *adjectives*. Thus, the term *to walk*, denotes a particular *energy* as conſidered perfectly apart from every *energizer*, in the ſame manner as the word *good* denotes a certain *quality* without regard to any particular *ſubſtance*.

It is evident, that, by the aſſiſtance of an aſſertion, the ſpeaker is enabled to unite any energy to any particular energizer, and thus, without making any change upon the attribute itſelf, repreſent a variety of changes produced upon other bodies by its means. Thus, if I ſay, *I write*, what do I more than aſſert that I myſelf am poſſeſſed of that particular attribute denoted by the verb *to write?* If I ſay, *You write*, or *He writes*, what do I more than aſſert, that another perſon is poſſeſſed of that particular attribute or energy? If I ſay, *He* DID *write*, I only aſſert that the ſame attribute was poſſeſſed at another time, by the ſame perſon, as before. Hence, therefore, by the help of this aſſertion of the ſpeaker, we are enabled to join this particular attribute to many different energizers, as well as to repreſent theſe different combinations as occurring at many different times; ſo that the ſame attribute may thus be made to appear under a great many different circumſtances, and exhibit a great variety of changes upon other objects, although itſelf remains unchanged; the ſeveral variations which we perceive, only relating to the objects, with which it is combined, or the means by which that union is effected. In the ſame manner it often happens, that any object in nature, a houſe, for example, may appear extremely different when viewed from different ſituations.

From theſe arguments, we muſt conclude that the verb itſelf admits of no other variations than thoſe already taken notice of; that before it can produce any active effect in language, like every other attribute, it muſt be united to ſome proper energizer; that this union in language can never be effected but by means of an exertion of the vital powers of the ſpeaker, whereby he either publiſhes his perception thereof, or his will that it ſhould be; and that this union may be repreſented as taking place at all the different times that can be aſſigned. Theſe, therefore, are each of them neceſſary accompaniments of a verb, but each of them ſeparate and diſtinct in their own nature, not only from this verb, but from one another; and it becomes an eſſential part of the ſyntax of every language, to conſider the various ways in which theſe can be combined and affect one another. Nay, ſo intimate has this connection been thought to be by ſome, that the contrivers of certain languages have arranged them under particular claſſes, for the ſake of diſtinctneſs and preciſion. The form which a verb aſſumed, when thus varied in all the ways that their particular language would admit of, was called the CONJUGATION of the verb; the ſeveral parts of which may be underſtood from the following ſketch.

When the verb is conſidered under the compound form of which we now ſpeak, it can admit of variations chiefly in three reſpects. For, firſt, ſuppoſing the *attribute*, the *energizer*, and the *time* when that attribute was exerted by the energizer, to be the ſame; a variation may be occaſioned by a change being produced in the *perception* or *volition* of the ſpeaker, (which, for brevity, we will call the *aſſertion*), as in theſe examples: *I write*, SCRIBO; *I may write*, SCRIBAM; *do you write*, SCRIBE. The variations produced by this means have been called MODES. Secondly, Suppoſing the *attribute*, the *energizer*, and the *aſſertion*, to be the ſame; a change may be produced in the *time*, as in theſe examples: *I ſhall write*, SCRIBAM, &c. The variations produced from this cauſe have been called TENSES. And thirdly, Suppoſing the *attribute*, the *time*, and the *aſſertion*, to remain unchanged, there may be a difference in the *energizer*; and this likewiſe admits of a diviſion: for as the energizer may be only *one* or more perſons, it muſt have a variation into *ſingular* and *plural* on theſe accounts; as in theſe examples: *I write*, SCRIBO; *thou writeſt*, SCRIBIS; *he writes*, SCRIBIT; and in the plural, *we write*, SCRIBIMUS; *ye write*, SCRIBITIS; *they write*, SCRIBUNT. The variations produced from this cauſe have been called PERSON and NUMBER. Theſe are all the variations which have been made in the Latin or Greek languages; and therefore our grammarians, who have adopted every idea they have of grammar from theſe languages, mention no more.

With regard to MODES; as this relates ſolely to the *perception* or *volition* of the ſpeaker, it neceſſarily follows, that there ought to be a diſtinct and particular MODE for each diverſity that there can be in his manner of perceiving or willing any thing whatever; the principal of which are the following. If we ſimply declare that we perceive any object, or that ſuch a thing is or will be, without any limitation or contingency, it forms what has been called the DECLARATIVE or INDICATIVE MODE; as, *I write*. Again, if we ſimply repreſent it to be within our *power*, or to depend upon our choice, it forms two other modes, which may be called the POTENTIAL, as, *I can write*; or the ELECTIVE, as, *I may write*. In the ſame manner, if the ſpeaker repreſents himſelf, or any other object, as *determined* to perform any action, or as *compelled* to it, or as it is his *duty* to perform it; theſe form ſo many diſtinct modes, which may be called the DETERMINATIVE, as, *I will write*; the COMPULSIYE, as, *I muſt write*; and OBLIGATIVE, as, *I ſhould write*. But although each of theſe repreſents the ſpeaker as perceiving the agent under a different light with reſpect to the action; yet as all of them, except the indicative, agree in this, that however much they may repreſent it as the *duty* or *inclination*, &c. of the agent to perform any action with which they are aſſociated, yet as they are ſtill of the nature of contingents which may never take effect, they are frequently ſubjoined to any other verb; therefore the Latins have comprehended all of theſe under one mode, which they have called the SUBJUNCTIVE.

All theſe modes only relate to the different *perceptions* of the ſpeaker. But as man is not only endowed with the powers of *perception*, but thoſe of *volition* alſo, he muſt have words to expreſs theſe; which forms another order of modes. As he is not only dependent himſelf, but has others depending on him, he may *command*, *intreat*, *beg*, *pray*, *wiſh*, *inquire*. Hence, therefore, ſo many different orders of modes, the IMPERATIVE, REQUISITIVE, PRECATIVE, OPTATIVE, INTERROGATIVE, &c. to which may be added, the VOCATIVE. But although each of theſe diſplays a diſtinct affection of the ſpeaker, yet grammarians have allotted only one variation of the verb for all of theſe purpoſes, called the IMPERATIVE MODE; all the other volitions being expreſſed by this, or ſome other modes, by the help of particular contrivances, which are different in different languages. With regard to that variation of the verb which relates to *time*, called TENSES: as an action or event may be repreſented as happening at any aſſignable period of time, it is neceſſary to divide that duration into certain parts, that we may be able to repreſent the different relations which events bear to one another with reſpect to this particular. The firſt and moſt obvious diviſion of time is into *preſent*, *paſt*, and *future*. But we may go farther ſtill in our diviſions of time. For as time paſt and future may be infinitely extended, we may in *univerſal time paſt* aſſume *many particular times paſt*, and in *univerſal time future many particular times future*, ſome more, ſome leſs remote, and correſponding to each other under different relations. Even *preſent time*, however, in ſtrict phyſical truth, it may be incapable of it, is by the power of the imagination brought to admit of theſe differences, and as neceſſarily implies *ſome degree of extenſion*, as every given line however minute: and hence it is not ſufficient for language to denote INDEFINITELY mere *paſt*, *preſent*, or *future* times; but on many occaſions to DEFINE with more preciſion what *kind* of *paſt*, *preſent* or *future*, is meant.

Tenſes, therefore, or thoſe variations of a verb which denote a difference of *time* only, may be all divided into PRESENT, PAST, and FUTURE; each of which may be ſubdivided into DEFINITE and INDEFINITE. The *definite tenſes* are thoſe where the particular inſtant of time, whether preſent, paſt, or future, is pointed out. The *indefinite* are thoſe where paſt, preſent, or future time is indicated in general, without confining it to a particular inſtant in either of theſe caſes. Theſe have been diſtinguiſhed among grammarians by the name of AORISTS. Thus when Milton makes Adam ſay,

> *Millions of ſpiritual creatures* WALK *the earth*
> *Unſeen, both when we wake and when we ſleep*,

the verb WALK means not that they were walking at that inſtant only when Adam ſpoke, but *indefinitely* in any inſtant whatever. So likewiſe, when the ſame author calls hypocriſy

> ——*the only evil which* WALKS
> *Inviſible except to God alone*,

the verb WALKS has the like aoriſtical ſignification. *He* WENT, *he* FELL, are *aoriſts* of the paſt, as they do not ſpecify any particular inſtant, but refer to paſt time in general. So likewiſe in the legiſlative ſentences, *thou ſhalt not kill, thou ſhalt not ſteal*, &c. the ſame aoriſtical meaning is perceived, as the prohibition does not relate to any *particular time future*, but is extended indefinitely to *every* time *future*. But it is not ſufficient for a language to denote time in this indefinite manner; it is neceſſary likewiſe that it ſhould be capable of ſpecifying any particular inſtant of time in an exact and definite manner. Thus, if, inſtead of the word WALK in the firſt ſentence above quoted, we were to put ARE WALKING, it brings down the verb to denote a particular time, and ſpecifies that theſe *ſpiritual creatures* are, at that very *inſtant* in which Adam ſpeaks, walking upon the earth unſeen. In like manner, in the ſecond ſentence, if the word WALKS were changed to IS WALKING, it denotes, that hypocriſy, at that *particular inſtant* in which the ſentence was pronounced, was walking inviſible upon the earth. And in the ſame manner, was WALKING, or WILL BE WALKING, each of them denote, that theſe energies *were* or *will be* exerted at a particular ſpecified time. Theſe, therefore, form ſo many diſtinct definite tenſes, under whatever technical name they may be known.

Here then we may ſee the uſe of that diſtinction of the different ſtates of the verb, into the *verb properly ſo called*, and *participles*. For as the verb itſelf exhibits the word as altogether *indefinite*; when this is joined to its proper energizer, it forms all theſe INDEFINITE TENSES which our language requires. Thus, *I write*, *I did write*, *I will write*, *I may write*, *I can write*, &c. each of them, although they repreſent the attribute as united to the energizer in ſome *paſt*, *preſent*, or *future* time, do not ſpecify any particular inſtant, and are therefore ſo many aoriſts or indefinite tenſes. Whereas in the *participle* the attribute is repreſented as in a ſtate of exertion, it neceſſarily follows, that if it be ever united to its energizer, it muſt point out the particular inſtant when that union took effect, and of conſequence form as great a variety of DEFINITE TENSES as the verb forms of indefinite. Thus, *I am writing*, neceſſarily implies that I am actually exerting this particular energy at the *very inſtant* that I declare it. So likewiſe, if I ſay, *I was writing*, it indicates, that at one *particular inſtant* of paſt duration, to which this has a reference, I was actually employed in that particular occupation. This inſtant is generally fixed by ſome collateral circumſtance; as, "upon the twentieth day of Auguſt laſt, at twelve o'clock, *I was writing*;" or, "when the thunder broke upon the tower in my neighbourhood, *I was writing*," &c. And the ſame may be ſaid of future time; as, "to-morrow at ten o'clock *I ſhall be writing*," &c. In all of which caſes it is obvious, that a particular *now* or *inſtant* is pointed out, in which the attribute is repreſented as united to its proper energizer. Beſides the variations already mentioned, verbs have been diſtinguiſhed from one another in a different manner; the names and nature of which may be thus explained.

We have already ſeen, that all the verbs, as they denote *energies*, neceſſarily have reference to certain *energizing ſubſtances*. For, how could there be ſuch energies as *to love*, *to fly*, *to wound?* &c. were there not ſuch beings as *men*, *birds*, *ſwords*, &c. Farther, every energy not only requires an energizer, but is neceſſarily converſant about ſome ſubject. For example, if we ſay, *Brutus loves*, we muſt needs ſupply—loves *Cato*, *Caſſius*, or ſome one. And thus it is, that every energy is neceſſarily ſituated between two ſubſtantives, an energizer which is *active*, and a ſubject which is *paſſive*. If the energizer leads the ſentence, the energy has been ſaid to follow its character, and becomes what we call a VERB ACTIVE: thus we ſay, BRUTUS AMAT, *Brutus loves*. On the contrary, if the paſſive ſubject be principal, it is ſaid to follow the character of this too, and becomes what we call a VERB PASSIVE: thus we ſay, PORTIA AMATUR, *Portia is loved*. But in ſome verbs it happens, that the energy *always keeps within the energizer*, and never paſſes out to any extraneous ſubject. Thus, when we ſay, *Cæſar walketh*, *Cæſar ſitteth*; it is impoſſible that the energy *ſhould paſs out*, becauſe both the *energizer* and the *paſſive ſubject* are united in the *ſame perſon*. For what is the cauſe of this walking or ſitting? it is the *will* and *vital powers* belonging to *Cæſar:* And what is the ſubject made ſo to move or ſit? it is the *body* and *limbs* belonging alſo to the ſame *Cæſar*. This ſpecies of verbs have been by grammarians diſtinguiſhed by the name of VERBS NEUTER, as if they were void both of *action* and *paſſion*, when perhaps they may be rather ſaid to imply both. It is in this manner, that verbs have been diſtinguiſhed into the three claſſes of *active*, *paſſive*, and *neuter*. Theſe, however, might with more propriety be divided into two claſſes, which might be called verbs TRANSITIVE, and NOT TRANSITIVE; the firſt claſs including all thoſe verbs which are uſually called *active*, with the *paſſives* belonging to them; for it is evident, that theſe paſſives are not verbs themſelves, but a variation only of a verb; and the ſecond claſs including thoſe verbs commonly called *neuter*.

Some languages, as the Greek and French, have another claſs of verbs, which are called by the firſt VERBS MIDDLE, and by the laſt RECIPROCAL VERBS; which are employed to denote that ſtate of any tranſitive verb, when the energizer himſelf becomes the ſubject; as thus, *Brutus killed himſelf*, &c. But as theſe only expreſs a ſlight variation of an accompaniment of a verb, they have no claim to be conſidered as a diſtinct ſpecies.

II. *Of* ADJECTIVES.

ADJECTIVES are all thoſe words which denote attributes whoſe eſſence does not conſiſt in motion or its privation: or, in other words, they are thoſe words which denote the attributes of quantity, quality and relation; ſuch as, *many*, *few*, *great* and *little*, *black* and *white*, *good* and *bad*, *double*, *treble*, *quadruple*, &c. As theſe attributes admit of no change of ſtate, nor can be affected by the variations of time, or any other accident, but are in their own nature perfectly fixed and invariable, the words which expreſs them ought to be in all ſituations and on all occaſions the ſame. For as the qualities *good* or *bad*, *black* or *white*, admit of no change in their own nature, whether they be applied to a *man*, to a *woman*, to *many* or to *few*; neither ought the word which expreſſes any one of theſe attributes in ſtrictneſs to admit of any alteration, whether it be joined to one or other of theſe ſubſtantives. So that although, in ſome languages, from the particular conſtruction of the other parts of ſpeech, it has been found neceſſary to endow their adjectives with the threefold diſtinction of *gender*, *number*, and *caſe*; yet this muſt only be conſidered as an accidental variation occcaſioned by particular circumſtances, and not in the leaſt eſſential to language, but rather a deviation from the order of nature, which would require them to be kept invariably the ſame in all caſes.

Beſides original adjectives, there is another claſs which are formed from ſubſtantives. Thus when we ſay, *the party of Pompey*, *the ſtyle of Cicero*, *the philoſophy of Socrates*; in theſe caſes, the party, the ſtyle, and philoſophy ſpoken of, receive a ſtamp and character, from the perſons they reſpect, and actually paſs into attributives, and as ſuch aſſume the form of *adjectives*. Hence we ſay, *the Pompeian party*, *the Ciceronian ſtyle*, and *the Socratic philoſophy*. In like manner, for a trumpet of braſs, we ſay, *a braſen trumpet*; for a crown of gold, *a golden crown*, &c. Even pronomial ſubſtances admit the like mutation; as, inſtead of ſaying the book *of me*, *of thee*, or *of him*, we ſay, *my* book, *thy* book, *his* book, &c. Yet it muſt be acknowledged, that theſe, as they often ſerve rather to define a noun than to denote any quality appertaining to it; they partake more of the nature of *articles* than *adjectives*; ſo that it is in many caſes difficult to aſcertain exactly to which claſs they are to be referred. The nature of theſe variations of adjectives, which have been called *degrees of compariſon*, will be more properly explained under the following ſection.

SECT. II. *Of* Attributives of *the Second Order, called* ADVERBS.

As the Attributives hitherto mentioned denote the *attributes of ſubſtances*, ſo there is an inferior claſs of them which denote the *attributes* only of *attributes*. To explain theſe by examples of either kind: When we ſay, "*Cicero and Pliny* were both of them *eloquent*; *Statius* and *Virgil* both of them *wrote*;" in theſe inſtances, the attributes *eloquent* and *wrote*, are immediately referable to the ſubſtantives *Cicero*, *Virgil*, &c.: As, therefore, denoting the *attributes of ſubſtances*, we call them ATTRIBUTIVES OF THE FIRST ORDER. But when we ſay, "*Pliny* was *moderately* eloquent, but *Cicero exceedingly* eloquent; *Statius* wrote *indifferently*, but *Virgil* wrote *admirably*:" in theſe inſtances, the attributives *moderately*, *exceedingly*, *indifferently*, and *admirably*, are not referable to *ſubſtantives*, but to *other attributes*; that is, to the words *eloquent* and *wrote*: As, therefore, denoting *attributes* of *attributes*, we call them ATTRIBUTIVES OF THE SECOND ORDER. Theſe have been by grammarians, called ADVERBS. Indeed, if we take the word VERB in its moſt comprehenſive ſignification, as including all the words which denote the *attributes* of *ſubſtances*, (which was the ſenſe in which Ariſtotle and many of the moſt ancient grammarians employed it) we ſhall find the name ADVERB to be a very juſt appellation, as denoting a *part of ſpeech the natural appendage of verbs*. So great is this dependence in grammatical ſyntax, that an *adverb* can no more ſubſiſt without its *verb*, than a *verb* can ſubſiſt without its *ſubſtantive*.

Among the attributes of ſubſtances are reckoned quantities and qualities. Thus we ſay, *a white garment*, *a high mountain*, &c. Now ſome of theſe quantities and qualities are capable of *intenſion* and *remiſſion*. Thus we ſay, a *garment* EXCEEDINGLY *white*, *a mountain* TOLERABLY or MODERATELY *high*. Hence, then, one copious ſource of ſecondary attributives, or adverbs, to denote theſe two, that is, *intenſion* and *remiſſion*; ſuch as, *greatly*, *vaſtly*, *extremely*, *ſufficiently*, *moderately*, *tolerably*, *indifferently*, &c. But where there are different intenſions of the ſame attribute, they may be *compared* together; thus, if the garment A be EXCEEDINGLY *white*, and the garment B be MODERATELY *white*, we may ſay, the garment A is MORE *white* than the garment B. In theſe inſtances, the adverb MORE not only denotes intenſion, but *relative intenſion*. Nay, we ſtop not here, as we not only denote intenſion *merely relative*, but *relative intenſion than which there is none greater*. Thus we not only ſay, the *mountain* A *is* MORE *high than the mountain* B, but that *it is the* MOST *high of all mountains*. Even *verbs* properly ſo called, as they admit of *ſimple intenſions*, ſo they admit alſo of theſe *comparative ones*. Thus, in the following example, *Fame he* LOVETH MORE *than riches, but virtue of all things he* LOVETH MOST; the words MORE and MOST denote the different *comparative intenſions* of the verbal attribute *loveth*.

Hence the riſe of COMPARISON of adjectives, and of its different *degrees*, which cannot well be more than the two ſpecies abovementioned; one to denote *ſimple exceſs*, and one to denote *ſuperlative*. Were we indeed to introduce more degrees than theſe, we ought perhaps to introduce *infinite*, which is abſurd. For why ſtop at a limited number, when in all ſubjects ſuſceptible of intenſion the intermediate exceſſes are in a manner infinite? There are infinite degrees of *more white*, between the firſt *ſimple white*, and the ſuperlative *whiteſt*; and the ſame may be ſaid of *more* great, *more* ſtrong, *more* minute, &c. The doctrine of grammarians about three ſuch degrees of compariſon, which they call the *poſitive*, the *comparative*, and the *ſuperlative*, muſt be abſurb; both becauſe in their poſitive there is no compariſon at all, and becauſe their ſuperlative is a comparative as much as their comparative itſelf. Examples to evince this may be met with every where; *Socrates was the* MOST WISE *of all the Athenians*; *Homer was the* MOST SUBLIME *of all poets*, &c.

The authors of language have in ſome inſtances contrived a way to retrench theſe comparative adverbs, by expreſſing their force by an inflection of the primary attributive. Thus, inſtead of *more fair*, they ſay FAIRER; inſtead of *moſt fair*, FAIREST; and the ſame method of compoſition takes place both in the Greek and Latin languages; with this difference, however, between the genius of theſe languages and ours, that we are at liberty to form the compariſon either in the one method or the other; but, in theſe languages, the compariſon is almoſt never formed by the aſſiſtance of the abverb, but always by the inflection of the adjective; and hence this inflection is always conſidered by them as a neceſſary accident of the adjective. But this method of expreſſing the power of the adverb has reached no farther than to adjectives, or to their participles, which are ſo nearly allied to adjectives. Verbs were perhaps thought to be too much diverſified, to admit of more variations without perplexity. Of the adverbs or ſecondary qualities, thoſe denoting intenſion and remiſſion may be called adverbs of QUANTITY CONTINUOUS; *once*, *twice*, *thrice*, &c. are adverbs of QUANTITY DISCRETE; *more* and *moſt*, *leſs* and *leaſt*, to which may be added *equally*, *proportionally*, &c. are adverbs of RELATION. There are others of QUALITY; as when we ſay, HONESTLY *induſtrious*, PRUDENTLY *brave*; *they fought* BRAVELY, *he painted* FINELY, &c. The adverbs hitherto mentioned, are common *to verbs of every ſpecies*; but there are ſome which are confined to *verbs* properly ſo called, that is to ſay, to ſuch as denote *motions* or *energies* with their *privations*. All *motion* and *reſt* imply *time* and *place* as a kind of neceſſary coincidence. Hence, if we would expreſs the *place* or *time* of either, we muſt needs have recourſe to adverbs formed for this purpoſe: of PLACE, as when we ſay, *he ſtood* THERE, *he went* HENCE, *he travelled* FAR, *&c.*; or of TIME, as when we ſay, *he ſtood* THEN, *he went* AFTERWARD, *he travelled* FORMERLY, *&c.* Should it be aſked, Why *adverbs of time*, when verbs have *tenſes?* The anſwer is, though tenſes may be ſufficient to denote the greater diſtinctions of time, yet to denote them all by tenſes would be a perplexity without end. What a variety of forms would be neceſſary to denote *yeſterday*, *to-day*, *to-morrow*, *formerly*, *juſt now*, *now*, *immediately*, *preſently*, *ſoon*, *hereafter? &c.*

To theſe adverbs juſt mentioned may be added thoſe which denote the *intenſions* and *remiſſions peculiar to* MOTION, ſuch as *ſpeedily*, *haſtily*, *ſwiftly*, *ſlowly*, &c.; as alſo adverbs of *place* made out of *prepoſitions*, ſuch as *upward* and *downward*, from *up* and *down*. In ſome inſtances the prepoſition ſuffers no change, but becomes an adverb by nothing more than its application; as when we ſay, *he rides* ABOUT, *he was* NEAR *falling*, &c. There are likewiſe adverbs of INTERROGATION; ſuch as, *where*, *whence*, *whither*, *how*, &c. of which there is this remarkable, that when they loſe their *interrogative power*, they aſſume that of a *relative*, ſo as to repreſent the *relative* or *ſubjunctive pronoun*; as in this doggerel tranſlation of a line from Virgil,

> *And corn doth grow* WHERE *Troy town ſtood*;

that is to ſay, *corn groweth in that place* IN WHICH *Troy ſtood*, the power of the relative being implied in the adverb. It is in like manner that the *relative pronoun* becomes an *interrogative*; as in this line from Milton,

> WHO *firſt ſeduc'd them to that foul revolt?*

The reaſon of this is as follows: the *pronoun* and *adverbs* here mentioned are all, in their original character, RELATIVES. Even when they become interrogatives, they loſe not this character, but are ſtill relatives as much as ever; the difference is, that, *without* an interrogation, they have reference to a ſubject which is *antecedent*, *definite*, and *known*; *with* an interrogation, to a ſubject which is *ſubſequent*, *indefinite*, and *unknown*, and which it is expected the anſwer ſhould expreſs and aſcertain. WHO *firſt ſeduc'd them?* The queſtion itſelf ſuppoſes a ſeducer, to which, though *unknown*, the pronoun *who* has reference —*Th' infernal ſerpent*. Here, in the anſwer, we have the ſubject, which was *indefinite*, aſcertained; ſo that we ſee WHO, in the *interrogation*, is as much a *relative* as if it had been ſaid originally, without any interrogation at all; *It was the infernal ſerpent who firſt ſeduced them:* and thus interrogatives and relatives mutually paſs into one another. Having thus conſidered all thoſe parts of ſpeech which ARE SIGNIFICANT OF THEMSELVES, we proceed to thoſe AUXILIARY PARTS which are ONLY SIGNIFICANT WHEN ASSOCIATED WITH OTHERS, which we have already ſaid are either DEFINITIVES or CONNECTIVES. Of which in their order.

CHAP. III.

Concerning DEFINITIVES *commonly called* ARTICLES.

The knowledge of man is at beſt but limited and confined. Although we have invented words to denominate almoſt all the ſubſtances which exiſt, yet as it is impoſſible for any perſon to be acquainted with all of theſe, it was neceſſary to fall upon ſome contrivance in language to obviate the difficulties which would ariſe from this cauſe. With this view, we have already ſeen, that ſubſtances have been divided into general claſſes, each of which includes under it ſeveral leſſer in ſubdiviſions; the names of which general claſſes, being but few, may be more eaſily retained, as *animal, edifice, motion,* &c. for by referring the ſeveral objects that we may accidentally ſee, and with which we are unacquainted, to the ſeveral claſſes to which they may belong, we are in ſome meaſure enabled to communicate our ideas without the knowledge of the particular names. But as this particular object muſt in ſome manner be diſtinguiſhed from others of the ſame claſs to which it belongs, a particular claſs of words was found neceſſary to define and aſcertain theſe individuals; which has given riſe to to this order of words of which we now treat, and which we have called *definitives* becauſe they ſerve to *define and aſcertain any particular object, ſo as to ſeparate it from the general claſs to which it does belong, and of courſe denote its individuality.* The principal of theſe definitives have been uſually called ARTICLES, the nature of which may be expained as follows. Suppoſing I ſee an object with which I am totally unacquainted, having a head and limbs, and appearing to poſſeſs the powers of ſelf-motion and ſenſation. If I know it not as an individual, I refer it to its proper ſpecies, and call it *a dog, a horſe, a lion,* or the like; and if none of the names of any ſpecies with which I am unacquainted fit it, I refer it to the genus, and call it *an animal.* But this is not enough. The object at which we are looking, and want to diſtinguiſh, is perhaps an individual. Of what kind? *Known* or *unknown?* Seen now *for the firſt time,* or *ſeen before* and now remembered? It is here we ſhall diſcover the uſe of the two articles A and THE; for the article A reſpects our *primary* perception, and denotes individuals as *unknown*; whereas THE reſpects our *ſecondary* perception, and denotes individuals as *known.* To explain this by an example, I ſee an object paſs by which I never ſaw till then: What do I ſay? *There goes a beggar with* A *long beard.* The man departs, and returns a week after: What do I then ſay? *There goes* THE *beggar with* THE *long beard.* Here the article only is changed, the reſt remains unaltered. Yet mark the force of this apparently minute change. The individual *once vague* is now recogniſed as *ſomething known,* and that merely by the efficacy of this latter article, which tacitly inſinuates a kind of *previous* acquaintance, by referring a preſent perception already paſt. Hence therefore we ſee, that although the articles A and THE are both of them *definitives,* as they circumſcribe the latitude of genera and ſpecies, by reducing them, for the moſt part, to denote individuals; yet they differ in this reſpect, that the article A leaves the individual itſelf *unaſcertained,* but the article THE *aſcertains the individual alſo,* and is for that reaſon the more accurate definitive of the two. They differ likewiſe in this reſpect, that as the article A ſerves only to ſeparate one particular object from the general claſs to which it belongs, it cannot be applied to plurals. But as the article THE ſerves to define objects, or refer to them as already known, without relation to number, or any other circumſtances, it is applicable to both numbers indiſcriminately, as well as nouns of every *gender,* without ſuffering any ſort of change; for it is evident, that no variation of the nature of the noun can make any difference in thoſe words which ſerve to define or denote a certain reference to them. So that although we find ſome modern languages which admit of a variation of their article, which relates to the gender of the noun with which it is aſſociated, yet this cannot be conſidered as eſſential to this ſpecies of words; and ſo far is this from being an improvement to the language, that it only ſerves to perplex and confuſe, as it always preſents a particular idea of ſex, where in many caſes it is not in the leaſt neceſſary.

As ſome words admit of no article, *becauſe they are by nature as definite as may be:* ſo there are others which admit it not, *becauſe they are not to be defined at all.* Of this ſort are all INTERROGATIVES. If we queſtion about ſubſtantives, we cannot ſay THE WHO IS THIS: but WHO IS THIS? And the ſame as to *qualities,* and both kinds of *quantities:* for we ſay without an article, WHAT SORT OF, HOW MANY, HOW GREAT? The reaſon is, the article THE reſpects beings *already known,* and interrogatives reſpect beings *about which we are ignorant*; for as to what we know, interrogation is ſuperfluous. In a word, the *natural aſſociators with articles* are ALL THOSE COMMON APPELLATIVES WHICH DENOTE THE SEVERAL GENERA AND SPECIES OF BEINGS. It is theſe, which, by aſſuming a different article, ſerve either to explain an individual upon its firſt being perceived, or elſe to indicate, upon its return, a recognition or repeated knowledge. The articles already mentioned are thoſe ſtrictly ſo called; but, beſide theſe, there are the PRONOMIAL ARTICLES, ſuch as *this, that, any, ſome, all, other, none,* &c. If the eſſence of an article be to *define* and *aſcertain*; pronouns are much more ſtrictly articles than any thing elſe, and ought to be conſidered as ſuch in univerſal grammar. Thus, when we ſay, "THIS picture I approve, but THAT I diſlike;" what do we perform by the help of theſe definitives, but bring down the common appellatives to denote individuals? So when we ſay, "SOME men are virtuous, but ALL men are mortal;" what is the natural effect of this ALL and SOME, but to define that *univerſality* and *particularity* which would remain indefinite were we to take them away?

Before we leave this ſubject, we ſhall produce one example to ſhew the utility of this ſpecies of words; which, although of themſelves inſignificant and ſeemingly of ſmall importance; yet, when properly applied, ſerve to make a few general terms ſufficient for the accurate expreſſion of a great variety of particulars, and thus makes language capable of expreſſing things *infinite,* without wandering into infinitude itſelf. ——To explain this: Let the general term be MAN, which I have occaſion to employ for the denoting of ſome particular. Let it be required to expreſs this particular, as *unknown*; I ſay, A *man:*—*Known*; I ſay, THE *man:*—*Definite*; A CERTAIN *man:*—*Indefinite*; ANY *man:*—*Preſent, and near*; THIS *man:*—*Preſent, and diſtant*; THAT *man:*—*Like to ſome other*; SUCH *a man:*—*Different from ſome other*; ANOTHER *man:*—*An indefinite multitude*; MANY *men*—*A definite multitude*; A THOUSAND *men:*—*The ones of a multitude, taken throughout*; EVERY *man:*—*The ſame ones, taken with diſtinction*; EACH *man:*—*Taken in order*; FIRST *man,* SECOND *man,* &c.—*The whole multitude of particulars taken collectively*; ALL *men:*—*The negation of that multitude*; NO *man:*—*A number of particulars preſent, and at ſome diſtance* THESE *men:*—*At a greater diſtance, or oppoſed to others,* THOSE *men:*—*A number preſent and near*; THESE *men:*—*A number of individuals from another number*; OTHER *men:*—*A great number of individuals taken collectively*; MANY *men:*—*A ſmall number*; FEW *men:*—*A proportionally greater number*; MORE *men:*—*Smaller number*; FEWER *men:*—And ſo on we might go almoſt to infinitude. But not to dwell longer upon this article, we ſhall only remark, "that minute changes in PRINCIPLES, lead to mighty changes in EFFECTS; ſo that PRINCIPLES are well entitled to regard, however trivial they may appear."

CHAP. IV. OF CONNECTIVES.

CONNECTIVES, according as they connect either *ſentences* or *words,* are called by the different names of CONJUNCTIONS or PREPOSITIONS. Of theſe names, that of the *prepoſition* is taken from a mere accident, as it commonly ſtands in connection before the part which it connects. The *conjunction,* as is evident, has refernce to its *eſſential character.* We ſhall treat of theſe two ſeparately.

SECT. I. OF CONJUNCTIONS.

A CONJUNCTION *is a part of ſpeech void of ſignification itſelf, but ſo formed as to help ſignification, by making* TWO *or more ſignificant ſentences to be one ſignificant ſentence.* As, therefore, it is the *eſſence* of conjunctions to *connect ſentences*; at the ſame time that they do this, they muſt either *connect* their *meaning* or *not.* For example, let us take theſe two ſentences, *Rome was enſlaved. Cæſar was ambitious,* and connect them together by the conjunction BECAUSE; *Rome was enſlaved* BECAUSE *Cæſar was ambitious.* Here the *meanings,* as well as the *ſentences,* appear to be connected. But if I ſay, *manners muſt be reformed,* OR *liberty will be loſt*; here the conjunction OR, though it join the ſentences, yet, as to their reſpective *meanings,* is a perfect *disjunctive.* And thus it appears, that though all conjunctions *conjoin ſentences,* yet, with reſpect to the *ſenſe,* ſome are CONJUNCTIVE, and others are DISJUNCTIVE. Thoſe *conjunctions which conjoin both ſentences and their meanings* are either COPULATIVES or CONTINUATIVES. The principal copulative in *Engliſh* is AND. The continuatives are much more numerous; IF, BECAUSE, THEREFORE, WHEREFORE, HENCE, THAT, &c. The difference between theſe is this: The *copulative* does no more than barely *couple* ſentences, and is therefore applicable to all ſubjects whoſe natures are *not incompatible: Continuatives,* on the contrary, by a more intimate connection, conſolidate ſentences *into one continuous whole*; and are therefore applicable only to ſubjects which have an *eſſential coincidence:* For example, it is no way improper to ſay, *Lyſippus was a ſtatuary,* AND *Priſcian a grammarian*; *the ſun ſhineth,* AND *the ſky is clear*; becauſe theſe are things that may co-exiſt, and yet imply no abſurdity. But it would be abſurd to ſay, *Lyſippus was a ſtatuary,* BECAUSE *Priſcian was a grammarian*; though not to ſay, *the ſun ſhineth,* BECAUSE *the ſky is clear.* The reaſon is, with reſpect to the firſt, the *coincidence* is merely *accidental:* with reſpect to the laſt, it is *eſſential,* and founded in nature.

As to the *continuatives,* they are SUPPOSITIVE, ſuch as *if*; or POSITIVE, ſuch as *becauſe, therefore, &c.* Take examples of each:—*You will live happily* IF *you live honeſtly: You live happily* BECAUSE *you live honeſtly:*—*You live honeſtly,* THEREFORE *you live happily.* The difference between theſe *continuatives* is this: The *ſuppoſitives* denotes *connection,* but do not aſſert actual exiſtence; the *poſitives* imply both the *one* and the *other.* DISJUNCTIVE CONJUNCTIONS; while they DISJOIN *the ſenſe,* they CONJOIN *the ſentences.* With reſpect to theſe, we may obſerve, that as there is a principal of UNION diffuſed through all things by which THIS WHOLE is kept together and preſerved from diſſipation; ſo there is, in like manner, a principle of DIVERSITY diffuſed through all, the ſource of *diſtinction,* of *number,* and of *order.* Now, it is to expreſs in ſome degree the *modifications of this diverſity,* that DISJUNCTIVE CONJUNCTIONS ſeem at firſt to have been invented. Of theſe *disjunctives,* ſome are SIMPLE, ſome ADVERSATIVE. *Simple*; as when we ſay, EITHER *it is day,* OR *it is night:*—*Adverſative*; as when we ſay, *It is not day,* BUT *it is night.* The difference between theſe is, that the *ſimple* do no more than *merely* disjoin; the *adverſative* disjoin with a concomitant *oppoſition.* Add to this that the *adverſative* are *definite*; the *ſimple indefinite.* Thus when we ſay, *the number three is not an even number,* BUT *an odd*; we not only *disjoin* two oppoſite attributes, but we *definitely* affirm one, and deny the other. But when we ſay, *the number of the ſtars is* EITHER *even* OR *odd*; though we aſſert one attribute *to be*, and the other *not to be*, yet the alternative is, notwithſtanding, left *indefinite*.

SECT. II. OF THOSE CONNECTIVES, CALLED PREPOSITIONS.

A PREPSITION *is a part of ſpeech devoid itſelf of ſignification, but ſo formed as to unite two words that are ſignificant, and that refuſe to coaleſce of themſelves.* The connective power (which relates to words only, and not to ſentences) will be better underſtood by the following obſervaions.

Some things naturally coaleſce and unite of *themſelves*, while others refuſe to do ſo *without help*, and as it were by compulſion. For example, all quantities and qualities coaleſce immediately with their ſubſtances: thus it is we ſay, *a fierce lion, a vaſt mountain*, &c. In like manner actions coaleſce with their agents, and paſſions with their patients: thus it is we ſay, *Alexander conquers, Darius is conquered.* Nay, as every energy is a kind of medium between its agent and patient, the whole three, agent, energy and patient, coaleſce with the ſame facility; as when we ſay, *Alexander conquers Darius.* Farther than this, as the greateſt part of attributives themſelves may be characteriſed, as when we ſay of ſuch attributives as *ran, beautiful, learned*, &c. "he ran *ſwiftly*, ſhe was *very* beautiful, he was *moderately* learned," &c. theſe muſt readily coaleſce with the attributes which they thus characteriſe. From all which it appears, that *thoſe parts of ſpeech unite of themſelves in grammar, whoſe original archetypes unite of themſelves in nature.* Hence, therefore, it is, that although ſubſtances naturally coincide with their attributes, yet they abſolutely refuſe doing ſo one with another: and hence thoſe known maxims in phyſics, that *body is impenetrable*, that *two bodies cannot poſſeſs the ſame place*, &c.

From theſe principles it follows, that when we form a ſentence, the ſubſtance without difficulty coincides with the verb, from the natural coincidence of ſubſtance with energy; *the* SUN WARMETH: ſo likewiſe the energy with the ſubject on which it operates; WARMETH *the* EARTH: ſo likewiſe both ſubſtance and energy with their proper attributes; *the* SPLENDID SUN GENIALLY WARMETH *the* FERTILE EARTH. But ſuppoſe we are to add other ſubſtantives, as, for inſtance, *air*, or *beams*; how could theſe coincide, or under what character be introduced? Not either as the *energizer* of the verb, nor as *the ſubject on which it operates*; for both of theſe places are already filled up, the firſt by the word SUN, and the laſt by the ſubſtance EARTH: not as *attributes* to theſe laſt, or to any other thing; for attributes by nature they neither *are* nor *can be made*. Here, then, we perceive the riſe and uſe of *prepoſitions*: by theſe we connect thoſe ſubſtantives to ſentences, which at the time are unable to *coaleſce of themſelves*. Let us aſſume, for inſtance, a pair of theſe connectives, THROUGH and WITH, and mark their effect upon the ſubſtances here mentioned; *the ſplendid ſun* WITH *his beams genially warmeth* THROUGH *the air the fertile earth*; the ſentenee, as before, remains entire and one; the ſubſtantives required are both introduced, and not a word which was there before is diſplaced from its proper ſituation.

It muſt be here obſerved, that *moſt* if not *all* prepoſitions ſeem originally formed to denote the relations of *place*; becauſe this is that grand *relation* which *bodies* or *natural ſubſtances* maintain at all times to one another, whether they are contiguous or remote, whether in motion or at reſt. Thus we have prepoſitions to denote the *contiguous relation of body*; as when we ſay, *Caias walked* WITH *a ſtaff*; *the ſtatue ſtood* UPON *a pedeſtal*; *the river ran* OVER *a precipice.* Others, for the *detached relation*; as when we ſay, *he is going* TO *Italy*; *the ſun is riſen* ABOVE *the hills*; *theſe figs came* FROM *Turkey.* So, as to *motion* and *reſt*: only with this difference, that here the prepoſition varies its character with the verb: thus if we ſay, *that lamp hangs* FROM *the ceiling*, the prepoſition FROM aſſumes the character of *quieſcence*; but if we ſay, *that lamp is falling* FROM *the ceiling*, the prepoſition aſſumes a character of *motion.* So in Milton:

> ——*To ſupport uneaſy ſteps*
> OVER *the burning marle*——

Again,

> ——*He with looks of cordial love*
> *Hung* OVER *her enamour'd*——

In the firſt of theſe examples, OVER denotes *motion*, and in the laſt it denotes *reſt*. But though the original uſe of prepoſitions was to denote the relations of *place*, they could not be confined to this office only; but by degrees extended themſelves to ſubjects *incorporeal*, and came to denote relations as well *intellectual* as *local*. Thus becauſe, in *place*, he who is *above* has commonly the advantage of him who is *below*, we transfer OVER and UNDER, to *dominion* and *obedience*: of a king we ſay, *he ruled* OVER *his people*; of a common ſoldier, *he ſerved* UNDER *ſuch a general*: ſo too we ſay, WITH *thought*; WITHOUT *attention*; *thinking* OVER *a ſubject*; UNDER *anxiety*; FROM *fear*; OUT OF *love*; THROUGH *jealouſy*, &c. All which inſtances, with many of the like kind, ſhew, that the *firſt words* of men, like their *firſt ideas*, had an immediate reference to *ſenſible objects*; and that, in after days, when they began to diſcern with their *intellect*, they took theſe words which they found already made, and transferred them, by *metaphor*, to *intellectual conceptions.* There is indeed no method to expreſs new ideas, but either by *metaphor*, or by *coining new words*; both which have been practiſed by philoſophers, according to the nature and exigence of the occaſion. In the foregoing uſe of prepoſitions, we have ſeen how they are employed by way of *juxta poſition*; that is to ſay, where they are prefixed to a word without becoming a part of it: But they may be uſed by way of *compoſition*; that is, they may be prefixed to a word ſo as to become a part of it: thus, to UNDER*ſtand*, to FORE*tell*, to OVER*act*, to UNDER*value*, to OUT*go*, &c. are ſo many diſtinct words formed by prepoſitions joined intimately with ſome other word: in all which caſes, the prepoſitions commonly transfuſe ſomething of their own meaning into the word with which they are compounded, and this imparted meaning, in moſt inſtances, will be found reſolvable into ſome of the relations of *place*, as uſed either in its *proper* or *metaphorical* acceptation.

BESIDES the above parts of ſpeech, there is another, which cannot be comprehended under any of the foregoing claſſes, called INTERJECTIONS: of this kind are the words, AH! ALAS! FIE! &c. *This ſpecies of words coincide with no part of ſpeech, but are either uttered alone, or elſe thrown into a ſentence, without altering its form either in ſyntax or ſignification.* It may be therefore objected, that as we ſay, that all language is divided into the ſeveral parts above enumerated, and this claſs cannot be comprehended in any of theſe diviſions; of courſe, the analyſis that we have made cannot be juſt, becauſe it does not comprehend the whole. To this objection it may be anſwered, that the language of which we have been treating, is that which has been formed by mutual compact, for the purpoſes of reaſoning and ſpeculation; that, beſides this artificial language, man, like every other ſenſitive animal, is endowed with a natural language, by which he can expreſs any ſtrong ſenſation. This language does not owe its characteriſtical expreſſion to the arbitrary form of articulation; but derives its whole force from the tone of voice, and modification of countenance and geſture; and of conſequence theſe tones and geſtures expreſs the ſame meaning without any relation to the articulation which they may aſſume, and are therefore univerſally underſtood by all mankind. Now, *interjection* is the name by which we diſtinguiſh theſe natural expreſſions: theſe cannot be properly called words, or parts of ſpeech; but certain adventitious ſounds, or voices of nature, expreſſing thoſe paſſions and natural emotions which ſpontaneouſly ariſe in the mind upon the view or narrative of intereſting events. We muſt, therefore, ſtill conclude, that all language properly ſo called is compoſed of *words*, all of which may be arranged into the ſeveral claſſes in which they are placed in this part of the Syſtem.

PART II.

PARTICULAR GRAMMAR,

Exemplified in the ELEMENTS *of the* ENGLISH LANGUAGE.

PREFATORY REMARKS.

In order to expreſs ourſelves with eaſe and propriety in converſation, to read with grace, and write with elegance, we ought to be thoroughly acquainted with the Grammar of our native tongue. The Engliſh Language is perhaps of all the preſent European Languages by much the moſt ſimple in its form and conſtruction. Of all the ancient Languages extant, that is the moſt ſimple which is undoubtedly the moſt ancient; but even that Language itſelf does not equal the Engliſh in ſimplicity. The words of the Engliſh Language are perhaps ſubject to fewer variations from their original form, than thoſe of any other. Its ſubſtantives have but one variation of caſe; nor have they any diſtinction of gender, beſide that which nature hath made. Its adjectives admit of no change at all, except that which expreſſes the degrees of compariſon. All the poſſible variations of the original form of the verb are not above ſix or ſeven; whereas in many languages they amount to ſome hundreds: and almoſt the whole buſineſs of modes, times, and voices, is managed with great eaſe by the aſſiſtance of eight or nine commodious little verbs, called from their uſe auxiliaries. The conſtruction of this language is ſo eaſy and obvious, that our grammarians have thought it hardly worth while to give us any thing like a regular and ſyſtematical ſyntax.

It doth not proceed from any peculiar irregularity or difficulty of our language, that the general practice both of ſpeaking and writing it, is chargeable with inaccuracy. It is not the language, but the practice that is in fault. The truth is, grammar is very much neglected among us; and it is not the difficulty of the language, but on the contrary the ſimplicity and facility of it, which occaſions this neglect. Were the language leſs eaſy and ſimple, we ſhould find ourſelves under a neceſſity of ſtudying it with more care and attention. But as it is, we take it for granted, that we have a competent knowledge and ſkill, and are able to acquit ourſelves properly, in our own native tongue: a faculty ſolely acquired by uſe, conducted by habit, and tried by the ear, carries us on without reflection; we meet with no rubs or difficulties in our way, or we do not perceive them; we find ourſelves able to go on without rules, and we do not ſo much as ſuſpect, that we ſtand in need of them. A Grammatical Study of our own Language makes no part of the ordinary method of inſtruction, which we paſs through in our childhood, and it is very ſeldom that we apply ourſelves to it afterward. Yet the want of it will not be effectually ſupplied by any other advantages whatſoever. Much practice in the polite world, and a general acquaintance with the beſt authors, are good helps; but alone will hardly be ſufficient: we have writers, who have enjoyed theſe advantages in their full extent, and yet cannot be recommended as models of an accurate ſtyle. Much leſs then will what is commonly called Learning ſerve the purpoſe; that is, a critical knowledge of ancient Languages, and much reading of ancient authors; the greateſt Critic and moſt able Grammarian of the laſt age, when he came to apply his Learning and his Criticiſm to an Engliſh Author, was frequently at a loſs in matters of ordinary uſe and common conſtruction in his own Vernacular Idiom.

It is with reaſon expected of every perſon of a liberal education, and it is indiſpenſably required of every one who undertakes to inform or entertain the public, that he ſhould be able to expreſs himſelf with propriety and accuracy. The obſervations interſperſed throughout this part of the ſyſtem, will furniſh a convincing argument; both of the truth of the charge of Inaccuracy brought againſt our Language, as it ſubſiſts in Practice; and of the neceſſity of inveſtigating the Principles of it, and ſtudying it Grammatically, if we would attain to a due degree of ſkill in it. The plain way of doing this is, to lay down rules, and to illuſtrate them by examples. But, beſide ſhewing what is right, the matter may be further explained by pointing out what is wrong. I will not take upon me to ſay, whether we have any Grammar, that ſufficiently inſtructs us by rule and example; but I am ſure we have few, that, in the manner here attempted, teach us what is right by ſhewing what is wrong: though this perhaps may prove the more uſeful and effectual method of inſtruction.

Beſide this principal Deſign of Grammar in our own Language, there is a ſecondary uſe to which it may be applied, and which, I think, is not attended to as it deſerves; the facilitating of the acquiſition of other Languages, whether ancient or modern. A good foundation in the General Principles of Grammar is in the firſt place neceſſary for all thoſe, who are initiated in a learned education; and for all others likewiſe, who ſhall have occaſion to furniſh themſelves with the knowledge of modern Languages. Univerſal Grammar cannot be taught abſtractedly; it muſt be done with reference to ſome Language already known; in which the terms are to be explained and the rules exemplified. The learner is ſuppoſed to be unacquainted with all, but his native tongue; and in what other, conſiſtently with reaſon and common ſenſe, can you go about to explain it to him? When he has a competent knowledge of the main principles of Grammar in general, exemplified in his own Language; he then will apply himſelf with great advantage to the ſtudy of any other. To enter at once upon the Science of Grammar, and the ſtudy of a foreign Language, is to encounter two difficulties together, each of which would be much leſſened by being taken ſeparately and in its proper order. For theſe plain reaſons, a competent grammatical knowledge of our own language is the true foundation, upon which all Literature, properly ſo called, ought to be raiſed. If this method were adopted in our Schools; if children were firſt taught the common principles of Grammar, by ſome ſhort and clear Syſtem of Engliſh Grammar, which happily by its ſimplicity and facility is perhaps fitter than that of any other Language for ſuch a purpoſe; they would have ſome notion of what they were going about, when they ſhould enter into the Latin Grammar; and would hardly be engaged ſo many years as they now are, in that moſt irkſome and difficult part of Literature, with ſo much labour of the memory, and with ſo little aſſiſtance of the underſtanding.

As Grammar, generally ſpeaking contains four grand Diviſions, viz.

Orthography	*or the Art of*	Spelling	Words
Proſody		Accenting and Pronouncing	
Analogy		Deriving and Varying	
Syntax, or Compoſition		Forming Words into a Sentence:	

In conſidering that part of it, which immediately relates to the Engliſh Languages, we ſhall treat of thoſe Diviſions in their reſpective order.

CHAP. I. ORTHOGRAPHY.

Orthography, from ορθος, *right*, and γραφη, *writing*; the art of ſpelling, that is, writing the words juſtly and with all the proper and neceſſary letters. Or, it is the art of combining letters into ſyllables, and ſyllables into words.

LETTERS.

A letter is the firſt principle, or leaſt part, of a word. An articulate ſound is the ſound of the human voice, formed by the organs of ſpeech. A vowel is a ſimple articulate ſound, formed by the impulſe of the voice, and by the opening only of the mouth in a particular manner. A conſonant cannot be perfectly ſounded by itſelf; but, joined with a vowel, forms a compound articulate ſound, by a particular motion or contact of the parts of the mouth. A diphthong, or compound vowel, is the union of two or more vowels pronounced by a ſingle impulſe of the voice. The Engliſh alphabet, like moſt others, is both deficient and redundant; in ſome caſes, the ſame letters expreſſing different ſounds, and different letters expreſſing the ſame ſounds.

SYLLABLES.

A ſyllable is a ſound either ſimple or compounded, pronounced by a ſingle impulſe of the voice, and conſtituting a word or part of a word. Spelling is the art of reading by naming the letters ſingly, and rightly dividing words into their ſyllables. Or, in writing, it is the expreſſing of a word by its proper letters. In ſpelling, a ſyllable in the beginning or middle of a word ends in a vowel, unleſs it be followed by *x*; or by two or more conſonants: theſe are for the moſt part to be ſeparated; and at leaſt one of them always belongs to the preceding ſyllable, when the vowel of that ſyllable is pronounced ſhort. Particles in compoſition, though followed by a vowel, generally remain undivided in ſpelling. A mute generally unites with a liquid following; and a liquid, or a mute, generally ſeparates from a mute following: *le* and *re* are never ſeparated from a preceding mute. Example: *ma-ni-feſt, ex-e-cra-ble, un-e-qual, miſ-ap-ply, diſ-tin-guiſh, cor-reſ-pond-ing.* But the beſt and eaſieſt rule, for dividing the ſyllables in ſpelling the Engliſh, is to divide them as they are naturally divided in a right pronunciation; without regard to the derivation of words, or the poſſible combination of conſonants at the beginning of a ſyllable.

CHAP. II. PROSODY.

Proſody from προς, and ωδη, *cantus*, *ſinging*, is the manner of *accenting* and *pronouncing* words properly; in which it is neceſſary to obſerve, that every ſyllable muſt be ſounded according to its proper *quantity*, and every word of two or more ſyllables pronounced according to its proper *accent*. *Quantity* is the different meaſure of time uſed in pronouncing ſyllables, and therefore is either *long* or *ſhort*; which to each other bear the proportion of *two* to *one*; that is, you ought to be twice as long in pronouncing a *long* ſyllable, as you are in pronouncing a *ſhort* one. The mark (-) over a ſyllable, ſhews it is long, and the mark (ᴗ) denotes it to be ſhort; thus the vowel *o* is ſounded ſhort in the word *nŏt*, but long in *nōte*. *Accent* is that particular ſtreſs, or force of voice, which we lay upon any particular ſyllable in a word, without regarding whether that ſyllable is *long* or *ſhort* in itſelf, with reſpect to quantity. Accents are either *acute* or *grave*. The *acute* accent marked thus (ʹ) ſhews that the voice is to be raiſed and the ſyllable over which it is placed, pronounced in a ſharp and elevated tone. The *grave* accent marked thus (\`) ſhews on the contrary, that the ſyllable over which it is placed, is to be pronounced in a low and deep tone.

PROSODY may with great propriety be called, the muſic of converſation, and reading; ſince, by modulatiug the voice, it renders the ſound harmonious, and by regulating its riſe and fall, prevents that diſagreeable ſameneſs of tone, which is generally called monotony. The accent may either relate to words of two, or more ſyllables; or it may relate to words formed of exactly the ſame ſyllables and letters, but different in ſignification; and therefore only to be diſtinguiſhed by their different accents. It is to be obſerved, that in the Engliſh Language the names of things, called *nouns*, are always accented on the firſt ſyllable; but affirmations, known by the name of *verbs* are always accented on the laſt ſyllable, as in the following inſtances.

NAMES		AFFIRMATIONS	NAMES		AFFIRMATIONS
A Cóllect	—	To colléct	A Cóntract	—	To contráct
A Cómpound	—	compóund	A Cónvert	—	convért
A Cónduct	—	condúct	A Cónvict	—	convíct
The Cónfines	—	confíne	A Déſert	—	deſért
A Cónflict	—	conflíct	An E'xile	—	exíle
A Cóncert	—	concért	A Férment	—	fermént
A Cónſort	—	conſórt	Fréquent	—	frequént
A Cónteſt	—	contéſt	&c. &c. &c.		

It may be remarked upon the whole, that the Engliſh Proſody turns chiefly on two things. *Numbers*, that is a certain number of feet, or ſyllables. *Rhyme*, or a ſimilitude of ſound, between the laſt ſyllables of words.

CHAP. III. ANALOGY.

Analogy treats of words, or thoſe diſtinct articulate ſounds, by which we convey our notions or ideas of things to each other; expreſs our wants or feelings; and become ſocial beings, by mutually communicating our ſentiments. There are in Engliſh nine ſorts of words, or, as they are commonly called, parts of ſpeech. 1. The ARTICLE; prefixed to ſubſtantives, when they are common names of things, to point them out, and to ſhew how far their ſignification extends. 2. The SUBSTANTIVE, or NOUN; being the name of any thing conceived to ſubſiſt, or of which we have any notion. 3. The PRONOUN; ſtanding inſtead of the noun. 4. The ADJECTIVE; added to the noun to expreſs the quality of it. 5. The VERB; or word, by way of eminence; ſignifying to be, to do, or to ſuffer. 6. The ADVERB; added to verbs, and alſo to adjectives and other adverbs, to expreſs ſome circumſtance belonging to them. 7. The PREPOSITION; put before nouns and pronouns chiefly, to connect them with other words, and to ſhew their relation to thoſe words. 8. The CONJUNCTION; connecting ſentences together. 9. The INTERJECTION; thrown in to expreſs the affection of the ſpeaker, though unneceſſary with reſpect to the conſtruction of the ſentence. We ſhall treat of theſe in their reſpective order.

I. ARTICLE.

The ARTICLE is a word prefixed to ſubſtantives, to point them out, and to ſhew how far their ſignification extends. In Engliſh there are but two articles, *a*, and *the*: *a* becomes *an* before a vowel, *y* and *w* excepted; and before a ſilent *h* preceding a vowel. *A* is uſed in a vague ſenſe to point out one ſingle thing of the kind, in other reſpects indeterminate; *the* determines what particular thing is meaned. A ſubſtantive, without any article to limit it, is taken in its wideſt ſenſe; thus *man* means all mankind; as,

> "The proper ſtudy of mankind is man." *Pope.*

Where *mankind* and *man* may change places, without making any alteration in the ſenſe. *A man* means ſome one or other of that kind, indefinitely; *the man* means, definitely, that particular man, who is ſpoken of: the former therefore is called the Indefinite, the latter the Definite Article. Example: "*Man* was made for ſociety, and ought to extend his good will to all *men:* but *a man* will naturally entertain a more particular kindneſs for the *men* with whom he has the moſt frequent intercourſe; and enter into a ſtill cloſer union with *the man*, whoſe temper and diſpoſition ſuit beſt with his own. It is of the nature of both the articles to determine or limit the thing ſpoken of; *a* determines it to be one ſingle thing of the kind, leaving it ſtill uncertain which: *the* determines which it is, or, of many, which they are. The firſt therefore can only be joined to ſubſtantives in the ſingular number; the laſt may alſo be joined to plurals. There is a remarkable exception to this rule in the uſe of the adjectives *few* and *many*, (the latter chiefly with the word *great* before it,) which though joined with plural Subſtantives, yet admit of the ſingular Article *a:* as, *a few men, a great many men.*

> "Told of *a many thouſand* warlike French:"
> "A care craz'd mother of *a many children.*" *Shakeſp.*

The reaſon of it is manifeſt from the effect, which the article has in theſe phraſes; it means a ſmall or great number collectively taken, and therefore gives the idea of a Whole, that is, of unity. Thus likewiſe *a hundred, a thouſand*, is one whole number, an aggregate of many collectively taken; and therefore ſtill retains the Article *a*, though joined as an adjective to a plural Subſtantive; as *a hundred years.*

> "For harbour at *a thouſand doors* they knock'd;
> Not one of all *the thouſand*, but was lock'd." *Dryden.*

The Definite Article *the* is ſometimes applied to Adverbs in the Comparative and Superlative degree; and its effect is to mark the degree the more ſtrongly, and to define it the more preciſely: as, "*The more* I examine it, *the better* I like it. I like this *the leaſt* of any." Theſe remarks may ſerve to ſhew the great importance of the proper uſe of the Article; the near affinity there is between the Greek Article and the Engliſh Definite Article; and the excellence of the Engliſh Language in this reſpect, which by means of its two Articles does moſt preciſely determine the extent of ſignification of Common Names; whereas the Greek has only one Article, and it has puzzled all the Grammarians to reduce the uſe of that to any clear and certain rules.

II. SUBSTANTIVE, OR NOUN.

The SUBSTANTIVE, or NOUN, is the *Name* of a thing; of whatever we conceive in any way to *ſubſiſt*, or of which we have any notion Subſtantives are of two ſorts; Proper, and Common, Names. Proper Names are the Names appropriated to individuals; as the names of perſons and places: ſuch are *George, London.* Common Names ſtand for kinds, containing many ſorts; or for ſorts, containing many individuals under them; as, *Animal, Man.* And theſe Common Names, whether of kinds or ſorts, are applied to expreſs individuals, by the help of Articles added to them, as hath been already ſhewn; and by the help of Definitive Pronouns, as we ſhall ſee hereafter. Proper Names being the Names of individuals, and therefore of things already as determinate as they can be made, admit not of Articles, or of Plurality of Number; unleſs by a Figure, or by Accident: as, when great Conquerors are called *Alexanders*; and ſome great Conqueror *An* Alexander, or *The* Alexander of his Age; when a common Name is underſtood, as *The* Thames, that is, the *River* Thames; *The* George, that is, the *Sign* of St. George; or when it happens, that there are many perſons of the ſame name: as, *The* two *Scipios.* Whatever is ſpoken of is repreſented as one, or more, in Number; theſe two manners of repreſentation in reſpect of Number are called the Singular, and the Plural, Number. In Engliſh, the Subſtantive Singular is made Plural, for the moſt part, by adding to it *s*; or *es*, where it is neceſſary for the pronunciation; as *king, kings*; *fox, foxes*; *leaf, leaves*; in which laſt, and many others, *f* is alſo changed into *v*, for the ſake of an eaſier pronunciation, and more agreeable ſound. Some few Plurals end in *en*; as, *oxen, children, brethren,* and *men, women*, by changing the *a* of the Singular into *e*. This form we have retained from the Teutonic; as likewiſe the introduction of the *e* in the former ſyllable of two of the laſt inſtances; *women*, (for ſo we pronounce it,) *brethren*, from *woman, brother:* ſomething like which may be noted in ſome other forms of Plurals; as, *mouſe, mice*; *louſe, lice*; *tooth, teeth*; *foot, feet*; *gooſe, geeſe.* The words *ſheep, deer*, are the ſame in both Numbers. Some Nouns, from the nature of the things which they expreſs, are uſed only in the Singular, others only in the Plural, Form; as, *wheat, pitch, gold, ſloth, pride*, &c. and *bellows, ſciſſars, lungs, bowels*, &c. The Engliſh Language, to expreſs different connexions and relations of one thing to another, uſes for the moſt part, Prepoſitions. The Greek and Latin among the ancient, and ſome too among the modern languages, as the German, vary the termination or ending of the Subſtantive, to anſwer the ſame purpoſe. Theſe different endings are in thoſe languages called Caſes. And the Engliſh being derived from the ſame origin as the German, that is, from the Teutonic, is not wholly without them. For inſtance, the relation of Poſſeſſion, or Belonging, is often expreſſed by a Caſe, or different ending of the Subſtantive. This Caſe anſwers to the Genitive Caſe in Latin, and may ſtill be ſo called; though perhaps more properly the Poſſeſſive Caſe. Thus "*God's* grace; which may alſo be expreſſed by the Prepoſition; as, "the grace *of God.*" It was formerly written; "*Godis* grace; we now always ſhorten it with an Apoſtrophe; often very improperly, when we are obliged to pronounce it fully; as, "*Thomas's* book:" that is, "*Thomaſis* book," not "*Thomas his* book," as it is commonly ſuppoſed.

When the thing, to which another is ſaid to belong, is expreſſed by a circumlocution, or by many terms, the ſign of the poſſeſſive caſe is commonly added to the laſt term; as, "The King of Great *Britain's* Soldiers." When it is a Noun ending in *s*, the ſign of the Poſſeſſive Caſe is ſometimes not added; as, "for *righteouſneſs'* ſake;" nor even to the Plural Number ending in *s*; as, "on *eagles'* wings." Both the Sign and the Prepoſition ſeem ſometimes to be uſed; as, "a ſoldier *of the king's*;" but here are really two poſſeſſives; for it means, "one *of* the ſoldiers *of* the king." The Engliſh in its Subſtantives has but two different terminations for Caſes; that of the Nominative, which ſimply expreſſes the Name of the thing, and that of the poſſeſſive Caſe. Things are frequently conſidered with relation to the diſtinction of Sex or Gender; as being Male, or Female, or neither the one, nor the other. Hence Subſtantives are of the Maſculine, or Feminine, or Neuter, (that is, Neither,) Gender: which latter is only the excluſion of all conſideration of Gender. The Engliſh Language, with ſingular propriety, following nature alone, applies the diſtinction of Maſculine and Feminine only to the names of Animals: all the reſt are Neuter: except when, by a Poetical or Rhetorical fiction, things Inanimate and qualities are exhibited as Perſons, and conſequently become either Male or Female; and this gives the Engliſh an advantage above moſt other languages in the Poetical and Rhetorical ſtyle; for when Nouns naturally Neuter are converted into Maſculine and Feminine, the Perſonification is more diſtinctly and forcibly marked. Some few ſubſtantives are diſtinguiſhed in their Gender by their termination: as, *prince, princeſs*; *actor, actreſs*; *lion, lioneſs*; *hero, heroine*, &c. The chief uſe of Gender in Engliſh is in the pronoun of the Third Perſon; which muſt agree in that reſpect with the Noun for which it ſtands.

III. PRONOUN.

A Pronoun is a word ſtanding *inſtead of a Noun*, as its Subſtitute or Repreſentative. In the Pronoun are to be conſidered the Perſon, Number, Gender, and Caſe. There are Three Perſons which may be the Subject of any diſcourſe: firſt, the Perſon who ſpeaks may ſpeak of himſelf; ſecondly, he may ſpeak of the Perſon to whom he addreſſes himſelf; thirdly, he may ſpeak of ſome other Perſon. Theſe are called, reſpectively, the Firſt, Second, and Third, Perſons: and are expreſſed in Engliſh by the Pronouns, *I, Thou, He.* As the Speakers, the Perſons ſpoken to, and the other Perſons ſpoken of, may be many; ſo each of theſe Perſons hath the Plural Number; *We, Ye, They.*

The Perſons ſpeaking and ſpoken to, being at the ſame time the Subjects of the diſcourſe, are ſuppoſed to be preſent; from which and other circumſtances their Sex is commonly known, and needs not to be marked by a diſtinction of Gender in their Pronouns: but the third Perſon or thing ſpoken of being abſent and in many reſpects unknown, it is neceſſary, that it ſhould be marked by a diſtinction of Gender; at leaſt when ſome particular Perſon or Thing is ſpoken of, which ought to be more diſtinctly marked: accordingly the Pronoun Singular of the Third Perſon hath the Three Genders: *He, She, It.* Pronouns have Three Caſes: the Nominative; the Genitive, or Poſſeſſive, like Nouns; and moreover a Caſe, which follows the Verb Active, or the Prepoſition, expreſſing the object of an Action, or of a Relation. It anſwers to the Oblique Caſes in Latin, and may be properly enough called the Objective Caſe.

ENGLISH PRONOUNS;
according to their Perſons, Numbers, Caſes and Genders.

PERSONS.

1.	2.	3.	1.	2.	3.
Singular.			Plural.		
I,	Thou,	He;	We,	Ye or You,	They.

CASES.

Nom.	Poſſ.	Obj.	Nom.	Poſſ.	Obj.
First Perſon.					
I,	Mine,	Me;	We,	Ours,	Us.
Second Perſon.					
Thou,	Thine,	Thee;	Ye or You,	Yours,	You.
Third Perſon.					
Maſ. He,	His,	Him;	They,	Theirs,	Them.
Fem. She,	Hers,	Her;			
Neut. It,	Its,	It;			

The Perſonal Pronouns have the nature of Subſtantives, and as ſuch, ſtand by themſelves; the reſt have the nature of Adjectives; and as ſuch are joined to Subſtantives; and may be called Pronominal Adjectives.

Thy, My, Her, Ours, Yours, Their, are Pronominal Adjectives: but *His* (that is, *He's*,) *Her's, Our's, Your's, Their's*, have evidently the Form of the Poſſeſſive Caſe: and by Analogy, *Mine, Thine*, may be eſteemed of the ſame rank. All theſe are uſed, when the Noun, to which they belong, is underſtood: the two latter ſometimes alſo inſtead of *my, thy*, when the Noun following them begins with a vowel. Beſide the foregoing, there are ſeveral other Pronominal Adjectives; which, though they may ſometimes ſeem to ſtand by themſelves, yet have always ſome Subſtantive belonging to them, either referred to or underſtood: as, *This, that, other, any, ſome, one, none*. Theſe are called Definitive, becauſe they *define* and limit the extent of the Common Name, or General Term, to which they refer, or are joined. The three firſt of theſe are varied, to expreſs Number; as, *Theſe, thoſe, others*; the laſt of which admits of the Plural form only when its Subſtantive is not joined to it, but referred to, or underſtood: none of them are varied to expreſs the Gender: only two of them to expreſs the Caſe; as, *other, one*, which have the Poſſeſſive Caſe. *One* in Engliſh is ſometimes uſed in an indefinite ſenſe, (anſwering to the French *on*,) as in the following phraſes; "*one* is apt to think;" "*one* ſees;" "*one* ſuppoſes." *Who, which, that*, are called Relatives, becauſe they more directly *refer* to ſome Subſtantive *going before*, which therefore is called the Antecedent. They alſo connect the following part of the Sentence with the foregoing. Theſe belong to all the three Perſons; whereas the reſt belong only to the Third. One of them only is varied to expreſs the three Caſes; *Who, whoſe*, (that is, *who's*) *whom*: none of them have different endings for the Numbers. *Who, which, what*, are called Interrogatives, when they are uſed in *aſking queſtions*. The two latter of them have no variation of Number or Caſe. *Each, every, either*, are called Diſtributive; becauſe they denote the Perſons, or things, that make up a number, as taken *ſeparately* and ſingly.

Whoſe is by ſome Engliſh authors made the poſſeſſive Caſe of *which*, and applied to things as well as perſons.

"The *queſtion*, *whoſe* ſolution I require,
Is, what the ſex of women moſt deſire." *Dryden.*

"Is there any other *doctrine*, *whoſe* followers are puniſhed?" *Addiſon.*

"Of man's firſt diſobedience, and the fruit
Of that forbidden Tree, *whoſe* mortal taſte
Brought death into the world, and all our woe." *Milton.*

Every was formerly much uſed as a Pronominal Adjective, ſtanding by itſelf: as, "He propoſeth unto God their neceſſities, and they their own requeſts, for relief in *every* of them." *Hooker*. "The corruptions and depravation to which *every* of theſe was ſubject." Swift, Conteſts and Diſſentions. We now commonly ſay, *every one*. *Own*, and *ſelf*, in the Plural *ſelves*, are joined to the Poſſeſſives, *my, our, thy, your, his, her, their*; as, *my own* hand; *myſelf, yourſelves*: both of them expreſſing emphaſis, or oppoſition; as, "I did it my *own ſelf*," that is, and no one elſe: the latter alſo forming the Reciprocal Pronoun; as, "he hurt *himſelf*." *Himſelf, themſelves*, ſeem to be uſed in the nominative Caſe by corruption, inſtead of *his ſelf, their ſelves*: as, "he came *himſelf*," "they did it *themſelves*;" where *himſelf, themſelves*, cannot be in the Objective Caſe. If this be ſo, *ſelf* muſt be, in theſe inſtances, not a Pronoun, but a Noun. Thus Dryden uſes it:

"What I ſhow,
Thy *ſelf may* freely on thyſelf beſtow."

The Poſſeſſives *his, thine, mine*, may be accounted either Pronominal Adjectives, or Genitive Caſes of the reſpective Pronouns. The form in the Engliſh is ambiguous; juſt in the ſame manner as, in the Latin phraſe "*cujus* liber," the word *cujus* may be either the Genitive Caſe of *qui*, or the Nominative Maſculine of the Adjective, *cujus, cuja, cujum*. So likewiſe, *mei, tui, ſui, noſtri, veſtri*, have the ſame form, whether Pronouns, or Pronominal Adjectives. *His ſelf* and *their ſelves* were formerly in uſe, even in the Objective Caſe after a Prepoſition: "Every of us, each for *his ſelf*, laboured how to recover him." *Sidney*. "That they would willingly, and of *their ſelves*, endeavour to keep a perpetual chaſtity." Stat. 2 and 3 Ed. VI. ch. 21.

Ourſelf, the Plural Pronominal Adjective with the Singular Subſtantive, is peculiar to the Regal Style. *Own* is an Adjective; or perhaps the Participle *own*, of the verb *to owe*; to be the right owner of a thing. All nouns whatever in Grammatical Conſtruction are of the Third Perſon; except when an addreſs is made to a Perſon: then the Noun, (anſwering to what is called the Vocative Caſe in Latin,) is of the Second Perſon.

IV. ADJECTIVE.

An ADJECTIVE is a word *added to* a Subſtantive to expreſs its quality. Adjectives are very improperly called *Nouns*; for they not the *Names* of things. The Adjectives *good, white*, are applied to the Nouns *man, ſnow*, to expreſs the Qualities belonging to thoſe Subjects; but the Names of thoſe Qualities in the abſtract, (that is, conſidered in themſelves, and without being attributed to any ſubject), are *goodneſs, whiteneſs*; and theſe are Nouns, or Subſtantives. In Engliſh the Adjective is not varied on account of Gender, Number or Caſe. The only variation which it admits of, is that of the Degrees of Compariſon. Qualities for the moſt part admit of *more* and *leſs*, or of different degrees, and the words that expreſs ſuch Qualities have accordingly proper forms to expreſs different degrees. When a Quality is ſimply expreſſed without any relation to the ſame in a different degree, it is called the Poſitive; as, *wiſe, great*. When it is expreſſed with augmentation, or with reference to a leſs degree of the ſame, it is called the Comparative; as, *wiſer, greater*: When it is expreſſed as being in the higheſt degree of all, it is called the Superlative: as, *wiſeſt, greateſt*. So that the ſimple word, or Poſitive, becomes Comparative by adding *r* or *er*; and Superlative by adding *ſt* or *eſt*, to the end of it. And the Adverbs *more* and *moſt* placed before the Adjective have the ſame effect; as *wiſe, more wiſe, moſt wiſe*. Double Comparatives and Superlatives are improper: as, *more braver, moſt wiſeſt, &c.* Monoſyllables in the Engliſh, for the moſt part, are compared by *er* and *eſt*; and Diſſyllables by *more* and *moſt*: as *mild, milder, mildeſt*; *frugal, more frugal, moſt frugal*. Diſſyllables ending in *y*, *happy, lovely*, and in *le* after a mute, as *able, ample*; or accented on the laſt ſyllable, as *diſcrete, polite*; eaſily admit of *er* and *eſt*. Words of more than two ſyllables hardly ever admit of thoſe terminations. In ſome few words the Superlative is formed by adding the Adverb *moſt* to the end of them; as, *nethermoſt, uttermoſt*, or *utmoſt, undermoſt, uppermoſt, foremoſt*. In Engliſh, as in moſt languages, there are ſome words of very common uſe, (in which the caprice of Cuſtom is apt to get the better of Analogy,) that are irregular in this reſpect: as *good, better, beſt*; *bad, worſe, worſt*; *little, leſs, leaſt*; *much* or *many, more, moſt*; and a few others.

But poetry is in poſſeſſion of improper Superlatives, and may be indulged in the uſe of them. The Double ſuperlative *moſt higheſt* is a Phraſe peculiar to the old Vulgar Tranſlation of the Pſalm; where it acquires a ſingular propriety from the Subject to which it is applied, the Supreme Being, who is *higher than the higheſt*. "*Leſſer*, ſays Mr. Johnſon, is a barbarous corruption of *leſs*, formed by the vulgar from the habit of terminating Compariſons in *er*."

"Attend to what a *leſſer* Muſe indites." *Addiſon.*

"The tongue is like a race-horſe; which runs the faſter, the *leſſer* weight it carries." Addiſon, Spect. N° 247.

Worſer ſounds much more barbarous, only becauſe it has not been ſo frequently uſed.

"Changed to a *worſer* ſhape thou canſt not be." *Shakeſpear* 1 *Hen.* VI.

"A dreadful quiet felt, and *worſer* far,
Than arms, a ſullen interval of war." *Dryden.*

V. VERB.

A VERB is a *word* which ſignifies to be, to do, or to ſuffer. There are three kinds of Verbs; Active, Paſſive, and Neuter. A Verb Active expreſſes an action, and neceſſarily implies an Agent, and an Object acted upon: as, *to love*; "I love Thomas." A verb Paſſive expreſſes a Paſſion, or a Suffering, or the Receiving of an Action; and neceſſarily implies an Object acted upon, and an Agent by which it is acted upon; as, *to be loved*; "Thomas is loved by me." So when the Agent takes the lead in the Sentence, the Verb is Active, and is followed by the Object: when the object takes the lead, the Verb is Paſſive, and is followed by the Agent. A Verb Neuter expreſſes Being; or a ſtate condition of being; when the Agent and the Object acted upon coincide, and the event is properly neither action nor paſſion, but rather ſomething between both: as, *I am, I ſleep, I walk*. The Verb Active is called alſo Tranſitive; becauſe the action *paſſeth over* to the Object, or hath an effect upon ſome other thing: the Verb Neuter is called Intranſitive; becauſe the effect is confined within the Agent, and doth *not paſs over* to any object. In Engliſh many Verbs are uſed both in an Active and Neuter ſignification, the conſtruction only determining of which kind they are. The diſtinction between Verbs abſolutely Neuter, as to *ſleep*, and Verbs Active Intranſitive, as *to walk*, though founded in nature and truth, is of little uſe in Grammar. Indeed it would rather perplex than aſſiſt the learner: for the difference between Verbs Active and Neuter, as Tranſitive and Intranſitive, is eaſy and obvious: but the difference between Verbs abſolutely Neuter and Intranſitively active is not always clear. However theſe latter may differ in nature, the Conſtruction of them both is the ſame, and Grammar is not ſo much concerned with their real, as their Grammatical properties. To the ſignification of the Verb is ſuperadded the deſignation of Perſon, by which it correſponds with the ſeveral Perſonal Pronouns; of Number, by which it correſponds with the Number of the Noun, Singular or Plural: of Time, by which it repreſents the being, action, or paſſion, as Preſent, paſt, or Future, whether Imperfectly, or Perfectly; that is, whether paſſing in ſuch time, or then finiſhed; and laſtly of Mode, or of the various Manner in which the being, action, or paſſion, is expreſſed. In a Verb therefore are to be conſidered the Perſon, the Number, the Time, and the Mode. The Verb in ſome parts of it varies its endings, to expreſs, or agree with, different Perſons of the ſame number: as, "*I love*, Thou *loveſt*, He *loveth*, or *loves*. So alſo to expreſs different Numbers of the ſame perſon: as, "Thou *loveſt*, Ye *love*: He *loveth*, They *love*." So likewiſe to expreſs different Times, in which any thing is repreſented as being, acting or acted upon: as, "*I love, I loved*; *I bear, I bore, I have borne*."

In the Plural Number of the Engliſh Verb, there is no variation of ending to expreſs the different perſons; and the three Perſons Plural are the ſame alſo with the firſt Perſon ſingular: moreover in the Preſent Time of the Subjunctive Mode all Perſonal

Variation is dropped. The Mode is the *Manner* of repreſenting the Being, action, or Paſſion. When it is ſimply *declared*, or a queſtion aſked, in order to obtain a *declaration* concerning it, it is called the Indicative Mode; as, "*I love*; *loveſt* thou?" when it is *bidden*, it is called the Imperative; as, "*love* thou:" when it is *ſubjoined* as the end or deſign, or mentioned under a condition, a ſuppoſition, or the like, for the moſt part depending on ſome other Verb, and having a Conjunction before it, it is called the Subjunctive; as, "If *I love*; If thou *love*:" when it is barely expreſſed *without any limitation* of perſon or number, it is called the Infinitive; as "*to love*;" and when it is expreſſed in a form in which it may be joined to a Noun as its quality or accident, *partaking* thereby of the nature of an Adjective, it is called the Participle; as, *loving*.

In Engliſh the ſeveral expreſſions of Conditional Will, Poſſibility, Liberty, Obligations, &c. come all under the Subjunctive Mode. The mere expreſſion of Will, Poſſibility, Liberty, Obligation, &c. belong to the Indicative Mode: it is their Conditionality, their being ſubſequent, and depending upon ſomething preceding, that determines them to the Subjunctive Mode. And in this Grammatical Modal Form, however they may differ in other reſpects Logically, or Metaphyſically, they all agree. But to expreſs the Time of the Verb, the Engliſh uſes alſo the aſſiſtance of other Verbs, called therefore Auxiliaries, or Helpers; *do*, *be*, *have*, *ſhall*, *will*: as I *do* love, I *did* love; I *am* loved, I *was* loved; I *have* loved, I *have been* loved; I *ſhall*, or *will*, love, or *be* loved."

The two principal Auxiliaries, to *have*, and *to be*, are thus varied, according to Perſon, Number, Time, and Mode.

Time is Preſent, Paſt, or Future.

TO HAVE

Indicative Mode.

Preſent Time.

Perſon	1. I have,	We	have.
	2. Thou haſt,	Ye	
	3. He hath, or has;	They	

Paſt Time.

1. I had,	We	had.
2. Thou hadſt,	Ye	
3. He had;	They	

Future Time.

1 I ſhall, or will	have,	We	ſhall, or will, have.
2 Thou ſhalt, or wilt,		Ye	
3 He ſhall, or will,		They	

Imperative Mode.

1. Let me have,	Let us have,
2. Have thou,	Have ye,
or, Do thou have,	or, Do ye have.
3. Let him have;	Let them have.

Subjunctive Mode.

Preſent Time.

1. I	have;	We	have;
2. Thou		Ye	
3. He		They	

Infinitive Mode.

Preſent; To have: Paſt, to have had.

Participle.

Preſent, Having: Perfect Had:
Paſt, Having had.

TO BE:

Indicative Mode.

Preſent Time.

1. I am,	We	are.
2. Thou art,	Ye	
3. He is;	They	

Paſt Time.

1. I was	We	were.
2. Thou waſt,	Ye	
3. He was;	They	

Future Time.

1 I ſhall, or will,	be;	We	ſhall or will, be.
2 Thou ſhalt, or wilt,		Ye	
3 He ſhall, or will,		They	

Imperative Mode.

1. Let me be,	Let us be,
2. Be thou,	Be ye,
or, Do thou be,	or, Do ye be,
3. Let him be;	Let them be.

Subjunctive Mode.

1. I	be;	We	be.
2. Thou		Ye	
3. He		They	

Paſt Time.

1. I were,	We	were.
2. Thou wert,	Ye	
3. He were;	They	

Infinitive Mode.

Preſent, To be: Paſt, To have been.

Participle.

Preſent, Being: Perfect, Been:
Paſt, Having been.

The Engliſh Verb Active is thus varied according to Perſon, Number, Time, and Mode.

Indicative Mode.

Preſent Time.

	Sing.	Plur.	
Perſon	1 I love,	We	love.
	2 Thou loveſt,	Ye	
	3 He loveth, or loves;	They	

Paſt Time.

1. I loved,	We	loved.
2. Thou lovedſt,	Ye	
3. He loved;	They	

Future Time.

1 I ſhall, or will,	love,	We	ſhall, or will, love.
2 Thou ſhalt, or wilt,		Ye	
3 He ſhall, or will,		They	

Imperative Mode.

1. Let me love,	Let us love,
2. Love thou,	Love ye,
or Do thou love,	or, Do ye love,
3. Let him love;	Let them love.

Subjunctive Mode.

Preſent Time.

1. I	love;	We	love.
2. Thou		Ye	
3. He		They	

And,

1 I may	love;	We	may love, and have loved
2 Thou mayeſt		Ye	
3 He may		They	

Paſt Time.

1 I might	love,	We	might love, and have loved.
2 Thou mighteſt		Ye	
3 He might		They	

Infinitive Mode.

Preſent, To love: To have loved.

Participle.

Preſent, Loving: Perfect, Loved:
Paſt, Having loved.

But in diſcourſe we have often occaſion to ſpeak of Time, not only as Preſent, Paſt, and Future, at large and indeterminately; but alſo as ſuch with ſome particular diſtinction and limitation; that is, as paſſing, or finiſhed; as imperfect, or perfect. This will be beſt ſeen in an example of a Verb laid out and diſtributed according to theſe diſtinctions of Time.

Indefinite or Undetermined, Time.

Preſent,	Paſt,	Future,
I love;	I loved;	I ſhall love.

Definite, or Determined, Time:

Preſent Imperfect:	I am (now) loving
Preſent Perfect:	I have (now) loved
Paſt Imperfect:	I was (then) loving
Paſt Perfect:	I had (then) loved
Future Imperfect:	I ſhall (then) be loving
Future Perfect:	I ſhall (then) have loved

It is needleſs here to ſet down at large the ſeveral Variations of the Definite Times, as they conſiſt only in the proper Variations of the Auxiliary, joined to the Preſent or Perfect Participle; which have already been given. The Paſſive Verb is only the Participle Paſſive, (which for the moſt part is the ſame with the Indefinite Paſt Time, Active, and always the ſame with the Perfect Participle,) joined to the Auxiliary Verb *to be*, through all its Variations: as, "I *am loved*; I *was loved*; I *have been loved*; I *ſhall be loved*;" and ſo on, through all the Perſons, the Numbers, the Times, and the Modes. The Neuter Verb is varied like the Active; but, having ſomewhat of the Nature of the Paſſive, admits in many inſtances of the Paſſive form, retaining ſtill the Neuter ſignification; chiefly in ſuch verbs, as ſignify ſome ſort of motion, or change of place or condition: as, "I *am come*; I *was gone*; I *am grown*; I *was fallen*." The Verb *am*, *was*, in this caſe preciſely defines the Time of the action or event, but does not change the nature of it; the Paſſive form ſtill expreſſing, not properly a Paſſion, but only a ſtate or condition of Being.

IRREGULAR VERBS.

There are many *Irregular Engliſh* Verbs; but it is to be noted, That that *Irregularity* relates only to the termination of the *Preterite* tenſe, and the *Paſſive Participle*. That it reaches only ſuch words as are native, and originally Engliſh. That it is to be found only in words of one ſyllable, or derived from words of one ſyllable. That where the *Preterite* is regular, the *Paſſive Participle* is the ſame with it. Except *hewed*, *mowed*, *ſhewed*, *ſnowed*, *ſowed*; which have *hewn*, *mown*, *ſhewn*, *ſown*.

Theſe *Irregularities* may be reduced to the following heads:

The *d* is changed into *t* after *c*, *ch*, *ſh*, *f*, *k*, *p*, *x*; and after *s* and *th*, when pronounced hard; and ſometimes after *l*, *m*, *n*, *r*, when a ſhort vowel goes before it; as, *plac't*, *ſnatch't*, *fiſh't*, *walk't*, *dwelt*, *ſmelt*. But when a long vowel goes before *p*, it is either ſhortened, or changed into a ſhort one; as, *kept*, *ſlept*, *wept*, *crept*, *ſwept*, *leapt*, from *keep*, *ſleep*, *weep*, *creep*, *ſweep*, *leap*: As alſo ſometimes before *l*, *m*, *n*, *r*, and *v*, turned into *f*; as, *feel*, *felt*; *dream*, *dreamt*; *mean*, *meant*; *leave*, *left*. When the *Preſent*, ends in *d* or *t*, the *Preterite* is ſometimes the ſame with it: as, *read*, *caſt*, *hurt*, *burſt*, *hit*, *quit*: And when two vowels precede, the laſt is left out: as, *ſpread*, *ſpred*; *lead*, *led*; *feed*, *fed*; *bleed*, *bled*; *meet*, *met*. When a conſonant comes before *d*, it is ſometimes changed into *t*: as, *bend*, *bent*; *lend*, *lent*; *ſend*, *ſent*; *rend*, *rent*; *gird*, *girt*.

To the Irregular Verbs, are to be added the Defective; which are not only for the moſt part Irregular, but are alſo wanting in ſome of their parts. They are in general words of moſt frequent and vulgar uſe; in which Cuſtom is apt to get the better of Analogy. Such are the Auxiliary verbs; moſt of which are of this number. They are in uſe only in ſome of their Times and Modes; and ſome of them are a Compoſition of Times of ſeveral Defective Verbs having the ſame Signification.

Preſent.	Paſt.	Participle.
Am,	was,	been.
Can,	could,	
Go,	went,	gone.

VI. ADVERB.

Adverbs are *added to Verbs*, and to Adjectives, to denote ſome modification or circumſtance of an action, or quality: as the manner, order, time, place, diſtance, motion, relation, quantity, quality, compariſon, doubt, affirmation, negation, demonſtration, interrogation. In Engliſh they admit of no Variation; except ſome few of them, which have the degrees of Compariſon; as, "often, oftener, ofteneſt;" "ſoon, ſooner, ſooneſt;" and thoſe Irregulars, derived from Adjectives in this reſpect likewiſe irregular; "well, better, beſt;" &c. An Adverb is ſometimes joined to another Adverb, to modify or qualify its meaning; as "very much; much too little; not very prudently."

VII. PREPOSITION.

Prepositions, ſo called becauſe they are commonly *put before* the words to which they are applied, ſerve to connect words with one another, and to ſhew the relation between them. One great Uſe of Prepoſitions in Engliſh is to expreſs relations, which in ſome languages are chiefly marked by Caſes, or the different endings of the Noun. Moſt Prepoſitions originally denote the relations of Place, and have been thence transferred to denote by ſimilitude other relations. Thus, *out*, *in*, *through*, *under*, *by*, *to*, *from*, *of*, &c. *Of* is much the ſame with *from*: "aſk *of* me, "that is *from* me: "made *of* wood;" "Son *of* Philip;" that is, ſprung *from* him. *For*, in its primary ſenſe, is *pro*, *loco alterius*, in the *ſtead*, or *place*, of another. The notion of Place is very obvious in all the reſt. Prepoſitions in the Engliſh language are alſo prefixed to words in ſuch a manner, as to coaleſce with them, and to become a part of them. Prepoſitions, ſtanding by themſelves, in Conſtruction, are put before Nouns and Pronouns; and ſometimes after Verbs; but in this ſort of Compoſition they are chiefly prefixed to Verbs: as, *to outgo*, *to overcome*, *to undervalue*. There are alſo certain Particles which are thus employed in Compoſition of words, yet cannot ſtand by themſelves in Conſtruction, as, *a*, *be*, *con*, *mis*, &c. in *abide*, *bedeck*, *conjoin*, *miſtake*, &c.; theſe are called Inſeparable Prepoſitions.

VIII. CONJUNCTION.

The Conjunction connects or *joins together* Sentences; ſo as, out of two, to make one Sentence. Thus, "You, *and* I, *and* Peter, rode to London," is one Sentence, made up of theſe three by the Conjunction *and* twice employed; "You rode to London; I rode to London; Peter rode to London." Again, "You *and* I rode to London, *but* Peter ſtaid at home," is one Sentence made up of three by the Conjunctions *and* and *but*: both of which equally connect the Sentences, but the latter expreſſes an Oppoſition in the Senſe. The firſt is therefore called a Conjunction Copulative; the other a Conjunction Disjunctive. The uſe of Copulative

pulative Conjunctions is to connect, or to continue, the Sentence, by expreſſing an addition, *and*; a ſuppoſition, or condition, *if*, *as*; a cauſe, *becauſe*, *then*; a motive, *that*; an inference, *therefore*; &c. The uſe of Disjunctives is to connect and to continue the Sentence; but withal to expreſs Oppoſition of meaning in different degrees; as, *or*, *but*, *than*, *although*, *unleſs*, &c.

IX. INTERJECTION.

Interjections, ſo called, becauſe they are *thrown in between* the parts of a ſentence without making any other alteration in it; are a kind of Natural Sounds to expreſs the affection of the Speaker. The different Paſſions have, for the moſt part, different Interjections to expreſs them. The Interjection *O*, placed before a Subſtantive, expreſſes more ſtrongly an addreſs made to that perſon or thing; as it marks in Latin what is called the Vocative Caſe.

Interjections in Engliſh have no government, though they are uſually attended with Nouns in the Nominative caſe, and Verbs in the Indicative mode; yet the caſe and mode are not influenced by them, but determined by the nature of the ſentence.

CHAP. IV. SYNTAX.

Syntax is the proper conſtruction or due diſpoſition of the words of a language into ſentences or phraſes.

SENTENCES.

A Sentence is an aſſemblage of words, expreſſed in proper form, and ranged in proper order, and concurring to make a complete ſenſe. Sentences are either Simple, or Compounded. A Simple Sentence hath in it but one Subject, and one Finite Verb; that is, a Verb in the Indicative, Imperative, or Subjunctive Mode. The Principal Parts of a Simple Sentence are the Agent, the Attribute, and the Object. The Agent is the thing chiefly ſpoken of; the Attribute is the thing or action affirmed or denied of it: and the Object is the thing affected by ſuch action. In Engliſh the Nominative Caſe, denoting the Agent, uſually goes before the Verb or Attribution; and the Objective Caſe, denoting the Object, follows the Verb Active; and it is the order that determines the Caſe in Nouns: as, "Alexander conquered the Perſians." But the Pronoun, having a proper form for each of thoſe Caſes, ſometimes, when it is in the Objective Caſe, is placed before the Verb; and, when it is the Nominative Caſe, follows the Object and Verb: as, "Whom ye ignorantly worſhip, *him declare* I unto you:" And the Nominative Caſe is ſometimes placed after a Verb Neuter: as, "Upon thy right hand *did ſtand the Queen*:" "On a ſudden *appeared the King*." And always, when the Verb is accompanied with the Adverb *there*; as, "there *was a man*." The reaſon of it is plain: the Neuter Verb not admitting of an Objective Caſe after it, no ambiguity of Caſe can ariſe from ſuch a poſition of the Noun; and where no inconvenience attends it, variety itſelf is pleaſing.

Simple Sentences are, Explicative, or explaining: Interrogative, or aſking: Imperative, or commanding. An explicative Sentence is, when a thing is ſaid to be, or not to be; to do, or not to do; to ſuffer, or not to ſuffer; in a direct manner: as in the foregoing examples. If the Sentence be Negative, the Adverb *not* is placed after the Auxiliary; or after the Verb itſelf, when it has no Auxiliary: as, "it *did not* touch him;" or, "it *touched* him *not*." In an Interrogative Sentence, or when a Queſtion is aſked, the Nominative Caſe follows the Principal Verb, or the Auxiliary: as, "*was* it he?" "*did Alexander* conquer the Perſians?" And the Adverb *there*, accompanying the Verb Neuter, is alſo placed after the Verb: as, "*was there a man?*" So that the Queſtion depends entirely on the order of the words. In an Imperative Sentence, when a thing is commanded to be, to do, to ſuffer, or not; the Nominative caſe follows the Verb, or the Auxiliary: as, "*Go, thou* traitor;" or, "*do thou* go;" or the Auxiliary *let*, with the Objective caſe after it, is uſed: as, "*let us* be gone."

The Adjective in Engliſh having no variation of Gender or Number, cannot but agree with the Subſtantive in thoſe reſpects; ſome of the Pronominal Adjectives only excepted, which have the plural number, as *thoſe*, *theſe*, which muſt agree in number with their ſubſtantives. Every Nominative caſe, except the caſe Abſolute, and when an addreſs is made to a Perſon, belongs to ſome Verb, either expreſſed or implied: as in the anſwer to a Queſtion: "Who wrote this Book? Cicero:" that is, Cicero *wrote it*." Or when the verb is underſtood, as, "To whom thus Adam:" that is, *ſpake*. Every Poſſeſſive caſe ſuppoſes ſome Noun to which it belongs: as when we ſay, "St. Paul's, or St. James's," we mean St. Paul's *Church*, or St. James's *Palace*. Every Adjective has relation to ſome Subſtantive, either expreſſed or implied: as, "The Twelve," that is, *Apoſtles*; "the wiſe, the elect," that is, *perſons*. Two Negatives in Engliſh deſtroy one another, or are equivalent to an Affirmative: as,

> "*Nor* did they *not* perceive the evil plight
> In which they were, or the fierce pains *not* feel." *Milton, P.L.* i. 335.

Two or more Simple Sentences, joined together by one or more Connective Words, become a compounded Sentence. There are two ſorts of words, which connect Sentences: 1. Relatives; 2. Conjunctions.

Examples: 1. "Bleſſed is the man, *who* feareth the Lord." 2. "Life is ſhort, *and* art is long." 1. and 2. "Bleſſed is the man, *who* feareth the Lord, and keepeth his commandments."

The Relatives, *who*, *which*, *that*, having no variation of gender or number, cannot but agree with their Antecedents. *Who* is appropriated to perſons; and ſo may be accounted Maſculine and Feminine only: we apply *which* now to things only; and to Irrational Animals, excluding them from Perſonality, without any conſideration of Sex; *which* therefore may be accounted Neuter. But formerly they were both indifferently uſed of perſons: "Our Father, *which* art in heaven." *That* is uſed indifferently both of perſons and things: but it would better become the ſolemn ſtyle to reſtrain it more to the latter, than is uſually done. *What* includes both the Antecedent and the Relative: as, "This was *what* he wanted;" that is, "*the thing which* he wanted." The Relative is the Nominative Caſe to the Verb, when no other Nominative comes between it and the Verb: but when another Nominative comes between it and the Verb, the Relative is governed by ſome word in its own member of the Sentence: as, "The God *who* preſerveth me; *whoſe* I am, and *whom* I ſerve." Becauſe in the different members of the ſentence the Relative performs a different office: in the firſt member it repreſents the Agent; in the ſecond the poſſeſſor; in the third the object of an action: and therefore muſt be in the different Caſes, correſponding to thoſe offices. Every Relative muſt have an Antecedent to which it refers, either expreſſed, or underſtood: as, "*Who* ſteals my purſe, ſteals traſh;" that is, "*the man, who*—"

The accuracy and clearneſs of the ſentence depend very much upon the proper and determinate uſe of the Relative; ſo that it may readily preſent its Antecedent to the mind of the hearer, or reader, without any obſcurity or ambiguity. The ſame may be obſerved of the Pronoun and the Noun; which by ſome are called alſo the Relative and the Antecedent.

Adverbs have no Government. The Adverb, as its name imports, is generally placed cloſe or near to the word, which it modifies or effects; and its propriety and force depends on its poſition. Its place for the moſt part is before Adjectives; after Verbs Active or Neuter; and it frequently ſtands between the Auxiliary and the Verb; as, "He made a *very elegant* harangue; he *ſpake unaffectedly* and *forcibly*; and *was attentively heard* by the whole audience."

Conjunctions have ſometimes a Government of Modes. Some Conjunctions require the Indicative, ſome the Subjunctive Mode, after them: others have no influence at all on the Mode. Hypothetical, Conditional, Conceſſive, and Exceptive Conjunctions ſeem in general to require the Subjunctive Mode after them: as, *if*, *though*, *unleſs*, *except*, *whether—or*, &c.: but by uſe they often admit of the Indicative; and in ſome caſes with propriety. Examples; "*If* thou *be* the Son of God." Matt. iv. 3. "*Though* he *ſlay* me, yet will I put my truſt in him." Job xiii. 15. "*Unleſs* he *waſh* his fleſh." Lev. xii. 6. "No power, *except* it *were* given from above." John xix. 11. "*Whether* it *were* I *or* they, ſo we preach." 1 Cor. xv. 11. The Subjunctive in theſe inſtances implies ſomething contingent or doubtful; the Indicative would expreſs a more abſolute and determinate ſenſe.

Prepositions have a Government of Caſes; and in Engliſh they always require the Objective Caſe after them; as, "*with him*; *from her*, *to me*. The Prepoſition is often ſeparated from the Relative which it governs, and joined to the Verb at the end of the Sentence, or of ſome member of it; as, "Horace is an author, *whom* I am much delighted *with*." "The world is too well bred to ſhock authors with a truth, *which* generally their bookſellers are the firſt that inform them *of*." This is an idiom, which our language is ſtrongly inclined to; it prevails in common converſation, and ſuits very well with the familiar ſtyle in writing; but the placing of the Prepoſition before the Relative is more graceful, as well as more perſpicuous; and agrees much better with the ſolemn and elevated ſtyle. Verbs are often compounded of a Verb and a Prepoſition; as *to uphold, to outweigh, to overlook*: and this compoſition ſometimes gives a new ſenſe to the Verb; as *to underſtand*, *to withdraw*, *to forgive*. But in Engliſh the Prepoſition is more frequently placed after the Verb; and ſeparate from it, like an Adverb; in which ſituation it is no leſs apt to affect the ſenſe of it, and to give it a new meaning; and may ſtill be conſidered as belonging to the Verb, and as a part of it. As, *to caſt*, is to throw; but *to caſt up*, or to compute, *an account*, is quite a different thing; thus, *to fall on*, *to bear out*, *to give over*; &c. So that the meaning of the Verb, and the propriety of the phraſe, depend on the Prepoſition ſubjoined.

PUNCTUATION.

Punctuation is the art of marking in writing the ſeveral pauſes, or reſts, between ſentences, and the parts of ſentences, according to their proper quantity or proportion, as they are expreſſed in a juſt and accurate pronunciation. As the ſeveral articulate ſounds, the ſyllables and words, of which ſentences conſiſt, are marked by Letters; ſo the reſts and pauſes, between ſentences and their parts, are marked by Points. But though the ſeveral articulate ſounds are pretty fully and exactly marked by Letters of known and determinate power; yet the ſeveral pauſes which are uſed in a juſt pronunciation of diſcourſe, are very imperfectly expreſſed by Points. For the different degrees of connexion between the ſeveral parts of ſentences, and the different pauſes in a juſt pronunciation, which expreſs thoſe degrees of connexion according to their proper value, admit of great variety; but the whole number of Points, which we have to expreſs this variety, amounts only to Four. Hence it is, that we are under a neceſſity of expreſſing pauſes of the ſame quantity, on different occaſions, by different points; and more frequently, of expreſſing pauſes of different quantity by the ſame points. So that the doctrine of Punctuation muſt needs be very imperfect: few preciſe rules can be given which will hold without exception in all caſes; but much muſt be left to the judgment and taſte of the writer. On the other hand, if a greater number of marks were invented to expreſs all the poſſible different pauſes of pronunciation; the doctrine of them would be very perplexed and difficult, and the uſe of them would rather embarraſs than aſſiſt the reader. It remains, that we be content with the Rules of Punctuation, laid down with as much exactneſs as the nature of the ſubject will admit: ſuch as may ſerve for a general direction, to be accommodated to different occaſions; and to be ſupplied, where deficient, by the writer's judgment. The ſeveral degrees of Connexion between Sentences, and between their principal conſtructive parts, Rhetoricians have conſidered under the following diſtinctions, as the moſt obvious and remarkable: the Period, Colon, Semicolon, and Comma. The Period is the whole Sentence, complete in itſelf, wanting nothing to make a full and perfect ſenſe, and not connected in conſtruction with a ſubſequent ſentence. The Colon, or Member, is a chief conſtructive part, or greater diviſion of a ſentence. The Semicolon, or Half-member, is a leſs conſtructive part, or ſubdiviſion, of a Sentence or Member. A Sentence or Member is again ſubdivided into Commas, or Segments; which are the leaſt conſtructive parts of a Sentence or Member, in this way of conſidering it; for the next ſubdiviſion would be the reſolution of it into Phraſes and Words. The Grammarians have followed this diviſion of the Rhetoricians, and have appropriated to each of theſe diſtinctions its mark or Point; which takes its name from the part of the Sentence which it is employed to diſtinguiſh; as follows:

The Period	is thus marked	.
The Colon		:
The Semicolon		;
The Comma		,

The proportional quantity, or time, of the points, with reſpect to one another, is determined by the following general rule: The Period is a pauſe in quantity or duration double of the Colon; the Colon is double of the Semicolon; and the Semicolon is double of the Comma. So that they are in the ſame proportion to one another, as the Semibref, the Minim, the Crochet, and the Quaver, in Muſic. The preciſe quantity, or duration, of each Pauſe or Note cannot be defined: for that varies with the Time; and both in Diſcourſe and Muſic the ſame Compoſition may be rehearſed in a quicker or a ſlower Time: but in Muſic the proportion between the Notes remains ever the ſame; and in Diſcourſe, if the doctrine of Punctuation were exact, the proportion between th[illegible] Pauſes would be ever invariable. The Points then being deſign[illegible] to expreſs the Pauſes which depend on the different degrees of connexion between Sentences, and between their principal conſtructive parts; in order to underſtand the meaning of the Points, and to know how to apply them properly, we muſt conſider the nature of a Sentence, as divided into its principal conſtructive parts; and the degrees of connexion, between thoſe parts, upon which ſuch diviſion of it depends. To begin with the leaſt of theſe principal conſtructive parts, the Comma. In order the more clearly to determine the proper application of the Point which marks it, we muſt diſtinguiſh between an Imperfect Phraſe, a Simple Sentence, and a compounded Sentence.

An imperfect Phraſe contains no aſſertion, or does not amount to a Propoſition or Sentence. A Simple Sentence has but one Subject, and one finite Verb. A Compounded Sentence has more than one Subject, or one finite Verb, either expreſſed or underſtood; or it conſiſts of two or more ſimple Sentences connected together. In a Sentence the Subject and the Verb may be each of them accompanied with ſeveral adjuncts; as the Object, the End, the Circumſtances of Time, Place, Manner, and the like: and the Subject or Verb may be either immediately connected with them, or mediately; that is, by being connected with ſome thing, which is connected with ſome other; and ſo on. If the ſeveral Adjuncts affect the Subject or the Verb in a different manner, they are only ſo many imperfect Phraſes; and the Sentence is Simple. A Simple Sentence admits of no Point by which it may be divided, or diſtinguiſhed into parts.

If the ſeveral Adjuncts affect the Subject or the Verb in the ſame manner, they may be reſolved into ſo many Simple Sentences: the Sentence then becomes Compounded, and it muſt be divided into its parts by Points. For, if there are ſeveral ſubjects belonging in the ſame manner to one Verb, or ſeveral Verbs belonging in the ſame manner to one Subject, the Subjects and Verbs are ſtill to be accounted equal in number: for every Verb muſt have its Subject, and every Subject its Verb; and every one of the Subjects, or Verbs, ſhould or may have its point of diſtinction.

EXAMPLES: "The paſſion for praiſe produces excellent effects in women of ſenſe." Addiſon Spect. N° 73. In this Sentence *paſſion* is the Subject, and *produces* the Verb: each of which is accompanied and connected with its Adjuncts. The Subject is not paſſion in general, but a particular paſſion determined by its Adjunct of Specification, as we may call it; the paſſion *for praiſe*. So likewiſe the Verb is immediately connected with its object, *excellent effects*; and mediately, that is, by the intervention of the word *effects*, with *women*, the Subject in which theſe effects are produced; which again is connected with its Adjunct of Specification; for it is not meaned of women in general, but of women *of ſenſe* only. Laſtly, it is to be obſerved, that the Verb is connected with each of theſe ſeveral Adjuncts in a different manner; namely, with *effects*, as the object; with *women*, as the ſubject of them; with *ſenſe*, as the quality or charactereſtic of thoſe women. The Adjuncts therefore are only ſo many imperfect Phraſes; the Sentence is a ſimple Sentence, and admits of no point, by which it may be diſtinguiſhed into parts. "The paſſion for praiſe, which is ſo very vehement in the fair ſex, produces excellent effects in women of ſenſe." Here a new Verb is introduced, accompanied with Adjuncts of its own; and the ſubject is repeated by the Relative Pronoun *which*. It now becomes a Compounded Sentence, made up of two Simple Sentences, one of which is inſerted in the middle of the other; it muſt therefore be diſtinguiſhed into its component parts by a point placed on each ſide of the additional Sentence. "How many inſtances have we [in the fair ſex] of chaſtity, fidelity, devotion! How many Ladies diſtinguiſh themſelves by the education of their children, care of their families, and love of their huſbands; which are the great qualities and atchievements of womankind: as the making of war, the carrying on of traffic, the adminiſtration of juſtice, are thoſe by which men grow famous, and get themſelves a name!"

In the firſt of theſe two Sentences, the Adjuncts *chaſtity*, *fidelity*, *devotion*, are connected with the Verb by the word *inſtances* in the ſame manner, and in effect make ſo many diſtinct Sentences: "how many inſtances have we of chaſtity! how many inſtances have we of fidelity! how many inſtances have we of devotion!" They muſt therefore be ſeparated from one another by a Point. The ſame may be ſaid of the Adjuncts, "education of their children, &c." in the former part of the next Sentence: as likewiſe o the ſeveral Subjects, "the making of war, &c." in the latter part; which have in effect each their Verb; for each of theſe "is an atchievement by which men grow famous." As Sentences themſelves are divided into Simple and Compounded, ſo the Members of Sentences may be divided likewiſe into Simple and Compounded Members: for whole Sentences, whether Simple or Compounded, may become Members of other Sentences by means of ſome additional connection. Simple Members of Sentences cloſely connected together in one compounded member, or ſentence, are diſtinguiſhed or ſeparated by a Comma: as in the foregoing examples. So likewiſe, the Caſe Abſolute; Nouns in Appoſition, when conſiſting of many terms; the Participle with ſomething depending on it; are to be diſtinguiſhed by the Comma: for they may be reſolved into Simple Members. When an addreſs is made to a perſon, the Noun anſwering to the Vocative Caſe in Latin, is diſtinguiſhed by a Comma.

EXAMPLES: "This ſaid, He form'd thee, Adam; thee, O man,
Duſt of the ground."
"Now morn, her roſy ſteps in th' eaſtern clime,
Advancing, ſow'd the earth with orient pearl." *Milton.*

Two Nouns, or two Adjectives, connected by a ſingle Copulative or Disjunctive, are not ſeparated by a Point: but when there are more than two, or where the Conjunction is underſtood, they muſt be diſtinguiſhed by a Comma. Simple Members connected by Relatives, and Comparatives, are for the moſt part diſtinguiſhed by a Comma: but when the Members are ſhort in Comparative Sentences; and when two Members are cloſely connected by a Relative, reſtraining the general notion of the Antecedent to a particular ſenſe; the pauſe becomes almoſt inſenſible, and the Comma is better omitted.

EXAMPLES: "Raptures, tranſports, and extaſies, are the rewards which they confer: ſighs and tears, prayers and broken hearts, are the offerings which are paid to them." Addiſon.

"Gods partial, changeful, paſſionate, unjuſt;
Whoſe attributes were rage, revenge, or luſt." *Pope.*

"What is ſweeter than honey? and what is ſtronger than a lion?" A circumſtance of importance, though no more than an Imperfect Phraſe, may be ſet off with a Comma on each ſide, to give it greater force and diſtinction.

EXAMPLE: "The principle may be defective or faulty; but the conſequences it produces are ſo good, that, for the benefit of mankind, it ought not to be extinguiſhed." Addiſon. A Member of a Sentence, whether Simple or Compounded, that requires a greater pauſe than a Comma, yet does not of itſelf make a complete Sentence, but is followed by ſomething, cloſely depending on it, may be diſtinguiſhed by a Semicolon.

EXAMPLE: "But as this paſſion for admiration, when it works according to reaſon, improves the beautiful part of our ſpecies in every thing that is laudable; ſo nothing is more deſtuctive to them, when it is governed by vanity and folly." Addiſon. Here the whole Sentence is divided into two parts by the Semicolon; each of which parts is a Compounded Member, divided into its

Simple Members by the Comma. A Member of a Sentence, whether Simple or Compounded, which of itſelf would make a complete Sentence, and ſo requires a greater pauſe than a Semicolon, yet is followed by an additional part making a more full and perfect Senſe, may be diſtinguiſhed by a Colon.

Example: " Were all books reduced to their quinteſſence, many a bulky author would make his appearance in a penny paper: there would be ſcarce any ſuch thing in nature as a folio; the works of an age would be contained on a few ſhelves: not to mention millions of volumes, that would be utterly annihilated. Addiſon, Spect. N° 124. Here the whole Sentence is divided into four parts by Colons: the firſt and laſt of which are Compounded Members, each divided by a Comma: the ſecond and third are Simple Members. When a Semicolon has preceded, and a greater pauſe is ſtill neceſſary; a Colon may be employed, though the Sentence be incomplete. The Colon is alſo commonly uſed, when an Example, or a Speech, is introduced. When a Sentence is ſo far perfectly finiſhed as not be connected in conſtruction with the following Sentence, it is marked with a Period. In all caſes, the proportion of the ſeveral Points in reſpect to one another is rather to be regarded, than their ſuppoſed preciſe quantity, or proper office, when taken ſeparately. Beſide the Points which mark the pauſes in diſcourſe, there are others which denote a different modulation of the voice in correſpondence with the ſenſe. Theſe are,

The Interrogation Point,	thus marked	?
The Exclamation Point,		!
The Parentheſis,		()

The Interrogation and Exclamation Points are ſufficiently explained by their names; they are indeterminate as to their quantity or time, and may be equivalent in that reſpect to a Semicolon, a Colon, or a period, as the ſenſe requires. They mark an Elevation of the voice. The Parentheſis incloſes in the body of a Sentence a Member inſerted into it, which is neither neceſſary to the Senſe, nor at all affects the Conſtruction. It marks a moderate Depreſſion of the voice, with a pauſe greater than a Comma.

A PRAXIS,

Or Example of Grammatical Reſolution, of a Sentence into its different Parts of Speech, in order to explain the Rules of Syntax.

1. In the fifteenth year of the reign of Tiberius Cæſar, Pontius Pilate being governor of Judea, the word of God came unto John, the ſon of Zacharias, in the wilderneſs. *In* is a Prepoſition; *the*, the Definite Article; *fifteenth*, an Adjective; *year*, a Subſtantive, or Noun, in the Objective Caſe, governed by the Prepoſition *in*; *of*, a Prepoſition; *the reign*, a Subſtantive, Objective Caſe, governed by the Prepoſition *of*; *Tiberius Cæſar*, both Subſtantives, Proper Names, Government and Caſe as before; *Pontius Pilate*, Proper Names: *being*, the preſent Participle of the Verb Neuter *to be*; *governor*, a Subſtantive; *of Judea*, a Proper Name, Government and Caſe as before; *Pontius Pilate being governor*, is the Caſe Abſolute; that is, the Nominative Caſe with a participle without a Verb following and agreeing with it; the meaning is the ſame as, *when* Pilate was governor; *the word*, a Subſtantive; *of God*, a Subſtantive, Objective Caſe, governed by the Prepoſition *of*; *came*, a Verb Neuter, Indicative Mode, Paſt Time, third Perſon Singular Number, agreeing with the Nominative Caſe *word*; *unto*, a Prepoſition; *John*, a Proper Name; *the ſon*, a Subſtantive, put in Oppoſition to *John*; that is, in the ſame Caſe, governed by the ſame Prepoſition *unto*; *of Zacharias*, a Proper Name; *in*, a Prepoſition; *the wilderneſs*, a Subſtantive, Government and Caſe as before.

2. And he came into all the country about Jordan, preaching the baptiſm of repentance for the remiſſion of ſins. *And* a Conjunction Copulative; *he*, a Pronoun, third Perſon Singular, Maſculine Gender, Nominative Caſe, ſtanding for *John*; *came*, as before; *into*, a Prepoſition; *all*, an Adjective; *the country*, a Subſtantive; *about*, a Prepoſition; *Jordan*, a Proper Name; Objective Caſes, governed by their Prepoſitions; *preaching*, the preſent Participle of the Verb Active *to preach*, joined like an Adjective to the Pronoun *he*; *the baptiſm*, a Subſtantive in the Objective Caſe following the Verb Active *preaching*, and governed by it; *of repentance*, a Subſtantive. Government and Caſe as before; *for*, a Prepoſition; *the remiſſion of ſins*, Subſtantives, the latter in the Plural Number, Government and Caſe as before.

3. And the ſame John had his raiment of camel's hair, and a leathern girdle about his loins; and his meat was locuſts and wild honey. *And*, that is, *as before*; *the ſame*, an Adjective; *John*, *had*, a Verb Active, Indicative Mode, Paſt Time, third Perſon Singular, agreeing with the Nominative Caſe *John*; *his*, a Pronoun, third Perſon Singular, Poſſeſſive Caſe; *raiment*, a Subſtantive in the Objective Caſe, following the Verb Active *had*, and governed by it; *of camel's*, a Subſtantive, Poſſeſſive Caſe; *hair*, Subſtantive, Objective Caſe, governed by the Prepoſition *of*, the ſame as, *of the hair of a camel*; *and*, *a*, the Indefinite Article; *leathern*, an Adj. *girdle*, a Subſt. *about*, *his*, *loins*, Subſt. Plural Number, Objective Caſe, governed by the Prepoſition *about*; *and his meat*, Subſt. *was*, Indicative Mode, Paſt Time, third Perſon Singular of the Verb Neuter, *to be*; *locuſts*, Subſtantive, Plural Number, Nominative Caſe after the Verb *was*; *and*, *wild*, Adjective; *honey*, Subſtantive, the ſame Caſe.

4. Then ſaid he to the multitude, that came forth to be baptized of him: O generation of vipers, who hath warned you to flee from the wrath to come; Bring forth therefore fruits meet for repentance. *Then*, an Adverb; *ſaid*, a Verb Active, Paſt Time, third Perſon Singular agreeing with the Nominative Caſe *he*; *to* a Prep. *the multitude*, Subſtantive, Objective Caſe, governed by the Prep. *to*; *that*, a Relative Pronoun, its Antecedent is *the multitude*; *came*, *forth*, an Adverb; *to*, a Prep. and before a Verb the ſign of the Infinitive Mode; *be baptized*, a Verb Paſſive, made of the Participle Paſſive of the Verb *to baptize*, and the Auxiliary Verb *to be*, in the Infinitive Mode; *of him*, Pronoun, third Perſon Sing. ſtanding for *John*, in the Objective Caſe, governed by the Prep. *of*; *O*, an Interjection; *generation*, Subſt. Nominative Caſe; *of Vipers*, Sub. Plural Number, Objective Caſe, governed by the Prep. *of*; *who*, an Interrogative Pronoun; *hath warned*, a Verb Active, Preſent Perfect time, made of the Perfect Participle *warned*, and the Auxiliary Verb *hath*, third Perſon Singular, agreeing with the Nominative Caſe *who*; *you*, Pronoun, ſecond Perſon Plural, Objective Caſe, following the Verb Active *warned*, and governed by it; *to flee*, Verb Neuter, Infinitive Mode; *from*, a Prep. *the Wrath*, Subit. Objective Caſe, governed by the Prep. *from*; *to come*, Verb Neuter, Infinitive Mode; *bring*, Verb Active, Imperative Mode, ſecond Perſon Plural, agreeing with the Nominative Caſe *ye* underſtood; as if it were, *bring ye*; *forth*, an Adverb; *therefore*, a conjunction; *fruits*, a Subſtantive Plural, Objective Caſe, following the Verb Active *bring*, and governed by it; *meet*, an Adjective joined to *fruits*, but placed after it, becauſe it hath ſomething depending on it; *for repentance*, a Subſtantive governed by a Prepoſition, as before.

5. And as all men muſed in their hearts of John, whether he were the Chriſt, or not; John anſwered, ſaying unto them all: I indeed baptize you with water; but one mightier than I cometh, the latchet of whoſe ſhoes I am not worthy to unlooſe: he ſhall baptize you with the Holy Ghoſt, and with fire.

And, *as*, a Conjunction: *all*, *men*, Subſt. Plural Number; *muſed*, a Verb Active, Paſt Time, third Perſon Plural, agreeing with the Nominative Caſe *men*; *in*, *their*, a Pronominal Adjective, from the Pronoun *they*; *hearts*, Subſt. Plural Number, Objective Caſe governed by the Prep *in*; *of John*, *whether*, a Conjuction; *he*, *were*, Subjunctive mode, governed by the Conjunction *whether*, Paſt Time, third Perſon Sing. of the Verb *to be*, agreeing with the Nominative Caſe *he*; *the Chriſt*, Subſt. Nominative Caſe after the Verb *were*; *or*, a Disjunctive Conjunction, corrreſponding to the preceding Conjunction *whether*; *not*, an Adverb; *John anſwered*, a Verb Active, Indicative Mode, Paſt Time, third Perſon Sing. agreeing with the Nominative Caſe *John*; *ſaying*, Preſent Participle of the Verb Active *to ſay*, joined to the Subſtantive *John*; *unto them*, a Pronoun, third Perſon Plural, Objective Caſe governed by the Prepoſition *unto*; *all I*, Pronoun, firſt Perſon Singular; *indeed*, an Adverb; *baptize*, a Verb Active, Indicative Mode, Preſent Time, firſt Perſon Singular, agreeing with the Nominative Caſe *I*; *you*, Pronoun, ſecond Perſon Plural, Objective Caſe, following the Verb Active *baptize* and governed by it; *with*, a Prep. *water*, Subſt. Objective Caſe, is governed by the Prepoſition *with*; *but*, a Disjunctive Conjunction; *one*, a Pronoun, ſtanding for ſome Perſon not mentioned by name; *mightier*, an Adjective in the Comparative Degree, from the Poſitive *mighty*; *than*, a Conjunction, uſed after a Comparative word; *I*, the verb *am* being underſtood; that is, *than I am*; *cometh*, a Verb Neuter, Indicative Mode, Preſent Time, third Perſon Sing. agreeing with the Nominative Caſe, *one*; *the latchet*, Subſt. *of*, *whoſe*, Pronoun Relative, *one* being the Antecedent to it in the Poſſeſſive Caſe; *ſhoes*, Subſt. Plural, Objective Caſe, governed by the Prepoſition *of*; *I*, *am*, Indicative Mode, Preſent Time, firſt Perſon Sing. of the Verb *to be*, agreeing with the Nominative Caſe *I*; *not worthy*, an Adjective; *to unlooſe*, a Verb Active, in the Infinitive Mode, governing the Subſtantive *latchet*, in the Objective Caſe; *he*, *ſhall baptize*, a Verb Active, Indicative Mode, Future Time, made by the Auxiliary *ſhall*, third Perſon Sing. agreeing with the Nominative Caſe *he*; *you*, *with the Holy*, an Adjective; *Ghoſt*, a Subſt. *and with fire*, a Subſtantive: this and the former both in the Objective Caſe governed by the Prep. *with*.

In this Syſtem I have endeavoured to explain the fundamental principles of Grammar; firſt, *as conſidered in an* univerſal ſenſe; *and* ſecondly, *in a* limited ſenſe: *The latter I have exemplified in the* Elements of the Engliſh Language. *In order to be as clear and intelligible as poſſible, I have principally attended to plainneſs and perſpicuity in the Definitions. The common Diviſions I have complied with as far as reaſon and truth would permit, and retained the known and received terms, except in ſome inſtances, where I judged others to be more ſignificant. Thoſe diſquiſitions which appeared more intricate than uſeful have been avoided. In a word, it has been my ultimate end in this Syſtem, to facilitate the acquiſition of a branch of Literature equally uſeful and ornamental in the general departments of ſocial life.*

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GRAMMARIAN, one that is ſkilled in, or teaches grammar. Anciently the name *grammarian* was a title of honour, literature, and erudition, being given to perſons accounted learned in any art or faculty whatever. But it is otherwiſe now, being frequently uſed as a term of reproach, to ſignify a dry plodding perſon, employed about words and phraſes, but inattentive to the true beauties of expreſſion and delicacy of ſentiment. The ancient grammarians, called alſo *philologers* muſt not be confounded with the grammatiſts, whoſe ſole buſineſs was to teach children the firſt elements of language. Varro, Cicero, Meſſala, and even Julius Cæſar, thought it no diſhonour to be ranked grammarians, who had many privileges granted to them by the Roman emperors.

GRAMPUS, in ichthyology, a ſpecies of *Delphinus*. For the deſcription ſee *Delphinus*; for claſſification ſee the SYSTEM.

GRANADILLA. See PASSION *flower*.

GRANADO, GRANADA, or GRENADE, in the military art, a hollow ball or ſhell, of iron, braſs, or even glaſs, or potters earth, filled with gunpowder, and fitted with a fuzee to give it fire. The name *granado* takes its riſe hence, that it is filled with grains of powder, as a pomegranate is with kernels. Of theſe there are two kinds; the one large, the other ſmall: the firſt are to be thrown at the enemy by a mortar, properly called BOMBS, or SHELLS. The latter to be caſt with the hand, and thence denominated *hand-granados*. Their compoſition is the ſame with that of BOMBS, which ſee. For ſize, they are uſually between two and three inches in diameter, about the bigneſs of a common iron bullet, and weigh about three pounds: as to dimenſions, they are commonly in thickneſs one eighth, one ninth, or one tenth of their diameter; their aperture, or orifice about $\frac{3}{10}$ wide, as preſcribed by Caſimir.

GRANATE, alſo called GARNET, in natural hiſtory, a gem, or precious ſtone, of a high red colour; thus called from the reſemblance it bears to that of the kernel of a pomegranate. *Granates* are either *oriental*, or *occidental*: the firſt are brought from divers parts of the Eaſt Indies: the ſecond from Spain, Bohemia, and Sileſia. Thoſe from the Eaſt are diſtinguiſhed by their colour into three kinds: the firſt, of a deep browniſh red, like black clotted blood: of which kind there are ſome as big as an hen's egg: the ſecond are nearly of the colour of a hyacinth, with which it were eaſy to confound them, but for their ſuperior redneſs: the laſt having a mixture of violet with their red, are called by the Italians, *rubini della rocha*. The *occidental granates* are of divers reds, according to the places they are found in. Thoſe of Spain imitate the colour of the kernel of a pomegranate: thoſe of Bohemia, have a golden caſt with their red, glittering like a live coal: thoſe of Sileſia are the darkeſt of all, and ſeldom thoroughly tranſparent. Of the occidental *granates*, thoſe of Bohemia are moſt valued; ſome even give them the preference to the oriental kind. They are found near Prague; not in any particular mines, but picked up by peaſants in the fields, from among the ſands and pebbles. This gem is the eighth ſtone in hardneſs from diamond and fuſible by fire.

GRANDEE is underſtood of a lord of the firſt rank or prime quality. In Spain the term *grandees* is uſed abſolutely to denote the prime lords of the courts, to whom the king has once given leave to be covered in his preſence: there are ſome *grandees* for life only; made by the king's ſaying ſimply, be covered. Others are *grandees* by deſcent; made by the king's ſaying, Be covered for thyſelf and heirs. The laſt are reputed far above the former. There are ſome who have three or four *grandeeſhips* in their family.

GRANDEUR *and* SUBLIMITY. Theſe terms have a double ſignification: they commonly ſignify the quality or circumſtance in objects by which the emotions of grandeur and ſublimity are produced; ſometimes the emotions themſelves. In handling the preſent ſubject, it is neceſſary that the impreſſion made on the mind by the magnitude of an object, abſtracting from its other qualities, ſhould be aſcertained. And becauſe abſtraction is a mental operation of ſome difficulty, the ſafeſt method for judging is, to chooſe a plain object that is neither beautiful nor deformed, if ſuch a one can be found. The plaineſt that occurs, is a huge maſs of rubbiſh, the ruins perhaps of ſome extenſive building; or a large heap of ſtones, ſuch as are collected together for keeping in memory a battle or other remarkable event. Such an object, which in miniature would be perfectly indifferent, makes an impreſſion by its magnitude, and appears agreeable. And ſuppoſing it ſo large, as to fill the eye, and to prevent the attention from wandering upon other objects, the impreſſion it makes will be ſo much the deeper. See ATTENTION. But though a plain object of that kind be agreeable, it is not termed *grand*; it is not entitled to that character, unleſs, together with its ſize, it be poſſeſſed of other qualities that contribute to beauty, ſuch as regularity, proportion, order, or colour: and according to the number of ſuch qualities combined with magnitude, it is more or leſs grand. Thus St. Peter's church at Rome, the great pyramid of Egypt, the Alps towering above the clouds, a great arm of the ſea, and above all a clear and ſerene ſky, are grand; becauſe, beſide their ſize, they are beautiful in an eminent degree. On the other hand, an overgrown whale, having a diſagreeable appearance, is not grand. A large building agreeable by its regularity and proportions, is grand; and yet a much larger building deſtitute of regularity, has not the leaſt tincture of grandeur. A ſingle regiment in battle-array, makes a grand appearance; which the ſurrounding crowd does not, though perhaps ten for one in number. Thus greatneſs or magnanimity is the circumſtance that diſtinguiſhes grandeur from beauty: agreeableneſs is the genus, of which beauty and grandeur are ſpecies. The emotion of grandeur, duly examined, will be found an additional proof of the foregoing doctrine. That this emotion is pleaſant in a high degree, requires no other evidence but once to have ſeen a grand object: and if an emotion of grandeur be pleaſant, its cauſe or object, as obſerved before, muſt infallibly be agreeable in proportion. The qualities of grandeur and beauty are not more diſtinct, than the emotions are which theſe qualities produce in a ſpectator. All the various emotions of beauty have one common character, that of ſweetneſs and gaiety. The emotion of grandeur has a different character: A large object that is agreeable, occupies the whole attention, but that object though extremely pleaſant, is rather ſerious than gay. And this affords a good reaſon for diſtinguiſhing in language theſe different emotions. In a word, regularity, proportion, order, and colour, contribute to grandeur as well as to beauty; but with a remarkable difference, that in paſſing from ſmall to great, they are not required in the ſame degree of perfection. This remark ſerves to explain the extreme delight we have in viewing the face of nature, when ſufficiently enriched and diverſified with objects. The bulk of the objects in a natural landſcape are beautiful, and ſome of them grand: a flowing river, a ſpreading oak, a round hill, an extended plain, are delightful; and even a rugged rock, or barren heath, though in themſelves diſagreeable, contribute by contraſt to the beauty of the whole; joining to theſe the verdure of the fields, the mixture of light and ſhade, and the ſublime canopy ſpread over all; it will not appear wonderful, that ſo extenſive a groupe of ſplendid objects ſhould ſwell the heart to its utmoſt bounds, and raiſe the ſtrongeſt emotion of grandeur. The ſpectator is conſcious of an enthuſiaſm which cannot bear confinement, nor the ſtrictneſs of regularity and order: he loves to range at large; and is ſo enchanted with magnificent objects, as to overlook ſlight beauties or deformities.

The ſame obſervation is applicable in ſome meaſure to works of art. In a ſmall building, the ſlighteſt irregularity is diſagreeable: but in a magnificent palace, or a large Gothic church, irregularities are leſs regarded. In an epic poem, we pardon many negligences that would not be permitted in a ſonnet or epigram. Notwithſtanding ſuch exceptions, it may be juſtly laid down for a rule, That in works of art, order and regularity ought to be governing principles; and hence the obſervation of Longinus, "In works of art we have regard to exact proportion: in thoſe of nature, to grandeur and magnificence." The ſame reflections are in a good meaſure applicable to ſublimity; particularly, that, like grandeur, it is a ſpecies of agreeableneſs; that a beautiful object placed high, appearing more agreeable than formerly, produces in the ſpectator a new emotion, termed *the emotion of ſublimity*; and that the perfection of order, regularity, and proportion, is leſs required in objects placed high, or at a diſtance, than at hand. The pleaſant emotion raiſed by large objects, has not eſcaped the poets:

——He doth beſtride the narrow world
Like a Coloſſus; and we petty men
Walk under his huge legs. *Julius Cæſar, act* 1. *ſc.* 3.
Cleopatra. I dreamt there was an emp'ror Anthony:
Oh ſuch another ſleep, that I might ſee
But ſuch another man!
His face was as the heav'ns: and therein ſtuck
A ſun and moon, which kept their courſe, and lighted
The little O o'th' earth.
His legs beſtrid the ocean, his rear'd arm
Creſted the world. *Anthony and Cleopatra, act* 5. *ſc.* 3.
————Majeſty
Dies not alone; but, like a gulph, doth draw
What's near it with it. It's a maſſy wheel
Fix'd on the ſummit of the higheſt mount;
To whoſe huge ſpokes ten thouſand leſſer things
Are mortis'd and adjoin'd; which when it falls
Each ſmall annexment, petty conſequence
Attends the boiſt'rous ruin. *Hamlet, Act* 3. *ſc.* 8.

The poets have alſo made good uſe of the emotion produced by the elevated ſituation of an object:

Oh thou! the earthly author of my blood,
Whoſe youthful ſpirit, in me regenerate,
Doth with a twofold vigour lift me up,
To reach at victory above my head. *Richard* II. *act* 1. *ſc.* 4.
Anthony. Why was I rais'd the meteor of the world,
Hung in the ſkies, and blazing as I travell'd,
Till all my fires were ſpent; and then caſt downward
To be trod out by Cæſar? *Dryden, All for Love, act* 1.

The deſcription of Paradiſe in the fourth book of *Paradiſe Loſt*, is a fine illuſtration of the impreſſion made by elevated objects:

So on he fares, and to the border comes
Of Eden, where delicious Paradiſe,
Now nearer, crowns with her incloſure green,
As with a rural mound, the champain head
With a ſteep wilderneſs; whoſe hairy ſides
Of thicket overgrown, groteſque and wild,
Acceſs deny'd and over head up grew
Inſuperable height of loftieſt ſhade,
Cedar, and pine, and fir, and branching palm,
A ſylvan ſcene; and as the ranks aſcend,
Shade above ſhade, a woody theatre
Of ſtatelieſt view. Yet higher than their tops

The verd'rous wall of Paradiſe up ſprung;
Which to our general ſire gave proſpect large
Into his nether empire, neighb'ring round.
And higher than that wall a circling row
Of goodlieſt trees, loaden with faireſt fruit,
Bloſſoms and fruits at once of golden hue
Appear'd, with gay enamell'd colours mix'd.

Though a grand object is agreeable, we muſt not infer that a little object is diſagreeable; which would be unhappy for man, conſidering that he is ſurrounded with ſo many objects of that kind. The ſame holds with reſpect to place: a body placed high is agreeable; but the ſame body placed low, is not by that circumſtance rendered diſagreeable. The difference between great and little with reſpect to agreeableneſs, is remarkably felt in a ſeries when we paſs gradually from the one extreme to the other. A mental progreſs from the capital to the kingdom, from that to Europe—to the whole earth—to the planetary ſyſtem—to the univerſe, is extremely pleaſant: the heart ſwells, and the mind is dilated at every ſtep. The ſame obſervation holds in a progreſs upward and downward. Aſcent is pleaſant becauſe it elevates us; but deſcent is never painful: to look down upon objects, makes part of the pleaſure of elevation: looking down becomes only painful when the object is ſo far below as to create dizzineſs; and even when that is the caſe, we feel a ſort of pleaſure mixed with the pain: witneſs Shakeſpear's deſcription of Dover cliffs:

———————— How fearful
And dizzy 'tis, to caſt one's eye ſo low!
The crows and coughs, that wing the midway air,
Show ſcarce ſo groſs as beetles. Half-way down
Hangs one that gathers ſamphire; dreadful trade!
Methinks he ſeems no bigger than his head.
The fiſhermen that walk upon the beach,
Appear like mice; and yon tall anchoring bark
Diminiſh'd to her cock; her cock, a buoy
Almoſt too ſmall for ſight. The murmuring ſurge,
That on th' unnumber'd idle pebble chafes,
Cannot be heard ſo high. I'll look no more,
Leſt my brain turn, and the deficient ſight
Topple down headlong. *King Lear, act* 4. *ſc.* 6.

A remark is made above, that the emotions of grandeur and ſublimity are nearly allied. And hence it is, that the one term is frequently put for the other: an increaſing ſeries of numbers, for example, producing an emotion ſimilar to that of mounting upward, is commonly termed *an aſcending ſeries*: a ſeries of numbers gradually decreaſing, producing an emotion ſimilar to that of going downward, is commonly termed *a deſcending ſeries*: we talk familiarly of going *up* to the capital, and of going *down* to the country: from a leſſer kingdom we talk of going *up* to a greater; whence the *anabaſis* in the Greek language, when one travels from Greece to Perſia. We diſcover the ſame way of ſpeaking in the language even of Japan; and its univerſality proves it the offspring of a natural feeling.

The foregoing obſervation leads us to conſider grandeur and ſublimity in a figurative ſenſe, and as applicable to the fine arts. Hitherto theſe terms have been taken in their proper ſenſe, as applicable to objects of ſight only: and it was of importance to beſtow ſome pains upon that article; becauſe, generally ſpeaking, the figurative ſenſe of a word is derived from its proper ſenſe, which holds remarkably at preſent. Beauty, in its original ſignification, is confined to objects of ſight; but as many other objects, intellectual as well as moral, raiſe emotions reſembling that of beauty, the reſemblance of the effects prompts us to extend the term *beauty* to theſe objects. This equally accounts for the terms *grandeur* and *ſublimity* taken in a figurative ſenſe. Every emotion, from whatever cauſe proceeding, that reſembles an emotion of grandeur or elevation, is called by the ſame name: thus generoſity is ſaid to be an *elevated* emotion, as well as great courage; and that firmneſs of ſoul which is ſuperior to misfortunes, obtains the peculiar name of *magnanimity*. On the other hand, every emotion that contracts the mind, and fixeth it upon things trivial or of no importance, is termed *low*, by its reſemblance to an emotion produced by a little or low object of ſight: thus an appetite for trifling amuſements, is called *a low taſte*. The ſame terms are applied to characters and actions: we talk familiarly of an *elevated* genius, of a *great* man, and equally ſo of *littleneſs* of mind: ſome actions are *great* and *elevated*, and others are *little* and *groveling*. Sentiments, and even expreſſions, are characteriſed in the ſame manner: an expreſſion or ſentiment that raiſes the mind, is denominated *great* or *elevated*; and hence the SUBLIME in poetry. In ſuch figurative terms, we loſe the diſtinction between *great* and *elevated* in their proper ſenſe; for the reſemblance is not ſo entire, as to preſerve theſe terms diſtinct in their figurative application. We carry this figure ſtill farther. Elevation, in its proper ſenſe, imports ſuperiority of place; and lowneſs, inferiority of place: and hence a man of *ſuperior* talents, of *ſuperior* rank; of *inferior* parts, of *inferior* taſte, and ſuch like.

The reſemblance in feeling between real and figurative grandeur, is humorouſly illuſtrated by Addiſon in criticiſing upon Engliſh tragedy: "The ordinary method of making an hero, is to clap a huge plume of feathers upon his head, which riſes ſo high, that there is often a greater length from his chin to the top of his head, than to the ſole of his foot. One would believe, that we thought a great man and a tall man the ſame thing. As theſe ſuperfluous ornaments upon the head, make a great man; a princeſs generally receives her grandeur, from thoſe additional incumbrances that fall into her tail: I mean the broad ſweeping train, that follows her in all her motions; and finds conſtant employment for a boy, who ſtands behind her to open and ſpread it to advantage." The Scythians, impreſſed with the fame of Alexander, were aſtoniſhed when they found him a little man. A gradual progreſs from ſmall to great, is not leſs remarkable in figurative than in real grandeur or elevation. Every one muſt have obſerved the delightful effect of a number of thoughts or ſentiments, artfully diſpoſed like an aſcending ſeries, and making impreſſions deeper and deeper: ſuch diſpoſition of members in a period, is termed a *climax*.

Such a judicious ſelection of capital circumſtances, is by Addiſon, ſtyled *grandeur* of *manner*. In none of the fine arts is there ſo great ſcope for that rule as in poetry; which, by that means, enjoys a remarkable power of beſtowing upon objects and events an air of grandeur: when we are ſpectators, every minute object preſents itſelf in its order; but in deſcribing at ſecond hand, theſe are laid aſide, and the capital objects are brought cloſe together. A judicious taſte in thus ſelecting the moſt intereſting incidents, to give them an united force, accounts for a fact that may appear ſurpriſing; which is, that we are more moved by ſpirited narrative at ſecond hand, than by being ſpectators of the event itſelf, in all its circumſtances.

Longinus exemplifies the foregoing rule by a compariſon of two paſſages.

Ye pow'rs, what madneſs! how on ſhips ſo frail
(Tremendous thought!) can thoughtleſs mortals ſail?
For ſtormy ſeas they quit the pleaſing plain,
Plant woods in waves, and dwell amidſt the main.
Far ov'r the deep (a trackleſs path) they go,
And wander oceans in purſuit of woe.
No eaſe their hearts, no reſt their eyes can find,
On heav'n their looks, and on the waves their mind,
Sunk are their ſpirits, while their arms they rear,
And gods are wearied with their fruitleſs prayer. ARISTÆUS.

Burſt as a wave that from the cloud impends.
And ſwell'd with tempeſts on the ſhip deſcends,
White are the decks with foam: the winds aloud
Howl ov'r the maſts, and ſing through every ſhroud.
Pale, trembling, tir'd, the ſailors freeze with fears,
And inſtant death on every wave appears. HOMER.

In the latter paſſage, the moſt ſtriking circumſtances are ſelected to fill the mind with terror and aſtoniſhment. The former is a collection of minute and low circumſtances, which ſcatter the thought and make no impreſſion; it is at the ſame time full of verbal antitheſes and low conceit, extremely improper in a ſcene of diſtreſs.

The following deſcription of a battle is remarkably ſublime, by collecting together, in the feweſt words, thoſe circumſtances which make the greateſt figure.

"Like autumn's dark ſtorms pouring from two echoing hills, toward each other approached the heroes; as two dark ſtreams from high rocks meet and roar on the plain, loud, rough, and dark in battle, meet Lochlin and Iniſfail. Chief mixes his ſtrokes with chief, and man with man; ſteel ſounds on ſteel, and helmets are cleft on high: blood burſts and ſmokes around; ſtrings murmur on the poliſh'd yew; darts ruſh along the ſky: ſpears fall like ſparks of flame that gild the ſtormy face of night.

"As the noiſe of the troubled ocean when roll the waves on high, as the laſt peal of thundering heaven, ſuch is the noiſe of battle. Though Cormac's hundred bards were there, feeble were the voice a hundred bards to ſend the deaths to future times; for many were the deaths of the heroes, and wide poured the blood of the valiant."

The following paſſage in the 4th book of the Iliad is a deſcription of a battle, wonderfully ardent. "When now gathered on either ſide, the hoſts plunged together in fight; ſhield is harſhly laid to ſhield; ſpears craſh on the brazen corſlets; boſſy buckler with buckler meets; loud tumult rages over all; groans are mixed with boaſts of men: the ſlain and ſlayer join in noiſe; the earth is floating round with blood. As when two ruſhing ſtreams from two mountains come roaring down, and throw together their rapid waters below, they roar along the gulphy vale. The ſtartled ſhepherd hears the ſound, as he ſtalks o'er the diſtant hills; ſo, as they mixed in fight, from both armies clamour with loud terror aroſe." But ſuch general deſcriptions are not frequent in Homer. Even his ſingle combats are rare. The fifth book is the longeſt account of a battle that is in the Iliad; and yet contains nothing but a long catalogue of chiefs killing chiefs, not in ſingle combat neither, but at a diſtance with an arrow or a javelin; and theſe chiefs named for the firſt time and the laſt. The ſame ſcene is continued through a great part of the ſixth book. There is at the ſame time a minute deſcription of every wound, which for accuracy may do honour to an anatomiſt, but in an epic poem is tireſome and fatiguing. There is no relief from horrid languor but the beautiful Greek language and melody of Homer's verſification. In the twenty-firſt book of the Odyſſey, there is a paſſage which deviates widely from the rule above laid down; it concerns that part of the hiſtory of Penelope and her ſuitors, in which ſhe is made to declare in favour of him who ſhould prove the moſt dextrous in ſhooting with the bow of Ulyſſes:

Now gently winding up the fair aſcent,
By many an eaſy ſtep, the matron went:
Then o'er the pavement glides with grace divine,
(With poliſh'd oak the level pavements ſhine);
The folding gates a dazzling light diſplay'd,
With pomp of various architrave o'erlay'd.
The bolt, obedient to the ſilken ſtring,
Forſakes the ſtaple as ſhe pulls the ring;
The wards reſpondent to the key turn'd round;
The bars fall back; the flying valves reſound.
Loud as a bull makes hill and valley ring:
So roar'd the lock when it releas'd the ſpring.
She moves majeſtic through the wealthy room,
Where treaſur'd garments caſt a rich perfume:
There from the column where aloft it hung,
Reach'd, in its ſplendid caſe, the bow unſtrung.

Virgil ſometimes errs againſt this rule: in the following paſſages minute circumſtances are brought into full view; and what is ſtill worſe, they are deſcribed with all the pomp of poetical diction, *Æneid, L.* 1. *l.* 214, *to* 219. *L.* 6. *l.* 176, *to* 182. *L.* 6. *l.* 212, *to* 231. and the laſt, which deſcribes a funeral, is the leſs excuſeable, as the man whoſe funeral it is, makes no figure in the poem. The ſpeech of Clytemneſtra, deſcending from her chariot in the Iphigenia of Euripides, is ſtuffed with a number of common and trivial circumſtances. But of all writers, Lucan in this article is the moſt injudicious: the ſea-fight between the Romans and Maſſilians, is deſcribed ſo much in detail, without exhibiting any grand or total view, that the reader is fatigued with endleſs circumſtances, without ever feeling any degree of elevation; and yet there are ſome fine incidents, thoſe, for example, of the two brothers, and of the old man and his ſon, which, taken ſeparately, would affect us greatly. But Lucan, once engaged in a deſcription, knows no end. See other paſſages of the ſame kind, *L.* 4. *l.* 292, *to* 337. *L.* 4. *l.* 750, *to* 765. The epiſode of the ſorcereſs Ericthọ, end of book 6th, is intolerably minute and prolix. This rule is alſo applicable to other fine arts. In painting it is eſtabliſhed, that the principal figure muſt be put in the ſtrongeſt light; that the beauty of attitude conſiſts in placing the nobler parts moſt in view, and in ſuppreſſing the ſmaller parts as much as poſſible; that the folds of the drapery muſt be few and large; and that the muſcles ought to be kept as entire as poſſible, without being divided into ſmall ſections Each one at preſent ſubſcribes to that rule as applied to gardening, in oppoſition to parterres ſplit into a thouſand ſmall parts in the ſtiffeſt regularity of figure. The moſt eminent architects have governed themſelves by the ſame rule in all their works.

We ſhall produce one inſtance, from Shakeſpear, which ſets a few objects before the eye, without much pomp of language; it operates its effect by repreſenting theſe objects in a climax, raiſing the mind higher and higher till it feel the emotion of grandeur in perfection:

The cloud-capt tow'rs, the gorgeous palaces,
The ſolemn temples, the great globe itſelf,
Yea all which it inherit, ſhall diſſolve, &c.

The cloud-capt tow'rs produce an elevating emotion, heightened by the *gorgeous palaces*; and the mind is carried ſtill higher and higher by the images that follow. Succeſſive images, making thus ſtronger and ſtronger impreſſions, muſt elevate more than any ſingle image can do. As, on the one hand, no means directly applied have more influence to raiſe the mind than grandeur and ſublimity; ſo, on the other, no means indirectly applied have more influence to ſink and depreſs it; for in a ſtate of elevation, the artful introduction of an humbling object, makes the fall great in proportion to the elevation. Of this obſervation Shakeſpear gives a beautiful example, in the paſſage laſt quoted:

The cloud-capt tow'rs, the gorgeous palaces,
The ſolemn temples, the great globe itſelf;
Yea all which it inherit, ſhall diſſolve,
And like the baſeleſs fabric of a viſion
Leave not a rack behind. — *Tempeſt, act.* 4. *ſc.* 4.

The elevation of the mind in the former part of this beautiful paſſage, makes the fall great in proportion, when the moſt humbling of all images is introduced, that of an utter diſſolution of the earth and its inhabitants. The mind, when warned, is more ſuſceptible of impreſſions than in a cool ſtate; and a depreſſing or melancholy object liſtened to, makes the ſtrongeſt impreſſion when it reaches the mind in its higheſt ſtate of elevation. But an humbling image is not always neceſſary to produce that effect: a remark is made above, that in deſcribing ſuperior beings, the reader's imagination, unable to ſupport itſelf in a ſtrained elevation, falls often as from a height, and ſinks even below its ordinary tone. The following inſtance comes luckily in view; for a better cannot be given: "God ſaid, Let there be light, and there was light." Longinus quotes this paſſage from Moſes as a ſhining example of the ſublime; and it is ſcarce poſſible, in fewer words, to convey ſo clear an image of the infinite power of the Deity.

The ſtraining an elevated ſubject beyond due bounds, and beyond the reach of an ordinary conception, is not a vice ſo frequent as to require the correction of criticiſm. But falſe ſublime is a rock that writers of more fire than judgment commonly ſplit on: and therefore a collection of examples may be of uſe as a beacon to future adventurers. One ſpecies of falſe ſublime, known by the name of *bombaſt*, is common among writers of a mean genius: it is a ſerious endeavour, by ſtrained deſcription, to raiſe a low or familiar ſubject above its rank; which, inſtead of being ſublime, fails not to be ridiculous. The mind, indeed, is extremely prone, in ſome animating paſſions, to magnify its objects beyond natural bounds; but ſuch hyperbolical deſcription has its limits; and when carried beyond the impulſe of the propenſity, it degenerates into burleſque. Take the following examples:

Sejanus.————Great and high
The world knows only two, that's Rome and I.
My roof receives me not: 'its air I tread,
And at each ſtep I feel my advanc'd head
Knock out a ſtar in heav'n. *Sejanus, Ben Johnſon, act* 5.

A writer who has no natural elevation of mind, deviates readily into bombaſt: he ſtrains above his natural powers; and the violent effort carries him beyond the bounds of propriety.

Guilford. Give way, and let the guſhing torrent come:
Behold the tears we bring to ſwell the deluge,
Till the flood riſe upon the guilty world,
And make the ruin common. *Lady Jane Gray, act* 4. *near the end.*

Another ſpecies of falſe ſublime, is ſtill more faulty than bombaſt; and that is, to force elevation by introducing imaginary beings without preſerving any propriety in their actions; as if it were lawful to aſcribe every extravagance and inconſiſtence to beings of the poet's creation. No writers are more licentious in that article than Johnſon and Dryden:

Methinks I ſee Death and the Furies waiting
What we will do, and all the heaven at leiſure
For the great ſpectacle. Draw then your ſwords:
And if our deſtiny envy our virtue
The honour of the day, yet let us care
To ſell ourſelves at ſuch a price, as may
Undo the world to buy us, and make Fate,
While ſhe tempts ours, to fear her own eſtate. *Catiline, act* 5.

————The furies ſtood on hills
Circling the place, and trembled to ſee men
Do more than they: whilſt Piety left the field,
Griev'd for that ſide, that in ſo bad a cauſe
They knew not what a crime their valour was.
The Sun ſtood ſtill, and was, behind the cloud
The battle made, ſeen ſweating to drive up
His frightened horſe, whom ſtill the noiſe drove back. *Iliad, act* 5.

An actor on the ſtage may be guilty of bombaſt as well as an author in his cloſet; a certain manner of acting, which is grand when ſupported by dignity in the ſentiment and force in the expreſſion, is ridiculous where the ſentiment is mean and the expreſſion flat.

GRANIVOROUS, an epithet or denomination given to ſuch animals as feed upon corn, or any other grain or ſeeds. *Granivorous* animals are chiefly of the BIRD kind. Theſe have a peculiar proviſion for the digeſting of ſo dry and hard a food. See Comparative ANATOMY, Sect. II.

GRANT, in law, a gift in writing of ſomething incorporeal, not lying in livery, and which cannot aptly be paſſed or conveyed by word only: as rents, reverſions, ſervices, advowſons in groſs, tythes, &c. Or, it is a gift made by ſuch perſons as cannot give but by deed; as the king, or bodies politic. See DONATION. This difference is often, in ſpeech, neglected; and the word *grant* taken generally for any gift whatſoever, made of any thing, by any perſon.

GRANULATION, in chymiſtry, an operation performed on metals, whereby they are reduced into ſmall grains or globules. It is done by melting them, and when in fuſion, caſting them from a certain height into cold water; in which they congeal into granules, as required, and are hereby rendered more eaſy to be diſſolved.

GRAPE, the fruit of the vine. See VITIS.

GRAPPLING, a ſort of ſmall anchor, fitted with four or five flukes or claws, and commonly uſed to ride a boat or other ſmall veſſel.

Fire GRAPPLING, an inſtrument nearly reſembling the former, but differing in the conſtruction of its flukes, which are furniſhed with ſtrong barbs on their points. Theſe machines are uſually fixed on the yard-arms of a ſhip, in order to grapple any adverſary whom ſhe intends to board. They are, however, more particularly uſeful in *fire ſhips* for the purpoſes deſcribed in that article.

GRASS, in botany, &c. a name given to ſeveral diſtinct plants; as the agroſtis or crouch-graſs, the briza or quaking-graſs, &c. Under the term *graſs* alſo are comprehended all manner of herbaceous plants ſerving for the food of cattle, as clover, rye-graſs, &c. For deſcription of the ſeveral kinds of graſs, and the moſt approved methods of their reſpective cultivation, ſee Syſtem of AGRICULTURE, Sect. VIII. IX. and X.

GRASSHOPPER, in entomology, a ſpecies of GRYLLUS. See GRYLLUS.

GRAVE, in grammar, a ſpecies of accent oppoſite to acute. The grave accent is expreſſed thus, (\`); and ſhews, that the voice is to be depreſſed, and the ſyllable over which it is placed, pronounced in a low, deep tone. See Syſtem of GRAMMAR, Part II. Chap II.

GRAVEL, in medicine, a diſeaſe of the bladder and kidneys, occaſioned by a ſandy or gritty matter gathered therein, which cohering into a ſtony maſs, prevents the due ſecretion and excretion of the urine. The *gravel* is generally conſidered as the ſame diſeaſe with the calculus or ſtone. The cauſes and ſymptoms of the *gravel* and ſtone are much the ſame, and they require a ſimilar treatment, both with regard to regimen and medicine. See Syſtem of MEDICINE.

GRAVER, a ſteel inſtrument, ſerving to engrave on metals. The *graver* conſiſts of four ſides or faces, and the point uſually terminates in a lozenge: in ſome it is round, and in others ſquare. See ENGRAVING.

GRAVING, the act or art of cutting lines, figures and deſigns, on metals; more properly called ENGRAVING, which ſee.

GRAVITATION, in natural philoſophy, is ſometimes diſtinguiſhed from *gravity*. Thus M. Maupertuis takes gravity for that force whereby a body would fall to the earth; but gravitation for the ſame diminiſhed by the centrifugal force. See NEWTONIAN *Philoſophy*.

GRAVITY, or GRAVITATION, (for the words are moſt commonly uſed ſynonymouſly,) ſignifies either the force by which bodies are preſſed towards the ſurface of the earth, or the manifeſt effect of that force; in which laſt ſenſe the word has the ſame ſignification with *weight*, or *heavineſs*. Concerning gravity in the firſt ſenſe of the word, or that active power by which all bodies are impelled towards the earth, there have been great diſputes. Many eminent philoſophers, and among the reſt Sir Iſaac Newton himſelf, have conſidered it as the firſt of all ſecond cauſes; an incorporeal or ſpiritual ſubſtance, which never can be perceived any other way than by its effects; and univerſal property of matter, &c. Others have attempted to explain the phenomena of gravitation by the action of a very ſubtile etherial fluid; and to this explanation Sir Iſaac, in the latter part of his life, ſeems not to have been averſe. He hath even given a conjecture concerning the manner in which this fluid might occaſion theſe phenomena. But for a full account of the diſcoveries of this great philoſopher concerning the laws of gravitation, the conjectures made by him and others concerning its cauſe, the various objections that have been made to his doctrine, and the ſtate of the diſpute at preſent, ſee the articles NEWTONIAN *Philoſophy*. EARTH, ELECTRICITY, FIRE, LIGHT, ATTRACTION, REPULSION, PLENUM, VACUUM, &c.

Specific GRAVITY, denotes the weight belonging to an equal bulk of every different ſubſtance. Thus the exact weight of a cubic inch of gold, compared with a cubic inch of water, tin, lead, &c. is called its *ſpecific gravity*. See HYDROSTATICS.

GREASE, among farriers, &c. a ſwelling and gourdineſs of the legs of a horſe. For the cauſes and methods of cure, ſee Syſtem of FARRIERY, Part II. Claſs II. Sect V.

GREAT, a term of COMPARISON, denoting a thing to have more extenſion than ſome other to which it is referred. Thus we ſay, a *great* ſpace; a *great* diſtance; a *great* figure; a *great* body, &c. GREAT is likewiſe uſed figuratively, in matters of morality, &c. to ſignify ample, noble, elevated, extraordinary, important, &c. Thus we ſay, Shakeſpeare was a *great* genius; queen Elizabeth had a *great* ſoul; Cromwell was a man of *great* deſigns; Da Vinci, a *great* painter; Galileo a *great* philoſopher; Boſſu a *great* critic, &c.

GREAT is alſo a title of quality appropriated to certain princes, and other illuſtrious perſonages. Thus we ſay the *great* Turk; the *great* Mogul; the *great* cham of Tartary; the *great* duke of Florence, &c.

GREAT is alſo a ſurname beſtowed on ſeveral kings and emperors. Thus we ſay, Alexander the *great*; Cyrus the *great*; Charles the *great*; or Charlemagne; Henry the *great* of France, &c. So the Engliſh frequently ſay, Edward the *great*, or the *great* Edward: William the *great*, meaning king William III. or the *great* William. The French ſay Louis the *great*, *le grand*, ſpeaking of Louis XIV. Giles of Paris ſays, Charlemagne firſt got the ſurname *great* from the tallneſs and eminence of his ſtature. Helgaud adds, that Hugh the *great* of France was thus denominated on account of his *great* piety, goodneſs, &c.

GREEK, or GRECIAN, any thing belonging to ancient Greece. The Greek language, as preſerved in the writings of the celebrated authors of antiquity, as Homer, Heſiod, Demoſthenes, Ariſtotle, Plato, Xenophon, &c. has a great variety of terms and expreſſions, ſuitable to the genius and occaſions of a polite and learned people, who had a taſte for arts and ſciences. In it, proper names are ſignificative; which is the reaſon that the modern languages borrow ſo many terms from it. When any new invention, inſtrument, machine, or the like, is diſcovered, recourſe is generally had to the Greek for a name to it; the facility wherewith words are there compounded, affording ſuch as will be expreſſive of its uſe: ſuch are, barometer, hygrometer, microſcope, teleſcope, thermometer, &c. But of all ſciences, medicine moſt abounds with ſuch terms; as diaphoretic, diagnoſis, diarrhœa, hæmorrhage, hydrophobia, phthiſis, atrophy, &c. Beſides the copiouſneſs and ſignificancy of the Greek, wherein it excels moſt, if not, all other languages, it has alſo three numbers, viz. a ſingular, dual, and plural: alſo abundance of tenſes in its verbs, which makes a variety in diſcourſe, prevents a certain dryneſs that always accompanies too great an uniformity, and renders that language peculiarly proper for all kinds of verſe. The uſe of the participles, of the aoriſt and preterite, together with the compound words already mentioned, give it a peculiar force and brevity without taking any thing from its perſpicuity. It is no eaſy matter to aſſign the preciſe difference between the modern and ancient Greek; which conſiſts in the terminations of the nouns, pronouns, verbs, &c. not unlike what obtains between ſome of the dialects of the Italian or Spaniſh. There are alſo in the modern Greek many new words, not to be met with in the ancient. We may therefore diſtinguiſh three ages of the Greek tongue: the firſt of which ends at the time when Conſtantinople became the capital of the Roman empire; the ſecond laſted from that period to the taking of Conſtantinople by the Turks; and the third, from that time to this.

GREEK *Bible*. See BIBLE.

The New Teſtament was tranſlated into modern *Greek* by Maximus a monk, who flouriſhed about the year 1630. It was undertaken at the requeſt of Cornelius Haga, the Dutch ambaſſador at the Port of Conſtantinople, and is prefaced and recommended by the patriarch Cyrillus Lucaris. An edition of this verſion, with the ancient *Greek* in one column, and the modern *Greek* in another, was publiſhed at Geneva in 1638. There was another edition printed at London in duodecimo in the year 1703. The tranſlation appears to be very literal, and ſo cloſe as to be ſometimes obſcure.

GREEK *Church* is that part of the Chriſtian church which is eſtabliſhed in Greece; extending likewiſe to ſome other parts of Turkey. See CHURCH.

GREEN, one of the original priſmatic colours, exhibited by the refraction of the rays of light. See Syſtem of OPTICS.

Artificial GREEN, are very rarely ſimple colours, but produced by mixture of yellow and blue. All the *greens* are firſt dyed blue, then taken down with woad, verdigriſe, &c. and then greened with the weed, there being no one ingredient that will give green alone. See Treatiſe on DYEING, Sect. II.

GREEN, *calcined*, and *diſtilled* GREEN. See VERDIGRISE.

GREEN-*Finch*, in ornithology, the Engliſh name of the greeniſh fringilla, with the wings and tail variegated with yellow. For the generic character, ſee FRINGILLA; for claſſification ſee the Syſtem.

GREEN *Sickneſs*. See CHLOROSIS.

GREENCLOTH, a board, or court of juſtice, held in the compting-houſe of the king's houſhold, for the taking cognizance of all matters of government and juſtice within the king's court royal; and for correcting all the ſervants therein, that ſhall any way offend. To this court alſo belongs the authority of maintaining the peace for twelve miles round the king's court, whereever it ſhall be, excepting at London. The judge of this court is the lord ſteward, aſſiſted by the treaſurer, comptroller, cofferer, clerks of the *greencloth*, &c. It takes its name *greencloth*, from a *greencloth* ſpread over the board where they ſit, whereon are the arms of the compting houſe.

GREEN-*Houſe*, or *Conſervatory*, a houſe in a garden, contrived for ſheltering and preſerving the moſt curious and tender exotic plants, which in our climate will not bear to be expoſed to the open air, eſpecially during the winter ſeaſon. Theſe are generally large and beautiful ſtructures, equallly ornamental and uſeful.

GREENLAND *Fiſhery*. See *Whale* FISHERY, under the article FISHERY.

GREENLAND *Company*. See COMPANY.

GREGARIOUS *Birds*, amongſt naturaliſts, are ſuch as do not live ſolitarily, but aſſociate in flights or coveys, a great many together in company.

GREGORIAN CALENDAR, that which ſhews the new and full moon, with the time of Eaſter, and the moveable feaſts depending thereon, by means of epacts diſpoſed through the ſeveral months of the Gregorian year.

GRIEF. The influence of this paſſion on the body is very great, ſo as often to deſtroy all appetite and deſire of meat, either by inſpiring men with a diſreliſh for life, or by a mechanical inſtinct; becauſe food taken at ſuch a time makes but bad nouriſhment; fitter to corrupt the blood than prolong life; on which account it is aſſigned as a phyſical cauſe for the faſting practiſed among the heathens. The influence of this paſſion extends itſelf even to beaſts; which, when indiſpoſed, not only take no pains to provide themſelves food, but alſo refuſe it when laid before them. Vide Mem. Acad. Inſcript. tom. v. p. 50, ſeq. This paſſion has been found to leſſen perſpiration and urine.

GRIFFON, in heraldry, an imaginary animal, feigned by the ancients to be half eagle and half lion. By this form they intended to give an idea of ſtrength and ſwiftneſs joined, together with an extraordinary vigilance in guarding the things intruſted to its care. Thus the heathen naturaliſts perſuaded the ignorant, that gold mines were guarded by theſe creatures with incredible watchfulneſs and reſolution.

GRINDING, *trituration*, the act of breaking or comminuting a ſolid body, and reducing it into powder, duſt, flour, farina, or the like. Some late phyſicians contend, that *digeſtion* is performed by *grinding* the food in the ſtomach. It is alledged, that every part in the body is a veſſel or veſſels; and all the veſſels have a motion of ſyſtole and diaſtole; all the operations of the body conſiſt in the attrition or *grinding* of the humours or matters contained in ſuch veſſels.

GRINDING *Glaſs* in general. See GLASS.

Grinding *Optic Glaſſes*. See Syſtem of Optics.

GRIPES, *tormina ventris*, a ſort of colic, or painful diſorder of the lower belly, occaſioned by ſome ſharp pungent matters vellicating the parts, or by wind pent up in the inteſtines. See Colic and Dysentery.

Gripes, or Colic, in farriery, is an acute diſeaſe, to which horſes are very often ſubject. For the cauſes and methods of cure, ſee Syſtem of Farriery. Part II. Claſs IX, Sect. XXVI. There are three different ſpecies of this diſorder, viz. the flatulent or windy, the bilious or inflammatory, and the dry *gripes*.

GROAT, an Engliſh money of account, equal to four pence. Other nations, as the Dutch, Polanders, Saxons, Bohemians, French, &c. have likewiſe their *groats*, groots, groches, gros, &c. We had no ſilver *money* in the Saxon times bigger than a penny; nor after the Conqueſt, till Edward III. who about the year 1351, coined groſſes, i. e. *groats*, or great pieces which went for 4*d*. apiece, and half groats; and ſo the matter ſtood till the reign of Henry VIII. who, in 1505, firſt coined ſhillings.

GROIN, that part of the belly next the thigh. In the Philoſophical Tranſactions we have an account of a remarkable caſe, where a peg of wood was extracted from the groin of a young woman of 21, after it had remained 16 years in the ſtomach and inteſtines, having been accidentally ſwallowed when ſhe was about five years of age. Vide Vol. LXVII. p. 459.

GROOM is the denomination of ſeveral officers and ſervants in the king's houſhold. There are *grooms* of the almonry, *grooms* of the compting houſe, *grooms* of the great chamber, the privy chamber, and the bed-chamber, *grooms* of the robes, of the wardrobe, &c.

Groom *Porter* is an officer of the houſhold, whoſe buſineſs is to ſee the king's lodging furniſhed with tables, chairs, ſtools, and firing; as alſo to provide cards, dice, &c. and to decide diſputes ariſing at cards, dice, bowling, &c.

GROOVE, in mining, is the ſhaft, or paſſage into the lead-mines, by which they draw up their ore. They are ſometimes ſunk in the vein, and ſometimes out.

GROSS *Weight*, is the weight of merchandizes, and goods, with their duſt and droſs, and alſo of the bag, caſk, cheſt, &c. wherein they are contained; out of which *groſs* weight, allowance is to be made of tare and tret.

GROTESQUE, Grotesc, or Grottesque, a wild, whimſical figure, or deſign of a painter, or engraver; having in it ſomething ridiculous, extravagant, and even monſtrous. The name ariſes hence, that figures of this kind were anciently much uſed to adorn the grottos wherein the tombs of eminent perſons, or families, were incloſed. Such was that of Ovid, whoſe grotto was diſcovered near Rome about one hundred years ago. We alſo extend the word *groteſque* to any thing whimſical or wildly pleaſant, in a perſon's dreſs, diſcourſe, &c. Maſquerade habits are the more valued, the more *groteſque* they are. Our theatres preſent us with entertainments in *groteſque* characters, i. e. perſons quaintly dreſſed; as harlequins, ſcaramouches, &c. Planudes has given us a very *groteſque* picture of Æſop. Arioſto and the Italian poets are full of *groteſque* deſcriptions.

Grotesques, or Grotescs, are particularly uſed for little fanciful ornaments, of animals, compounded with foliages, fruit, &c. Such are thoſe painted by Raphael in the apartments of the Vatican, and thoſe carved by Michael Angelo in the cielings of the Portico in the Capitol. Vitruvius calls compartments of this kind *harpaginetuli*.

GROTTO, a large deep cavern or den in a mountain or rock. Of theſe there are ſeveral remarkable ones in different parts of the world. The moſt celebrated one of our own country, is that called *Ookley-hole*, on the ſouth ſide of Mendip hills. Its length is about two hundred yards, and its height various; being in ſome places very low, and in others eight fathoms.

Grotto is alſo uſed for a ſmall artificial edifice made in a garden, in imitation of a natural grotto. The outſides of theſe grottos are uſually adorned with ruſtic architecture, and their inſide with ſhell-work, coral, &c. and alſo furniſhed with various fountains and other ornaments.

Grotta *del Cani*, a little cavern near Pozzuoli, four leagues from Naples, the ſteams whereof are of a mephitical or noxious quality; whence alſo it is called *bocca venenoſa*, the poiſonous mouth. "Two miles from Naples, ſays Dr. Mead, juſt by the Lago de Agnano, is a celebrated mofeta, commonly called *la Grotta del Cani*, equally deſtructive to all within the reach of its vapours. It is a ſmall *grotto* about eight feet high, twelve long, and ſix broad; from the ground ariſes a thin, ſubtile, warm fume, viſible enough to a diſcerning eye, which does not ſpring up in little parcels here and there, but in one continued ſtream, covering the whole ſurface of the bottom of the cave: having this remarkable difference from common vapours, that it does not, like ſmoke, diſperſe itſelf into the air, but quickly after its riſe falls back again, and returns to the earth, the colour of the ſides of the *grotto* being the meaſure of its aſcent; for ſo far it is of a darkiſh green, but higher only common earth. And as I found no inconveniency by ſtanding in it, ſo no animal, if its head be above this mark, is the leaſt injured. But when, as the manner is, a dog, or any other creature, is forcibly kept below it, or by reaſon of its ſmallneſs cannot hold its head above it, it preſently loſes all motion, falls down as dead or in a ſwoon, the limbs convulſed and trembling, till at laſt no more ſigns of life appear, than a very weak and almoſt inſenſible beating of the head and arteries; which if the animal be left a little longer, quickly ceaſes too, and then the caſe is irrecoverable; but if ſnatched out, and laid in the open air, ſoon comes to life again, and ſooner if thrown into the adjacent lake." "The fumes of the *grotto*, the ſame author argues, are no real poiſon, but act chiefly by their gravity; elſe the creatures could not recover ſo ſoon: or if they did, ſome ſymptoms, as faintneſs, &c. would be the conſequence of it. He adds, that in creatures killed therewith, when diſſected, no marks of infection appear; and that the attack proceeds from a want of air, by which the circulation tends to an entire ſtoppage, and this ſo much the more, as the animal inſpires a fluid of a quite different nature from the air, and ſo nowiſe fit to ſupply its place. Taking the animal out while alive, and throwing it into the neighbouring lake, it recovers. This is owing to the coldneſs of the water, which promotes the contraction of the fibres, and ſo aſſiſts the retarded circulation. The ſmall portion of the air which remains in the veſiculæ, after every expiration, may be ſufficient to drive out the noxious fluid. After the ſame manner, cold water acts in a deliquium animi: the lake of Agnano has no other virtue in it more than others. The ſteam ariſing in this grotto was for a long time reckoned to be of a poiſonous nature, and thought to *ſuffocate* the animals which breathed it. Dr. Hales imagined that it deſtroyed the elaſticity of the air, cauſed the veſicles of the lungs to collapſe, and thus occaſioned ſudden death.—It is now, however, found that this ſteam is nothing elſe than fixed air, which from time immemorial hath iſſued out of the earth in that place in very great quantity, the cauſes of which cannot yet be inveſtigated from any of the modern diſcoveries concerning that ſpecies of air. It proves pernicious when breathed in too great quantity, by rarefying the blood too much; and hence the beſt method of recovering perſons apparently killed by fixed air, is to apply a great degree of cold all over their bodies, in order to condenſe the blood as much as poſſible. This is the reaſon why the dogs recover when thrown into the lake Agnano, as above mentioned."

Grotta *del Serpi*, is a ſubterraneous cavern near the village of Saſſa, eight miles from the city of Braccano in Italy, deſcribed by Kircher thus: "The *grotta del ſerpi* is big enough to hold two perſons. It is perforated with ſeveral faſtular apertures, ſomewhat in manner of a ſieve; out of which, at the beginning of the ſpring ſeaſon, iſſues a numerous brood of young ſnakes of divers colours, but all free from any particular poiſonous quality. In this cave they expoſe their lepers, paralytics, arthritics, and elephantiac patients, quite naked; where the warmth of the ſubterraneous ſteams reſolving them into a ſweat, they become perfectly reſtored.

GROVE, in gardening, a ſmall wood impervious to the rays of the ſun. Groves are not only great ornaments to gardens; but are alſo the greateſt relief againſt the violent heats of the ſun, affording ſhade to walk under in the hotteſt parts of the day, when the other parts of the garden are uſeleſs; ſo that every garden is defective which has not ſhade. Groves are of two ſorts, viz. either open or cloſe. Open groves are ſuch as have large ſhady trees, which ſtand at ſuch diſtances, as that their branches approach ſo near to each other as to prevent the rays of the ſun penetrating through them. Cloſe groves have frequently large trees ſtanding in them; but the ground under theſe are filled with ſhrubs or underwood: ſo that the walks which are in them are private, and ſcreened from winds; by which means they are rendered agreeable for walking, at thoſe times when the air is either too hot or too cold in the more expoſed parts of the garden. Theſe are often contrived ſo as to bound the open groves, and frequently to hide the walls or other incloſures of the garden: and when they are properly laid out, with dry walks winding through them, and on the ſides of theſe ſweet-ſmelling ſhrubs and flowers irregularly planted, they have a charming effect. See ſyſtem of Gardening, Part I. Article I. Sect. II.

GROUND, in agriculture, is a piece of land, or ſoil; or a portion of earth, whether fit or unfit, to be tilled, and cultivated. All ſorts of *ground* may be reduced to boggy or marſhy, chalky, gravelly, and ſtony. See Syſtem of Agriculture, Sect. I.

Ground, in etching, denotes a varniſh ſmeared over the ſurface of the metal to be etched, to prevent the aqua fortis from eating, or having effect, except in places where this *ground* is cut through, or pared off, with the points of needles. See Etching.

Paſture Ground. See Syſtem of Agriculture, Sect. XIX.

Ground *Plates*, in architecture, are the outermoſt pieces of timber lying on, or near the *ground*, and framed into one another with mortiſes and tenons. In theſe alſo are mortiſes made to receive the tenons of joiſts, the ſummers and girders; and ſometimes the trimmers for the ſtair-caſe and chimney-way, and the binding joiſts.

Ground *of a Shield*, or *Eſcutcheon*, in heraldry, is properly called the Field.

Ground, in painting, is the ſurface upon which the figures, and other objects, are raiſed or repreſented. See Painting.

GROUP, or Grouppe, in painting and ſculpture, an aſſemblage,

blage, or knot, of two or more figures of men, beaſts, fruits, or the like, which have ſome apparent relation to each other. In a good painting, it is neceſſary that all the figures be divided into two or three *groups*, or ſeparate collections. Such and ſuch a thing make a *group*, with ſuch and ſuch others of different nature and kind. The antique Laocoon is a fine *group* of three beautiful figures. A *group* has ſomewhat in it of the nature of a ſymphony, or concert of voices: as, in the one, the voices muſt ſuſtain each other, in order to fill the ear with an agreeable harmony from the whole; whence, if any part were to ceaſe, ſomething would neceſſarily be miſſed; ſo in the other, if the parts, or figures, be not well balanced, ſomething will be found diſagreeable.

GROUSE, or Grous, in ornithology, the Engliſh name of a ſpecies, according to Linnæus, belonging to the 63d genus, called Tetrao and of the order of Gallinæ; but Latham in his improved arrangement, makes it of the 53d Genus and of the ſame Order. For the generic character, ſee Tetrao; for the claſſification, ſee the Syſtem; for the repreſentation, ſee Plate III. Order V. Genus 53.

GROWTH, the gradual increaſe of bulk and ſtature that takes place, in animals or vegetables, to a certain period. The increaſe of bulk in ſuch bodies as have no life, owing to fermentations excited in their ſubſtance, or to other cauſes, is called Expansion, Swelling, &c. In the Paris Memoirs alſo there is an account of a girl who had her menſes at three months of age. When four years old, ſhe was four feet ſix inches in height, and had her limbs well proportioned to that height, her breaſts large and plump, and the parts of generation like thoſe of a girl of eighteen; ſo that there is no doubt but that ſhe was marriageable at that time, and capable of being a mother of children. Theſe things are more ſingular and marvellous in the northern than in the ſouthern climates, where the females come ſooner to maturity. In ſome places of the Eaſt Indies, the girls have children at nine years of age. Many other inſtances of extraordinary growth might be brought, but the particulars are not remarkably different from what is already related. It is at firſt ſight aſtoniſhing that children of ſuch early and prodigious growth do not become giants; but when we conſider that the ſigns of puberty appear ſo much ſooner than they ought, it ſeems evident that the whole is only a more than uſually rapid expanſion of the parts, as in hot climates; and accordingly it is obſerved that ſuch children, inſtead of becoming giants, always decay and die apparently of old age, long before the natural term of human life.

GRUS, or Crane, in aſtronomy, a ſouthern conſtellation not viſible in our latitude. See Syſtem of Astronomy, Sect. VIII. For repreſentation, ſee Plate VI.

GRYLLUS, in entomology, the name of the cricket and locuſt kind; which, together with the graſshoppers, make only one genus of inſects, belonging to the order of hemiptera. The characters are theſe: the antennæ are ſetaceous and filiform; the exterior wings are membranaceous, narrow, and have much of the appearance of the wings of ſome of the fly kind; the thorax is compreſſed and angulated; and the legs are formed for leaping. For the claſſification, ſee the Syſtem, Part II. Order II. Genus 33.

GUAJACUM, Lignum Vitæ, or *Pockwood*; a genus of the monogynia order, belonging to the decandria claſs of plants. The wood of the firſt ſpecies or common lignum vitæ is of very conſiderable uſe both in medicine and in the mechanical arts. It is brought from the Weſt Indies, in large pieces, each weighing from four to five hundred weight: it is hard, compact, and ſo heavy as to ſink in water: the outer part is often of a pale yellowiſh colour; but the heart is blacker, or of a deep brown. Sometimes it is marbled with different colours. It has little or no ſmell, except when heated, and then a ſlight aromatic one is perceived. When chewed, it impreſſes a mild acrimony, biting the palate and fauces. Its pungency reſides in its reſinous matter, which it gives out in ſome degree to water by boiling, but ſpirit extracts it wholly. The guaiac wood was firſt introduced into Europe as a remedy for the venereal diſeaſe. It is a good aſſiſtant to mercury, as it warms and ſtimulates, and ſo promotes perſpiration and urine; it alſo proves gently purgative in a ſomewhat increaſed doſe: and theſe ſeem to be its primary virtues. When the excretory glands are obſtructed, the veſſels are lax and flaccid, the habit replete with ſerous humours, in many cutaneous and catarrhous diſorders, ſome female weakneſſes, in gouty complaints, and rheumatic diſorders, it produces good effects. The hectic fever which ſometimes follows a ſalivation, gives way to a decoction of the woods. The wood of this tree is ſo hard, that it breaks the tools which are employed in felling it; and is therefore ſeldom uſed as fire wood, but is of great uſe to the ſugar planters for making wheels and cogs to the ſugar mill. It is alſo frequently wrought into bowls, mortars, and other utenſils.

GUARANTEE, or Warrantee, in law, a term relative to *warrant*, or *warranter*; properly ſignifying him whom the warranter undertakes to indemnify or ſecure from damage.

GUARANTY, in politics, an engagement of mediatorial or neutral ſtates, whereby they pledge their faith, that the articles of a particular treaty ſhall be inviolably obſerved on both ſides. This engagement implies, that the guarantees are obliged to aſſiſt the party invaded contrary to the treaty, againſt the injurious aggreſſor; but not if the war is occaſioned by any other cauſes than the violation of the articles of peace. Puffendorf, Law of Nature and Nations, book viii. ch. 8. § 7.

GUARD, and Guards, in the military ſenſe; for an explanation at large, ſee Military Art.

Guard, in fencing, an action or poſture, proper to defend or ſcreen the body from the efforts or attacks of an enemy's ſword. For the different guards; ſee Treatiſe on the art of Fencing; for their repreſentation, ſee three Plates, which illuſtrate the Syſtem.

GUARDANT, or Gardant, in heraldry, a term applied to a beaſt when borne in a coat of arms, full faced, or with his face turned towards the ſpectator, and thus appearing in a poſture of guard or defence. For repreſentation, ſee the Syſtem, Plate V.

GUARDIAN, in law, a perſon who has the charge of any thing; but more commonly it ſignifies one who has the cuſtody and education of ſuch perſons as have not ſufficient diſcretion to take care of themſelves and their own affairs, as children and idiots. The *guardian*, when his WARD comes of age, is bound to give him an account of all which he has tranſacted on his behalf, and muſt anſwer for all loſſes incurred by his wilful default or negligence. To prevent conteſts, the *guardians* of large eſtates apply to and act under the direction of the court of chancery, accounting annually before the officers of that court: for the lord chancellor, by right derived from the crown, is the general and ſupreme *guardian* of all infants, as well as idiots and lunatics. The court of chancery may, and ſometimes does remove a *guardian* who abuſes his truſt, and appoint another in his room.

GUDGEON, in ichthyology; a ſpecies of cyprinus. For the claſſification, ſee the Syſtem.

GUILD-HALL, or Gild-Hall, the great court of judicature, for the city of London. In it are kept the *mayor's* COURT, the ſheriff's court, the COURT *of huſtings*, COURT *of conſcience*, court of common council, chamberlain's court, &c.

GUINEA, a gold coin, ſtruck and current in England. The value, or rate of *guineas*, has varied: it was firſt ſtruck on the footing of twenty ſhillings; by the ſcarcity of gold it was afterwards advanced to twenty-one ſhillings and ſixpence; but it is now ſunk to twenty-one ſhillings. The pound weight troy of gold is cut into forty-four parts and a half; each part makes a *guinea*. This coin took its denomination, *guinea*, becauſe the gold, whereof the firſt was ſtruck, was brought from that part of Africa, called *Guinea*; for which reaſon it likewiſe bore the impreſſion of an elephant.

Guinea *Hen*, the Engliſh name of a ſpecies belonging, according to Linnæus, to the 62d genus, called *Numida*, and of the order of *Gallinæ*. In Latham's improved arrangement, it is called Pintado, and ranked as the 49th genus, but of the ſame order. For the generic character, ſee Numida; for the claſſification, ſee the Syſtem; for the repreſentation, ſee Plate III. Order V. Genus 49.

Guinea *Pig*, in zoology, a ſpecies of the genus *Mus*. See Mus.

GUITTAR, Guitarra, a muſical inſtrument of the ſtringed kind, with five double rows of ſtrings; of which thoſe that are baſs are in the middle, except it be for the burthen, an octave lower than the fourth. This inſtrument was firſt uſed in Spain, and by the Italians. In the former country it is ſtill greatly in vogue. There are few of that nation who cannot play on the guittar; and with this inſtrument they ſerenade their miſtreſſes at night. At Madrid, and other cities in that country, it is common to meet in the ſtreets young men equipped with a guittar and a dark lanthorn, who, taking their ſtation under the windows, ſing, and accompany their voices with this inſtrument; and there is ſcarce an artificer or day-labourer in any of the cities or principal towns, who does not entertain himſelf with his guittar.

GULES, in heraldry, a corruption of the French word *geules*, which in this ſcience ſignifies *red*, and is repreſented in engraving by perpendicular lines. It may ſerve of itſelf to denote martial proweſs, boldneſs, and hardineſs: for the ancients uſed this colour to make themſelves terrible to their enemies, to ſtir up magnanimity, and to prevent the ſeeing of blood, by the likeneſs of the colours; for which reaſon perhaps it is uſed by the Engliſh. For the deſcription, ſee the Syſtem; for the repreſentation, ſee Plate I.

GUM, *Gummi*, is a concrete vegetable juice, of no particular ſmell or taſte, becoming viſcous and tenacious when moiſtened with water; totally diſſolving in water into a liquid, more or leſs glutinous in proportion to the quantity of the gum; not diſſolving in vinous ſpirits or in oils; burning in the fire to a black coal, without melting or catching flame: ſuffering no diſſipation in the heat of boiling water. The true gums are gum arabic, gum tragacanth, gum ſenega, the gum of cherry and plum trees, and ſuch like. All elſe have more or leſs of reſin in them. The virtues of gums are ſimilar to all mucilaginous ſubſtances in general, vegetable and animal; the more tenacious, glutinous, vegetable productions are called *gums*, thoſe that are leſs ſo are *mucilages*. The firſt diſtil naturally from trees, the ſecond are the produce of art.

Gum, among gardeners, a kind of gangrene incident to fruit-trees of the ſtone-kind, ariſing from a corruption of the ſap, which, by its viſcidity, not being able to make its way through the fibres of the tree, is, by the protruſion of other juice, made to extravaſate and ooze out upon the bark. When the diſtemper ſurrounds the branch, it admits of no remedy; but when only on one part of a bough, it ſhould be taken off to the quick, and ſome cow-dung clapped on the wound, covered over with a linen cloth, and tied down. M. Quintinie directs to cut off the morbid branch two or three inches below the part affected.

Gums, in anatomy, the hard fleſhy ſubſtance in either jaw, through which the teeth ſpring from the jawbone.

GUN, in the military art, a fire-arm, or weapon of offence, which forcibly diſcharges a ball or other hard and ſolid matter through a cylindric tube, by means of inflamed gun-powder. See Gunpowder.

It is not known at what time theſe weapons were firſt invented. Though, comparatively ſpeaking, the introduction of guns into the weſtern part of the world is but of a modern date; yet it is certain that in ſome parts of Aſia they have been uſed, though in a very rude and imperfect manner, for many ages.—Philſtratus ſpeaks of a city near the river Hyphaſis in the Indies, which was ſaid to be impregnable, and that its inhabitants were relations of the gods, becauſe they threw thunder and lightning upon their enemies. Hence ſome imagine that guns were uſed by the eaſtern nations even in the time of Alexander the Great; but however this may be, many of our modern travellers aſſert that they were uſed in China as far back as the year of Chriſt 85, and have continued in uſe ever ſince. The firſt hint of the invention of guns in Europe, is in the works of Roger Bacon, who flouriſhed in the 13th century. In a treatiſe wrote by him about the year 1280, he propoſes to apply the violent exploſive force of gun-powder, for the deſtruction of armies. In 1320, Bartholdus Schwartz, a German monk, is commonly ſaid to have invented gun-powder; though it is certainly known that this compoſition is deſcribed by Bacon in ſome of his treatiſes long before the time of Schwartz. Soon after the time of Schwartz, we find guns commonly made uſe of as inſtruments of war. Great guns were firſt uſed. They were originally made of iron bars ſoldered together, and fortified with ſtrong iron hoops; ſome of which are ſtill to be ſeen, viz. one in the tower of London, two at Woolwich, and one in the royal arſenal at Liſbon. Others were made of thin ſheets of iron rolled up together, and hooped; and on emergencies they were made of leather, with plates of iron or copper. Theſe pieces were made in a rude and imperfect manner, like the firſt eſſays of many new inventions. Stone balls were thrown out of them, and a ſmall quantity of powder uſed on account of their weakneſs. King Edward III. made uſe of cannon at the battle of Creſſy in 1346, and at the ſiege of Calais in 1347. Cannon were made uſe of by the Turks at the ſiege of Conſtantinople, then in poſſeſſion of the Chriſtians, in 1394, and in that of 1452, and then threw a weight of 100 lb. but they generally burſt, either the ſecond, or third ſhot.

Cannon take their names from the weight of the ball they diſcharge. Thus a piece that diſcharges a ball of 24 pounds is called a 24 *pounder*; one that carries a ball of 12 pounds is called a 12 *pounder*; and ſo of the reſt divided into the following ſorts, viz. Ships-guns, conſiſting in 42, 36, 32, 24, 18, 12, 9, 6 and 3 pounders. Garriſon-guns in 42, 32, 24, 18, and 12 pounders. Field-pieces in 12, 9, 6, 3, 2, 1 ½, 1 and ½ pounders.

GUNNERY, the art of ſhooting with guns and mortars, i. e. of charging, directing and exploding thoſe fire-arms to the beſt advantage.

To Gunnery, conſidered as a military art, belongs the knowledge of the force and effect of the powder, the dimenſions of pieces, and the proportions of the powder and ball they carry, with the methods of managing, charging, pointing, ſpunging, &c. Some parts of *Gunnery* are brought under mathematical conſideration, which among mathematicians are called abſolutely by the name *Gunnery*; viz. the method of elevation or raiſing the piece to any given angle, and computing the range, or raiſing and directing it in ſuch a manner as it may hit a mark or object propoſed. For the particular principles and laws of *Gunnery*, ſee Projectiles.

GUNPOWDER, a compoſition of ſalt-petre, ſulphur, and charcoal, mixed together, and uſually granulated, which eaſily takes fire, and, when fired, rarifies, or expands, with greater vehemence, by means of its elaſtic force. It is to this power we owe all the action and effect of guns, ordnance, &c. ſo that the modern military art, fortification, &c. depend wholly thereon. The invention of *gunpowder* is aſcribed, to different perſons of different countries. Bartholdus Schwartz, or the Black, diſcovered it, as ſome ſay, about the year 1320; but it appears that Roger Bacon knew of *gun-powder* near a hundred years before Schwartz was born. That excellent friar tells us, in his treatiſe De Secretis Operibus Artis & Naturæ, & de Nullitate Magiæ, cap. 6. which is ſuppoſed by ſome to have been publiſhed at Oxford in 1216, and which was undoubtedly written before his Opus Majus, in 1267, "that from ſalt-petre, and other ingredients, we are able to make a fire that ſhall burn at what diſtance we pleaſe." Bacon expreſly ſays, that ſounds like thunder, and corruſcations, may be formed in the air, much more horrible than thoſe that happen naturally. He adds, that there are many ways of doing this, by which a city or an army might be deſtroyed; and he ſuppoſes that, by an artifice of this kind, Gideon defeated the Midianites with only three hundred men. Judges, chap. vii. There is alſo another paſſage to the ſame purpoſe, in the treatiſe De Scientia Experimentali. See Dr. Jebb's edition of the Opus Majus, p. 474. It appears from the preface to the Code of Gentoo Laws, 1776; where it is aſſerted, that *gunpowder* was known to the inhabitants of Hindoſtan far beyond all periods of inveſtigation.

Method of making Gun-powder. Dr. Shaw's receipt for this purpoſe is as follows: Take four ounces of refined ſaltpetre, an ounce of brimſtone, and ſix drams of ſmall-coal: reduce theſe to a fine powder, and continue beating them for ſome time in a ſtone mortar, with a wooden peſtle, wetting the mixture between whiles with water, ſo as to form the whole into an uniform paſte, which is reduced to grains, by paſſing it through a wire-ſieve fit for the purpoſe; and in this form being carefully dried, it becomes the common gun-powder. For greater quantities, mills are uſually provided; by means of which more work may be performed in one day, than a man can do in an hundred. The nitre or ſalt-petre is refined thus: Diſſolve four pounds of rough nitre as it comes to us from the Indies, by boiling it in as much water as will commodiouſly ſuffice for that purpoſe; then let it ſhoot for two or three days in a covered veſſel of earth, with ſticks laid acroſs for the cryſtals to adhere to. Theſe cryſtals being taken out, are drained and dried in the open air. In order to reduce this ſalt to powder, they diſſolve a large quantity of it in as ſmall a proportion of water as poſſible; then keep it conſtantly ſtirring over the fire, till the water exhales, and a white dry powder is left behind. In order to purify the brimſtone employed, they diſſolve it with a very gentle heat; then ſcum and paſs it through a double ſtrainer. If the brimſtone ſhould happen to take fire in the melting, they have an iron cover that fits on cloſe to the melting veſſel, and damps the flame. The brimſtone is judged to be ſufficiently refined if it melts, without yielding any fetid odour, between two hot iron-plates, into a kind of red ſubſtance. The coal for the making of gun-powder is either that of willow, or hazel, well charred in the uſual manner, and reduced to powder. And thus the ingredients are prepared for making this commodity: but as theſe ingredients require to be intimately mixed, and as there would be danger of their firing if beat in a dry form, the method is to keep them continually moiſt, either with water, urine, or a ſolution of ſal ammoniac: they continue thus ſtamping them together for twenty-four hours, after which the maſs is fit for corning and drying in the ſun, or otherwiſe, ſo as ſeduloully to prevent its firing. Dr. Shaw obſerves that there are other ways of increaſing the ſtrength of powder, particularly by the mixture of ſalt of tartar; but perhaps, it were improper to divulge any thing of this kind, as gunpowder ſeems already ſufficiently deſtructive.

When the ſeveral ingredients of *gun powder* are properly prepared, mixed, and grained, in the manner recited, if the leaſt ſpark be ſtruck thereon from a ſteel and flint, the whole will be immediately inflamed, and burſt out with extreme violence. The effect is not hard to account for: the charcoal part of the grain whereon the ſpark falls, catching fire like tinder, the ſulphur and nitre are readily melted, and the former alſo breaks into flame; and at the ſame time the contiguous grains undergo the ſame fate. Now it is known, that ſalt-petre, when ignited, rarefies to a prodigious degree. Sir Iſaac Newton reaſons thus on the point: the charcoal and ſulphur in *gun-powder* eaſily take fire, and kindle the nitre; and the ſpirit of the nitre, being thereby rarefied into vapour, ruſhes out with an exploſion much after the manner that the vapour of water ruſhes out of an æolipile; the ſulphur alſo, being volatile, is converted into vapour, and augments the exploſion: add, that the acid vapour of the ſulphur, namely that which diſtils under a bell into oil of ſulphur, entering violently into the fixt body of the nitre, lets looſe the ſpirit of the nitre, and excites a greater fermentation, whereby the heat is farther augmented, and the fixt body of the nitre is alſo rarefied into fume; and the exploſion is thereby made more vehement and quick. For if ſalt of tartar be mixed with *gun-powder*, and that mixture be warmed till it takes fire, the exploſion will be greatly more violent and quick than that of *gun-powder* alone, which cannot proceed from any other cauſe than the action of the vapour of the *gun-powder* upon the ſalt of tartar, whereby that ſalt is rarefied. The exploſion of *gun-powder* ariſes, therefore, from the violent action whereby all the mixture being quickly and vehemently heated, is rarefied and converted into fume and vapour; which vapour, by the violence of that action, becoming ſo hot as to ſhine, appears in the form of a flame.

Dr. Ingenhouſz accounts for the effects of *gun-powder* by obſerving, that nitre yields by heat a ſurpriſing quantity of pure dephlogiſticated air, and charcoal a conſiderable quantity of inflammable air; the fire employed to inflame the powder extricates theſe two airs, and ſets fire to them at the inſtant of their extrication. See his Theory largely explained in Phil. Tranſ. vol. lxix. part ii. art. 26.

The velocity of expanſion of the flame of *gun-powder*, when fired in a piece of artillery, without either bullet or other body before it, is prodigious. By the experiments of the author ſo often quoted, it ſeems this velocity cannot be much leſs than 7000 feet in a ſecond. This however muſt be underſtood of the moſt active part of the flame.

It is this prodigious celerity of expanſion of the flame of fired *gun-powder*, which is its peculiar excellence, and the circumſtance in which it ſo eminently ſurpaſſes all other inventions, either ancient or modern, for the purpoſe of military projections.

In regard to the medical virtues of gun-powder, Boerhaave informs us, that the flame of it affords a very healthy fume in the height of the plague, becauſe the exploſive acid vapour of nitre and ſulphur, corrects the air, and that the ſame vapour, if received in a ſmall cloſe pent-up place, kills inſects.

Gunter's *Line*, a logarithmic line, uſually graduated upon ſcales, ſectories, &c. It is alſo called the *line of lines*, and *line of numbers*; being only the logarithms graduated upon a ruler, which therefore ſerves to ſolve problems inſtrumentally in the ſame manner as logarithms do arithmetically.

Gunter's *Quadrant*, one made of wood, braſs, &c. containing a kind of ſtereographic projection of the ſphere, on the plane of the equinoctial; the eye being ſuppoſed placed in one of the poles.

Gunter's *Scale*, called by navigators ſimply the *gunter*, is a large plain ſcale, generally two feet long, and about an inch and a half broad; with artificial lines delineated on it, of great uſe in ſolving queſtions in trigonometry, navigation, &c.

GUNWALE, a piece of timber reaching on either ſide of the ſhip, from the half deck to the forecaſtle, wherein they put the ſtanchions, which ſupport the waſte tree.

GURNARD, in ichthyology, a ſpecies of the genus Trigla, ſee Trigla.

GUTS. It is obſerved, in the diſſections of many of the beaſts of prey, that the *guts* are very remarkably ſhort in compariſon of thoſe of other animals. The lion and the lynx are of this number; the *guts* being in theſe only of three times the length of the body. This argues ſpeedy digeſtion, and a great voracity of the creature. For a further account, ſee Intestines, and *Comparative* Anatomy.

GUTTA SERENA, a diſeaſe of the eyes, being an entire loſs of ſight, without any apparent fault or diſorder of the part, excepting that the pupil looks ſomewhat larger and blacker than before.

GUTTURAL *Letters*, are thoſe pronounced or formed, as it were in the throat. Dr. Wallis diſtinguiſhes the vowels in our language into labial, palatine, and *guttural*; according to the ſeveral degrees of opening the mouth to pronounce them, larger, middle, and leſs. On this footing he makes three *guttural* vowels, three labial, and as many palatines. The four *guttural* letters in Hebrew are א, ח, ה, and ע, formed into the technical word אחהע.

GYMNASIUM, in Grecian antiquity, a place fitted for performing exerciſes. The word is Greek, formed of *γυμνος*, "naked;" by reaſon they anciently put off their clothes, to practiſe with the more freedom. Gymnaſia, according to Potter, were firſt uſed at Lacedæmon, but were afterwards very common in all parts of Greece; and imitated, very much augmented, and improved, at Rome. They were not ſingle edifices, but a knot of buildings united, being ſufficiently capacious to hold many thouſands of people at once; and having room enough for philoſophers, rhetoricians, and the profeſſors of all other ſciences to read their lectures; and wreſtlers, dancers, and all others who had a mind, to exerciſe; at the ſame time, without the leaſt diſturbance or interruption. They conſiſted of a great many parts; the chief of which were the porticoes, eleotheſium, palæſtra, coniſtorium, &c. Athens had ſeveral gymnaſia, of which the lycæum, academia, and cynoſurges, were thoſe of moſt note. The lycæum was ſeated on the banks of the river Iliſſus; and received its name from Apollo, to whom it was dedicated. This was the place where Ariſtotle taught philoſophy, walking there every day till the hour of anointing: whence he and his followers were named *Peripatetics*. The academy was part of the Ceramicus without the city, were Plato lectured. The cynoſurges was allotted for the populace.

GYMNASTICS, the art of performing the ſeveral bodily exerciſes, as wreſtling, running, fencing, dancing, &c. That part of medicine which regulates the exerciſes of the body, whether for preſerving or reſtoring health, is alſo termed *gymnaſtic*.

GYMNOSOPHISTS, a ſet of Indian philoſophers, famous in antiquity; ſo denominated from their going barefoot. The word is formed of the Greek *γυμνοσοφιστης*, q. d. a ſophiſt or philoſopher who goes naked. This name was given to the Indian philoſophers, whom the exceſſive heat of the country obliged to go naked; as that of *Peripatetics* was given to thoſe who philoſophiſed walking.

In general, the gymnoſophiſts were wiſe and learned men: their maxims and diſcourſes, recorded by hiſtorians, do not in the leaſt ſavour of a barbarous education; but are plainly the reſult of great ſenſe and deep thought. They kept up the dignity of their character to ſo high a degree, that it was never their cuſtom to wait upon any body, not even upon princes themſelves; for which reaſon Alexander, who would not condeſcend to viſit them in perſon, ſent ſome of his courtiers to them in order to ſatisfy his curioſity. Their way of educating their diſciples is very remarkable: every day, at dinner, they examined them how they had ſpent the morning; and every one was obliged to ſhew, that he had diſcharged ſome good office, practiſed ſome virtue, or improved in ſome part of learning: if nothing of this appeared, he was ſent back without his dinner. They held a tranſmigration of ſouls; and it is probable that Pythagoras borrowed his doctrine from them.

GYMNOSPERMIA, in botany, from *γυμνος naked*, and *σπερμα, ſeed*; the firſt order in Linnæus's claſs of didynamia. It comprehends thoſe plants of that claſs which have naked ſeeds. The ſeeds are conſtantly four in number, except in one genus, viz. phryma, which is monoſpermous. See Syſtem of Botany, Sect. V. Claſs XIV. For the repreſentation, ſee Plate V.

GYMNOTUS, in ichthyology, a genus of fiſhes belonging to the order of apodes. They have two tentacula at the upper lip; the eyes are covered with the common ſkin; there are five rays in the membrane of the gills; the body is compreſſed, and carinated on the belly with a fin. There are five ſpecies; the moſt remarkable of which is the electricus. This ſpecies is peculiar to Surinam; and is found in the rocky parts of the river, at a great diſtance from the ſea. For a copious account of the electrical properties of this fiſh, ſee the concluſive part of the Syſtem of Electricity. For the Claſſification, ſee the Syſtem of Ichthyology.

GYNANDRIA, from *γυνη*, a woman; and *ανηρ*, a man. The name of the 20th claſs in Linnæus's ſexual ſyſtem, conſiſting of plants with hermaphrodite flowers, in which the ſtamina are placed upon the ſtyle, or, to ſpeak more properly, upon a pillar ſhaped receptacle, reſembling a ſtyle, which riſes in the middle of the flower, and bears both the ſtamina and pointal; that is, both the ſuppoſed organs of generation. The flowers of this claſs, ſays Linnæus, have a monſtrous appearance, ariſing, as he imagines, from the ſingular and unuſual ſituation of the parts of fructification. The firſt order of this claſs called diandria, is a very natural diſtinction among plants; and its genera differ from one another in no other grand particular, but the nectaria. Botaniſts in general have judged the roots of this order of plants, which are either teſticulated, or palmated, to be a very certain mark of diſtinction; but this obſervation of the difference of the nectaria, which is owing to Linnæus, is much to be preferred, as being both more certain and more obvious. See Syſtem of Botany, Sect. V. For repreſentation of the ſeveral orders of this Claſs, ſee Plate V.

GYPSIES, or Egyptians, in our ſtatutes, a kind of impoſtors and jugglers, who diſguiſing themſelves in uncouth habits, ſmearing their faces and bodies, and framing to themſelves a canting language, wander up and down, and, under pretence of telling fortunes, curing diſeaſes, &c. abuſe the common people, trick them of their money, and ſteal all that they can come at. There are ſeveral ſtatutes made againſt them.

Egyptians coming into England are to depart the realm in fifteen days, or be impriſoned, by 22 Hen. VIII. cap. 10. And by 1 & 2 P. & M. cap. 4. any perſon importing them into this kingdom, ſhall forfeit forty pounds; and if they remain here above one month, or if any perſon, fourteen years old, conſort with them, they are guilty of felony, without benefit of clergy; 5 Eliz. cap. 20. And we are informed by Sir M. Hale, that at one Suffolk aſſizes, no leſs than thirteen Gypſies were executed upon theſe ſtatutes, a few years before the Reſtoration. See alſo 39 Eliz. cap. 4. § 2. 17 & Geo. II. cap. 5. § 2.

The origin of this tribe of vagabonds is ſomewhat obſcure; at leaſt, the reaſon of the denomination is ſo. It is certain, the ancient Egyptians had the character of great cheats, and were famous for the ſubtilty of their impoſtures; whence the name might afterwards paſs proverbially into other languages, as it is pretty certain it did into the Greek and Latin: or elſe, the ancient Egyptians, being much verſed in aſtronomy, which in thoſe days was little elſe but aſtrology, the name was on that ſcore aſſumed by theſe tellers of good fortune.

GYPSUM, or Plaster-stone, in natural hiſtory, a genus of foſſils, naturally and eſſentially ſimple, not inflammable nor ſoluble in water, and compoſed of flat ſmall particles, which form bright, gloſſy, and in ſome degree tranſparent maſſes, not flexible or elaſtic, not giving fire with ſteel, nor fermenting with or being ſoluble in acid menſtrua, and very eaſily calcined in the fire. Of theſe gypſums, ſome are harder, others ſofter, and are of ſeveral colours, as white, grey, red, green, &c. ſometimes diſtinct, and ſometimes variouſly blended together.

The origin of all theſe gypſums is from the vitriolic acid and calcareous earth. They are much uſed for ſtuccoing rooms, and for caſting buſts and ſtatues; for which laſt purpoſe they are excellently adapted by the property they have of expanding when they *ſet*, or become ſolid, after being mixed with water. See Syſtem of Chymistry, Part II. under the head of Earth *in General*.

GYR-Falco, in ornithology, the name of a large and fierce ſpecies of falcon called in Engliſh the *jer-falcon*. See Falco. It is a very bold and daring bird, attacking all other fowl without reſerve, particularly the heron and ſtork kinds. The other falcons are all afraid of this.

H

H, THE eighth letter and ſixth conſonant in the Engliſh alphabet; though ſome Grammarians will have it to be only an aſpiration or breathing. But nothing can be more abſurd than to diſpute its being a diſtinct ſound, and formed in a particular manner by the organs of ſpeech, at leaſt in our language: witneſs the words *eat* and *heat*, *ear* and *hear*, *at* and *hat*, and as pronounced with or without the *h*. It is pronounced by a ſtrong aſpiration of the breath between the lips, cloſing as it were by a gentle motion of the lower jaw to the upper, and the tongue nearly approaching the palate. There ſeems to be no doubt but that our *h*, which is the ſame with that of the Romans, derived its figure from that of the Hebrew ח. And, indeed, the Phœnicians, moſt ancient Greeks and Romans, uſed the ſame figure with our H, which in the ſeries of all theſe alphabets keeps its primitive place, being the eighth letter. H, uſed as a numeral, denotes 200; and with a daſh over it, H̄, 200,000. As an abbreviation, H was uſed by the ancients to denote *homo*, *hæres*, *hora*, &c. Thus H. B. ſtood for *hæres bonorum*; and H. S. corruptly for L L S. ſeſterce; and H. A. for Hadrianus.

HABAKKUK, one of the twelve leſſer prophets, whoſe prophecies are taken into the canon of the Old Teſtament. The name is written in Hebrew with ח *hheth*; and ſignifies a *wreſtler*, or *grappler*. The Greek tranſlators call him *Abbakoum*. The preciſe time is not known when *Habakkuk* propheſied; but from his predicting the ruin of the Jews by the Chaldeans, it may be concluded that he was contemporary with Jeremiah, and propheſied in the reign of Joſiah. His prophecy only conſiſts of three chapters.

HABDALA, or HABHDALAH, a Jewiſh ceremony, practiſed among that people every ſabbath-day evening. The word is Hebrew, and literally ſignifies *ſeparation*: it is formed of כרל, *badal*, *to ſeparate*; the ceremony being looked upon as the diviſion or parting of the ſabbath from the reſt of the week. It was eſtabliſhed to prevent their being too haſty in ending the ſabbath. Towards the cloſe of the ſabbath, when the ſtars begin to appear, every maſter of a family lights a torch or flambeau, or at leaſt a lamp with two wicks. A little box of ſpices is then prepared, and a glaſs of wine taken; then ſinging, or rehearſing a prayer, and bleſſing the wine and the ſpices, they all ſmell at them; and, after a few ceremonies performed about the torch, or lamp, they caſt a little of the conſecrated wine into the flame; every body taſtes; and thus they break up, wiſhing each other, not a good night, but a good week.

HABEAS *Corpus*, in law, a writ, which a man indicted and impriſoned for any crime, or treſpaſs, before the juſtices of peace, or in a court of franchiſe; having offered ſufficient bail, which is refuſed, though the caſe be bailable, may have out of the king's bench, thereby to remove himſelf thither, at his own coſts, to anſwer the cauſe at the bar thereof. The order, in this caſe, is firſt to procure a *certiorari* out of the chancery, directed to the ſaid juſtices, for removing the indictment into the king's bench; and upon that to procure this writ to the ſheriff, for cauſing his body to be brought at a certain day. This writ is alſo uſed to bring the body of a perſon into court, who is committed to any gaol, either in criminal or civil cauſes; and a *habeas corpus* will remove a perſon and cauſe from one court and priſon to another. The writ of *habeas corpus* was originally ordained by the common law of the land, as a remedy for ſuch as were unjuſtly impriſoned, to procure their liberty; but many abuſes having been introduced into the mode of granting it, it became neceſſary to prevent them by modern ſtatutes. Accordingly, by the petition of right, 3 Car. I. it is enacted, that no freeman ſhall be impriſoned or detained, without cauſe ſhewn, to which he may make anſwer according to law. And by 16 Car. I. cap. 10. if any perſon be reſtrained of his liberty by order or decree of any illegal court, or by command of the king's majeſty in perſon, or by warrant of the council-board, or of any of the privy-council, he ſhall, upon demand of his counſel, have a writ of *habeas corpus*, to bring his body before the court of king's bench or common pleas; who ſhall determine whether the cauſe of his commitment be juſt, and thereupon do as to juſtice ſhall appertain. The methods of obtaining this are farther pointed out and enforced by 31 Car. II. cap. 2. See the next article.

HABEAS *Corpus Act* is the famous ſtatute 31 Car. II. cap. 2. which ſome have called the ſecond *Magna Charta*, and bulwark of Engliſh liberty. The ſubſtance of this important ſtatute is compriſed in the following particulars; viz. 1. That the writ of *habeas corpus* ſhall be returned, and the priſoners brought up within a limited time according to the diſtance, not exceeding in any caſe twenty days. 2. That ſuch writs ſhall be endorſed as granted in purſuance of this act, and ſigned by the perſon awarding them. 3. That on complaint and requeſt in writing by or on behalf of any perſon committed and charged with any crime (unleſs committed for treaſon, or felony, expreſſed in the warrant, or for ſuſpicion of the ſame, or as acceſſary thereto before the fact, or convicted or charged in execution by legal proceſs) the lord chancellor, or any of the twelve judges, in vacation, upon viewing a copy of the warrant, or affidavit, that a copy is denied, ſhall (unleſs the party has neglected for two terms to apply to any court for his enlargement) award a *habeas corpus* for ſuch priſoner, returnable immediately before himſelf, or any other of the judges; and upon the return made ſhall diſcharge the party, if bailable, upon giving ſecurity to appear and anſwer to the accuſation in the proper court of judicature. 4. That officers and keepers neglecting to make due returns, or not delivering to the priſoner or his agent within ſix hours after demand a copy of the warrant of commitment, or ſhifting the cuſtody of a priſoner from one to another, without ſufficient reaſon or authority (ſpecified in the act), ſhall for the firſt offence forfeit 100*l.* and for the ſecond offence 200*l.* to the party grieved, and be diſabled to hold his office. 5. That no perſon, once delivered by *habeas corpus*, ſhall be recommitted for the ſame offence, on penalty of 500*l.* 6. That every perſon committed for treaſon or felony ſhall, if he requires it, the firſt week of the next term, or the firſt day of the next ſeſſion of oyer and terminer, be indicted in that term or ſeſſion, or elſe admitted to bail; unleſs the king's witneſſes cannot be produced at that time; and if acquitted, or if not indicted and tried in the ſecond term or ſeſſion, he ſhall be diſcharged from his impriſonment for ſuch imputed offence; but that no perſon, after the aſſiſes ſhall be opened for the county in which he is detained, ſhall be removed by *habeas corpus*, till after the aſſiſes are ended; but ſhall be left to the juſtice of the judges of aſſiſe. 7. That any ſuch priſoner may move for and obtain his *habeas corpus*, as well out of the chancery or exchequer, as out of the king's bench or common pleas; and the lord chancellor or judges denying the ſame, on ſight of the warrant or oath that the ſame is refuſed, forfeit ſeverally to the party grieved the ſum of 500*l.* 8. That this writ of *habeas corpus* ſhall run into the counties palatine, cinque ports, and other privileged places, and the iſlands of Jerſey and Guernſey. 9. That no inhabitant of England (except perſons contracting, or convicts praying to be tranſported, or having committed ſome capital offence in the place to which they are ſent) ſhall be ſent priſoner to Scotland, Ireland, Jerſey, Guernſey, or any places beyond the ſeas, within or without the king's dominions; on pain that the party committing, his adviſers, aiders, and aſſiſtants, ſhall forfeit to the party grieved a ſum not leſs than 500*l.* to be recovered with treble coſts; ſhall be diſabled to bear any office of truſt or profit; ſhall incur the penalties of *præmunire*, and ſhall be incapable of the king's pardon. And, leſt this act ſhould be evaded, by demanding unreaſonable bail, or ſureties, for the priſoner's appearance, it is declared by 1 W. & M. ſtat. 2. cap. 2. that exceſſive bail ought not to be required. In conſequence of this act, it is now expected by the court, that, upon writs of *habeas corpus* at the common law, the writ ſhould be immediately obeyed, without waiting for any *alias* or *pluries*; otherwiſe an attachment will iſſue. Blackſt. Com. vol. iii. p. 136, &c.

HABIT, in philoſophy, an aptitude, or diſpoſition, either of mind or body, acquired by a frequent repetition of the ſame act. See CUSTOM.

HABIT, in medicine, is what we otherwiſe call the temperament or conſtitution of the body; whether obtained by birth, or occaſioned by the manner of living. A thing is ſaid to *enter the habit*, when it becomes intimately diffuſed throughout the body, and is conveyed to the remoteſt ſtages of circulation.

HACKNEY *Coach*. See COACH.

HADDOCK, the Engliſh name of a ſpecies of *Gadus*. See GADUS.

HÆMATOPUS, the *ſea-pye*, in ornithology, a genus belonging to the order of *Grallæ*, for the Generic character, ſee GRALLÆ, for the Claſſification, ſee the Syſtem.

HÆMOPTYSIS, formed of *αιμα*, *blood*, and ϖτυειν, *to ſpit*, corruptly alſo called HÆMOPTOSIS, and HÆMOPTOE, in *medicine*, ſpitting of blood; occaſioned by the rupture or eroſion of ſome veſſel of the lungs; and accompained uſually with a cough, and a ſenſe of preſſure on the breaſt. See Syſtem of MEDICINE.

HÆMATOXYLUM, LOGWOOD, or *Campeachy Wood*; a genus of the monogynia order, belonging to the decandria claſs of plants. Of this genus there is only one ſpecies, viz. the campechianum, which grows naturally in the bay of Campeachy at Honduras, and other parts of the Spaniſh Weſt-Indies, where it riſes from 16 to 24 feet high. The logwood is uſed in great quantities for dying purple, but eſpecially black colours. All the colours, however, which can be prepared from it, are of a fading nature, and cannot by any art be made equally durable with thoſe prepared from ſome other materials. Of all the colours prepared from logwood, the black is the moſt durable. Logwood is the material which adds blackneſs to the vitriol and gall-brown: and this black dye, though not of the moſt durable kind, is the moſt common. On blue cloth a good black may be dyed by vitriol and galls alone; but even here, an addition of logwood contributes not a little to improve the colour. Logwood is alſo found to have a conſiderable aſtringent virtue as a medicine, and an extract of it is ſometimes given with great ſucceſs in diarrhœas. See Treatiſe on Dyeing.

HAGGAI, a canonical book of the Old Teſtament, ſo called from the prophet of that name, who in all probability was born at Babylon, from whence he returned with Zerubbabel. This prophet, in the ſecond year of Darius or the five hundred and twentieth before Chriſt, exhorted the Jews, after their return from their captivity, to finiſh rebuilding the temple, which they had intermitted for fourteen years. His remonſtrances had the deſired effect; and to encourage them to proceed in the work, he aſſured them from God that the glory of this latter houſe ſhould exceed the glory of the former; which was accordingly fulfilled when Chriſt honoured it with his preſence: for with reſpect to the building, this latter temple was not to be compared with the former.

HAIL, *Grando*, in phyſiology, an aqueous concretion, in form of white or pellucid ſpherules, deſcending out of the atmoſphere. *Hail* is conceived to be formed of drops of rain, frozen in their paſſage through the middle region. Others take it for the fragments of a frozen cloud, half-melted, and thus precipitated and congealed again. Accordingly the Carteſians define *hail* to be a cloud, either wholly, or in part, liquefied; which tending downwards by its own gravity, is, in its paſſage, frozen again by the action of ſome very cold wind; and thus precipitated, for the moſt part, in round tranſparent globes. They add, that if the cloud have been totally liquefied, the *hailſtones* are pellucid; otherwiſe they are only partly ſo. Signior Beccaria ſuppoſes, that it is formed in the higher regions of the air, where the cold is intenſe, and where the electric matter is very copious. In theſe circumſtances, a great number of particles of water are brought near together, where they are frozen, and in their deſcent collect other particles; ſo that the denſity of the ſubſtance of the *hail* ſtone grows leſs and leſs from the centre; this being formed firſt in the higher regions, and the ſurface being collected in the lower. Accordingly, in mountains, *hail*-ſtones as well as drops of rain, are very ſmall; and both agree in this circumſtance, that the more intenſe is the electricity that forms them, the larger they are. *Hail* is obſerved frequently to attend thunder and lightning; with regard to which, Beccaria obſerves, that as motion is known to promote freezing, ſo the rapid motion of the electrified clouds may promote that effect in the air. Natural hiſtories furniſh us with a great variety of inſtances of extraordinary ſhowers of *hail*. See Phil. Tranſ. N° 203. and Hiſt. de France, tom ii. p. 339.

HAIR, ſmall filaments, iſſuing out of the pores of the ſkins of animals; and ſerving moſt of them as a tegument or covering. In lieu of hair, the nakedneſs of ſome animals is covered with feathers, wool, ſkins, &c. Hair is found on all parts of the human body, except the ſoles of the feet and the palms of the hands. But it grows longeſt on the head, chin, breaſt, in the arm-pits, and about the privities. The ancients held the hair a ſort of excrement, fed only with excrementitious matters, and no proper part of a living body. They ſuppoſed it generated of the fuliginous parts of the blood, exhaled by the heat of the body to the ſurface, and there condenſed in paſſing through the pores. They added, that hair does not feed and grow, like the other parts, by introſuſception, *i. e.* by a juice circulating within it; but, like the nails, by juxtapoſition, each part next the root thruſting forward that immediately before it. But the moderns are agreed, that every hair does properly and truly live, and receive nutriment to fill and diſtend it like the other parts; which they argue hence, that the roots do not turn grey in aged perſons ſooner than the extremities, but the whole changes colour at once, and the like is obſerved in boys, &c. which ſhews that there is a direct communication, and that all the parts are affected alike. It may be obſerved, however, that, in propriety, the life and growth of hairs is of a different kind from that of the reſt of the body; and is not immediately derived therefrom, or reciprocated therewith. It is rather of the nature of vegetation. They grow as plants do out of the earth; or as ſome plants ſhoot from the parts of others; from which though they draw their nouriſhment, yet each has, as it were, its ſeveral life and a diſtinct œconomy. They derive their food from ſome juices in the body, but not from the nutritious juices of the body; whence they may live, though the body be ſtarved. The hairs ordinarily appear round or cylindrical; but the microſcope alſo diſcovers triangular and ſquare ones; which diverſity of figure ariſes from that of the pores, to which the hairs always accommodate themſelves. Their length depends on the quantity of the proper humour to feed them, and their colour on the quality of that humour; whence, at different ſtages of life, the colour uſually differs. Their extremities ſplit into two or three branches, eſpecially when kept dry, or ſuffered to grow too long; ſo that what appears only a ſingle hair to the naked eye, ſeems a bruſh to the microſcope.

Diſeaſes of the HAIR. Almoſt the only diſeaſe of the hair, beſides the remarkable one called *plica polonica*, is its falling off, or *baldneſs*. For this many remedies have been recommended, but ſcarce any of them can be depended upon. The juice of burdock, and the lixivial ſalts of vine-aſhes, are ſaid to be efficacious; alſo the powder of hermodactyls, and the decoction of boxwood. Some authors give inſtances of the hair changing its colour in a ſhort time, through grief, or by reaſon of a fright, &c.

HAIR *as an Enſign of Dignity, or of Religion.* It was eſteemed a notable honour among the ancient Gauls to have long hair, and hence came the appellation *Gallia comata*. For this reaſon Julius Cæſar, upon ſubduing the Gauls, made them cut off their hair as a token of ſubmiſſion. It was with a view to this, that ſuch as afterwards quitted the world to go and live in cloiſters, procured their hair to be ſhaven off; to ſhew that they bid adieu to all earthly ornaments, and made a vow of perpetual ſubjection to their ſuperiors. Greg. of Tours aſſure us, that in the royal family of France, it was a long time the peculiar mark and privilege of kings and princes of the blood to wear long hair, artfully dreſſed and curled; every body elſe was obliged to be polled, or cut round, in ſign of inferiority and obedience. Some writers aſſure us, that there were different cuts for all the different qualities and conditions; from the prince who wore it at full length, to the ſlave or villain who was quite cropt.

HALCYON, in ornithology, the name of a ſpecies of the genus *Alcedo* or *King-fiſher*. For deſcription ſee *Alcedo*; for claſſification ſee the Syſtem; for repreſentation ſee Plate II. Order II. Genus 23.

HALCYON *Days*, a name given to ſeven days before and as many after the winter-ſolſtice; by reaſon the halcyon, invited by the calmneſs of the weather, laid its eggs in neſts built in the rocks, cloſe by the brink of the ſea, at this ſeaſon.

HALF *Moon*, in fortification; an outwork compoſed of two faces, forming a ſaliant angle, whoſe gorge is in form of a creſcent or half-moon, whence the name.

HALIÆTUS, in ornithology, a ſpecies belonging to the Genus *Falco*. See FALCO.

HALIOTIS, in Conchology. For deſcription ſee the Syſtem; for claſſification ſee the Synoptical Table.

HALL is particularly uſed for a court of juſtice; or an edifice wherein there is one or more tribunals. In Weſtminſter-*hall* are held the great courts of this kingdom, viz. the King's Bench, Chancery, Common-Pleas, and Exchequer. See COURTS.

HALLELUJAH, a term of rejoicing, ſometimes ſung, or rehearſed, at the end of verſes on ſuch occaſions. The word is Hebrew, or rather it is two Hebrew words joined together: one of them הללו, *hallelu*, and the other יה, *jah*; an abridgment of the name of God, יהוה *Jehovah*. The firſt ſignifies *laudate, praiſe ye*; and the other *Dominum, the Lord*.

HALT, in war, a pauſe or ſtop in the march of a military body. Some derive the word from the Latin *halitus, breath*, it being a frequent occaſion of *halting*, to take breath; others from *alto*, becauſe in *halts* they raiſe their pikes, &c. on end.

HAM, in commerce, &c. is uſed for a leg or thigh of pork, dried, ſeaſoned, and prepared to make it keep, and to give it a briſk agreeable flavour. Weſtphalia *hams*, ſo much in vogue, are prepared by ſalting them with ſalt-peter, preſſing them in a preſs eight or ten days, then ſteeping them in juniper-water, and drying them by the ſmoke of juniper-wood. A *ham* may be ſalted in imitation of thoſe of Weſtphalia, by ſprinkling a *ham* of young pork with ſalt for one day, in order to fetch out the blood: then wiping it dry, and rubbing it with a mixture of a pound of brown ſugar, a quarter of a pound of ſalt-petre, half a pint of bay ſalt, and three pints of common ſalt, well ſtirred together in an iron pan over the fire till they are moderately hot: let it lie three weeks in this ſalting, and be frequently turned, and then dry it in a chimney.

HAND, in anatomy, the extreme part of the arm. For the Oſteology, ſee Syſtem of ANATOMY, Part II. Sect. IV. For the Myology, ſee the ſame Syſtem, Part III. Sect. XIV. See alſo Plates II. and III.

HANGING, a common method of inflicting death on criminals, by ſuſpending them by the neck. Phyſicians are not agreed as to the manner in which death is brought on by hanging. Dr Haen hanged three dogs, whom he afterwards opened. In one, nothing remarkable appeared in the lungs. In another, from whom half an ounce of blood was taken from the jugular vein, the dura and pia mater were of the natural appearance; but the lungs were much inflamed. In the third, the meninges were ſound, and there was no effuſion of blood in the ventricles of the brain, but the left lobe of the lungs was turgid with blood. Wepfer, Littræus, Alberti, Bruhierius, and Boerhaave, affirm that hanged animals die apoplectic. Their arguments for this are chiefly drawn from the livid colour of the face: from the turgeſcency of the veſſels of the brain; the inflammation of the eyes; and from the ſparks of fire which thoſe who have ſurvived hanging alledge they have ſeen before their eyes. On the contrary, Bonetus, Petit, Haller, and Lanciſi, from obſerving that death is occaſioned by any ſmall body falling into the glottis, have aſcribed it to the ſtoppage of reſpiration. Others, deeming both theſe cauſes ill-founded, have aſcribed it to a luxation of the vertebræ of the neck. De Haen adduces the authority of many eminent authors to prove the poſſibility of recovering hanged perſons; and obſerves, in general, that with bleeding in the jugular vein, and anointing the neck with warm oil, the ſame remedies are to be employed in this caſe as for the recovery of drowned people.

HARANGUE, a modern French name for a ſpeech, or oration, i. e. a diſcourſe made by an orator in public. The word is alſo frequently uſed in an ill ſenſe; viz. for a too pompous, prolix, or unſeaſonable ſpeech or declamation. In Homer the heroes generally *harangue* before they come to fight; as, in England, criminals *harangue* on the ſcaffold before they die.

HARDNESS, a quality of certain bodies, which conſiſts in an intimate union and ſtrong adheſion of their integrant parts, which cannot therefore be eaſily disjoined. The hardeſt of bodies which we know, are vitrifiable ſtones; and amongſt theſe the hardeſt are alſo the moſt pure and homogeneous, that is, diamonds. Not any one of all known bodies is perfectly hard. This quality belongs undoubtedly to the primary or elementary particles of matter, which of all beings we know the leaſt of.

HARE, *Lepus*, in the Linnæan ſyſtem of Quadrupeds, makes a diſtinct genus of animals, of the order of *glires*; the characters of which are, that the animals of it have feet made for running, with five toes on the fore ones, and four on the hinder, have very long ears, a ſhort tail, and two cutting teeth in each jaw. Under this genus the author takes in all the creatures of the *hare* and rabbit kind. See Lepus. For the Claſſification, ſee the Syſtem.

HARLEIAN Collection. A moſt valuable collection of uſeful and curious manuſcripts, begun near the end of the laſt century, by Robert Harley of Brampton Bryan, eſq. in Herefordſhire, afterwards earl of Oxford and lord high-treaſurer; and which was conducted upon the plan of the great Sir Robert Cotton. He publiſhed his firſt conſiderable collection in Auguſt 1705, and in leſs than ten years he got together near 2500 rare and curious MSS. Soon after this, the celebrated Dr. George Hicks, Mr. Anſtis garter king at arms, biſhop Nicholſon, and many other eminent antiquaries, not only offered him their aſſiſtance in procuring MSS. but preſented him with ſeveral that were very valuable. Being thus encouraged to perſeverance by his ſucceſs, he kept many perſons employed in purchaſing MSS. for him abroad, giving them written inſtructions for their conduct. By theſe means the MS. library was, in the year 1721 increaſed to near 6000 books, 14,000 original charters, and 500 rolls. On the 21ſt of May 1724, lord Oxford died: but his ſon Edward, who ſucceeded to his honours and eſtate, ſtill farther enlarged the collection; ſo that when he died, June 16th 1741, it conſiſted of 8000 volumes, ſeveral of them containing diſtinct and independent treatiſes, beſides many looſe papers which have been ſince ſorted and bound up in volumes; and above 40,000 original rolls, charters, letters patent, grants, and other deeds and inſtruments of great antiquity. The principal deſign of making this collection was the eſtabliſhment of a MS. Engliſh hiſtorical library, and the reſcuing from deſtruction ſuch national records as had eluded the diligence of preceding collectors: but lord Oxford's plan was more extenſive; for his collection abounds alſo with curious MSS. in every ſcience. This collection is now in the Britiſh Muſæum; and an enumeration of its contents may be ſeen in the Annual Regiſter, vi. 140, &c.

HARLEQUIN, in the Italian comedy, a buffoon, dreſſed in party-coloured cloaths; anſwering much the ſame purpoſe as a merry-andrew, or jack pudding, in our drolls, on mountebanks ſtages, &c. We have alſo introduced the *harlequin* upon our theatres; and this is one of the ſtanding characters in this modern groteſque, or Pantomime entertainments. The term took its riſe from a famous Italian comedian, who came to Paris under Henry III. and who frequenting the houſe of M. de Harlay, his companions uſed to call him *Harlequin*, q. d. *little Harlay*; a name which has deſcended to all thoſe of the ſame rank and profeſſion.

HARLOT, a woman given to incontinency; or that makes a habit, or trade, of proſtituting her body. See Courtesan. The word is ſuppoſed to be uſed for the diminutive *whorelet*, a *little whore*. Others derive it from *Arlotta*, miſtreſs to Robert duke of Normandy, and mother to William the Conqueror. Camden derives it from one *Arlotha*, concubine to William the Conqueror: others from the Italian *arlotta*, a *proud whore*.

HARMONICA, Harmonics, a branch or diviſion of the ancient muſic. The *harmonica* is that part which conſiders the differences and proportions of ſounds, with reſpect to acute and grave: in contradiſtinction from RHYTHMICA, and METRICA.

HARMONICAL *Compoſition*, in its general ſenſe, includes the compoſition both of harmony and melody; i. e. of muſic, or ſongs, both in a ſingle part, and in ſeveral parts.

HARMONY, in muſic, the agreeable reſult of an union of ſeveral muſical ſounds, heard at one and the ſame time; or, the mixture of divers ſounds, which together have an agreeable effect on the ear. See Syſtem of Music.

HARP, a muſical inſtrument of the ſtring kind, being of a triangular figure, and placed upright between the legs of the perſon who plays upon it. The *harp*, within the laſt forty years, has been in ſome degree improved, by the addition of eight ſtrings to the uniſon, viz. from E to double F in alt. This inſtrument is ſtruck with the finger and thumb of both hands. Its muſic is much like that of the ſpinet, all its ſtrings going from ſemitone to ſemitone; whence ſome call it an *inverted ſpinet*.

HARPSICHORD, the moſt harmonious of all the muſical inſtruments of the ſtring kind. It is played on after the manner of the organ, and is furniſhed with a ſet, and ſometimes with two ſets of keys; the touching or ſtriking of theſe keys moves a kind of little jacks, which alſo move a double row of chords or ſtrings, of braſs or iron, ſtretched over four bridges on the table of the inſtrument.

HARRIGATE *Well Water*, a ſtrong ſulphureous water, containing beſides ſulphur, marine ſalt and nitre, or nitre only and earth.

HARROW, in huſbandry, a drag made in a ſquare form, ſet with long iron teeth, to break the clods of earth after ploughing.

HART, a ſtag or male deer of five years old. See Deer.

Hart's *Horns*, in pharmacy, the whole horns of the common male deer, as ſeparated from the head, without farther preparation. The chymical analyſis of hart's horn is ſufficiently known: it yields a water highly impregnated with a volatile ſalt, which is called *ſpirit of hartſhorn*, with a fetid oil, and a volatile ſalt, by the common diſtillation in a retort. The ſalt of hartſhorn, when pure, differs in nothing from other purified volatile alkalies.

HARVEST, probably derived from a Saxon word ſignifying *herb-feaſt*, is that ſeaſon of the year, when the corn is ripe and fit to be reaped and gathered into barns.

Harvest *Fly*, in entomology, a large four winged fly of the cicada kind, very common in Italy, and erroneouſly ſuppoſed to be a graſshopper. See Cicada. For the Claſſification ſee the System.

HASSELQUISTIA, in botany, a genus of the *pentandria digynia* claſs: the characters of which are, that the diſc is hemiſpheric and urceolated, and that the rays are oval, plain, marginated, and convex in the middle; and that the fruit is a ſmooth ſeed.

HAT, a covering for the head, worn by the men throughout the weſtern part of Europe. Hats are chiefly made of hair, wool, &c. worked, fulled, and faſhioned to the figure of the head. Hats make a very conſiderable article in commerce: the fineſt, and thoſe moſt valued, are made of pure hair of an amphibious animal, called the caſtor or beaver, frequent in Canada, Nootka Sound, and other parts of North America. See Castor.

Hat is alſo figuratively uſed for the dignity of a cardinal, or a promotion to that dignity. In this ſenſe they ſay, to expect a *hat*; to claim, or have pretenſion to the *hat*, &c.

HATCHING, the maturating fecundated eggs, whether by the incubation and warmth of the parent bird, or by artificial heat, ſo as to produce young chickens alive. The art of hatching chickens by means of ovens has long been practiſed in Egypt; but it is there only known to the inhabitants of a ſingle village named *Berme*, and to thoſe that live at a ſmall diſtance from it. Towards the beginning of autumn they ſcatter themſelves all over the country; where each perſon among them is ready to undertake the management of an oven, each of which is of a different ſize; but, in general, they are capable of containing from forty to foreſcore thouſand eggs. The number of theſe ovens placed up and down the country is about 386, and they uſually keep them working for about ſix months: as, therefore, each brood takes up in an oven, as under a hen, only 21 days, it is eaſy in every one of them to hatch eight different broods of chickens. Every Bermean is under the obligation of delivering to the perſon who intruſts him with an oven, only two thirds of as many chickens as there have been eggs put under his care; and he is a gainer by this bargain, as more than two thirds of the eggs uſually produce chickens. In order to make a calculation of the number of chickens yearly ſo hatched in Egypt, it has been ſuppoſed that only two thirds of the eggs are hatched, and that each brood conſiſts of at leaſt 30,000 chickens; and thus it would appear, that the ovens of Egypt give life yearly to at leaſt 92,640,000 of theſe animals. This uſeful and advantageous method of hatching eggs has been lately diſcovered in France, by the ingenious Mr. Reaumur; who, by a number of experiments, has reduced the art to certain principles. He found by experience, that the heat neceſſary for this purpoſe is nearly the ſame with that marked 32 on his thermometer, or that marked 96 on Farenheit's. This degree of heat is nearly that of the ſkin of the hen, and, what is remarkable, of the ſkin of all other domeſtic fowls, and probably of all other kinds of birds. The degree of heat which brings about the developement of the cygnet, the goſling, and the turkey-pout, is the ſame as that which fits for hatching the canary-ſongſter, and, in all probability, the ſmalleſt humming bird: the difference is only in the time during which this heat ought to be communicated to the eggs of different birds; it will bring the canary bird to perfection in 11 or 12 days, while the turkey-pout will require 27 or 28.

After many experiments, Mr. Reaumur found, that ſtoves heated by means of a baker's oven, ſucceeded better than thoſe made hot by layers of dung: and the furnaces of glaſs-houſes and thoſe of the melters of metals, by means of pipes to convey heat into a room, might, no doubt, be made to anſwer the ſame purpoſe. As to the form of the ſtoves, no great nicety is required. A place over an oven will do very well. Nothing more will be neceſſary but to aſcertain the degree of heat; which may be done by melting a lump of butter of the ſize of a walnut, with half as much tallow, and putting it into a phial. This will ſerve to indicate the heat with ſufficient exactneſs: for when it is too great, this mixture will become as liquid as oil; and when the heat is too ſmall, it will remain fixed in a lump: but it will flow like a thick ſyrup, upon inclining the bottle, if the ſtove be of a right temper. Great attention therefore ſhould be given to keep the heat always at this degree, by letting in freſh air if it be too great, or ſhutting the ſtove more cloſe if it be too ſmall: and that all the eggs in the ſtove may equally ſhare the irregularities of the heat, it will be neceſſary to ſhift them from the ſides to the centre; thereby imitating the hens, who are frequently ſeen to make uſe of their bills, to puſh to the outer parts thoſe eggs that were neareſt to the middle of their neſts, and to bring into the middle ſuch as lay neareſt the ſides.

Mr. Reaumur has invented a ſort of low boxes, without bottoms, and lined with furs. Theſe, which he calls *artificial parents*, not only ſhelter the chickens from the injuries of the air, but afford a kindly warmth, ſo that they preſently take the benefit of their ſhelter as readily as they would have done under the wings of a hen. After hatching, it will be neceſſary to keep the chickens, for ſome time, in a room artfully heated and furniſhed with theſe boxes; but afterwards they may be ſafely expoſed to the air in the court yard, in which it may not be amiſs to place one of theſe artificial-parents to ſhelter them if there ſhould be occaſion for it. As to the manner of feeding the young brood, they are generally a whole day after being hatched, before they take any food at all; and then a few crumbs of bread may be given them for a day or two, after which they will begin to pick up inſects and graſs for themſelves.

Hatchings are of great uſe in heraldry, to diſtinguiſh the ſeveral colours of an eſcutcheon.

HATCHMENT, in heraldry, the marſhalling of ſeveral coats of arms in an eſcutcheon.

Hatchment is alſo a common name for an Atchievement. By theſe *hatchments* or funeral eſcutcheons, it may be known after any perſon's deceaſe, what rank either he or ſhe held when living; and if it be a gentleman's *hatchment*, whether he was a batchelor, married man, or widower, with the like diſtinctions for gentlewomen. See Syſtem of Heraldry, Plate I.

HAURIANT, in heraldry, denotes the poſture of a fiſh when bore directly upright.

HAUTBOY, or Hoboy, a muſical inſtrument, of the wind kind, with a reed, by means of which it is blown or ſounded. The word is French, *haut-bois*, q. d. *high wood*; and is given to this inſtrument, becauſe its tone is higher than that of the violin.

HAWK, *Accipiter*, in ornithology, a ſpecies of the genus Falco. See Falco.

HAWKERS, anciently were fraudulent perſons, who went from place to place, buying and ſelling braſs, pewter, and other merchandize, which ought to be uttered in open market. In this ſenſe the word is mentioned, anno 25 Hen. VIII. cap. 6. and 33 ejuſdem, cap. 4. The appellation *hawkers* ſeems to have ariſen from their uncertain wandering, like thoſe who, with *hawks*, ſeek their game where they can find it. The term is now uſed as ſynonymous with pedlar; a perſon who travels about the country ſelling wares. Every *hawker* muſt take out an annual licence, for which he muſt pay 4*l.* and if he travels with a horſe, aſs, or mule, for every one of them 8*l.* If he travels without a licence, or contrary to it, he forfeits for every offence to the informer, and the poor of the pariſh where diſcovered, 12*l.* If he travels with a forged licence, he forfeits 50*l.* The acts relating to *hawkers* do not extend to makers of goods, or their agents; or thoſe who ſell goods in fairs or markets; to the ſellers of fiſh, fruit, or other victuals; nor to the venders of books and news-papers. 9 and 10 W. c. 27. 3 and 4 Anne, c. 4. But *hawkers* ſhall not, by virtue of ſuch licence, ſell or offer to ſale any tea, or ſpirituous liquors, tho' with a permit, under the penalty of having the ſame ſeized, and impriſonment and proſecution of the offender. 9 Geo. II. cap. 35. And if any foreign cambrick or French lawn ſhall be found in the poſſeſſion of any *hawker*, &c. the ſame ſhall be forfeited, together with all the goods in his pack; and he ſhall be adjudged to have forfeited his licence. 7 Geo. III. cap. 43.

HAWKING, the exerciſe of taking wild fowl by means of hawks. The method of reclaiming, manning, and bringing up a hawk to this exerciſe, is called *falconry*. There are only two countries in the world where we have any evidence that the exerciſe of hawking was very anciently in vogue. Theſe are, Thrace and Britain. In the former, it was purſued merely as the diverſion of a particular diſtrict, if we may believe Pliny, whoſe account is rendered obſcure by the darkneſs of his own ideas of the matter. The primæval Britons, with a fondneſs for the exerciſe of hunting, had alſo a taſte for that of hawking; and every chief among them maintained a conſiderable number of birds for that ſport. It appears alſo from a curious paſſage in the poems of Oſſian, that the ſame diverſion was faſhionable at a very early period in Scotland. The poet tells us, that a peace was endeavoured to be gained by the proffer of 100 managed ſteeds, 100 foreign captives, and "100 hawks with fluttering wings, that fly acroſs the ſky." To the Romans this diverſion was ſcarce known in the days of Veſpaſian; yet it was introduced immediately afterwards. Moſt probably they adopted it from the Britons; but we certainly know that they greatly improved it by the introduction of ſpaniels into the iſland. In this ſtate it appears among the Roman Britons in the ſixth century. Gildas, in a remarkable paſſage in his firſt epiſtle, ſpeaks of Maglocunus, on his relinquiſhing the ſphere of ambition, and taking refuge in a monaſtery; and proverbially compares him to a dove, that haſtens away at the noiſy approach of the dogs, and with various turns and windings takes her flight from the talons of the hawk.

In after-times, hawking was the principal amuſement of the Engliſh; a perſon of rank ſcarce ſtirred out without his hawk on his hand; which, in old paintings, is the criterion of nobility. Harold, afterwards king of England, when he went on a moſt important embaſſy into Normandy, is painted embarking with a bird on his fiſt, and a dog under his arm; and in an ancient picture of the nuptials of Henry VI. a nobleman is repreſented in much the ſame manner: for in thoſe days, *it was thought ſufficient for noblemen to winde their horn, and to carry their hawk fair, and leave ſtudy and learning to the children of mean people.* The former were the accompliſhments of the times; Spenſer makes his gallant Sir Triſtam boaſt,

> Ne is there hawk which mantleth her on perch,
> Whether high towring, or accoaſting low,
> But I the meaſure of her flight doe ſearch,
> And all her prey, and all her diet know. B. vi. Canto 2.

In ſhort, this diverſion was, among the old Engliſh, the pride of the rich, and the privilege of the poor; no rank of men ſeems to have been excluded the amuſement: we learn from the book of St. Alban's, that every degree had its peculiar hawk, from the *emperor* down to the *holy-water clerk*. Vaſt was the expence that ſometimes attended this ſport. In the reign of James I. Sir Thomas Monſon is ſaid to have given 1000l. for a caſt of hawks: we are not then to wonder at the rigour of the laws that tended to preſerve a pleaſure that was carried to ſuch an extravagant pitch. In the 34th of Edward III. it was made felony to ſteal a hawk; to take its eggs, even in a perſon's own ground, was puniſhable with impriſonment for a year and a day, beſides a fine at the king's pleaſure: in queen Elizabeth's reign, the impriſonment was reduced to three months; but the offender was to find ſecurity for his good behaviour for ſeven years, or lie in priſon till he did. Such was the enviable ſtate of the times of *old* England: during the whole day the gentry were given to the fowls of the air, and the beaſts of the field; in the evening, they celebrated their exploits with the moſt abandoned and brutiſh ſottiſhneſs; at the ſame time, the inferior rank of people, by the moſt unjuſt and arbitrary laws, were liable to capital puniſhments, to fines, and loſs of liberty, for deſtroying the moſt noxious of the feathered tribe.

HAY, in agriculture, is a general name for any kind of graſs, cut and dried for the food of cattle. For a particular account of the management of hay in general, ſee Syſtem of Agriculture, Sect. XX.

HAZARD, a game on dice, without tables, is very properly ſo called, ſince it ſpeedily makes a man, or undoes him. It is played with only two dice; and as many play at it as can ſtand round the largeſt round table. Two things are chiefly to be obſerved, viz. main and chance; the latter belonging to the caſter, and the former, or main, to the other gameſters. There can be no main thrown above nine nor under five; ſo that five, ſix, ſeven eight, and nine, are the only mains flung at hazard. Chances and nicks are from four to ten: thus four is a chance to nine, five to eight, ſix to ſeven, ſeven to ſix, eight to five; and nine and ten a chance to five, ſix, ſeven, and eight: in ſhort, four, five, ſix, ſeven, eight, nine, and ten, are chances to any main, if any of theſe nick it not. Now nicks are either when the chance is the ſame with the main, as five and five, or the like; or ſix and twelve, ſeven and eleven, eight and twelve. Here obſerve, that twelve is out to nine, ſeven, and five; eleven is out to nine, eight, ſix, and five; and ames-ace and duce-ace, are out to all mains whatever.

To illuſtrate this game by a few examples: ſuppoſe the main to be ſeven, and the caſter throws five, which is his chance; he then throws again, and if five turn up, he wins all the money ſet him; but if ſeven is thrown, he muſt pay as much money as there is on the board: again, if ſeven be the main, and the caſter throws eleven, or a nick, he ſweeps away all the money on the table; but if he throws a chance, as in the firſt caſe, he throws again: laſtly, if ſeven be the main, and the caſter throws ames-ace, duce-ace, or twelve, he is out: but if he throws from four to ten, he hath a chance; though they are accounted the worſt chances on the dice, as ſeven is reputed the beſt and eaſieſt main to be flung. Four and five are bad throws (the former of which being called by the tribe of nickers, little dick-fiſher) as having only two chances, viz. trey-ace, and two duces, or trey-duce and quarter-ace; whereas ſeven hath three chances, viz. cinque-duce, ſice-ace, and quarter-trey. Nine and ten are in the like condition with four and five; having only two chances. Six and eight have indeed the ſame number of chances with ſeven, viz. three; but experienced gameſters nevertheleſs prefer the ſeven, on account of the difficulty to throw the doublets, two quarters, or two treys. It is alſo the opinion of moſt, that at the firſt throw the caſter hath the worſt of it. On the whole, *hazard* is certainly one of the moſt bewitching and ruinous games played on the dice. Happy, therefore, the man who either never heard of it, or who has reſolution enough to leave it off in time. See Gaming under the head, *Application of* Chance.

HEAD, in anatomy, ſee Syſtem of Anatomy. For a deſcription of the Oſteology, ſee Part II. Sect. XIII. For repreſentation, ſee Plate I. *Fig.* 1. For a deſcription of the Myology, ſee Part III. Sect. IX. For repreſentation, ſee Plate III. *Fig.* 1.

Head *Ach*, in medicine. For the cauſes and methods of cure, ſee the Syſtem.

HEALING, in its general ſenſe, includes the whole proceſs of curing or removing a diſorder, and recovering health. In this ſenſe, medicine is defined the art of *healing*. In its more reſtrained ſenſe, as uſed in ſurgery, &c. *healing* denotes the uniting or conſolidating the lips of a wound or ulcer. The medicines proper for this intention, are called *incarnatives*, *agglutinatives*, *vulneraries*, &c. Dr. Beal has a diſcourſe of ſanative or *healing* ſprings and waters, in the Philoſophical Tranſactions, N° 20.

HEALTH, is a right diſpoſition of the body, and of all its parts; conſiſting in a due temperature, a right conformation, juſt connection, and ready and free exerciſe of the ſeveral vital functions. Health admits of latitude, as not being the ſame in all ſubjects, who may yet be ſaid to enjoy health. That part of medicine, which ſhews the means of preſerving health, is termed *hygieine.* See MEDICINE. The Greeks and Romans deified Health, repreſenting it under the figure of a woman, whom they ſuppoſed to be the daughter of Æſculapius. We find the name of the goddeſs *Salus,* or Health, on many medals of the Roman emperors, with different inſcriptions; as, *Salus Publica, Salus Republicæ, Salus Auguſti,* &c.

Methods of preſerving the HEALTH *of Mariners.* See TUTAMEN NAUTICUM, in the Treatiſe on Naval Affairs.

HEARING, the act or faculty of perceiving ſounds. *Hearing* is reckoned among our external ſenſes. Its organ is the *ear,* and particularly the auditory nerve diffuſed through the ſame; and its object, certain motions or vibrations of the air. See Syſtem of ACOUSTICS, Definition I. See alſo Syſtem of ANATOMY, Part VI. Sect. X. For repreſentation of the organ of Hearing, ſee Plate on the Organs of Senſe, *Fig.* 6, 7, and 8.

HEARING is particularly uſed in civil and judicial concerns, for a cauſe being brought before the judge and jury, and the parties being *heard* as to the merits thereof. The method of *hearing* cauſes in the court of Chancery is this: the parties on both ſides appearing by their counſel, the plaintiff's bill is firſt opened or briefly abridged, and the defendant's anſwer alſo, by the junior counſel on each ſide; after which the plaintiff's leading counſel ſtates the caſe and the matters in iſſue, and the points of equity ariſing from them; and then ſuch depoſitions as are called for by the plaintiff are read by one of the ſix clerks; and the plaintiff may alſo read ſuch part of the defendant's anſwer as he thinks material or convenient: and, after this, the reſt of the counſel for the plaintiff make their obſervations and arguments. Then the defendant's counſel go through the ſame proceſs for him, except that they may not read any part of his anſwer; and the counſel for the plaintiff are heard in reply. When all are heard, the court pronounces the decree, adjuſting every point in debate according to equity and good conſcience; which decree, being uſually very long, the minutes of it are taken down, and read openly in court by the regiſter. Black. Com. vol. iii. p. 451. 4to.

HEARSE is the name of a well known carriage, uſed for conveying the dead to the grave. The word is alſo uſed by Shakeſpeare in his Henry VI. for a monument erected over a grave.

HEART, *cor,* in anatomy, a muſculous part of the human body, ſituated in the thorax, on the anterior part of the diaphragm, between the two laminæ of the mediaſtinum, wherein the veins all terminate, and from which all the arteries ariſe, and which, by its alternate contraction and dilatation, is the chief inſtrument of the circulation of the blood, and the principle of life. Several ingenious perſons have from time to time attempted to make eſtimates of the force of the blood in the heart and arteries; who have as widely differed from each other, as they have from the truth, for want of a ſufficient number of data to argue upon. For a copious deſcription, ſee Syſtem of ANATOMY, Part V. Sect. XX and XXI. For repreſentation, ſee Plate V. *Fig.* 5. For a particular deſcription of the Hearts of *Quadrupeds, Birds,* and *Fiſhes,* ſee COMPARATIVE ANATOMY. Sect. I, II, and III.

HEAT, in phyſiology, is uſed in a double ſenſe, either as that peculiar ſenſation which is felt on the approach of burning bodies; or the cauſe of that ſenſation, in which laſt ſenſe it is ſynonymous with FIRE. The diſputes which were formerly carried on with regard to the nature of heat, namely, whether we were to account it merely an effect of motion in the parts of terreſtrial bodies, or of a fluid *per ſe,* ſeem now to be generally determined in favour of the latter opinion. *Heat* may be defined a phyſical being, whoſe preſence is known, and its degree meaſured by the expanſion of air, or ſpirit, or mercury, in the thermometer. *Heat,* with reſpect to our ſenſation, or the effect produced on us by a hot body, is eſtimated by its relation to the organ of feeling; no object appearing to be hot, unleſs its *heat* exceeds that of our body. *Heat,* as it exiſts in the hot body, or that which conſtitutes and denominates a body hot, and enables it to produce ſuch effects on our organ, is variouſly conſidered by the philoſophers. Some will have it a quality, others a ſubſtance, and others only a mechanical affection, viz. motion. The Epicureans, and other corpuſcularians, define *heat* not as an accident of fire, but as an eſſential power or property thereof, the ſame in reality with it, and only diſtinguiſhed from it in the manner of our conception. *Heat,* then, on their principles, is no other than the volatile ſubſtance of fire itſelf, reduced into atoms, and emitted in a continual ſtream from ignited bodies; ſo as not only to *warm* the objects within its reach, but alſo, if they be inflammable, to *kindle* them, turn them into fire, and conſpire with them to make flame. The Carteſians, improving on this doctrine, aſſert *heat* to conſiſt in a certain motion of the inſenſible particles of a body, reſembling the motion whereby the ſeveral parts of our body are agitated by the motion of the heart and blood. Our lateſt and beſt writers of mechanical, experimental, and chymical philoſophy, differ very conſiderably about *heat.* The fundamental difference is, whether it be a peculiar property of one certain immutable body, called *fire*; or whether it may be produced mechanically in other bodies, by inducing an alteration in the particles thereof. The former tenet, which is as ancient as Democritus, and the ſyſtem of atoms, had given way to that of the Carteſians, and other mechaniſts; but is now with great addreſs retrieved, and improved on, by ſome of the lateſt writers, particularly Homberg, the younger Lemery, Graveſande, and, above all, by the learned and induſtrious Boerhaave, in a courſe of lectures expreſly on *fire*; the reſult whereof we have already laid down under the article FIRE.

It appears that the effects of fire have a dependence on concurring circumſtances; ſome more and others leſs. One thing ſeems to be required in common to them all, viz. that the fire be collected, or brought into leſs compaſs. This collection is performed two ways; the firſt, by directing and determining the fluctuating corpuſcles of fire into lines, or trains, called *rays*; and thus driving infinite ſucceſſions of the fiery atoms upon the ſame place or body, each to produce its ſeveral effort, and ſecond that of the preceding ones, till by a ſeries of augumentations, the effect is ſenſible. This is the office of thoſe bodies which we call *luminaries*; ſuch as the ſun, and other heavenly bodies; and alſo of our culinary fires, lamps, &c. on earth, which do not emit the fire from their own ſubſtance, as is commonly conceived, but only by their rotatory mutation direct the undermined corpuſcles into parallel rays. And the effect may ſtill be farther increaſed by a ſecond collection of theſe parallel, into converging rays, by means of a concave ſpeculum, or a convex glaſs, which at length brings them all into a point; whence thoſe aſtoniſhing effects of our large burning-glaſſes. The ſecond way wherein the collection is made, is not by determining the vague fire, or giving it any new direction, but merely by aſſembling it; which is done by the attrition or rubbing of two bodies ſwiftly againſt each other; ſo ſwiftly, in effect, as that nothing in the air, except the floating fire, has activity enough to move an equal pace, or ſucceed faſt enough into the places continually relinquiſhed by it: by which means fire, the moſt agile body in nature, ſlipping in, becomes collected in the path of the moving body; ſo that the moveable has, as it were, a fiery atmoſphere around it. Thus it is, that the axes of chariot-wheels, mill-ſtones, the ropes of ſhips, cannon-balls, &c. conceive *heat,* and ſome of them kindle into flame.

The mechanical philoſophers, particularly lord Bacon, Mr. Boyle, and Sir Iſaac Newton, look on *heat* in another light. They do not conceive it as an original inherent property of any particular ſort of body; but as mechanically producible in any body. Lord Bacon, in an expreſs treatiſe De Forma Calidi, deduces, from a particular enumeration of the ſeveral phenomena, and effects of *heat,* 1. That *heat* is motion; not that motion generates *heat,* or *heat* motion; though, in many caſes, this be true; but the very thing *heat* is motion, and nothing elſe. But this motion, he ſhews, has ſeveral peculiar circumſtances, which conſtitute it *heat,* As, 2. That it is an expanſive motion, whereby a body endeavours to dilate or ſtretch into a larger dimenſion than it had before. 3. That this expanſive motion is directed towards the circumference, and at the ſame time upwards; which appears hence, that an iron rod, being erected in the fire will burn the hand that holds it, much ſooner than if put in laterally. 4. That this expanſive motion is not equable, and of the whole, but only of the ſmaller particles of the body: as appears from the alternate trepidation of the particles of *hot* liquors, ignited iron, &c. And laſtly, that this motion is very rapid. Hence he defines *heat* an expanſive undulatory motion in the minute particles of the body; whereby they tend with ſome rapidity, towards the circumference, and at the ſame time incline a little upwards.

There is a great variety in the *heat* of different places and ſeaſons. Naturaliſts commonly lay it down, that the nearer any place is to the centre of the earth, the hotter it is found; but this does not hold ſtrictly true. In digging mines, wells, &c. they find, that at a little depth below the ſurface it feels cool; a little lower, and it is yet colder, as being now beyond any reach or influence of the ſun's rays, inſomuch that water will freeze almoſt inſtantaneouſly; and hence the uſe of ice-houſes, &c. but when a little lower, viz. about forty or fifty feet deep, it begins to grow warmer, ſo that no ice can bear it: thus, in the cave of the obſervatory at Paris, about ninety feet under ground, the *heat* keeps the thermometer at 53°; and then the deeper they go, ſtill the greater is the *heat,* till, at length, reſpiration grows difficult, and the candles go out. Hence ſome have recourſe to the notion of a fund of fire lodged in the centre of the earth, which they conſider as a central ſun, and the great principle of the generation, vegetation, nutrition, &c. of foſſil and vegetable bodies.

But Mr. Boyle, who had been at the bottom of ſome mines himſelf, ſuſpects that this degree of *heat,* at leaſt in ſome of them, may riſe from the peculiar nature of the minerals generated therein. To confirm this, he inſtances a mineral of the vitriolic kind, dug up in large quantities, in ſeveral parts of England, which, by the bare effuſion of common water, will grow ſo hot as almoſt to take fire. On the other hand, as you aſcend high mountains, the air grows more and more piercing and cold: thus the tops of the Pico de Theide in Bohemia, the pike of Teneriff, and ſeveral others, even in the moſt ſultry countries, are found always inveſted with ſnow and ice, the *heat* never being ſufficient to thaw the ſame. In ſome of the mountains of Peru there is no ſuch thing as running water, but all ice; plants grow about the feet of the mountains, but near the top no vegetable can live; and this it is not for want of food, but through the intenſeneſs of the cold. This effect is attributed to the thinneſs of the air, and the little ſurface of earth there is to reflect the rays. The rays here are only determined into a paralleliſm; but the effect of direct parallel rays is found, by computation, to be very inconſiderable, this effect being really greater in winter than ſummer.

HEAT, in Geography. The diverſity of the *heat* of climes and ſeaſons ariſes from the different angles under which the ſun's rays ſtrike upon the earth's ſurface. It is ſhewn in mechanics, that a moving body, ſtriking perpendicularly on another, acts on it with all its force; and that a body ſtriking obliquely, acts with the leſs force, the more it deviates from the perpendicular. Now fire, moving in right lines, muſt obſerve the ſame mechanical law as other bodies; and conſequently its action muſt be meaſured by the ſine of the angle of incidence: and hence fire ſtriking on any obſtacle in a direction parallel thereto, has no ſenſible effect, becauſe the ratio is almoſt infinite, i. e. it is nothing. Accordingly, the ſun, radiating on the earth in the morning, ſcarce produces any warmth at all.

Animal HEAT. A late author thinks the *heat* of animals explicable from the phoſphorus and air they contain. Phoſphorus exiſts, at leaſt in a dormant ſtate, in animal fluids: and it is alſo known that they all contain air; it is therefore only neceſſary to bring the phoſphoreal and aerial particles into contact, and *heat* muſt of conſequence be generated; and where it not for the quantity of aqueous humours in animals, fatal accenſions would frequently happen. Dr. Mortimer, ap. Phil. Tranſ. N° 476. § 20. See PHOSPHORUS. Dr. Cullen, maintains that the vital principle may have ſuch a peculiar power, that where it is different, different degrees of *heat* may be generated; though the velocity of the blood be the ſame. But this appears to be only an occult principle in the animal œconomy, producing effects in a manner not yet ſatisfactorily explained. And it ſeems contrary to experience, and abſurd, to aſſert, that the principle of life can generate *heat* or cold, independently of chymical or mechanical means.

Dr. Black ſuppoſes that animal *heat* is generated altogether in the lungs, by the action of the air on the principle of inflammability, and is thence diffuſed over the reſt of the body by means of the circulation; but a late ingenious writer, Dr. Leſlie, hath urged ſeveral arguments againſt this hypotheſis, tending to ſhew that it is repugnant to the known laws of the animal machine. Dr. Leſlie advances another hypotheſis of his own, viz. that the ſubtle principle by chymiſts termed phlogiſton, which enters into the compoſition of natural bodies, is in conſequence of the action of the vaſcular ſyſtem gradually evolved through every part of the animal machine, and that during this evolution, *heat* is generated. This opinion, he candidly acknowledges, was firſt delivered by Dr. Duncan of Edinburgh, and ſomewhat ſimilar to it is to be found in Dr. Franklin's works, and in a paper of Dr. Mortimer's, in the Philoſophical Tranſactions. He endeavours to eſtabliſh this hypotheſis by the following arguments: 1. That the blood contains phlogiſton. 2. That the action of the blood-veſſels evolves phlogiſton. 3. That the evolution of phlogiſton is attended with *heat*. 4. That the *heat* thus generated is ſufficient to account for the *heat* of living animals. 5. That the moſt ſtriking phenomena of animal *heat* evince the truth of theſe propoſitions, Philoſ. Inquiry into the Cauſe of Animal *heat*, &c. 8vo. 1778. With reſpect to this hypotheſis, it may be obſerved, that it is altogether inconſiſtent with thoſe experiments of Dr. Prieſtley, from which it appears, that arterial blood has ſo ſtrong an attraction to phlogiſton, as to be capable of ſeparating it from fixed and phlogiſticated air. See BLOOD. For the different definitions and opinions of Philoſophers on this ſubject, ſee the Articles *Electricity, Evaporation, Fermentation, Fire, Flame, Ignition, Light, &c.*

HEAVEN, *Cœlum*, an azure, tranſparent orb, inveſting our earth; wherein the celeſtial bodies perform their motions. The popular notion of *heaven*, it muſt be obſerved, has various ideas, in the language of philoſophers, divines, and aſtronomers: agreeable to which we may lay down divers *heavens*; as the *higheſt*, or *empyrean heaven*; the *ætherial*, or *ſtarry heaven*; the *planetary heaven, &c.*

HEAVEN, among Divines, called alſo the *empyrean heaven*, is the abode of God, and bleſſed ſpirits; as angels, and the ſouls of the righteous deceaſed. In this ſenſe, *heaven* ſtands oppoſed to *hell*. This is alſo frequently called in Scripture, the *kingdom of heaven*, the *heaven of heavens*, and by St. Paul the *third heaven*; ſometimes *Paradiſe*, the *New-Jeruſalem*, &c. This *heaven* is conceived as a place in ſome remote part of infinite ſpace, wherein the Deity is pleaſed to afford a nearer and more immediate view of himſelf, and a more ſenſible manifeſtation of his glory; and a more adequate perception of his attributes, than in the other parts of the univerſe, where he is likewiſe preſent. This makes what the divines alſo call the *beatific viſion*. Authors are much divided as to the reality of ſuch *local heaven*. The inſpired writers give us very magnificent deſcriptions of *heaven*, the ſtructure, apparatus, and attendance thereof; particularly Iſaiah, and St. John the Divine. Plato, in his Dial. de Anim. ſpeaks of *heaven* in terms that bear ſo near a reſemblance to thoſe of Scripture, that Euſebius charges him with borrowing his account thence. De Præpar. Evangel. lib. xi. cap. 37. The ancient Romans had a kind of *heaven* in their ſyſtem of theology, which they called ELYSIUM, or the *elyſian fields*. The Mahometan *heaven, or paradiſe*, is very groſs, agreeable to the genius of their religion.

Heaven, taken in this general ſenſe, for the whole expanſe between our earth and the remote regions of the fixed ſtars, may be divided into two very unequal parts, according to the matter found therein; viz. the atmoſphere, or *aerial heaven*, poſſeſſed by air; and the *ætherial heavens*, poſſeſſed by a thin, unreſiſting medium, called *æther*.

HEAVEN is more particularly uſed, in aſtronomy, for an orb, or circular region, of the æthereal *heaven*.

HEBREW, or HEBREW *Language*, that ſpoken by the ancient Jews, and wherein the old Teſtament is wrote. This appears to be the moſt ancient of all the languages in the world, at leaſt we know of none older; and ſome learned men are of opinion, that this is the language in which God ſpoke to Adam in Paradiſe. The books of the Old Teſtament are the only pieces to be found, in all antiquity, written in pure Hebrew; and the language of many of theſe is extremely ſublime: it appears perfectly regular, and particularly ſo in its conjugations, and affords a great variety of expreſſions to repreſent by a ſingle word the different modifications of a verb, and many ideas which in the modern and in many of the ancient and learned languages cannot be expreſſed without a periphraſis. The primitive words, which are called *roots*, have ſeldom more than three letters or two ſyllables. In this language there are 22 letters, only five of which are uſually reckoned vowels, which are the ſame with ours, viz. *a, e, i, o, u*; but then each vowel is divided into two, a long and a ſhort, the ſound of the former being ſomewhat grave and long, and that of the latter ſhort and acute: it muſt however be remarked, that the two laſt vowels have ſounds that differ in other reſpects beſides quantity and a greater or leſs elevation. To theſe 10 or 12 vowels may be added others, called *ſemi-vowels*, which ſerve to connect the conſonants, and to make the eaſier tranſitions from one to another. The number of accents in this language are, indeed, prodigious: of theſe there are near 40, the uſe of ſome of which, notwithſtanding all the inquiries of the learned, are not yet perfectly known. We know, in general, that they ſerve to diſtinguiſh the ſentences like the points called *commas, ſemicolons*, &c. in our language; to determine the quantity of the ſyllables; and to mark the tone with which they are to be ſpoken or ſung. It is no wonder, then, that there are more accents in the Hebrew than in other languages, ſince they perform the office of three different things, which in other languages are called by different names.

HEBREWS, or *Epiſtle to the* HEBREWS, a canonical book of the New Teſtament. Though St. Paul did not prefix his name to this epiſtle, the concurrent teſtimony of the beſt authors ancient and modern afford ſuch evidence of his being the author of it, that the objections to the contrary, are of little or no weight. The Hebrews, to whom this epiſtle was wrote, were the believing Jews of Paleſtine; and its deſign was to convince them, and by their means all the Jewiſh converts whereſoever diſperſed, of the inſufficiency and aboliſhment of the ceremonial and ritual law.

HECTIC, or HECTIC FEVER, in medicine, a ſort of ſlow habitual fever, ſeated in the ſolids, and gradually preying on and conſuming the ſubſtance thereof. The word is εκτικος, formed of ἑξος, *habitus*, a quality hard to ſeparate from its ſubject. See the SYSTEM.

HEDGE, in agriculture, &c. a fence incloſing a field, garden, or the like, made of branches of trees interwoven. See INCLOSURE.

HEDGE-*Hog*, the Engliſh name of a genus of quadrupeds, called *Erinaceus*. For the generic character and different ſpecies, ſee ERINACEUS. For the Claſſification, ſee the SYSTEM.

HEEL, in anatomy, the hind part of a FOOT. See Syſtem of ANATOMY, Part II. Sect. XII. Plate I, *Fig.* 1. Letter *b*.

HEGIRA, in chronology, a celebrated epocha, uſed by the Arabs and Mahometans for the computation of time. The word is Arabic, ſignifying *to fly, to quit one's country, family, friends*, &c. The event which gave occaſion to this epocha, was Mahomet's flight from Mecca: the magiſtrates of that city, fearing his impoſtures might raiſe a ſedition, reſolved to expel him: this, they accordingly effected in the year of our Lord 622, on the evening of the 15th or 16th of July. See EPOCHA.

HEIGHT, in general, ſignifies the difference between the ground and the top of any object meaſured perpendicularly. For the methods of meaſuring HEIGHTS, ſee ALTITUDE, TRIGONOMETRY, BAROMETER, and MOUNTAIN.

HEIR, in law, ſignifies the perſon who ſucceeds another by deſcent to lands, tenements, and hereditaments, being an eſtate of inheritance, or an eſtate in fee; becauſe nothing paſſes by right of inheritance but in fee. See the articles CONSANGUINITY, DESCENT, FEE, and SUCCESSION. There are two principal kinds of *heirs*, the *apparent* and *preſumptive*.

HEIR *Apparent*, is he on whom the ſucceſſion is ſo ſettled, that he cannot be ſet aſide without altering the laws of ſucceſſion: or, whoſe right of inheritance is indefeaſible, provided he outlives the anceſtor; as the eldeſt ſon or his iſſue, who muſt by the courſe of the common law be *heir* to the father, whenever he happens to die.

Heir *Preſumptive*, is one who, if the anceſtor ſhould die immediately, would, in the preſent circumſtances of things, be his *heir*; but whoſe right of inheritance may be defeated by contingency of ſome nearer *heir* being born; as a brother or nephew, whoſe preſumptive ſucceſſion may be deſtroyed by the birth of a child; or a daughter, whoſe preſent hopes may be cut off by the birth of a ſon. Nay, even, if the eſtate hath deſcended, by the death of the owner, to ſuch brother or nephew, or daughter; in the former caſe the eſtate ſhould be taken away by the birth of a poſthumous child, and in the latter, by the birth of a poſthumous ſon.

HELIACAL, in aſtronomy, a term applied to the riſing and ſetting of the ſtars; or, more ſtrictly ſpeaking, to their emerſion out off, and immerſion into, the rays and ſuperior ſplendor of the ſun. A ſtar is ſaid to riſe heliacally, when, after having been in conjunction with the ſun, and on that account inviſible, it comes to be at ſuch a diſtance from him, as to be ſeen in the morning before ſun-riſing; the ſun, by his apparent motion, receding from the ſtar towards the Eaſt. On the contrary, the heliacal ſetting is, when the ſun approaches ſo near a ſtar as to hide it with his beams which prevent the fainter light of the ſtar from being perceived; ſo that the terms *apparition* and *occultation* would be more proper than *riſing* and *ſetting*. *To find the* Heliacal *riſing and ſetting by the globe*, ſee the Treatiſe on the uſe of the Celeſtial Globe, Prob. 26 and 27.

HELIANTHUS, the *Great Sunflower*; a genus of the polygamia fruſtanea order, belonging to the ſyngeneſia claſs of plants. There are 12 ſpecies, moſt of which are now very common in our gardens, though all of them are natives of America. They are all very hardy, and will proſper in almoſt any ſoil or ſituation. They may be propagated either by ſeeds, or by parting their roots.

We have in the Univerſal Magazine for Feb. 1790 *a very curious account of the uſes of the ſeeds of this plant, by a perſon who ſigns himſelf* Botanicus, *and as it appears of importance to this country, we ſhall cite it in his own words.*

"I have long been of the common, and, I conceive, highly reaſonable opinion, that every country is furniſhed with all things neceſſary to the ſubſiſtence and well-being of its inhabitants, however few may have appeared, or are known, in many of them; which, though apparently ill ſupplied, might be found, on proper inveſtigation, to contain innumerable bleſſings of which ignorance is yet uninformed, and which induſtry and cultivation have not hitherto explored. Of this ſentiment, I am the more fully convinced, from my own knowledge of many articles poſſeſſed by ourſelves, and ſpontaneouſly ſpringing beneath our feet, growing almoſt at our doors, or in which our fields, hills, and dales abound, of which the ſuppoſed defect, has cauſed the expenſive importation, from diſtant countries, of what we have, better adapted to our purpoſes, at home: by the knowledge and uſe whereof, much coſt might be ſpared, and many neceſſities more eaſily ſupplied.

"I will only exemplify this in one inſtance. It is imagined that a ſufficiency of oil for edible purpoſes cannot be eaſily obtained from any plant of Engliſh growth. But this is a falſe ſuppoſition. Finer and ſweeter oil, no country can ſupply, than what we can, with little trouble and expence, prepare for ourſelves. The tall annual Sun Flower will prove this: its ſeed bruiſed and preſſed, will yield an oil as ſweet, and as fine, as that we import from Florence. From a buſhel of this ſeed, a gallon of oil may be drawn. And with this advantage, that it can be obtained at any time, quite ſoft, bland, and freſh. The ſeed alſo, and the moſs that remain after the expreſſion of the oil, are of excellent uſe to feed and fatten hogs, poultry, &c. But beſides theſe uſes, the growing plant is of eminent ſervice—it having been proved, that near twenty times as much pure dephlogiſticated air is exhaled from one plant in twenty four-hours, in light and clear weather, as a man perſpires in a vitiated and impure ſtate, in that ſpace of time. Hence the inhabitants of cloſe, ill-aired, and unwholeſome places, ſhould be diligent in its cultivation!" Botanicus.

HELIX, in anatomy, is the whole circuit or extent of the auricle, or border of the ear outwards. In oppoſition to which, the inner protuberance ſurrounded thereby, and anſwering thereto, is called *anthelix*. For their repreſentation, ſee Syſtem of Anatomy. Plate on the Organs of Senſe *Fig*. 8. Letters *aa*, and *b*.

Helix, the ſnail, a genus belonging to the order of vermes teſtacea. The ſhell conſiſts of one ſpiral, brittle, and almoſt diaphanous valve; and the aperture is narrow. For the Claſſification, ſee Synoptical Table to the Syſtem of Conchology.

HELL, the place of divine puniſhment after death. As all religions have ſuppoſed a future ſtate of exiſtence after this life, ſo all have their hell or place of torment in which the wicked are ſuppoſed to be puniſhed. Divines reduce the torments of hell to two kinds; *pæna damni*; the loſs and privation of the beatific viſion; and *pæna ſenſus*, the horrors of darkneſs, with the continual pains of fire unextinguiſhable. Moſt nations and religions have their notions of a *hell*. The *hell* of the poets is terrible enough: witneſs the puniſhment of Tityus Prometheus, the Danaids, Lapithæ, Phlegyas, &c. deſcribed by Ovid in his Metamorphoſis. Virgil, after a ſurvey of *hell*, Æneid, lib. vi. declares, that if he had a hundred mouths and tongues, they would not ſuffice to recount all the plagues of the tortured. But theſe are all to be conſidered as only fables of poets, who, according to the genius of their art, allegorizing and perſonifying every thing, from the certain death met with in thoſe places, took occaſion to repreſent them as ſo many gates or entering places into the other world.

The Jews placed hell in the centre of the earth, and believed it to be ſituated under waters and mountains. According to them, there are three paſſages leading to it: the firſt is in the wilderneſs, and by that Korah, Dathan, and Abiram, deſcended into hell; the ſecond is in the ſea, becauſe Jonah, who was thrown into the ſea, cried to God out of the belly of hell; the third is in Jeruſalem, becauſe it is ſaid the fire of the Lord is in Zion, and his furnace is in Jeruſalem. They likewiſe acknowledged ſeven degrees of pain in hell, becauſe they find this place called by ſeven different names in ſcripture. Though they believed that infidels, and perſons eminently wicked, will continue for ever in hell; yet they maintained, that every Jew who is not infected with ſome hereſy, and has not acted contrary to the points mentioned by the rabbins, will not be puniſhed therein for any other crimes above a year at moſt. The Mahometans believe the eternity of rewards and puniſhments in another life. In the Koran it is ſaid, that hell has ſeven gates, the firſt for the Muſſulmans, the ſecond for the Chriſtians, the third for the Jews, the fourth for the Sabians, the fifth for the Magians, the ſixth for the Pagans, and the ſeventh for the hypocrites of all religions.

Among Chriſtians, there are two controverted queſtions in regard to hell; the one concerns locality, the other the duration of its torments. The locality of hell, and the reality of its fire, began firſt to be controverted by Origen. That father, interpreting the ſcripture account metaphorically, makes hell to conſiſt, not in external puniſhments, but in a conſciouſneſs or ſenſe of guilt, and a remembrance of paſt pleaſures. Among the moderns, Mr. Whiſton advanced a new hypotheſis, but as abſurd as it is extravagant. According to him, the comets are ſo many hells appointed in their orbits alternately to carry the damned into the confines of the ſun, there to be ſcorched by its violent heat, and then to return with them beyond the orb of Saturn, there to ſtarve them in thoſe cold and diſmal regions. Another modern author, not ſatisfied with any hypotheſis hitherto advanced, aſſigns the ſun to be the local hell. As to the ſecond queſtion, viz. the duration of hell-torments, we have Origen again at the head of thoſe who deny that they are eternal; it being that father's opinion, that not only men, but devils, after a due courſe of puniſhment ſuitable to their reſpective crimes, ſhall be pardoned and reſtored to heaven. The chief principle upon which Origen built his opinion, was the nature of puniſhment, which he took to be emendatory, applied only as phyſic for the recovery of the patients health. The chief objection to the eternity of hell torments among modern writers, is the diſproportion between temporary crimes and eternal puniſhments. Thoſe who maintain the affirmative, ground their opinions on ſcripture-accounts, which repreſent the pains of hell under the figure of a worm which never dies, and a fire which is not quenched; as alſo upon the words, "Theſe ſhall go away into everlaſting puniſhment, but the righteous into life eternal."

The ſcripture phraſes for eternity, as is obſerved by archbiſhop Tillotſon, do not always import an infinite duration: thus, in the Old Teſtament, *for ever* often ſignifies only a long time, particularly to the end of the Jewiſh diſpenſation: thus, in the Epiſtle of Jude, ver. 7. the cities of Sodom and Gomorrah are ſaid to be ſet forth for an example, ſuffering the vengeance of *eternal fire*; that is, of a fire that was not extinguiſhed till thoſe cities were utterly conſumed. So one generation is ſaid to come, &c. but the earth endureth *for ever*. In effect, M. Le Clerc notes, that there is no Hebrew word which properly expreſſes eternity: הולם, *holam*, only imports a time whoſe beginning or end is not known; and is accordingly uſed in a more or leſs extenſive ſenſe according to the thing treated of.

HELLENISM, a ſort of Greciſm; or a phraſe peculiarly accommodated to the genius and conſtruction of the Greek tongue.

HELMET, an ancient defenſive armour worn by horſemen both in war and in tournaments. It covered both the head and face, only leaving an aperture in the front ſecured by bars, which was called the *viſor*. In atchievements, it is placed above the eſcutcheon for the principal ornament, and is the true mark of chivalry and nobility. Helmets vary according to the different degrees of thoſe who bear them. They are alſo uſed as a bearing in coats of arms. See Syſtem of Heraldry, Plate I.

HELVETIC, ſomething that has a relation to the Switzers or inhabitants of the Swiſs cantons, who were anciently called *Helvetii*. The *Helvetic* body comprehends the republic of Switzerland, conſiſting of thirteen cantons, which make ſo many particular commonwealths. By the laws and cuſtoms of the *Helvetic* body, all differences between the ſeveral ſtates and republics are to be decided within themſelves, without the intervention of any foreign power. The government of this body is chiefly democratic, with ſome mixture of the ariſtocratic.

HEMIPTERA, derived from ἥμισυς, *half*, and πτερον, *wing*, in the *Linnæan Syſtem*, the ſecond order of inſects, comprehending twelve genera. For the characters of this order and its ſeveral genera, as well as claſſification; ſee Syſtem of Entomology, Part II, and Order II.

HEMISPHERE, Hemispherium, compounded of ἡμισυς, *half*: and σφαιρα, *ſphere*, in geometry, is one half of a globe, or ſphere, when divided into two by a plane paſſing through its centre.

Hemisphere, in Aſtronomy and Geography, is particularly uſed for one half of the mundane ſphere. The equator divides the ſphere into two equal parts, called the *northern* and *ſouthern hemiſpheres*. The *northern hemiſphere* is that half into whoſe vertex is the north pole. The *ſouthern hemiſphere* is the other half terminated by the equator. The horizon alſo divides the ſphere into two *hemiſpheres:* the *upper*, and the *lower*. See Treatiſe on the Globes.

Hemisphere, is alſo uſed for a map, or projection, of half the terreſtrial globe, or half the celeſtial ſphere, on a plane.

HEMLOCK, in botany, a genus of the *pentandria dyginia* claſs. This plant is eſteemed by many phyſicians as an excellent remedy to diſſolve ſchirrous tumors; and ſome have greatly recommended it for cancers: moſt of them agree that it may be preſcribed as a good narcotic. We are chiefly indebted for the knowledge of the beneficial effects of *hemlock* to the experiments of Dr. Storck, phyſician at Vienna, an account of which was publiſhed in the year 1760. This ingenious writer relates, that bags of the dry leaves, quilted together, boiled for a few minutes in water, or milk, then ſqueezed from the ſuperfluous liquor, and applied warm, checked the progreſs of very bad gangrenes, and procured a ſuppuration of the corrupted parts; that the ſame application abated the pains of an obſtinate gout, and diſcuſſed the tophaceous concretions; and that its effects were likewiſe conſiderable in œdematous tumors, ſchirrous ſtrumæ, indurations of the glands of the breaſt, and in very bad cancers; and that plaſters, containing the juice of *hemlock*, often reſolve and diſcuſs what reſiſts all other applications. With us the herb has been chiefly uſed in the form of plaſter, prepared by mixing the recent juice with a ſolution of twice its quantity of gum ammoniac, made in vinegar of ſquills, and boiling down the mixture to a due conſiſtence.

For internal purpoſes, Dr. Storck directs the freſh juice to be inſpiſſated in an earthern veſſel over a very gentle fire, till it acquires the conſiſtence of a thick extract; which is to be mixed with as much of the powdered leaves as will reduce it into a maſs fit for pills. This preparation produced very powerful and ſalutary effects in ſome diſeaſes that were reputed incurable, acting, though ſlowly and inſenſibly, as a high reſolvent. He relates hiſtories of inveterate ſchirruſes, cancers, and the worſt kinds of ulcers, and fiſtulæ, being completely cured by it; and ſays, that it alſo reſolves recent cataracts, or at leaſt reſtrains their progreſs. He begins always with ſmall doſes; giving one pill of two grains, firſt twice a day, then thrice a day, and gradually increaſing the number to ſix or more for a doſe. The good effects of the medicine were ſometimes viſible in a few days, though the cure generally required ſeveral months. It appears from ſeveral late trials of this medicine, both in England and Ireland, particularly by Dr. Fothergill, and Dr. Rutty, that though it is far from anſwering the high expectations which Dr. Storck had formed of it, it may nevertheleſs be a very uſeful acquiſition, and may aſſiſt in curing or alleviating diſorders, in which the common medicines are inſufficient.

HEMP, in botany. For the cultivation of hemp; ſee Syſtem of Agriculture, Sect. XVIII.

Hemp is dreſſed as coarſe flax, but is ſooner dreſſed; and its greater length requires more care, and renders it more troubleſome in the handling, eſpecially in the ſkutching of it by the water lintmills with horizontal ſkutchers, when it muſt be folded double. What is too coarſe and ſtrong in the ſtalk for the hand or foot machines, may be broke and peeled by the hand.

HEPATIC, in medicine and anatomy, any thing belonging to the liver. Hepatitis, in medicine, is an inflammation of the liver; ſee the System.

HEPTAGON, ἑπτα, *ſeptum*, *ſeven*, and γωνια, *angle*, in geometry, a figure conſiſting of ſeven ſides, and ſeven angles. If the ſides be all equal, it is called a *regular heptagon*.

Heptagon, in fortification, a place ſtrengthened with ſeven *baſtions*, for its defence.

HEPTAGONAL *Numbers*, are a ſort of polygonal numbers, wherein the difference of the terms of the correſponding arithmetical progreſſion is five. One property, among others, of theſe numbers, is, that if they be multiplied by 40, and 9 be added to the product, the ſum is alſo a ſquare *number*.

HEPTANDRIA, in botany, the ſeventh claſs of plants with hermaphrodite flowers, and ſeven male parts or ſtamina in each. The word is formed from the Greek ἑπτα, *ſeven*, and ἀνηρ, *male*. This claſs comprehends four orders; viz. *monogynia*, which includes three genera; *digynia*, having one genus; *tetragynia*, including one genus; and *heptagynia*, of which there is alſo one genus. See the Syſtem, Sect. V.

HEPTARCHY, compounded of the Greek, ἑπτα, *ſeven*, and αρχη, *imperium*, *government*, a government compoſed of ſeven perſons; or a country governed by ſeven perſons, or divided into ſeven kingdoms.

The Saxon *heptarchy* included all England, which was cantoned out into ſeventy petty independent kingdoms, peopled and governed by different clans and colonies; viz. thoſe of Kent, the South Saxons, Weſt Saxons, Eaſt Saxons, Northumberland, the Eaſt Angles, and Mercia. The *heptarchy* was formed by degrees, from the year 445, when firſt the kingdom of Kent was erected, and Hengiſt aſſumed the title of king of Kent immediately after the battle of Eglesford; and it terminated in 827, or 828, when king Egbert reunited them into one, made the *heptarchy* into a *monarchy*, and aſſumed the title of king of England. It muſt be obſerved, however, that though Egbert became monarch of England, he was not perfectly abſolute. The kingdom which he actually poſſeſſed conſiſted of the ancient kingdoms of Weſſex, Suſſex, Kent, and Eſſex, that had been peopled by Saxons and Jutes. As for the other three kingdoms, whoſe inhabitants were Angles, he contented himſelf with preſerving the ſovereignty over them, permitting them to be governed by kings, who were his vaſſals and tributaries. The government of the *heptarchy*, reckoning from the founding of the kingdom of Mercia, the laſt of the ſeven Anglo-Saxon kingdoms, laſted two hundred and forty-three years; but if the time ſpent by the Saxons in their conqueſts from the arrival of Hengiſt in 449 be added, the *heptarchy* will be found to have laſted three hundred and ſeventy-eight years, from its commencement to its diſſolution. The cauſes of the diſſolution of the *heptarchy* were the great inequality among the ſeven kingdoms, three of which greatly ſurpaſſed the others in extent and power; the default of male heirs in the royal families of all the kingdoms, that of Weſſex excepted; and the concurrence of various circumſtances which combined in the time of Egbert.

HERALD, an officer of arms, anciently in great repute, and poſſeſſed of ſeveral conſiderable functions, rights, and privileges. The origin of *herald* is very ancient. Stentor is repreſented, by Homer, as *herald* of the Greeks, who had a voice louder than fifty men together. The Greeks called them κηρυκες and ειρηνοφυλακες; and the Romans *feciales*. The Romans had a college of *heralds*, appointed to decide whether a war were juſt or unjuſt; and to prevent its coming to open hoſtilities, till all means had been attempted for deciding the difference in a pacific way. They were formerly created and chriſtened by the king; who ſlowly pouring a gold cup of wine on their head, gave their *herald's* name: now it is done by the earl marſhal. They could not arrive at the dignity of *herald*, without having been ſeven years *purſuivant*; nor could they quit the function of *herald*, but to be made *king at arms*. Their principal employment was, to compoſe, or make out, coats of arms, genealogies, and titles, of the nobility. They were the ſuperintendents of military exploits, and the conſervators of the honours of war. They had a right to take away the arms of ſuch as, for cowardice, treaſon, &c. deſerved to be degraded. They had a commiſſion to examine and correct the vices and diſorders of the nobles, and, on ſuch occaſions, to exclude them from juſts, tournaments, &c. to them belonged alſo the correcting of all uſurpations and abuſes relating to crowns, coronets, caſks, creſts, ſupporters, &c. They took cognizance of all differences among the nobles, with reſpect to their bearings, the antiquity of their families, precedencies, &c. They went into the ſeveral countries to ſearch into the grounds and pretenſions of nobility; and had a right to open all libraries, and to command all the ancient charters and inſtruments in the archives to be ſhewn them; they had admiſſion into all foreign courts, where they were commiſſioned to proclaim war and peace: and their perſons were held ſacred as thoſe of embaſſadors. To them it belonged to make publication of juſts and tournaments; to call the people to them; to ſignify the cartels; to mark the ground, liſt, or place of duel; to ſee fair play obſerved; and to divide the ſun between the two parties. In the army, they advertiſed the cavaliers and captains of the day of battle, and aſſiſted therein before the ſtandard; retiring, after the firſt onſet, to ſome place of eminence, there to obſerve who behaved beſt, and to give a faithful report thereof to the king. They alſo numbered the dead, relieved the enſigns, re-demanded priſoners, ſummoned places to ſurrender, and in capitulations walked before the governor of the place, to ſecure and warrant his perſon. They were the principal arbitrators of the diſtribution of the ſpoils of the vanquiſhed, and of military rewards. They publiſhed victories, and gave notifications thereof to foreign courts. They convened the eſtates of the kingdom, aſſiſted at royal marriages, and frequently made the firſt demand; they alſo officiated at ſolemn feaſts, &c. The modern *heralds*, i. e. thoſe we properly call *heralds*, have loſt a good deal of the diſtinction and office of the ancient ones. What relates to the making out arms, the rectifying of abuſes therein, &c. is chiefly committed to the king at arms. And in the army, drums and trumpets have ſucceeded to the functions of *heralds*, being ſent by the generals on the ſame errands; and on that account enjoying the ſame rights and privileges. Their perſons are under the protection of the law of nations, when they bear the marks of their offices publickly, i. e. the trumpeter his trumpet, and the drummer, his drum; in the ſame manner as the *herald* his coat. The *heralds*, with the kings at arms, and the four pourſuivants, are a *college* or corporation; erected into ſuch by charter of Richard III. who granted them divers privileges, as to be free from ſubſidies, tolls, and all troubleſome offices. Clarencieux and Norroy king at arms, are alſo called *provincial heralds*.

HERALDRY, the art of armoury and blazoning, or the knowledge of what relates to the bearing of arms, and the laws and regulations thereof.

SYSTEM OF HERALDRY.

DEFINITION AND ORIGIN.

HERALDRY, according to its modern acceptation, is to be conſidered not only as a ſcience of armories and their blazons, but as comprehending a perfect knowledge of whatever relates to thoſe ſeveral marks of honour and dignity, regularly compoſed of certain figures and tinctures borne upon ſhields, enſigns, creſts, ſurcoats, &c. &c. appropriated to communities and offices, or according to the law of arms, either taken and authoriſed to be retained, or originally granted by Potentates, or ſuch as they have authoriſed for that purpoſe; as hereditary tokens, whereby families and perſons of antient and worthy deſcent are not only diſtinguiſhed among themſelves, but ſeparated from the common rank of people, who are not entitled to uſe ſuch badges of honour and reſpect. Daily experience ſhews the numerous and great advantages, which reſult from being verſed in theſe neceſſary marks of diſtinction, inſomuch that on various occaſions, a knowledge of them becomes abſolutely neceſſary; in order to aſcertain the ſeveral ranks and degrees of mankind. Heraldic writers vary conſiderably in their opinions, as to the origin and riſe of armorial bearings. There are thoſe who attribute them even to the divine command ſignified to the children of Iſrael, when they pitched their tents in the wilderneſs, by being directed to uſe every one his own ſtandard with the enſigns of his father's houſe. The Pagans of the Heroic age are not without advocates, for their having made uſe of armorial bearings. The inſtitution of the office of heralds, hath been attributed to Alexander the Great, who granted particular diſtinctions, as marks of their valour to ſome of his principal officers, as well as teſtimonies of his approbation. The Roman ſoldiery were diſtinguiſhed by Auguſtus and ſome preceding emperors, by ornaments on their ſhields of certain images and other repreſentations. Some writers aſſert that it was from the Romans that the cuſtom aroſe of carrying banners, ſhields, armour, creſts, and other enſigns of nobility at the funerals of great men. Other writers aſcribe the origin of armories, to the Spaniards during their wars with the Moors in the reign of Julian the apoſtate. Again there are not wanting thoſe who fix the origin of armorial bearings to the time of Theodoſius. Our Engliſh king Arthur, the Danes, Saxons, and other northern nations, have likewiſe been honoured with being the inventors of armory.

The emperor Charlemagne according to ſome writers, hath a juſt claim to be conſidered as the great regulator of armories, which they ſay were in general uſe in his time. Other writers tell us that armories were invented by the Germans in the tenth century, and ſome ſay that they are of no higher origin, than the reign of Hugh Capet. The Croiſades and Expeditions to the Holy Land, have more generally been ſuppoſed to have given riſe to the uſe of armories, which is controverted, and the honour by ſome is conferred on the emperor Babaroſſa. There are other writers that will not admit of their origin higher than the powerful factions of the Guelphs, and Gibelins, who they ſay were the firſt that made uſe of ſuch devices, to diſtinguiſh their reſpective Partizans. Some modern authors of diſtinguiſhed abilities are of opinion that the primary inſtitution of armories is to be referred to the tournaments held towards the end of the tenth century; their growth to the Croiſades, and their perfection to juſts and other feats of arms. The ſeal of Edward the confeſſor is the earlieſt known to exiſt. The faſhion of ſurcoats ſpread over the noblemens coats of tournaments, as well as over their horſes, commenced in the reign of king John. Arms having increaſed and become hereditary, ſoon acquired ſuch additional eſtimation and importance, that they were ſometimes transferred as teſtimonies of favour and affection, from the legal poſſeſſor to ſome other perſon; an inſtance of which is ſhewn in Coindeir's remains. Being no longer aſſumeable at pleaſure by any man whatever, they came to be conſidered as teſtimonials of merit, valour, and good ſervices performed, beſtowed on them or their anceſtors, by emperors, kings, or princes, who by ſevere laws reſtricted any from aſſuming them without authority, and appointed a conſtable, or marſhal, to take cognizance of the ſame. The firſt in England was appointed by William the Conqueror, who, as he grew up in authority and dignity, has been variouſly ſtyled maſter marſhal, lord marſhal, great marſhal, and for ſome centuries paſt, the earl marſhal of England, under whom are appointed certain miniſters diſtinguiſhed by the general title of heralds, as being originally meſſengers of war, or peace. Whoever may attempt to fix the preciſe time in which the office of heralds, under that or any other appellation, was firſt introduced into England will find himſelf under great embarraſſments, as our ancient hiſtorians and records furniſh little information on that ſubject. The firſt time they are mentioned is in the 12th of Edward III. and yet it is certain that they were eſtabliſhed long before that period. The management of all public ſhows and triumphs, was committed to their care, and they were generally created in the moſt public manner, by ancient kings, who inveſted them with the royal habit, or furcoats of the ſovereigns arms, which kept them ſacred, and they paſſed with ſafety through foreign dominions; and never were moleſted even by enemies. The moſt common diſtinction of theſe officers hath been into claſſes, or degrees, viz. kings, heralds and purſuivants of arms, conſiſting of 3 kings, viz. Garter, Clarence and Norroy; 6 heralds, viz. Cheſter, Somerſet, Richmond, Lancaſter, Windſor, and York; and 4 purſuivants, viz. Portcullis, Blue Mantle, Rouge Dragon, and Rouge Croix. To theſe may be added four heralds extraordinary, but as they have no connection, or authority with the others who were incorporated by Charter, and have conſiderable privileges; and the herald extraordinary have only the titles, it is ſuperfluous to name them. The College was incorporated by Edward VI. and again by Philip and Mary, who granted them Derby Houſe, which was on the ſtyle of their preſent college, but burnt down in 1606. The provincial kings formerly uſed to make viſitations for regulating abuſes, and reſtraining the aſſumption of arms without authority, but there has been no viſitation ſince the year 1686. Theſe marks of honour are called *arms*, from their being principally and firſt worn by military men at wars and tournaments, who had them engraved, emboſſed, or depicted on ſhields, targets, banners, or other martial inſtruments. They are alſo called *coats-of-arms*, from the cuſtom of the ancients embroidering them on the coats they wore over their arms, as heralds do to this day. Arms are diſtinguiſhed by different names, to denote the cauſes of their bearing; ſuch as,

ARMS

Of Dominion,
Of Pretenſion,
Of Conceſſion,
Of Community,

Of Patronage,
Of Family,
Of Alliance,
Of Succeſſion.

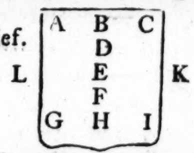
For a particular deſcription of theſe ſeveral kinds of arms, ſee the article ARMS, or ARMORIES.

The art of blazoning arms, conſiſts in the knowledge of thoſe colours and metals which are made uſe of in the Science of Heraldry, ſo as to explain in proper terms all that belong to armorial bearings, which are hereditary marks of honour, made up of fixed and determined colours and figures, and of the ſeveral parts, lines of partitions, ordinaries and charges whereof the coat of arms is compoſed. We now proceed to conſider the eſſential parts of arms, viz. the ſhield or eſcutcheon, the tinctures, the charges or bearings; and the ornaments.

SECT. I. OF THE SHIELD, OR ESCUTCHEON.

The ſhield or eſcutcheon, is the field or ground whereon are repreſented the figures that make up a coat of arms, and as theſe marks of diſtinction were put on bucklers and ſhields before they were painted on banners, flags, or coats of armour, wherever they are now fixed they are ſuppoſed to be on a plane, or ſuperficies, whoſe form reſembles a ſhield; the ſhield being always deemed a neceſſary inſtrument in the defence of the body, judged by all nations the moſt convenient tabula, to contain marks of valour and honour. Hiſtorians furniſh us with various forms of ſhields, uſed by the ancients at the time of inſtituting armorial bearings as hereditary tokens of family honour; ſhields for the moſt part were triangular, as may be ſtill ſeen on the moſt ancient monuments, &c. From this form came the general cuſtom in heraldry of placing the greateſt number of figures above, and the ſmalleſt below, as three, two, and one. In ſubſequent times different forms of ſhields have prevailed. The Spaniards and Portugueſe have their ſhields round at the bottom without a point; and the Germans have various forms, one of which hath its ſides ſloping and bulging at the flanks. They have another with notches, as convenient for reſting a lame limb on, which indeed is not ſo convenient for the reception of armorial figures as thoſe uſed by the Engliſh, French, &c. After having ſaid thus much of their forms, it is neceſſary to know the places of their different points. Armoriſts diſtinguiſh ſeveral parts or points in eſcutcheons, in order to determine exactly the poſition of the bearings they are charged with; they are denoted by the firſt nine letters of the alphabet, ranged in the following manner.

A, the dexter chief.
B, the preciſe middle chief.
C, the ſiniſter chief.
D, the honour point.
E, the feſs point.



F, the nombril point.
G, the dexter baſe.
H, the preciſe middle baſe.
I, the ſiniſter baſe.

The knowledge of theſe points is of great importance, and ought to be particularly attended to, for they are particularly blended with ſeveral things of different kinds. It is neceſſary to remark that K, the dexter ſide of the ſhield is oppoſite to the left hand, and L, the ſiniſter ſide to the right hand of the perſon, who looks at it.

Shields are either of one tincture or more than one; thoſe that are only of one, that is when ſome metal, colour, or fur, is ſpread all over the ſurface or field of the ſhield, ſuch a tincture is ſaid to be predominant; but in ſuch as have on them more than one, as moſt have, the field is divided by lines, which, according to their divers forms, receive various names.

SECT. II.

LINES USED IN THE PARTING OF SHIELDS.

Lines may be either ſtraight or crooked. Straight lines are carried evenly through the eſcutcheon; and are of four different kinds, viz. a perpendicular line, | ; a horizontal line,—; a diagonal dexter, ╲; a diagonal ſiniſter, ╱.

Crooked lines are thoſe which are carried unevenly through the eſcutcheon with riſing and falling. French armoriſts reckon 11 different ſorts of them; Guillim admits of ſeven only; but there are many diſtinct kinds, the figures and names of which are as in Plate II.

The indented and dancette are lines of nearly the ſame form, but differing in the ſize and quantity of the cuts or indents. Thoſe of the indented are ſmaller and more numerous than thoſe of the dancette, viz. a feſs dancette ſhould be compoſed of three indents, and no more; but the feſs indented may have double the number.

Theſe lines when ſingle form the partitions and their re-partitions, but when there are more lines than one in the ſame direction, they then form ſome one of the ordinaries.

The principal reaſon why lines are thus uſed in heraldry, is to different bearings which would be otherwiſe the ſame; for an eſcutcheon charged with a chief engrailed, differs from one charged with a chief wavy, as much as if the one bore a croſs and the other a ſaltier.

If the diviſion conſiſts of two equal parts, made by a ſingle perpendicular line, it is called parted per pale; by the horizontal line, parted per feſs; by the diagonal dexter, parted per bend; by the diagonal ſiniſter, parted per bend ſiniſter, as in Plate II.

If a field is divided into four equal parts by any of theſe lines, it is ſaid to be quartered; which may be done two ways, viz.

Quartered, or parted per croſs; which is made by a perpendicular and horizontal line, which croſſing each other at the center of the field, divide it into four equal parts called quarters.

Quartered, or parted per ſaltier; which is made by two diagonal lines, dexter and ſiniſter, that croſs one another in the center of the field, and likewiſe divide it into four equal parts.

The eſcutcheon is ſometimes divided into a greater number of parts, in order to place in it the arms of the ſeveral families to which there is an alliance; and in this caſe it is called a genealogical atchievement.

Theſe diviſions may conſiſt of 6, 8, 12, and 16, quarters, and even ſometimes of 20, 32, 64, and upwards; there being examples of ſuch diviſions frequently exhibited at pompous funerals. An extraordinary inſtance of this kind was ſome years paſt exhibited at the pompous funeral of the late viſcounteſs Townſhend, whoſe corps was brought from Dublin caſtle in Ireland, to Rainham-hall in Norfolk, one of the principal tenants on horſeback carrying before the hearſe a genealogical banner, containing the quarterings of his lordſhip's and her ladyſhip's family, to the amount of upwards of 160. Sir William Dugdale very juſtly objects to ſo many arms being cluſtered together in one ſhield or banner, on account of the difficulty of diſcerning and knowing aſunder one coat-of-arms from another.

SECT. III. METALS, COLOURS, OR TINCTURES.

By Tinctures is meant that variable hue of which are compoſed both the Shield and the Bearings, which Tinctures have their reſpective, proper, and fixed terms, taken from the French, and theſe have been chiefly adhered to by heralds in their blazons, and are received by almoſt all nations, as an univerſal rule, which cauſe arms, when deſcribed, to be generally underſtood. Some fanciful heraldic authors, however, of late, not ſatisfied with this uſual mode, have thought fit to deviate from it, and to blazon the armorial colours in different terms according to the rank and dignity of the perſon whoſe arms they are deſcribing, viz. baronets and all below that dignity they blazon by tinctures; thoſe of nobles by names of precious ſtones; and thoſe of ſovereign princes, by planets, according to the following ſcheme:

Colours.	*Tinctures.*	*Precious Stones.*	*Planets.*
Gold, Yellow	— Or,	or Topaz,	by Sol,
Silver, White	— Argent,	— Pearl,	— Luna,
Black	— Sable,	— Diamond,	— Saturn,
Red	— Gules,	— Ruby,	— Mars,
Blue	— Azure,	— Sapphire,	— Jupiter,
Green	— Vert,	— Emerald,	— Venus,
Purple	— Purpure	— Amethyſt,	— Mercury,
Orange	— Tenny	— Jacinth,	— Dragon's Head.
Dark Red	— Sanguine	— Sardonix,	— Dragon's Tail.

Theſe are but mere fancies, and are likewiſe unfit for the art, for theſe reaſons: 1ſt, The French (from whom the Engliſh derive their heraldry, not only in principles, but in words of the French language,) do not only not uſe theſe different ways of blazoning, but treat them *en ridicule.* 2dly, The Italian, Spaniſh, and Latin heralds uſe no ſuch different forms, but blazon by the ordinary metals and colours. 3dly, Art ſhould imitate nature; and as it would be an unnatural thing in common diſcourſe not to call red *red*, becauſe a prince wears it, ſo it is unnatural to uſe theſe terms in heraldry, and it may fall out to be very ridiculous in ſome arms: for inſtance, if a prince had for his arms an *aſs couchant* under his burden *gules*, how ridiculous would it be to ſay he had an *aſs couchant Mars?* A hundred other examples might be given; but it is enough to ſay, that this is to confound colours with charges, and the things that are borne with colours. 4thly, It makes the art unpleaſant, and deters gentlemen from ſtudying it, and ſtrangers from underſtanding what our heraldry is; nor could the arms of our princes and nobility be tranſlated in this diſguiſe into Latin or any other language. But that which convinces moſt that this is an error is, becauſe it makes that great rule unneceſſary, whereby colour cannot be put upon colour, nor metal upon metal; but this cannot hold but where metals and colours are expreſſed.

Tinctures are repreſented in engravings and drawings by dots and lines as in Plate 2. *Or* is expreſſed by dots. *Argent* is plain. *Azure*, by horizontal lines. *Gules*, by perpendicular lines. *Vert*, by diagonal lines, from the dexter chief to the ſiniſter baſe points. *Purpure*, by diagonal lines, from the ſiniſter chief to the dexter baſe points. *Sable*, by perpendicular and horizontal lines, croſſing each other. *Tenny*, by diagonal lines, from the ſiniſter chief to the dexter baſe points, traverſed by horizontal lines. *Sanguine*, by lines croſſing each other diagonally, from dexter to ſiniſter, and from ſiniſter to dexter. When natural bodies, ſuch as animals, plants, celeſtial bodies, &c. are introduced into arms, they frequently retain their natural colours, which is expreſſed by the word *proper*.

Heraldic writers give different names to the roundlet according to its colour; thus if it is

Or,	it is called a	Bezant,
Argent,		Plate,
Azure,		Hurt,
Gules,		Torteau,
Vert,		Pomey,
Purpure,		Golpe,
Sable,		Pellet,
Tenny		Orange,
Sanguine,		Guze.

See Plate II. under the Article FURS.

The fourth are to repreſent a flat piece of gold without any impreſſion, and are thus named from a current coin of Byzantium, now Conſtantinople.

The fifth are likewiſe flat, as repreſenting thin pieces of ſilver bullion.

Neither of theſe are ever repreſented globular unleſs through ignorance of the engraver or painter, but always flat.

The other ſeven are to be always painted and engraven globular, as they are repreſentations of apples, hurtle berries, pallets or gunſtones, round cakes called waſtals; golpes or wounds; oranges, and eye-balls. See Plate II. of Heraldry under the Article FURS.

It is proper to mention a particular kind of charge often uſed, which receives divers forms of blazonry according to the variation of colours or tinctures, in the ſame manner as the roundlets. This charge is called guttes or drops of things that are liquid, either by art or by nature, viz.

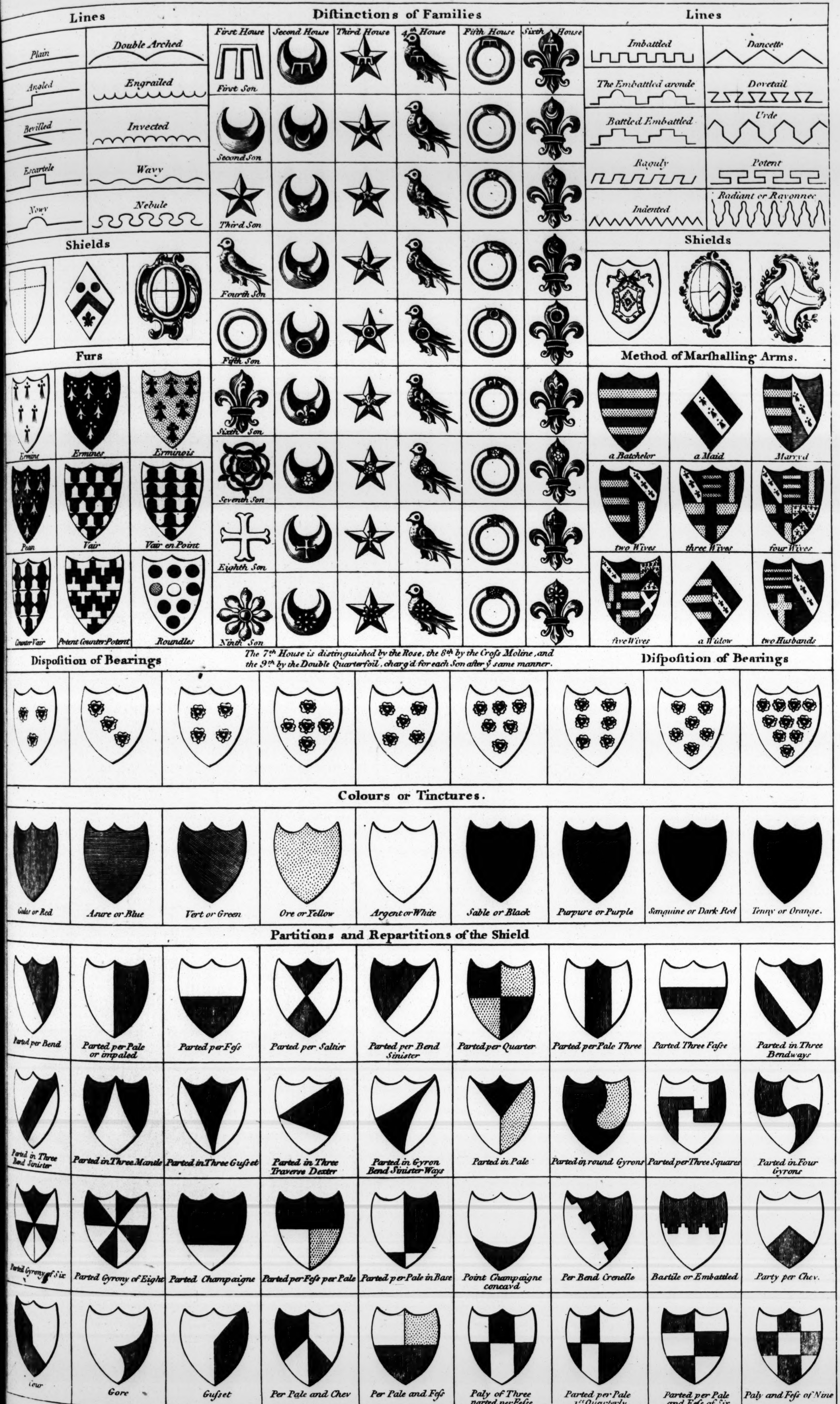
If they are	they are called	Which are meant to reſemble
Or,	Gutte d'Or,	Drops of Gold,
Argent,	Gutte d'Eau,	Drops of Water,
Azure,	Gutte d'Olive,	Drops of Olive Oil,
Gules,	Gutte d'Larmes,	Drops of Tears,
Vert,	Gutte d'Poix,	Drops of Pitch,
Sable,	Gutte d'Sang,	Drops of Blood.

SECT. IV. FURS.

Furs repreſent the hairy ſkins of certain beaſts, prepared for the doublings or linings of robes and garments of ſtate: and as ſhields were anciently covered with furred ſkins, they are therefore uſed in Heraldry, not only for the linings of the mantles, and other ornaments of the ſhields, but alſo in the coats-of-arms themſelves. The furs uſed in arms are compoſed of two or more colours, and are eſteemed by Heralds as highly honourable; they are neither metal or colour, but a compound of both. Authors differ as to the preciſe number and variety of heraldic furs. The white fur cannot be uſed in arms ſingly, becauſe it hath but one colour, but when it is ſprinkled with the black tip of the tail of the animal called ermine, and thereby become of two colours, is commonly called ermine, and is to be conſidered as the firſt of the principal heraldic furs, and is termed in blazonry, ermine only. When the ſpots are many, their number is not expreſſed, but when a certain number only, the bearings is not to be blazoned ermine, the ſpots being charges, and are called ermine ſpots, and their name, number, and diſpoſition are to be expreſſed.

There are three different kinds in general uſe, viz. 1. *Ermine*; which is a field argent, powdered with black ſpots, their tails terminating in three hairs. 2. *Counter-ermine*, where the field is ſable, and the powdering white, as in Plate II. 3. *Vair*, which is expreſſed by blue and white ſkins, cut into the forms of little bells, ranged in rows oppoſite to each other, the baſe of the white ones being always next to that of the blue ones. Vair is uſually of ſix rows; if there be more or fewer, the number ought to be expreſſed; and if the colours are different from thoſe abovementioned, they muſt likewiſe be expreſſed. The Engliſh multiply the furs, as well as the names of the tinctures, though no other nation has adopted ſuch varieties. Thus they give us, 1. *White*, which is the natural colour of the ermine; but it is uſed on no other occaſion but in the deſcriptions of mantles. 2. *Ermines*, which is the ſame with contra-ermine. 3. *Erminois*; the field is Or, the powdering Sable. For the uſe of this fur Guillim cites Bara, but no ſuch fur is to be found in Bara. 4. *Pean*; the field is Sable, the powdering Or; the French uſe no ſuch term; but they call all furs or doublings *des pannes*, or *pennes*, which term has poſſibly given riſe to this miſtake, and many others, in thoſe who do not underſtand the French language. 5. *Erminites*; the ſame as Ermine, with the addition of a red hair on each ſide of the black. Sir Geo. Mackenzie calls theſe diſtinctions " but fancies, for *Erminites* ſignifies properly *little Ermines*. 6. *Counter vair*; when the bells of the ſame tincture are placed baſe againſt baſe, and point

Introductory Principles of Heraldry See the Syſtem.


Lines
Plain
Angled
Bevilled
Escartele
Nowy
Double Arched
Engrailed
Invected
Wavy
Nebule
Diſtinctions of Families
First House
Second House
Third House
4th House
Fifth House
Sixth House
First Son
Second Son
Third Son
Fourth Son
Fifth Son
Sixth Son
Seventh Son
Eighth Son
Ninth Son
Lines
Imbattled
Dancette
The Embattled arondé
Dovetail
Battled Embattled
Urde
Raguly
Potent
Indented
Radiant or Rayonnee
Shields
Shields
Furs
Ermine
Ermines
Erminois
Pean
Vair
Vair en Point
Counter Vair
Potent Counter Potent
Roundles
Method of Marſhalling Arms.
a Batchelor
a Maid
Marry'd
two Wives
three Wives
four Wives
five Wives
a Widow
two Husbands
Diſpoſition of Bearings
The 7th House is distinguished by the Rose, the 8th by the Croſs Moline, and the 9th by the Double Quarterfoil, charg'd for each Son after ẏ same manner.
Diſpoſition of Bearings
Colours or Tinctures.
Gules or Red
Azure or Blue
Vert or Green
Ore or Yellow
Argent or White
Sable or Black
Purpure or Purple
Sanguine or Dark Red
Tenny or Orange.
Partitions and Repartitions of the Shield
Parted per Bend
Parted per Pale or impaled
Parted per Feſs
Parted per Saltier
Parted per Bend Sinister
Parted per Quarter
Parted per Pale Three
Parted Three Faſse
Parted in Three Bendways
Parted in Three Bend Sinister
Parted in Three Mantle
Parted in Three Guſset
Parted in Three Traverse Dexter
Parted in Gyron Bend Sinister Ways
Parted in Pale
Parted in round Gyrons
Parted per Three Squares
Parted in Four Gyrons
Parted Gyrony of Six
Parted Gyrony of Eight
Parted Champaigne
Parted per Feſs per Pale
Parted per Pale in Base
Point Champaigne concavd
Per Bend Crenelle
Bastile or Embattled
Party per Chev.
Gore
Gore
Guſset
Per Pale and Chev
Per Pale and Feſs
Paly of Three parted per Feſse
Parted per Pale 1st Quarterly
Parted per Pale and Feſs of Six
Paly and Feſs of Nine

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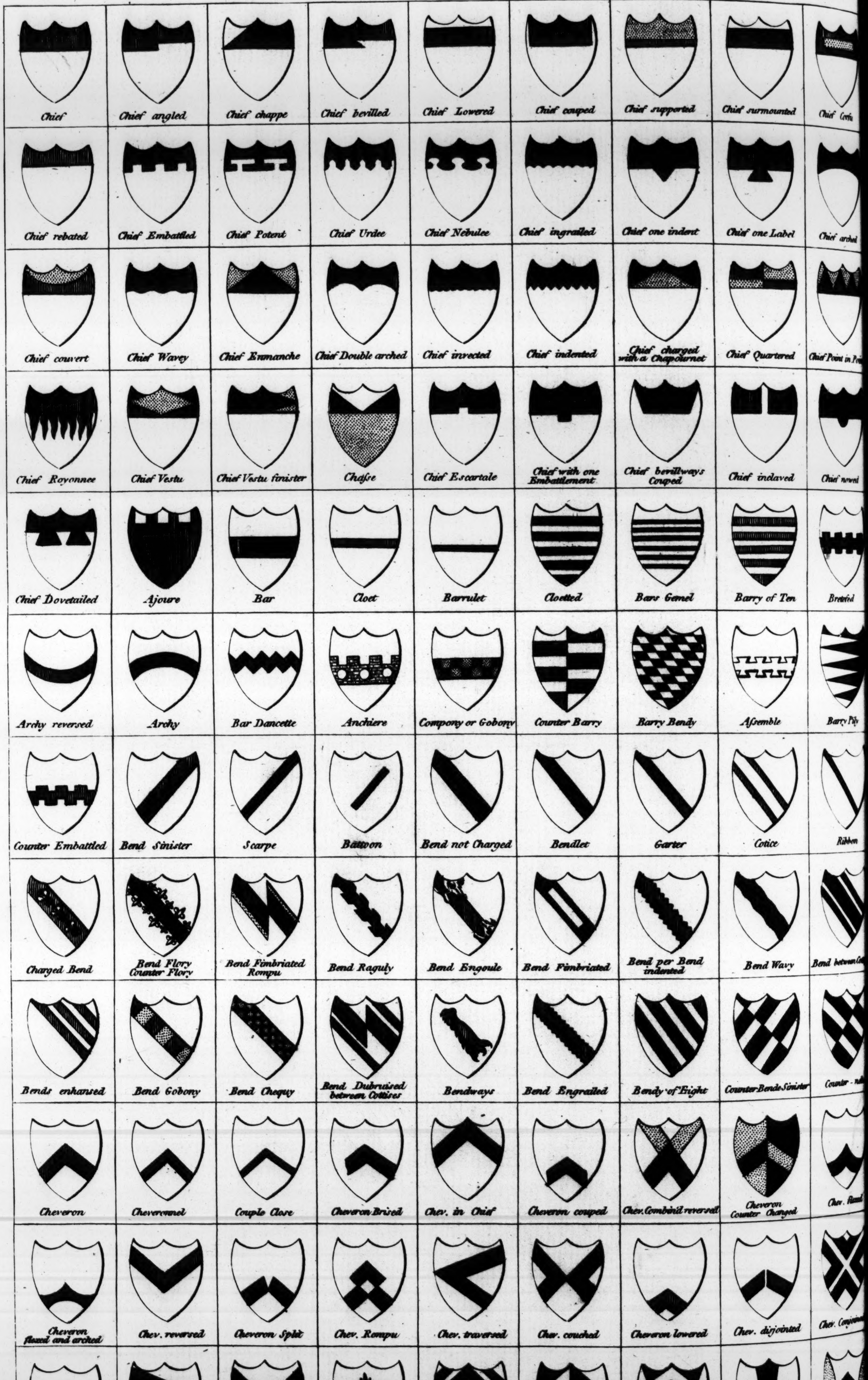
The Ordinaries and their Diminatives — See System of Heraldry.

Plate 3


Chief
Chief angled
Chief chappe
Chief bevilled
Chief Lowered
Chief couped
Chief supported
Chief surmounted
Chief Corfu
Chief rebated
Chief Embatled
Chief Potent
Chief Urdee
Chief Nebulee
Chief ingrailed
Chief one indent
Chief one Label
Chief arched
Chief couvert
Chief Wavey
Chief Enmanche
Chief Double arched
Chief invected
Chief indented
Chief charged with a Chapournet
Chief Quartered
Chief Point in Po
Chief Royonnee
Chief Vestu
Chief Vestu finister
Chaſse
Chief Escartale
Chief with one Embattlement
Chief bevillways Couped
Chief inclaved
Chief nowed
Chief Dovetailed
Ajoure
Bar
Cloet
Barrulet
Cloetted
Bars Gemel
Barry of Ten
Bretessed
Archy reversed
Archy
Bar Dancette
Anchiere
Compony or Gobony
Counter Barry
Barry Bendy
Aſsemble
Barry Pily
Counter Embattled
Bend Sinister
Scarpe
Battoon
Bend not Charged
Bendlet
Garter
Cotice
Ribbon
Charged Bend
Bend Flory Counter Flory
Bend Fimbriated Rompu
Bend Raguly
Bend Engoule
Bend Fimbriated
Bend per Bend indented
Bend Wavy
Bend between Co
Bends enhansed
Bend Gobony
Bend Chequy
Bend Dubruised between Cottises
Bendways
Bend Engrailed
Bendy of Eight
Counter Bende Sinister
Counter - ra
Cheveron
Cheveronnel
Couple Close
Cheveron Brised
Chev. in Chief
Cheveron couped
Chev. Combin'd reversed
Cheveron Counter Changed
Chev. Flexed
Cheveron flexed and arched
Chev. reversed
Cheveron Split
Chev. Rompu
Chev. traversed
Chev. couched
Chereron lowered
Chev. disjointed
Chev. Conjoin
Chev. raccourci
Chev. transversed sin
Chev. intelaied
Chev. Spiked
Cheveronned
Counter Cheveronny
Counter Cheveronny
Chev. and Pile Counter changed
Chev. bet Flan

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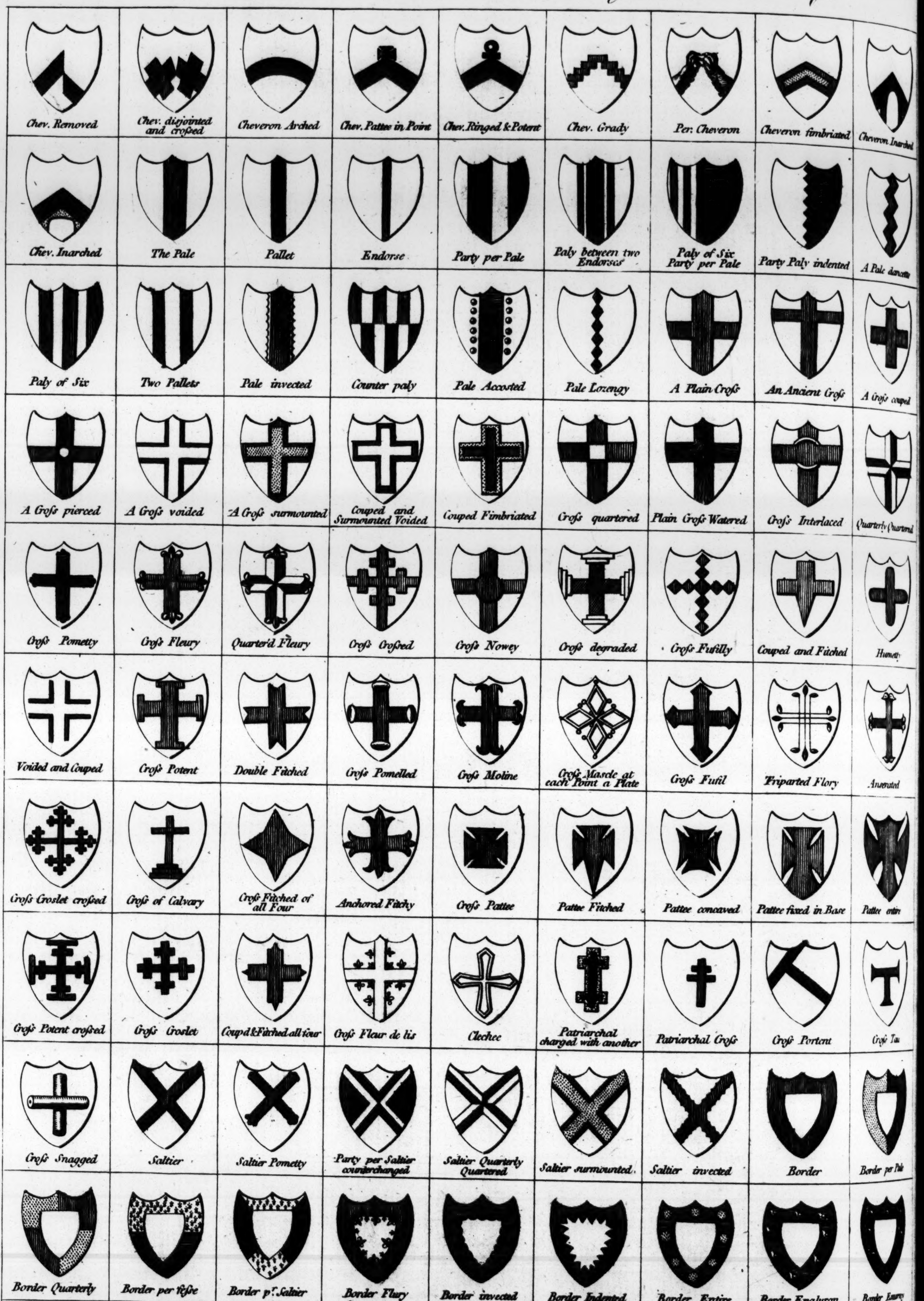
Ordinaries & their Diminatives _ See System of Heraldry.


Chev. Removed
Chev. disjointed and croſsed
Cheveron Arched
Chev. Pattee in Point
Chev. Ringed & Potent
Chev. Grady
Per. Cheveron
Cheveron fimbriated
Cheveron Inarched
Chev. Inarched
The Pale
Pallet
Endorse
Party per Pale
Paly between two Endorses
Paly of Six Party per Pale
Party Paly indented
A Pale dancette
Paly of Six
Two Pallets
Pale invected
Counter paly
Pale Accosted
Pale Lozengy
A Plain Croſs
An Ancient Croſs
A Croſs couped
A Croſs pierced
A Croſs voided
A Croſs surmounted
Couped and Surmounted Voided
Couped Fimbriated
Croſs quartered
Plain Croſs Watered
Croſs Interlaced
Quarterly Quartered
Croſs Pometty
Croſs Fleury
Quarter'd Fleury
Croſs Croſsed
Croſs Nowey
Croſs degraded
Croſs Fusilly
Couped and Fitched
Humetty
Voided and Couped
Croſs Potent
Double Fitched
Croſs Pomelled
Croſs Moline
Croſs Mascle at each Point a Plate
Croſs Fusil
Triparted Flory
Anserated
Croſs Croslet croſsed
Croſs of Calvary
Croſs Fitched of all Four
Anchored Fitchy
Croſs Pattee
Pattee Fitched
Pattee concaved
Pattee fixed in Base
Pattee entire
Croſs Potent croſsed
Croſs Croslet
Coup'd & Fitched all four
Croſs Fleur de lis
Clechee
Patriarchal charged with another
Patriarchal Croſs
Croſs Portent
Croſs Tau
Croſs Snagged
Saltier
Saltier Pometty
Party per Saltier counterchanged
Saltier Quarterly Quartered
Saltier surmounted.
Saltier invected
Border
Border per Pale
Border Quarterly
Border per feſse
Border p^r. Saltier
Border Flury
Border invected
Border Indented
Border Entire
Border Enaluron
Border Enurny
Counter Compony
Border Nebulee
Border Bendy
Border Embattled
Border Engraild
Border Dovetail
Border Gobony
Border indented Point in Point
Border Chequy
Border invected Gobony
Border of the Field
Border Potent
Border Diapered
Border Ermine
Border Erminoies
Border Verdoy
Border Purflewed
Border Wavd

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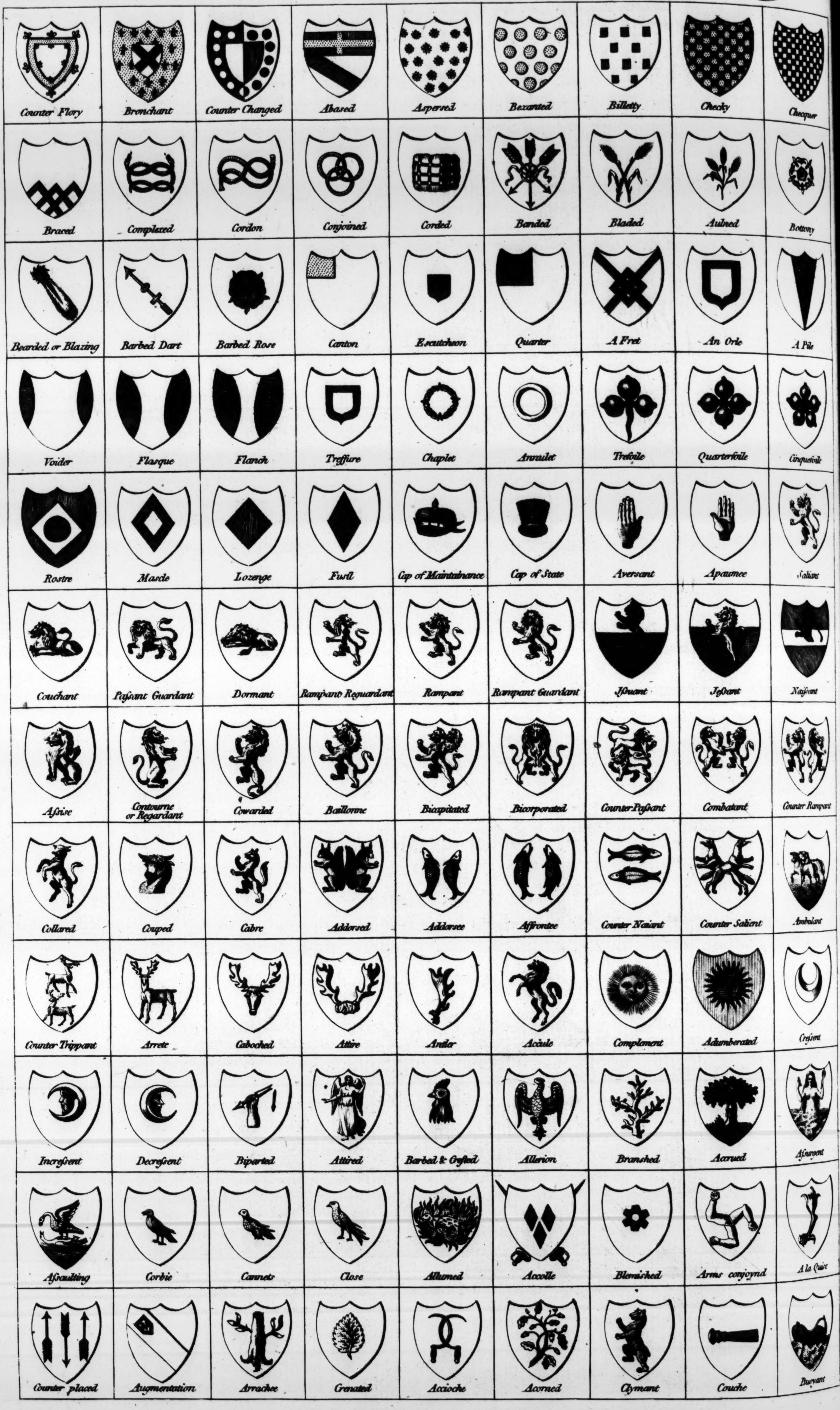
BRITISH 18 MR 63 MUSEUM

Ordinaries, Diminutives, Heraldic Bearings – See System of Heraldry.


Counter Flory
Bronchant
Counter Changed
Abased
Aspersed
Bezanted
Billetty
Checky
Chequer
Braced
Complexed
Cordon
Conjoined
Corded
Banded
Bladed
Aulned
Bottony
Bearded or Blazing
Barbed Dart
Barbed Rose
Canton
Escutcheon
Quarter
A Fret
An Orle
A Pile
Voider
Flasque
Flanch
Treſsure
Chaplet
Annulet
Treſoile
Quarterfoile
Cinquefoile
Rostre
Mascle
Lozenge
Fusil
Cap of Maintainance
Cap of State
Aversant
Apaumee
Saliant
Couchant
Paſsant Guardant
Dormant
Rampant Reguardant
Rampant
Rampant Guardant
Iſsuant
Jeſsant
Naiſsant
Aſsise
Contourne or Regardant
Cowarded
Baillonne
Bicapitated
Bicorporated
Counter Paſsant
Combatant
Counter Rampant
Collared
Couped
Cabre
Addorsed
Addorsee
Affrontee
Counter Naiant
Counter Salient
Ambulant
Counter Trippant
Arrete
Caboched
Attire
Antler
Accule
Complement
Adumberated
Creſcent
Increſcent
Decreſcent
Biparted
Attired
Barbed & Creſted
Allerion
Branshed
Accrued
Aſsurgent
Aſsaulting
Corbie
Cannets
Close
Allumed
Accolle
Blemished
Arms conjoynd
A la Quise
Counter placed
Augmentation
Arrachee
Grenated
Accioche
Acorned
Clymant
Couche
Buoyant

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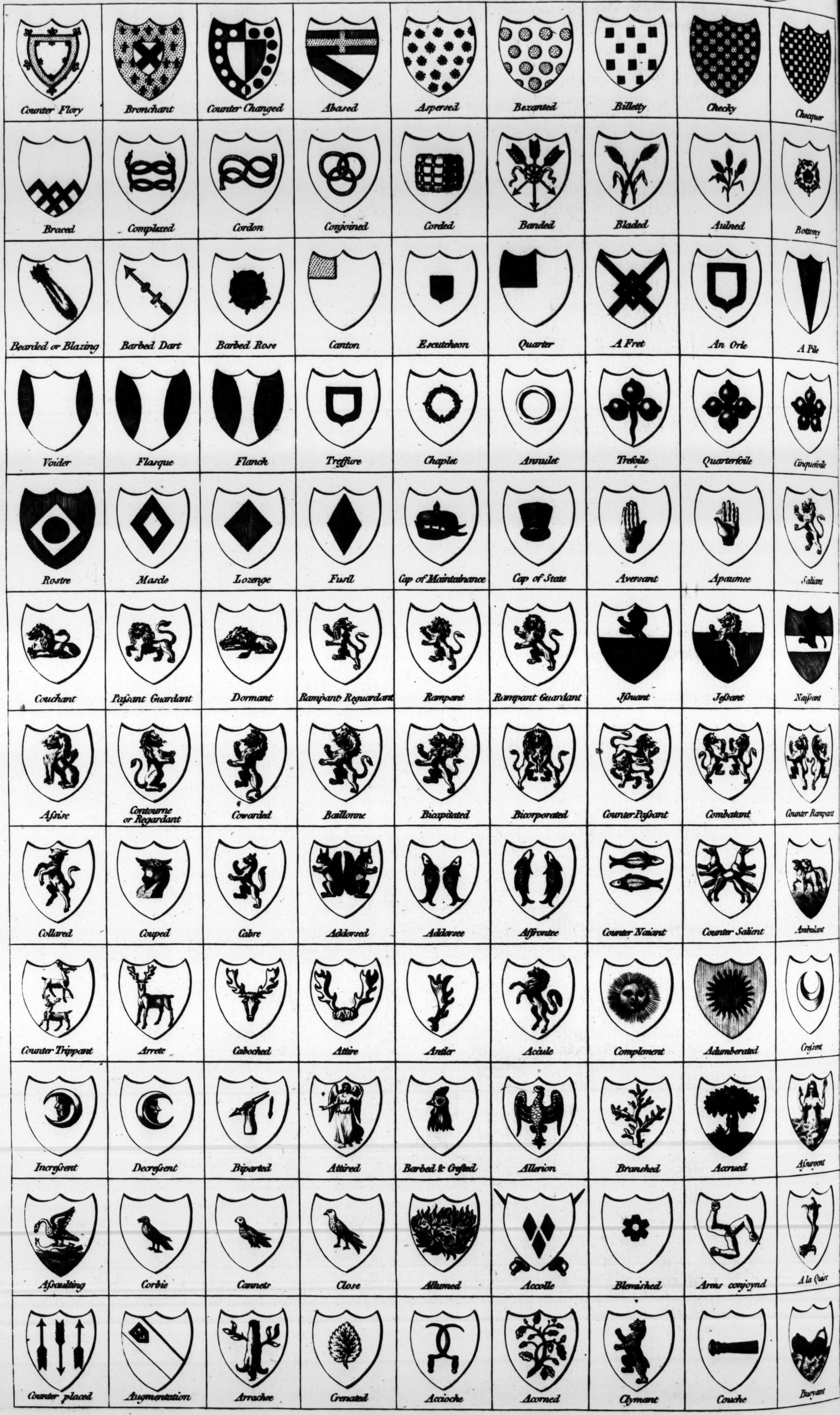
Ordinaries, Diminutives, Heraldic Bearings _ See System of Heraldry.


Counter Flory
Bronchant
Counter Changed
Abased
Aspersed
Bezanted
Billetty
Checky
Chequer
Braced
Complexed
Cordon
Conjoined
Corded
Banded
Bladed
Aulned
Bottony
Bearded or Blazing
Barbed Dart
Barbed Rose
Canton
Escutcheon
Quarter
A Fret
An Orle
A Pile
Voider
Flasque
Flanch
Treſsure
Chaplet
Annulet
Trefoile
Quarterfoile
Cinquefoile
Rostre
Mascle
Lozenge
Fusil
Cap of Maintainance
Cap of State
Aversant
Apaumee
Saliant
Couchant
Paſsant Guardant
Dormant
Rampant Reguardant
Rampant
Rampant Guardant
Iſsuant
Jeſsant
Naiſsant
Aſsise
Contourne or Regardant
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Cabre
Addorsed
Addorsee
Affrontee
Counter Naiant
Counter Salient
Ambulant
Counter Trippant
Arrete
Caboched
Attire
Antler
Accule
Complement
Adumberated
Creſsent
Increſcent
Decreſcent
Biparted
Attired
Barbed & Creſted
Allerion
Branshed
Accrued
Aſsurgent
Aſsaulting
Corbie
Cannets
Close
Allumed
Accolle
Blemished
Arms conjoynd
A la Quise
Counter placed
Augmentation
Arrachee
Grenated
Accioche
Acorned
Clymant
Couche
Burvant

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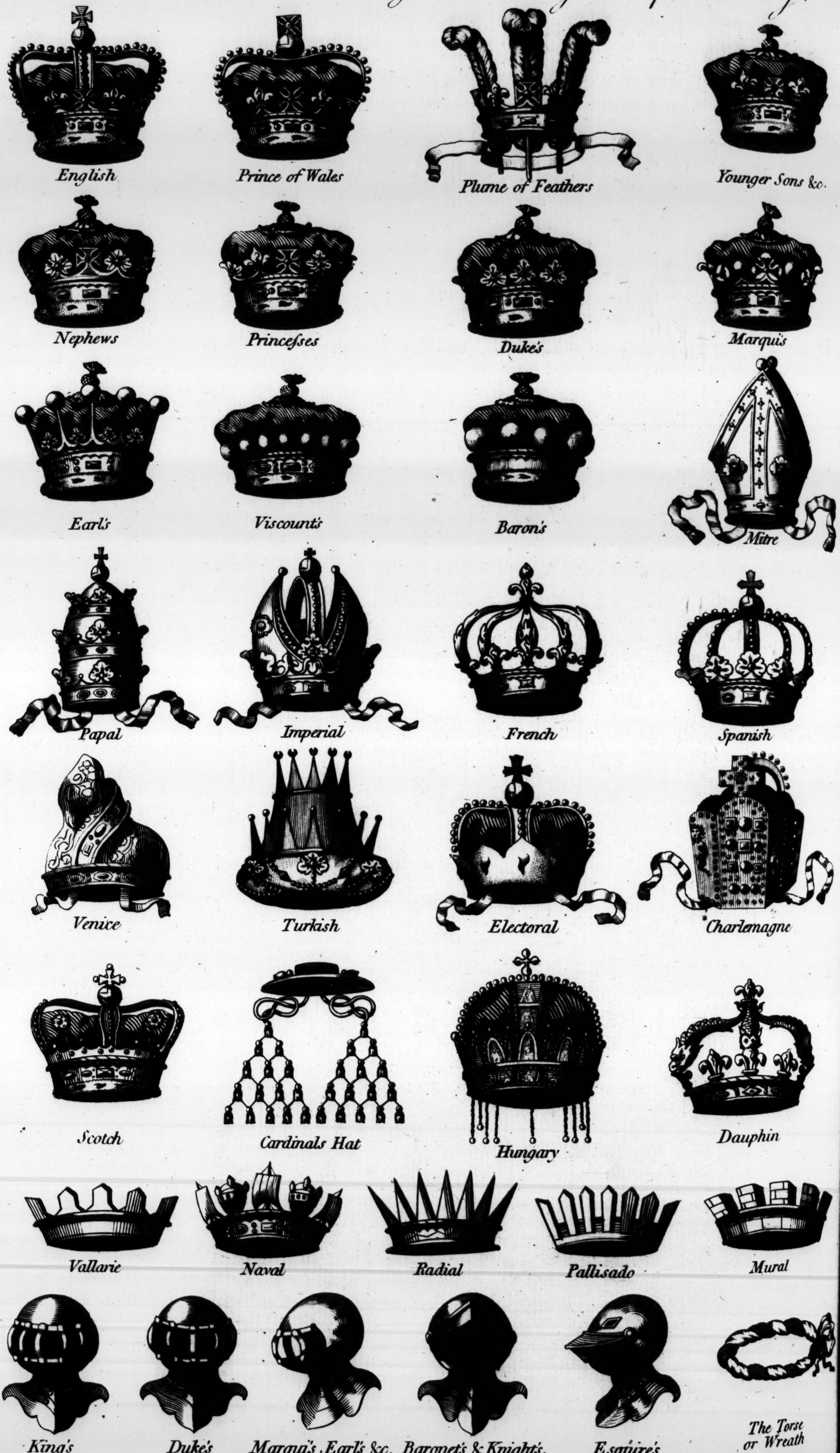
Crowns, Coronets, Helmets, &c — See System of Heraldry

Plate 3.



English
Prince of Wales
Plume of Feathers
Younger Sons &c.

Nephews
Princesses
Duke's
Marquis

Earl's
Viscount's
Baron's
Mitre

Papal
Imperial
French
Spanish

Venice
Turkish
Electoral
Charlemagne

Scotch
Cardinals Hat
Hungary
Dauphin

Vallarie
Naval
Radial
Pallisado
Mural

King's
Duke's
Marquis, Earl's &c.
Baronet's & Knight's.
Esquire's
The Torse or Wreath

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point againſt point, as in Plate II. 7. *Potent-counter-potent*, anciently called *Vairy-cuppy*, as when the field is filled with crutches or potents counter-placed, as in Plate II.

It may not be improper to obſerve, that the uſe of the tinctures took its riſe from the ſeveral colours uſed by warriors whilſt they were in the army, which S. de Petra Sancta proves by many citations. And becauſe it was the cuſtom to embroider gold and ſilver on ſilk, or ſilk on cloth of gold and ſilver, the heralds did therefore appoint, that in imitation of the clothes ſo embroidered, colour ſhould never be uſed upon colour, nor metal upon metal.

SECT. V. DISTINCTION of HOUSES.

The ſeveral marks of cadency, or diſtinctions of houſes, in order that their degrees of deſcent may be known, are given in a table, in Plate 2, viz. For the heir, or firſt ſon, the label; 2d. ſon, the creſcent; 3d. ſon, the mullet; 4th. ſon, the martlet; 5th. ſon, the annulet; 6th. ſon, the Fleur-de-lis; 7th. ſon, the roſe; 8th. ſon, the croſs-moline; 9th. ſon, the double quater-foil.

It muſt be obſerved, that of all the above-mentioned marks of diſtinction, none but the label is affixed on the coats of arms belonging to any of the royal family; which the introducers of this peculiarity have, however, thought proper to difference by additional pendants and diſtinct charges on them.

As to the diſtinction to be made in the arms of the off-ſpring belonging to each of the above-mentioned brothers, it is expreſſed by figures on the top and margin of the table contained in Plate 2: for inſtance, the heir or firſt ſon of the ſecond houſe, beareth a creſcent, charged with a label, during his father's life only; the ſecond ſon of the ſecond houſe, a creſcent, charged with another creſcent; the third ſon of the ſecond houſe, a creſcent, charged with a mullet: the fourth ſon of the ſecond houſe, a creſcent, charged with a martlet; the fifth ſon of the ſecond houſe, a creſcent, charged with an annulet; the ſixth ſon of the ſecond houſe, a creſcent, charged with a fleur-de-lis: and ſo on of the other ſons, taking care to have them of a different tincture, as repreſented in Plate 2.

SECT. VI. CHARGES.

Armoriſts call a charge whatſoever is contained in the field, whether it occupy the whole, or only a part thereof. All charges are diſtinguiſhed by the names of *honourable ordinaries*, *ſub-ordinaries*, and *common charges*.

Honourable ordinaries, the principal charges in heraldry, are made of lines only, which, according to their diſpoſition and form, receive different names.

Subordinaries are ancient heraldric figures frequently uſed in coats-of-arms, and which are diſtinguiſhed by terms appropriated to each of them.

Common charges are compoſed of natural, artificial, and even chimerical things, ſuch as planets, creatures, vegetables, inſtruments, &c.

Art. I. Honourable Ordinaries.

Moſt armoriſts admit only of nine honourable ordinaries: viz.

The Chief, The Bend-ſiniſter, The Cheveron,
The Pale, The Feſs, The Croſs, and
The Bend, The Bar, The Saltier.

all of which are varied by lines ſhewn in Plates 1, 3, and 4.

The *Chief* is an ordinary determined by an horizontal line, which, if it is of any other form but ſtraight, muſt be expreſſed. It is placed in the upper part of the eſcutcheon, and containeth in depth the third part of the field; its diminutive is a fillet, the contents of which are not to exceed one fourth of the chief, and ſtand in the loweſt part thereof. This ordinary is ſubject to be charged with variety of figures; and may be indented, wavy, nebule, &c. as is repreſented in Plates 2, 3, and 4.

2. The *Pale* is an ordinary conſiſting of two perpendicular lines drawn from the top to the baſe of the eſcutcheon, and contains the third middle part of the field: its diminutives are, the pallet, which is the half of the pale, and the endorſe, which is the fourth part of the pale. Theſe diminutives according to the ſtrict rules of blazonry, cannot be charged with any bearing: ſee Plate IV.

3. The *Bend* is an ordinary formed by two diagonal lines drawn from the dexter chief to the ſiniſter baſe, and contains the fifth part of the field in breadth, if uncharged: but if charged, then the third: its diminutives are, the bendlet, which is the half of a bend: the coſt or cotice, when two of them accompany a bend, which is the fourth part of a bend: and the ribband, the moiety of a coſt, or the eighth part of the field. Theſe diminutives cannot be charged.

4. The *Bend-ſiniſter*, which is of the ſame breadth as the bend, but drawn the contrary way; this is ſubdivided into a ſcrape, which is the half of the bend: and into a bâton, which is the fourth part of a bend: but this does not extend itſelf to the extremities of the field, there being part of it ſeen at both ends; it is generally a mark of illegitimacy: and by ſome is not admitted as a diminutive of the bend. When granted by princes to their illegitimate children, it may be of metal, fur, or both: but, when it is granted to any under their degree, muſt be colour only. When there are more than one bend in a coat, they are called bendlets: but when the field is divided by an equal number, it is termed bending, ſpecifying their number: ſee Plate III.

5. The *Feſs* is an ordinary which is produced by two parallel lines drawn horizontally acroſs the center of the field, and contains in breadth the third part thereof. This ordinary has no diminutive but may be voided, or as it were have its middle extant, and the field appear through, which frequently makes it appear as two bars, as repreſented in Plate II.

6. The *Bar* is formed of two lines, and contains but the fifth part of the field; which is not the only thing wherein it differs from the feſs; for there may be more than one in an eſcutcheon, placed in different parts thereof; whereas the feſs is limited to the centre point. The bar has two diminutives; the barulet, which contains half the bar; and the cloſet, which is the half of the barulet. When the ſhield contains a number of bars of metal and colour alternate, of even number, that is called *barry* of ſo many pieces, expreſſing their number, as repreſented in Plate III.

7. The *Cheveron*, which repreſents the two rafters of a houſe well joined together, or a pair of compaſſes half open, takes up the fifth part of the field; its diminutives are, the cheveronel, which contains the half of the cheveron; and the couple-cloſe, which is half of a cheveronel; that is, its breadth is but the fourth part of a cheveron.

When there are more than two in a field they are termed cheveronels, but if placed in pairs and not at equal diſtances, they are then to be termed couple cloſſes. See Plate III. and IV.

8. The *Croſs* is an ordinary formed by the meeting of perpendicular with two horizontal lines in the feſs point, where they make four right angles; the lines are not drawn throughout, but diſcontinued the breadth of the ordinary, which takes up only the fifth part of the field, when not charged; but if charged, then the third: it is borne as well engrailed, indented, &c. as plain, as is ſhewn in Plate IV.

9. The *Saltier*, which is formed by the bend and bend-ſiniſter croſſing each other in right angles, as the interſecting of the pale and feſs forms the croſs, contains the fifth part of the field; but if charged, then the third. It has its varieties with other ordinaries by the application of the different lines, as in Plate IV.

Art. II. Subordinaries.

Beſides the honourable ordinaries and their diminutions already mentioned, there are other heraldic figures called Subordinaries, or Ordinaries only; which, by reaſon of their ancient uſe in arms, are of worthy bearing; viz. The Gyron, Franc-quarter, Canton, Pairle, Fret, Pile, Orle, In Eſcutcheon, Treſſure, Annulet, Flanches, Flaſques, Voiders, Billet, Lozenge, Guts, Fuſil, Ruſtre, Maſcle, Papillone, and Diaper. The Bordure never paſſes over a Chief, a Quarter, or a Canton, ſo that in Coats charged with either of them, the *Bordure* goes round the field until it touches them, and there finiſhes; but in reſpect to all other Ordinaries it ſurrounds them; but when it is empaled with another, the Bordure muſt terminate at the impaled Line. This method is alſo to be obſerved in impaling a Coat that hath either a ſingle or double treſſure, as may be ſeen by the impalement of the Arms of Scotland in the Royal Arms. The Variety of Bordures are ſhewn in Plate IV.

1. *The Gyron* is of a triangular or conical form, compoſed of two lines drawn from divers parts of the eſcutcheon meeting in an acute angle in the treſs point. It may be borne in ſingle or in couple to the number of 12. If a ſingle one, and it iſſues from any but the dexter chief point it muſt be expreſſed. If there are ſix or any higher number, it muſt be mentioned.

2. *The Franc Quarter* is formed of two ſtrait lines and contains one fourth of the field. When a coat is charged with thoſe ſimilar figures, two and one, beſides the quarter; yet although in the blazon you mention three, in drawing the coat you muſt ſhew but two, the third being ſuppoſed to be hid by the quarter.

3. *The Canton* is a ſquare figure leſs than the quarter whoſe edges might be indented, ingrailed, &c. and poſſeſſes only the third part of the chief. If placed any where but in the dexter chief point it muſt be expreſſed. In baronet's arms, the arms of Ulſter are exhibited on a canton. This as well as the quarter will cover one of the bearings and ſometimes part of a bearing. See Plate V.

4. The *Pairle* is half a ſaltier and half a pale, and reſembles the letter Y, or the pall uſed in the archbiſhop of Canterbury's arms.

5. The *Fret* lies over the whole coat to the extremity of the field, and is liable to be charged, as other ordinaries are. When the fret is compoſed of 8 or 10 lines which extend all over the field, it is termed *Fretty*. See Plate V.

6. The *Pile* is compoſed of two lines which form a long wedge, broad at the upper end, and ſo leſſening by degrees and meeting together at the lower end in an acute angle. It admits of no diminution, and therefore when there are more than one in a coat, they are called *Piles*. When they iſſue from any part of the ſhield but the chief it muſt be expreſſed. See Plate V.

7. The *Orle* is an inner border of the ſame ſhape as the eſcutcheon, and appears like an eſcutcheon voided; the edges of which might be varied by being ingrailed, &c. When any bearings, as

martlets, trefoils, &c. are ranged round an eſcutcheon on a field, they are ſaid to be in orle. See Plate V.

8. The *Ineſcutcheon* is a little eſcutcheon borne within the ſhield, which according to Guillim's opinion is only to be ſo called when it is borne ſingle, in the ſeſs point or center: but modern heralds with more propriety, give the name of ineſcutcheon to ſuch as are contained in Plate 5. and call that which is fixed on the ſeſs point, *Eſcutcheon of pretence*, which is to contain the arms of a wiſe that is an heireſs.

9. The *Treſſure* is a diminutive of the orle, formed by a ſmall line paſſing along the field, in the ſame form, whether the field be round, oval, or other ſhape. In ſome coats the treſſure is formed of two lines, flory, counter-flory, as in the arms of Scotland. See Plate V.

10. The *Annulet* or *Ring* is a well known figure, and is frequently to be found in arms through every kingdom in Europe.

11. The *Flanch* is formed nearly like the former, but ſomewhat more ſwelling in the middle; and may like that have a charge placed on it, though it is not admitted by all heraldic writers. See Plate V.

12. The *Flaſque* conſiſts of one arched line on each ſide the ſhield, drawn from nearly the corner of the chief, to nearly the middle of the eſcutcheon in a ſwelling direction, and decreaſing thence to the ſiniſter and dexter baſe points. See Plate V.

13. The *Voider*, appears as a diminutive of the two laſt, being much leſs extended from the ſides of the eſcutcheon, and cannot admit of being charged. See Plate V.

14. The *Billet* is an oblong ſquare figure, twice as long as broad. Some Heralds imagine that they repreſent bricks for building, others more properly conſider them as repreſenting folded papers or letters.

15. The *Lozenge*, when drawn in its full proportion ſhould have its width three Parts in four of its height. See Plate V.

16. *Gutts*, or *Drops*, are round at bottom, waved at the ſides, and terminated at the top in points. Heralds have given them different names according to their different tinctures.

Yellow,	are called	d'Or,
White,		d'Eau,
Red,		de Sang,
Blue,		de Larmes,
Green,		de Vert,
Black,		de Poix.

17. The *Fuſil* is compoſed of four Geometrical Lines, as the Lozenge, with only this Difference, that its upper and lower parts are more acute than thoſe of the Lozenge, and conſequently not ſo wide in the middle, being but half as wide as the Lozenge. See Plate V.

Both this and the Lozenge might cover a field, and be termed Fuſilly and Lozengy. They may alſo be borne in ſeſs, in pale, &c.

18. The *Ruſtre* is a Lozenge pierced round in the Middle. See Plate V.

19. The *Maſcle* differs both from the Lozenge and Fuſil, and ſhould be exactly ſquare and voided, or pierced through. Their number muſt be mentioned and their poſition. See Plate V.

20. *Papillone*, is an expreſſion for a field or charge, that is covered with figures like the ſcales of a fiſh. The proper term for it in Engliſh would be Scallop-work.

21. *Diapering* is ſaid of a field or charge ſhadowed with flouriſhings or foliage, with a colour a little darker than that on which it is wrought. The Germans frequently uſe it; but it does not enter into the blazoning or deſcription of an arms; ſerving only to embelliſh the coat.

Art. III. Common Charges borne in Coats-of-Arms.

It has been already obſerved, that in all ages men have made uſe of the repreſentation of living creatures, and other ſymbolical ſigns, to diſtinguiſh themſelves in war; and that theſe marks, which were promiſcuouſly uſed for hieroglyphs, emblems, and perſonal devices, gave the firſt notion of heraldry. But nothing ſhews the extent of human wit more, than the great variety of theſe marks of diſtinction, ſince they are compoſed of all ſorts of figures, ſome natural, others artificial, and many chimerical; in alluſion, it is to be ſuppoſed, to the ſtate, quality, or inclinatiou of the bearer.

Among the multitude of natural things which are uſed in coats of arms, thoſe moſt uſually borne are, for the ſake of brevity and perſpicuity, diſtributed into the following claſſes, viz. *Celeſtial figures*; as the ſun, moon, ſtars, &c. and their parts. *Effigies* of men, women, and their parts. *Beaſts*; as lions, ſtags, foxes, boars, &c. and their parts. *Birds*; as eagles, ſwans, ſtorks, pelicans, &c. and their parts. *Fiſhes*; as dolphins, whales, ſturgeons, trouts, &c. and their parts. *Reptiles* and *Inſects*; as tortoiſes, ſerpents, graſshoppers, &c. and their parts. *Vegetables*; as trees, plants, flowers, herbs, &c. and their parts. *Stones*; as diamonds, rubies, pebbles, rocks, &c. Theſe charges have, as well as ordinaries, divers attributes or epithets, which expreſs their qualities, poſitions, and diſpoſitions. Thus the ſun is ſaid to be *in his glory*, *eclipſed*, &c. The moon *in her complement*, *increſcent*, &c. Animals are ſaid to be *rampant*, *paſſant*, &c. Birds have alſo their denominations, ſuch as *cloſe*, *diſplayed*, &c. Fiſhes are deſcribed to be *hauriant*, *naiant*, &c.

SECT. VII.

EXTERNAL ORNAMENTS of ESCUTCHEONS.

The ornaments that accompany or ſurround eſcutcheons were introduced to denote the birth, dignity, or office, of the perſons to whom the coat-of-arms appertaineth; which is practiſed both among the laity and clergy. Thoſe moſt in uſe are of ten ſorts, viz. crowns, coronets, mitres, helmets, mantlings, chapeaux, wreaths, creſts, ſcrolls, ſupporters.

Art. I. Crowns.

The firſt crowns were only diadems, bands, or fillets; afterwards they were compoſed of branches of divers trees, and then flowers were added to them. Among the Greeks, the crowns given to thoſe who carried the prize at the Iſthmian games, were of pine; at the Olympick of laurel; and at the Nemean, of ſmallage. The Romans had various crowns to reward martial exploits and extraordinary ſervices done to the republic. They had alſo other enſigns of honour, ſuch as chains of gold, gilt ſpurs, and lances, and frequently crowns of different forms, which at firſt were made of bays in token of mirth and victory, but afterwards they were made of gold. The crowns of the Romans were, 1. The oval crown, which was made of myrtle, and beſtowed upon generals, who were intitled to the honours of the leſſer triumph, called ovation. 2. The naval, or roſtral crown, compoſed of a circle of gold, with ornaments repreſenting beaks of ſhips, and were given to the Captain who firſt grappled, or the Soldier who firſt boarded an enemy's ſhip. See Plate VI. 3. The vallaris, or caſtrenſis, was a circle of gold raiſed with jewels or paliſades, the reward of him who firſt forced the enemies entrenchments. 4. The mural crown was a circle of gold indented and embattled, given to him who firſt mounted the wall of a beſieged place, and there lodged a ſtandard. See Plate VI. 5. The civic crown was made of the branch of green oak, and given to him who had ſaved the life of a citizen. 7. The obſidionalis, or graminea crown, was made of graſs growing on the plane; the reward of a general who had delivered a Roman army from a ſiege. 8. The radial crown was given to princes at their tranſlation among the gods. We meet alſo with the corona aurea, often beſtowed on ſoldiers, without any other additional term. See Plate VI.

But modern crowns are only uſed as an ornament, which emperors, kings, and independent princes ſet on their heads, in great ſolemnities, both to denote their ſovereign authority, and to render themſelves more awful to their ſubjects. Theſe are the moſt in uſe in heraldry, and are as follow:

The imperial crown is made of a circle of gold, adorned with fleurs-de-lis, bordered and ſeeded with pearls, raiſed in the form of a cap voided at the top, like a creſcent. From the middle of this cap riſes an arched fillet enriched with pearls, and ſurmounted of a mound, whereon is a croſs of pearls. See Plate VI.

The crown of the kings of Great Britain, is a circle of gold, bordered with ermine, enriched with pearls and precious ſtones, and heightened up with four croſſes pattee and four large fleurs-de-lis alternately; from theſe riſe four arched diadems adorned with pearls, which cloſe under a mound, ſurmounted of a croſs like thoſe at bottom. See Plate VI.

The crown of the kings in France is a circle enamelled, adorned with precious ſtones, and heightened up with eight arched diadems, riſing from as many fleurs-de-lis, that conjoin at the top under a double fleur-de-lis, all of gold. See Plate VI.

The crowns of Spain, Portugal, and Poland, are all three of the ſame form, and are, amongſt others, thus deſcribed. A ducal coronet, heightened up with eight arched diadems that ſupport a mound, enſigned with a plain croſs. Thoſe of Denmark and Sweden are both of the ſame form; and conſiſt of eight arched diadems, riſing from a marquis's coronet, which conjoin at the top under a mound enſigned with a croſs bottony.

The crowns of Bohemia and Hungary are compoſed of ſixteen plates of gold, heightened by two ſemi-circles, on the top of which is a croſs ornamented with pearls. The plates are ornamented with the buſts of Jeſus Chriſt and his Apoſtles, enriched with jewels and pearls. To the bottom are pendant ſeven chains of gold, each ſuſpending a gold ball. This crown they pretend was dropped from heaven, for the crowning Stephen firſt king of Hungary.

The crowns of moſt other kings are circles of gold, adorned with precious ſtones, and heightened up with large trefoils, and cloſed by four, ſix, or eight diadems, ſupporting a mound, ſurmounted of a croſs.

The Great Turk, bears over his arms a turband, enriched with pearls and diamonds, under two coronets, the firſt of which is made of pyramidical points heightened up with large pearls, and the uppermoſt is ſurmounted with creſcents.

The Pope, or biſhop of Rome, appropriates to himſelf a Tiara, or long cap of golden cloth, from which hang two pendants embroidered and fringed at the ends, *ſemée* of croſſes of gold. This cap is incloſed by three marquis's coronets; and has on its top a mound of gold, whereon is a croſs of the ſame, which croſs is ſometimes repreſented by engravers and painters, pometted, recroſſed, or flowery plain. See Plate VI.

Art. II. Coronets

The Coronet of the prince of Wales, or eldeſt ſon of the king of Great Britain, was anciently a circle of gold ſet round with four croſſes-pattee; and as many fleurs-de-lis alternately; but ſince the reſtoration, it has been cloſed with one arch only, adorned with pearls, and ſurmounted of a mound and croſs, and bordered with ermine like the king's. Beſides the aforeſaid coronet, his royal highneſs the prince of Wales has another diſtinguiſhing mark of honour, peculiar to himſelf, called by the vulgar the *prince's arms*, viz. A plume of three oſtrich-feathers, with an ancient coronet of a prince of Wales. Under it, in a ſcroll, is this motto, *Ich Dien*, which in the German or old Saxon language ſignifies "I ſerve." This device was at firſt taken by Edward prince of Wales, commonly called the *black prince*, after the famous battle of Creſſy, in 1346, where having with his own hand killed John, king of Bohemia, he took from his head ſuch a plume, and put it on his own. See Plate VI.

The coronet of the preſent dukes of York, Glouceſter and Cumberland, and of all the immediate ſons and brothers of the kings of Great Britain, is a circle of gold, bordered with ermine, heightened up with four fleurs-de-lis, and as many croſſes-pattee alternate. See Plate VI.

The coronet of the princeſſes of Great Britain is a circle of gold, bordered with ermine, and heightened up with croſſes-pattee, fleurs-de-lis and ſtrawberry leaves alternate; whereas a prince's coronet has only fleurs-de-lis and croſſes. See Plate VI.

A duke's coronet is a circle of gold, bordered with ermine, enriched with precious ſtones and pearls, and ſet round with eight large ſtrawberry or parſley leaves. See Plate VI.

A marquis's coronet is a circle of gold, bordered with ermine, ſet round with four ſtrawberry leaves, and as many pearls on pyramidical points of equal height, alternate. See Plate VI.

An earl's coronet is a circle of gold, bordered with ermine, heightened up with eight pyramidical points or rays, on the tops of which are as many large pearls, and are placed alternately with as many ſtrawberry-leaves, but the pearls much higher than the leaves. See Plate VI.

A viſcount's coronet differs from the preceding ones as being only a circle of gold bordered with ermine, with large pearls ſet cloſe together on the rim, without any limited number, which is his prerogative above the baron, who is limited. See Plate VI.

A baron's coronet, which was granted by king Charles II. is formed with ſix pearls ſet at equal diſtances on a gold circle, bordered with ermine, four of which only are ſeen on engravings, paintings, &c. to ſhew he is inferior to the viſcount. See Plate VI.

The eldeſt ſons of peers, above the degree of a baron, bear their father's arms and ſupporters with a label, and uſe the coronet appertaining to their father's ſecond title: and all the younger ſons bear their arms with proper differences, but uſe no coronets.

As the crown of the king of Great Britain is not quite like that of other potentates, ſo do moſt of the coronets of foreign noblemen differ a little from thoſe of the Britiſh nobility: as for example, the coronet of a French earl is a circle of gold with 18 pearls ſet on the brim of it: a French viſcount's coronet is a circle of gold only enamelled, charged with four large pearls; and a French baron's coronet is a circle of gold enamelled and bound about with a double bracelet of pearls; and theſe coronets are only uſed on French noblemens coats-of-arms, and not worn on their heads, as the Britiſh noblemen and their ladies do at the king's coronation.

Art. III. Mitres.

The archbiſhops and biſhops of England and Ireland place a mitre over their coats-of-arms. It is a round cap pointed and cleft at the top, from which hang two pendants fringed at both ends; with this difference, that the biſhop's mitre is only ſurrounded with a fillet of gold, ſet with precious ſtones, whereas the archbiſhop's iſſues out of a ducal coronet. This ornament, with other maſquerade garments, is ſtill worn by all the archbiſhops and biſhops of the church of Rome, whenever they officiate with ſolemnity; but it is never uſed in England, otherwiſe than on coats-of-arms, as before mentioned.

Art. IV. Helmets.

The Helmet was formerly worn as a defenſive weapon, to cover the bearer's head: and is now placed over a coat-of-arms as its chief ornament, and the true mark of gentility. There are ſeveral ſorts, diſtinguiſhed, 1ſt, by the matter they are made of; 2dly, by their form; and, 3dly, by their poſition.

1ſt, As to the matter they are, or rather were, made of. The helmets of ſovereigns were of burniſhed gold damaſked; thoſe of princes and lords, of ſilver figured with gold; thoſe of knights, of ſteel adorned with ſilver; and thoſe of private gentlemen, of poliſhed ſteel.

2dly, As to their form: Thoſe of the king and the royal family, and noblemen of Great Britain, are open-faced and grated, and the number of bars ſerves to diſtinguiſh the bearers quality; that is, the helmet appropriated to the dukes and marquiſes is different from the king's, by having a bar exactly in the middle, and two on each ſide, making but five bars in all, whereas the king's helmet has ſix bars, viz. three on each ſide. The other grated helmet with four bars is common to all degrees of peerage under a marquis. The open-faced helmet without bars denotes baronets and knights. The cloſe helmet is for all eſquires and gentlemen.

3dly, Their poſition is alſo looked upon as a mark of diſtinction. The grated helmet in front belongs to ſovereign princes. The grated helmet in profile is common to all degrees of peerage. The helmet ſtanding direct without bars, and the beaver a little open, denotes baronets and knights. Laſtly, the ſide-ſtanding helmet, with the beaver cloſe, is the way of wearing it amongſt eſquires and gentlemen. See Plate VI.

Art. V. Mantlings.

Mantlings are pieces of cloth jagged or cut into flowers and leaves, which now ſerve as an ornament for eſcutcheons. They were the ancient covering of helmets, to preſerve them, or the bearer, from the injuries of the weather, as alſo to prevent the ill conſequences of their too much dazzling the eye in action. But Guillim very judiciouſly obſerves, that their ſhape muſt have undergone a great alteration ſince they have been out of uſe, and therefore might more properly be termed *flouriſhings* than *mantlings*.

Art. VI. Chapeaux.

A chapeaux is an ancient hat, or rather cap, of dignity worn by dukes, generally ſcarlet-coloured velvet on the outſide, lined and turned up with fur: of late frequently to be met with above an helmet, inſtead of a wreath, under gentlemens and noblemens creſts. Heretofore they were ſeldom to be found, as of right appertaining to private families; but by the grants of Robert Cooke, Clarencieux, and other ſucceeding heralds, theſe, together with ducal coronets, are now frequently to be met with in families, who yet claim not above the degree of gentlemen.

Art. VII. Wreaths.

The Wreath is a kind of roll made of two ſkains of ſilk of different colours twiſted together, which ancient knights wore as a head-dreſs when equipped for tournaments. The colours of the ſilk are always taken from the principal metal and colour contained in the coat-of-arms of the bearer. They are ſtill accounted as one of the leſſer ornaments of eſcutcheons, and are placed between the helmet and the creſt; (ſee Plate VI.) In the time of Henry I. and long after, no man, who was under the degree of a knight, had his creſt ſet on a wreath; but this, like other prerogatives, has been infringed ſo far, that many perſons wear a wreath.

Art. VIII. Crests.

The Creſt is the higheſt part of the ornaments of a coat-of-arms. It is called *creſt*, from the Latin word *criſta*, which ſignifies a comb or tuft, ſuch as many birds have upon their heads, as the peacock, pheaſants, &c. in alluſion to the place on which it is fixed.

Creſts were formerly great marks of honour, becauſe they were only worn by heroes of great valour, or by ſuch as were advanced to ſome ſuperior military command, in order that they might be the better diſtinguiſhed in an engagement, and thereby rally their men if diſperſed; but they are at preſent conſidered as a mere ornament. The creſt is frequently a part either of the ſupporters, or of the charge borne in the eſcutcheon. Thus the creſt of the royal atchievement of Great Britain is a "Lion guardant crowned." The creſt of France is "a double Flower-de-luce."

Art. IX. The Scroll and Motto.

The Scroll is the ornament placed above the creſt, containing a motto, or ſhort ſentence, alluding thereto, or to the bearings: or to the bearer's name, as in the following inſtance. The motto of the noble earl of Cholmondeley is, *Caſſis tutiſſima virtus*: i. e. "Virtue is the ſafeſt helmet."

Art. X. Of Supporters.

Supporters are figures ſtanding on the ſcroll, and placed at the ſide of the eſcutcheon; they are ſo called, becauſe they ſeem to ſupport or hold up the ſhield. The riſe of ſupporters is, by F. Meneſtrier, traced up to ancient tournaments, wherein the knights cauſed their ſhields to be carried by ſervants or pages under the diſguiſe of lions, bears, griffons, blackamoors, &c. who alſo held and guarded the eſcutcheons, which the knights were obliged to expoſe to public view for ſome time before the liſts were opened.

It is to be obſerved, that bearing coats-of-arms ſupported, is, according to the heraldrical rules of England, the prerogative, 1ſt, Of thoſe called *nobiles majores*, viz. dukes, marquiſes, earls, viſcounts, and barons; 2d, Of all knights of the garter, though they ſhould be under the degree of barons; 3d, Of knights of the Bath, who both receive on their creation a grant of ſupporters. And, laſtly, of ſuch knights as the king chooſes to beſtow this honour upon; neither peereſſes or biſhops have mottos or creſts, and the latter though peers of parliament have no ſupporters. In Scotland, all the chiefs of clans or names have the privilege of claiming ſupporters; alſo the baronets. But by act of parliament, 10th September, 1672, none are allowed to uſe either arms or ſupporters, under a penalty and confiſcation of all moveables whereon arms are put.

SECT. VIII. RULES OR LAWS OF HERALDRY.

The ſeveral eſcutcheons, tinctures, charges, and ornaments of coats-of-arms, and their various properties, being now explained; it may not be improper to ſubjoin ſuch rules for blazoning the ſame, as the ancient uſuage and laws of heraldry have eſtabliſhed amongſt us.

1. The *firſt* and moſt general rule is, to expreſs one's ſelf in proper terms, ſo as not to omit any thing that ought to be ſpecified, and at the ſame time to be clear and conciſe without tautology.

2. One muſt begin with the tincture of the field, and then proceed to the principal charges which poſſeſs the moſt honourable place in the ſhield, ſuch as Feſs, Cheveron, &c. always naming

that charge firſt which lies next and immediately upon the field.

3. After naming the tincture of the field, the honourable ordinaries, or other principal figures, you muſt ſpecify their attributes, and afterwards their metal or colour.

4. When an honourable ordinary, or ſome one figure, is placed upon another, whether it be a Feſs, Cheveron, Croſs, &c. it is always to be named after the ordinary or figure over which it is placed, with one of theſe expreſſions, *ſurtout*, or *over-all*.

5. In the blazoning of ſuch ordinaries as are plain, the bare mention of them is ſufficient; but if an ordinary ſhould be made of any of the crooked lines mentioned above, its form muſt be ſpecified; that is, whether it be Engrailed, Wavy, &c. as engraved in Plate I.

6. When a principal figure poſſeſſes the centre of the field, its poſition is not to be expreſſed: or (which amounts to the ſame thing) when a bearing is named, without ſpecifying the point where it is placed, then it is underſtood to poſſeſs the middle of the ſhield.

7. The number of the points of mullets or ſtars muſt be ſpecified when more than five; and alſo if a mullet or any other charge be pierced, it muſt be mentioned as ſuch, to diſtinguiſh it from what is plain.

8. When a ray of the ſun, or other ſingle figure, is borne in any other part of the eſcutcheon than the centre, the point it iſſues from muſt be named.

9. The natural colour of trees, plants, fruits, birds, &c. is no otherwiſe to be expreſſed in blazoning but by the word *proper*: but if diſcoloured, that is, if they differ from their natural colour, it muſt be particularized.

10. When three figures are in a field, and their poſition is not mentioned in the blazoning, they are always underſtood to be placed two above, and one below.

11. When there are many figures of the ſame ſpecies borne in a coat-of-arms, their number muſt be obſerved as they ſtand, and diſtinctly expreſſed.

SECT. IX. MARSHALLING COATS-OF-ARMS.

By *marſhalling* coats-of-arms, is to be underſtood the art of diſpoſing divers of them in one eſcutcheon, and of diſtributing their contingent ornaments in proper places. Various cauſes may occaſion arms to be thus conjoined, which J. Guillim compriſes under two heads, viz. *manifeſt* and *obſcure*. What this learned and judicious herald means by *manifeſt cauſes* in the marſhalling of coats-of-arms, are ſuch as betoken marriages, or a ſovereign's gift, granted either through the ſpecial favour of the prince, or for ſome eminent ſervices. Concerning marriages, it is to be obſerved,

1. When the coats-of-armsof a married couple, deſcended from diſtinct families, are to be put together in one eſcutcheon, the field of their reſpective arms is conjoined Paleways, and blazoned *parted per Pale, Baron and Femme, two coats; firſt, &c.* In which caſe the baron's arms are always to be placed on the dexter ſide, and the femme's arms on the ſiniſter-ſide. If a widower marry again, his late and preſent wife's arms are, according to G. Leigh, "to be both placed on the ſiniſter-ſide, in the eſcutcheon with his own, and parted per Pale. The firſt wife's coat ſhall ſtand on the Chief, and the ſecond on the Baſe; or he may ſet them both in Pale with his own, the firſt wife's coat next to himſelf, and his ſecond outermoſt. If he ſhould marry a third wife, then the two firſt matches ſhall ſtand on the Chief, and the third ſhall have the whole Baſe. And if he take a fourth wife, he muſt participate one-half of the Baſe with the third wife, and ſo will they ſeem to be ſo many coats quartered." But it muſt be obſerved, that theſe forms of impaling are meant of hereditary coats, whereby the huſband ſtands in expectation of having the hereditary poſſeſſions of his wife united to his patrimony.

2. In the arms of femmes joined to the paternal coat of the baron, the proper differences by which they were borne by the fathers of ſuch women muſt be inſerted.

3. If a coat-of-arms that has a Bordure be impaled with another, as by marriage, then the Bordure muſt be wholly omitted in the ſide of the arms next the centre.

4. The perſon that marries an heireſs, inſtead of impaling his arms with thoſe of his wife, is to bear them in an eſcutcheon placed in the centre of his ſhield, after the ſame manner as the baronet's badge is marſhalled in n° 3. and which, on account of its ſhewing forth his pretenſion to her eſtate, is called *an eſcutcheon of pretence*, and is blazoned *ſur tout*, i. e. *over all*, as the ineſcutcheon borne in the fourth quarter of the royal atchievement. But the children are to bear the hereditary coats-of-arms of their father and mother *quarterly*, which denotes a fixed inheritance, and ſo tranſmit them to poſterity. The firſt and fourth quarters generally contain the father's arms, and the ſecond and third the mother's; except the heirs ſhould derive not only their eſtate, but alſo their title and dignity, from their mother.

5. If a maiden or dowager lady of quality marry a commoner, or a nobleman inferior to her rank, their coats of arms may be ſet aſide of one another in two ſeparate eſcutcheons, upon one mantle or drapery, and the lady's arms ornamented according to her title.

6. Archbiſhops and biſhops impale their arms differently from the fore-mentioned coats, in giving the place of honour,, that is, the dexter-ſide, to the arms of their dignity. It may be obſerved of the prelates, that they thus bear their arms pared by Pale, to denote their being joined to their cathedral church in a ſort of ſpiritual marriage.

With reſpect to ſuch armorial enſigns as the ſovereign thinks fit to augment a coat-of-arms with, they may be marſhalled various ways, as may be ſeen by the arms of his grace the duke of Rutland, in the Plate of Peerage. To thoſe augmentations may be added, 1ſt, The ancient and reſpectable badge of the moſt noble order of the garter, inſtituted by king Edward III. 1349, and which, ever ſince its inſtitution, has been looked upon as a great honour beſtowed on the nobleſt perſons of this nation and other countries. It is an augmentation made to ſurround, as with a garter, the arms of ſuch knights, and is inſcribed with this motto, "Honi ſoit qui mal y penſe." 2d. The badge of the order of the Bath, firſt inſtituted 1399, by king Henry IV. and re-eſtabliſhed by Geo. I. is inſcribed within a circular bordure, with this motto, "Tria juncta in uno." 3d. The badge of the order of the thiſtle, inſtituted in 819, by Achaius, was re-eſtabliſhed by James II. of England; and is inſcribed with this motto, "Nemo me impune laceſſit." 4th. The badge of the order of St. Patrick, inſtituted by king George III. March 11, 1783, is inſcribed within a circular bordure, with this motto, "Quis Separabit." 5th. The baronet's mark of diſtinction is the arms of the province of Ulſter in Ireland, granted and made hereditary by king James I. who erected this dignity on the 22d of May 1611, in order to propagate a plantation in that province. This mark is "*Argent, a ſiniſter hand couped at the wriſt, and erected, Gules*:" which is borne either in a canton or an eſcutcheon, as will beſt ſuit the figures of the arms. See Plate VII.

SECT. X. FUNERAL ESCUTCHEONS.

After having treated of the eſſential parts of the coats-of-arms, of the various charges and ornaments uſually borne therewith, of their attributes and diſpoſitions, and of the rules for blazoning and marſhalling them; we ſhall next deſcribe the ſeveral funeral eſcutcheons, uſually called *hatchments*; whereby may be known, after any perſon's diſeaſe, what rank either he or ſhe held when living; and if it be a gentleman's hatchment, whether he was a batchelor, married man, or widower, with the like diſtinctions for gentlewomen.

The hatchment, in Plate I. repreſents ſuch as are affixed to the fronts of houſes, when any of the nobility and gentry dies; the arms wherein being thoſe of a private gentleman and his wife parted per pale; the dexter-ſide, which is Gules, three Bars Or, for the huſband; having the ground without the eſcutcheon black, denotes the man to be dead; and the ground on the ſiniſter-ſide being white, ſignifies that the wife is living, which is alſo demonſtrated by the ſmall hatchment, in the ſecond repreſentation Plate I. which is there depicted without mantling, helmet, and creſt, for perſpicuity's ſake only.

When a married gentlewoman dies firſt, the hatchment is diſtinguiſhed by a contrary colour from the former; that is, the arms on the ſiniſter-ſide have the ground without the eſcutcheon black; whereas thoſe on the dexter-ſide, for her ſurviving huſband, are upon a white ground: the hatchment of a gentlewoman is, moreover, differenced by a cherub over the arms inſtead of a creſt. See *Fig*. 3. Plate I.

When a bachelor dies, his arms may be depicted ſingle or quartered, with a creſt over them, but never impaled as the two firſt are, and all the ground without the eſcutcheon is alſo black. See *Fig*. 4. Plate I.

When a maid dies, her arms, which are placed in a lozenge, may be ſingle or quartered, as thoſe of a bachelor; but, inſtead of a creſt, have a cherub over them, and all the ground without the eſcutcheon is alſo black. See *Fig*. 5. Plate I.

When a widower dies, his arms are repreſented impaled with thoſe of his deceaſed wife, having a helmet, mantling, and creſt over them, and all the ground without the eſcutcheon black. See *Fig*. 6. Plate I.

When a widow dies, her arms are alſo repreſented impaled with thoſe of her deceaſed huſband, but incloſed in a lozenge, and, inſtead of a creſt, a cherub is placed over them; all the ground without the eſcutcheon is alſo black. See *Fig*. 7. Plate I.

If a widower or bachelor ſhould happen to be the laſt of his family, the hatchment is depicted as in *fig*. 6. and that of a maid or or widow, whoſe family is extinct by her death, is depicted as in *fig*. 7. with this difference only, that a death-head is generally annexed to each hatchment, to denote, that death has conquered all.

By the forementioned rules, which are ſometimes neglected through the ignorance of illiterate people, may be known, upon the ſight of any hatchment, what branch of the family is dead; and by the helmet or coronet, what title and degree the deceaſed perſon was of.

The ſame rules are obſerved with reſpect to the eſcutcheons placed on the hearſe and horſes uſed in pompous funerals, except that they are not ſurmounted with any creſt, as in the foregoing examples of hatchments, but are always plain. It is neceſſary, however, to enſign thoſe of peers with coronets, and that of a maiden lady with a knot of ribbands.

Distinctions of Funeral Atchievements.
See System of Heraldry.

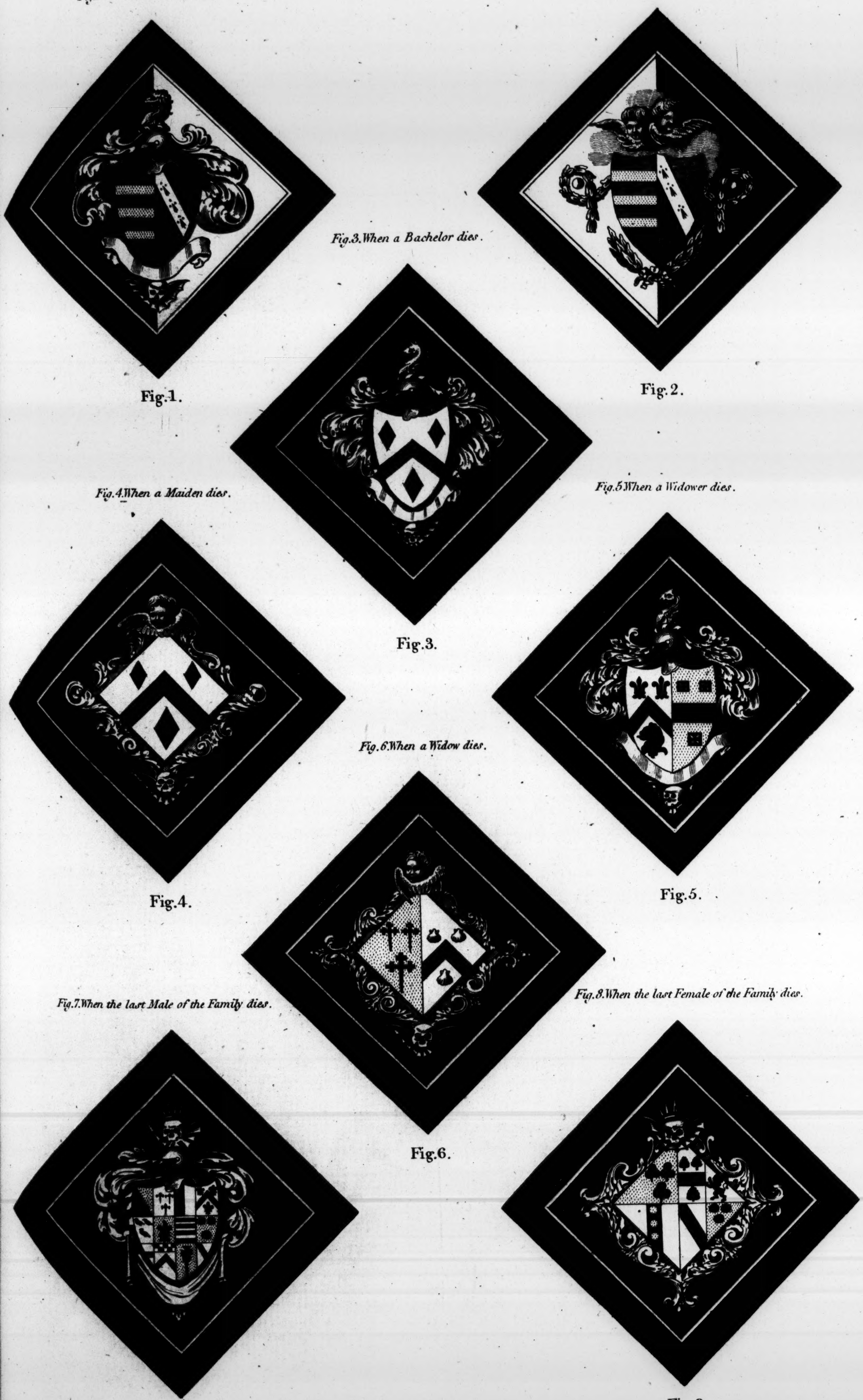

Fig.1. When the Husband dies.

Fig.1.

Fig.2. When the Wife dies.

Fig.2.

Fig.3. When a Bachelor dies.

Fig.3.

Fig.4. When a Maiden dies.

Fig.4.

Fig.5. When a Widower dies.

Fig.5.

Fig.6. When a Widow dies.

Fig.6.

Fig.7. When the last Male of the Family dies.

Fig.7.

Fig.8. When the last Female of the Family dies.

Fig.8.

Published as the Act directs by C. Cooke, No. 17, Paternoster Row, March 26th 1790.

BRITISH
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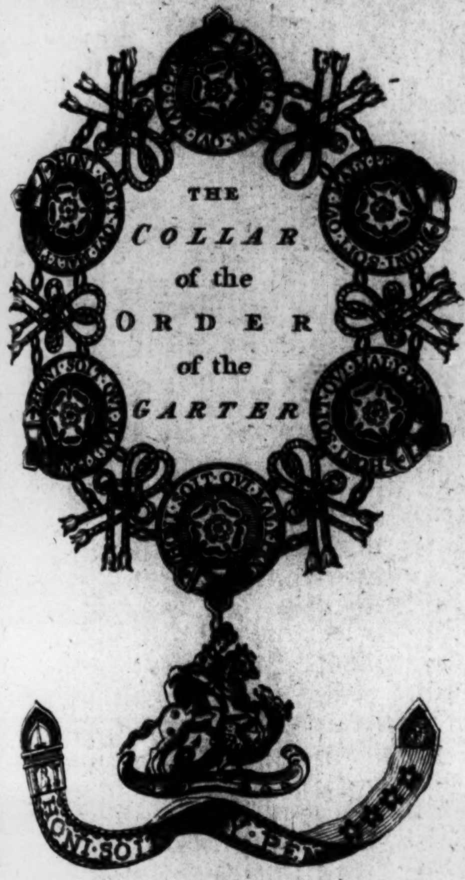
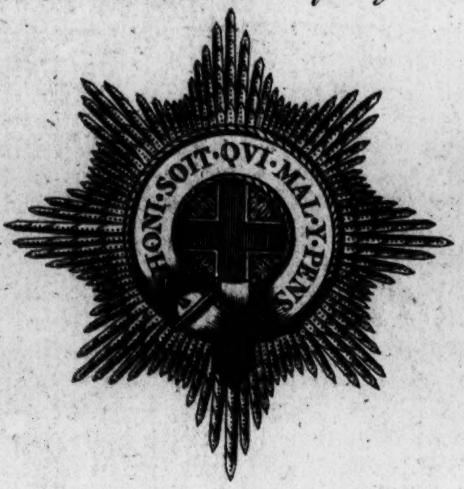
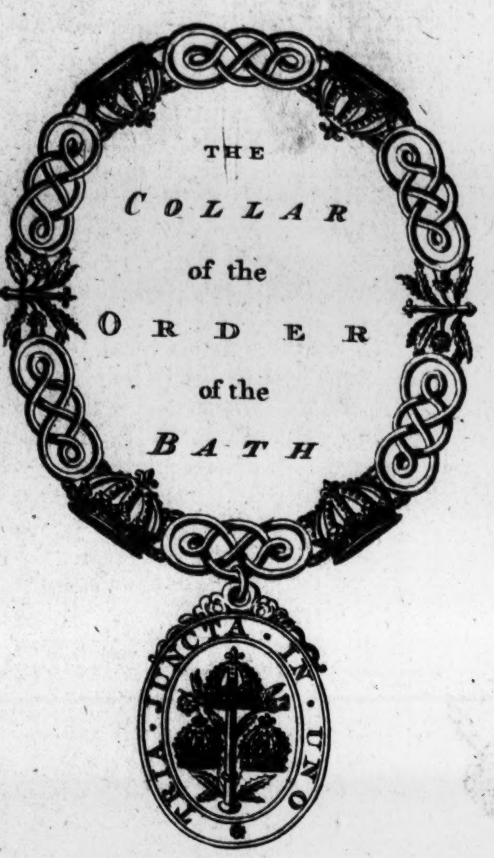
MUSEUM

Orders of Knighthood.—See System of Heraldry.

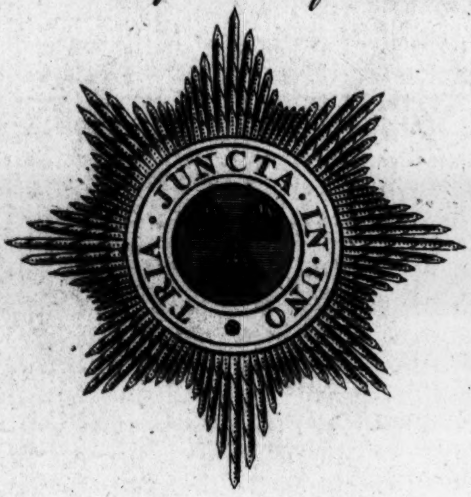

THE
COLLAR
of the
ORDER
of the
GARTER
HONI SOIT

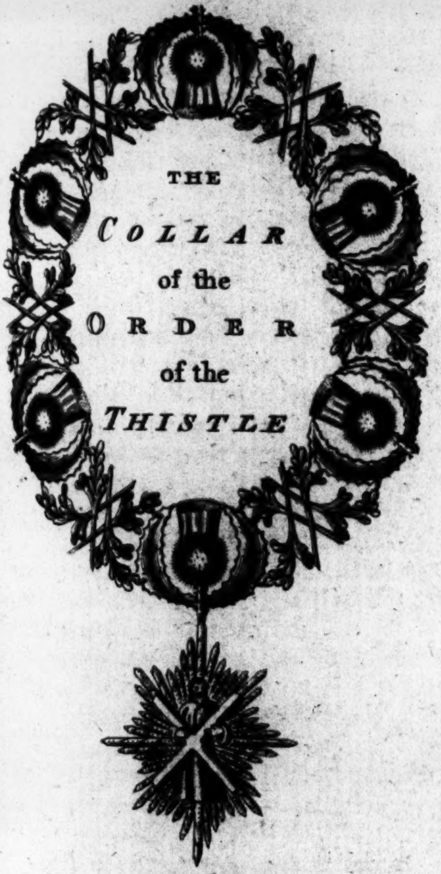
The Star of the Order of the Garter.


HONI·SOIT·QUI·MAL·Y·PENS

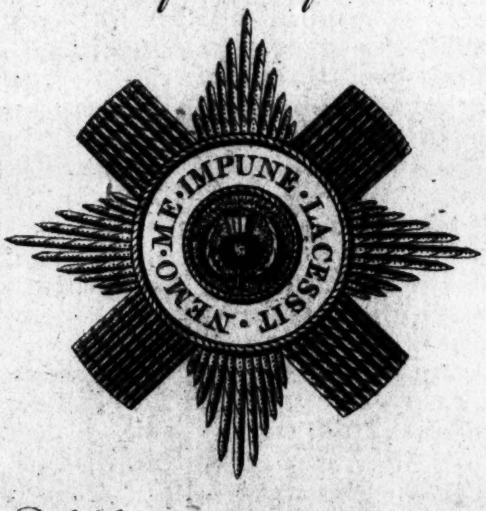

THE
COLLAR
of the
ORDER
of the
BATH
TRIA JUNCTA IN UNO

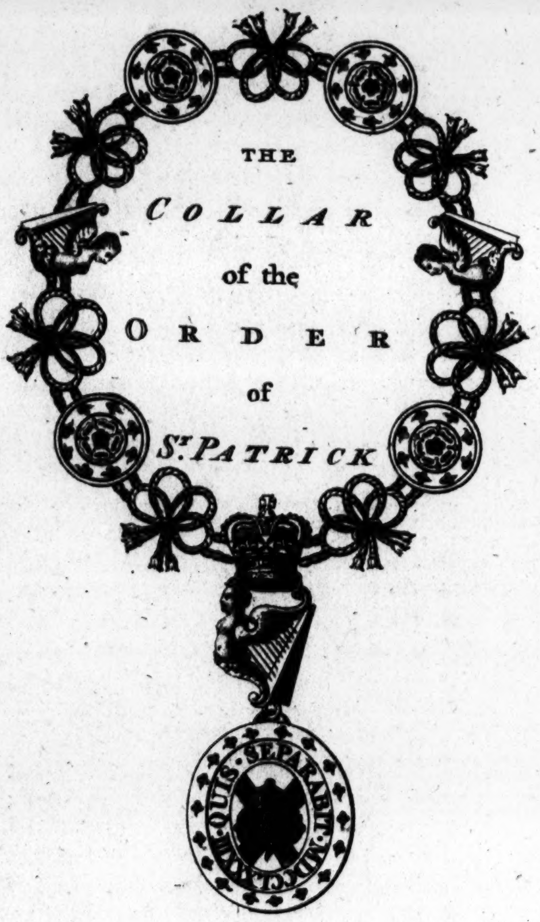
The Star of the Order of the Bath


TRIA JUNCTA IN UNO

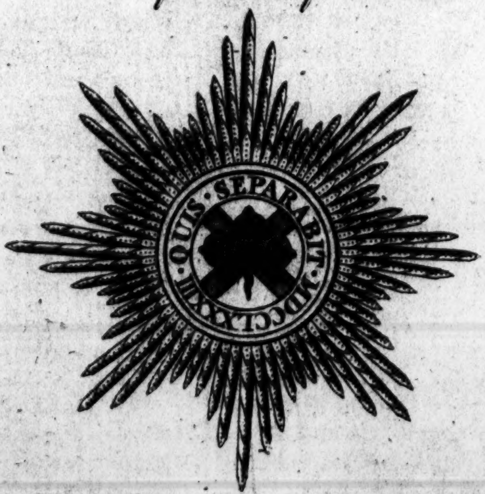

THE
COLLAR
of the
ORDER
of the
THISTLE

The Star of the Order of the Thistle.

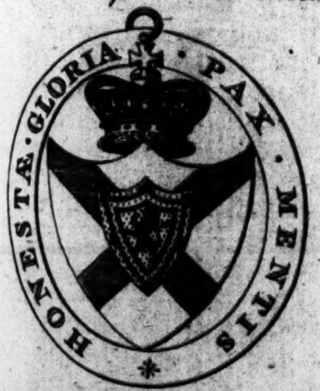

NEMO·ME·IMPUNE·LACESSIT


THE
COLLAR
of the
ORDER
of
St. PATRICK
QUIS·SEPARABIT·MDCCLXXXIII

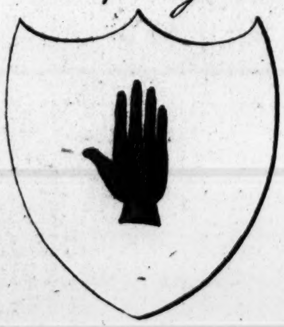
The Star of the Order of St. Patrick.


QUIS·SEPARABIT·MDCCLXXXIII

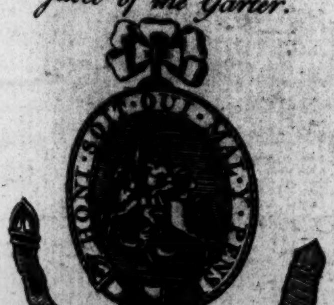
Baronet of Nova Scotia.


HONESTÆ·GLORIA·PAX MENTIS

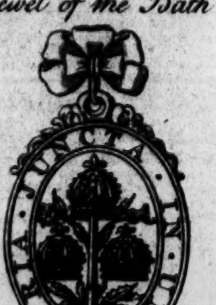
Baronet of England.



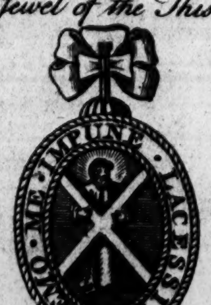
Jewel of the Garter.


HONI·SOIT·QUI·MAL·Y·PENS

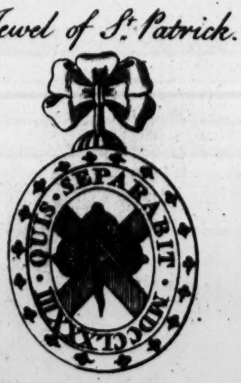
Jewel of the Bath.


TRIA JUNCTA IN UNO

Jewel of the Thistle.


NEMO·ME·IMPUNE·LACESSIT

Jewel of St. Patrick.


QUIS·SEPARABIT·MDCCLXXXIII

Published According to Act of Parliament by C. Cooke No. 17 Paternoster Row, Oct.r 31. 1788.

BRITISH 18 MR 63 MUSEUM

HERB, in botany; a name by which Linnæus denominates that portion of every vegetable which ariſes from the root, and is terminated by the fructification. It comprehends, 1. The trunk, ſtalk, or ſtem. 2. The leaves. 3. Thoſe minute external parts called by the ſame author the *fulcra*, or ſupports of plants. 4. The buds, or, as he alſo terms them, the *winter-quarters* of the future vegetable. See the Syſtem, Sect. III.

Herbaceous *Plants*, are thoſe which have ſucculent ſtems or ſtalks that die down to the ground every year. Of herbaceous plants, thoſe are annual which periſh ſtem and root and all every year; biennial, which ſubſiſt by the roots two years; perennial which are perpetuated by their roots for a ſeries of years, a new ſtem being produced every ſpring. See the Syſtem, Sect. VII.

HERBAL, ſignifies a book that treats of the claſſes, genera, ſpecies, and virtues of plants.

HERCULANEUM is the name of an ancient city of Campania, in Italy, which was deſtroyed by an eruption of Veſuvius in the firſt year of the empire of Titus, or the 79th of the Chriſtian æra, and rendered famous on account of the curious monuments of antiquity diſcovered in its ruins; an account of which has been publiſhed by order of the king of Naples, in a work of ſix volumes folio. The epocha of the foundation of Herculaneum is unknown; Dionyſius Halicarnaſſenſis conjectures, that it may be referred to ſixty years before the war of Troy, or about 1342 years before Chriſt, and therefore that it laſted about 1400 years.

HERCULES, in aſtronomy, one of the conſtellations of the northern hemiſphere. See the Syſtem, Sect. VIII, under the Article Northern Constellations

Hercules, in mythology, a celebrated hero of antiquity, who, on account of his ſingular exploits, was deified by the Pagans. He is ſaid to have been the ſon of Jupiter and Alcmena, the wife of Amphitrion, king of Thebes. Herodotus fixes his birth a hundred years before the taking of Troy by the Greeks, or about the year 1382 before the commencement of the Chriſtian æra.

The famous ſtatue of Hercules, in the Farneſe palace at Rome, is well known to the connoiſſeurs: this repreſents him, reſting after the laſt of his twelve labours above recited, leaning on his club, and holding the apples of the Heſperides in his hand. In this ſtatue, as in all the other figures of him, he is formed, by the breadth of his ſhoulders, the ſpaciouſneſs of his cheſt, the largeneſs of his ſize, and the firmneſs of his muſcles, to expreſs ſtrength and a capacity of enduring great fatigue, which conſtituted the chief idea of virtue among the ancient heathens. His other attributes are his lion's ſkin, his club, and his bow. For repreſentation of this figure, ſee Treatiſe on the Art of Drawing, Plate III. in which are repreſented all the meaſurements from the real antique, for the purpoſe of illuſtrating the principles of drawing.

HEREDITARY, ſomething appropriated to a family, or belonging thereto by right of ſucceſſion, from heir to heir. Of monarchies, ſome are *hereditary*, others elective: of *hereditary* monarchies, ſome deſcend only to the heirs-male, as in France; others to the next of blood, whether male or female, as in England, Spain, &c. The dominions of the emperor are diſtinguiſhed into *hereditary*, which are thoſe he derives from his anceſtors by right of blood and inheritance; and thoſe he enjoys in quality of emperor, by virtue of his election.

Hereditary is alſo applied to offices and honours annexed to certain families. Thus the office of earl marſhal and lord great chamberlain of England are *hereditary* in the families of, the duke of Norfolk and the duke of Ancaſter. It is of no very long date, that the dignities of duke, count, &c. are *hereditary*. The canon law has taken all poſſible precautions to prevent benefices from becoming *hereditary*.

Hereditary is alſo applied figuratively to good or evil qualities, habitudes, &c. capable of being tranſmitted by blood from father to ſon. The gout, king's evil, madneſs, &c. are *hereditary* diſeaſes; i. e. they are ſometimes tranſmitted from the parents in the ſtamen or firſt rudiments of the fœtus: and ſuch, probably, is the origin of numerous other chronic diſeaſes.

Hereditary *Right* denotes a right or privilege, in virtue whereof a perſon ſucceeds to the effects of his anceſtors. The nonjurors, &c. hold *hereditary* right to be divine right; i. e. of God's own appointment; and conſequently indiſpenſible, or, as they call it, *indefeaſible*. On this account they contend for the obligation of *hereditary* right in favour of the deſcendants of king James II.

HERESY, an error in ſome eſſential point of Chriſtian faith, maintained with obſtinacy and diſingenuity. It is properly the obſtinacy that conſtitutes the character of *hereſy*, not the error. When a man is humble and ingenuous, ready and deſirous to receive farther light and inſtruction, and when he gives every thing urged againſt him its due weight, he is not guilty of *hereſy*. *Errare poſſum*, hæreticus *eſſe nolo*, is a celebrated maxim of St. Auguſtine. Tertullian, in his treatiſe of Preſcriptions, defines *hereſy* by *choice*, agreeably to the etymology of the word. An heretic, in this ſenſe, is one who, knowingly and of his own choice, propoſes, or even embraces, any new dogma or article of faith. The word is formed of the Greek *αιρεσις*, from *αιρεω*, *I chuſe*, which among the ancients, had nothing of that odious ſignification attached to it by eccleſiaſtical writers of later times. It only ſignified a peculiar opinion, dogma, or ſect. In this ſenſe they ſaid, the *hereſy* of the ſtoics, of the peripatetics, &c. meaning their ſect, their ſyſtem, &c.

HERETIC, in a general ſenſe, is one that ſets up to be the head, or chuſes to join himſelf to a particular religious ſect.

Heretic, in a bad ſenſe, according to the opinion of Whitby, Foſter, and many others, is one who knowingly eſpouſes a falſe doctrine, is inſincere in his profeſſion, and aſſerts and defends what he is convinced is contrary to Chriſtianity, and conſequently ſupports the intereſt of a faction, in order to ſerve ſome bad deſigns. According to this opinion, a *heretic* not only entertains wrong ſentiments of Chriſtianity, but doth this wilfully, by a ſtiff diſingenuous and turbulent adherence, with an ill intention, ſo that no mere error of the judgment can be hereſy, and no honeſt man, who is not condemned of himſelf, can poſſibly be a *heretic*.

The *heretics* whom, in the New Teſtament, we are directed to avoid, were not the humble, modeſt, and peaceable, though erroneous Chriſtians, who adhered to the authority of Chriſt, and deſired to know and do his will; but the proud, pragmatical, turbulent party-men, who diſturbed and divided the church by their impoſitions and innovations, on the terms of brotherly affection and Chriſtian communion, and by aſſuming authority over their fellow-Chriſtians. Hereſy in the ſenſe of ſcripture, doth not conſiſt in ſimple error; nor were thoſe *heretics* who were anathematized and perſecuted: but only thoſe who anathematized and perſecuted others, refuſing to acknowledge them for true Chriſtians, on account of their ſuppoſed or real miſtakes: agreeably to this ſenſe of the appellation, it is juſtly obſerved by Mr. Hallet that the pope is the greateſt *heretic* in the world. See Hallet's Notes, &c. vol. iii. diſc. ix. p. 390. Furneaux's Letters to Judge Blackſtone, p. 30. A real *heretic* is properly he who maintains a falſe opinion, out of a ſpirit of obſtinacy, faction or hypocriſy. A *heretic* makes profeſſion of Chriſtianity, by which he is diſtinguiſhed from an infidel, Jew, and idolater.

HERMAPHRODITE, 'Ερμαφροδιτος, a perſon who has both the ſexes, or the genital parts both of male and female. The word is formed of the Greek 'Ερμαφροδιτος, a compound of 'Ερμης, *Mercury*, and Αφροδιτη, *Venus*; q. d. a mixture of Mercury and Venus, i. e. of male and female. It is beyond a doubt that there are no human *Hermaphrodites*, and that this erroneous notion muſt have ariſen from the clitoris being longer than ordinary in ſome women. To this notion may be added, ſteatomatous tumors of the labia pudendi, which have ſometimes paſſed for teſticles. Dr. Quincy thinks that the frequent uſe of laſcivious frictions and titillations may contribute greatly to the extenſion of the clitoris, and make it paſs with the ignorant for a penis. This, he adds, was the caſe in the celebrated inſtance of the two nuns at Rome, who, after they had lived women for many years, were ſaid to have become men. The extraordinary ſize of the clitoris, ſays Dr. Drake, and its propendence, ſometimes, out of the body in infants, makes the women miſtake ſuch children for that ſort of monſters called *hermaphrodites*. Of this kind I had one brought to me the clitoris whereof hung out the body ſo far, at about three years old, that it reſembled very much a penis, but it wanted a perforation; and inſtead of that juſt behind it, the urine iſſued at a hole, which was nothing elſe but the corner of the rima, the clitoris filling all the reſt of the orifice; ſo that the parents miſtook it for a boy, and as ſuch chriſtened it. Anthropol. p. 148. Dr. Parſons has given us a treatiſe on this ſubject, where he ſhews the notions of *hermaphrodites* to be a vulgar error; and in particular, that the Anglo-Negro, ſhewn about this town ſome years ago, was a woman whoſe clitoris was overgrown. See his Mechanical and Critical Enquiry into the Nature of *Hermaphrodites*, Lond. 1741, 8vo. Phil. Tranſ. vol. xlvii. p. 142.

In the memoirs of the French Academy, we have an account of this very extraordinary kind of *hermaphrodites*, which not only have both ſexes, but do the office of both at the ſame time. Such are earth-worms, round-tailed worms found in the inteſtines of men and horſes, land-ſnails, and thoſe of freſh waters, and all the ſorts of leeches. And, as all theſe are reptiles, and without bones, M. Poupart concludes it probable, that all other inſects, which have theſe two characters, are alſo *hermaphrodites*. Theſe animals, being male in one part of the body and female in another, and the body flexible withal, M. Homberg does not think it impoſſible but that an earth-worm may couple with itſelf, and be both father and mother of its young; an obſervation which, to ſome, appears highly extravagant!

Hermaphrodite *Flowers*, in botany. Theſe are ſo called by the ſexualiſts on account of their containing both the antheræ and ſtigma, the pretended organs of generation, within the ſame calix and petals. Of this kind are the flowers of all the claſſes in Linnæus's ſexual method, except the claſſes *monœcia* and *diœcia*; in the former of which, male and female flowers are produced on the ſame root; in the latter, in diſtinct plants from the ſame ſeed. In the claſs *polygamia*, there are always hermaphrodite flowers mixed with male or female, or both, either on the ſame or diſtinct roots. In the plantain-tree the flowers are all hermaphrodite; in ſome, however, the antheræ or male organ, in others the ſtigma or female organ, proves abortive. The flowers in the former caſe are ſtyled *female hermaphrodites*; in the latter, *male* *hermaphrodites.* Hermaphrodites are thus as frequent in the vegetable kingdom as they are rare and ſcarce in the animal one. See Syſtem of Botany.

HERMETICAL *Philoſophy* is that which undertakes to ſolve and explain all the phenomena of nature, from the three chymical principles, ſalt, ſulphur, and mercury. A conſiderable augmentation was made to the ancient hermetical philoſophy, by the modern doctrine of alcali and acid.

HERNIA, in medicine, a deſcent of the inteſtines or omentum out of their natural place; or rather, the tumor formed by that deſcent, commonly called a rupture. See the Syſtem.

HERO, a great, illuſtrious, and extraordinary perſonage; particularly in reſpect of valour, courage, intrepidity, and other military virtues. F. Bohours makes this diſtinction between a great man and a *hero*, that the latter is more daring, fierce, and enterprizing; and the former more prudent, thoughtful, and reſerved. In this ſenſe we properly ſay, Alexander was a *hero*, Julius Cæſar a great man.

Hero *of a Poem*, or *romance*, is the principal perſonage, or he who has the chief part in it. Thus the *hero* of the Iliad is Achilles; of the Odyſſey, Ulyſſes; of the Æneid, Æneas; of Taſſo's Jeruſalem, Godfrey of Bulloign; of Milton's Paradiſe Loſt, Adam; though Mr. Dryden will have the devil to be Milton's *hero*, becauſe he gets the better of Adam, and drives him out of Paradiſe.

HEROIC *Poem* is that which undertakes to deſcribe ſome extraordinary action, or enterprize. Homer, Virgil, Statius, Lucan, Taſſo, Camoens, Milton, and Voltaire, have compoſed *heroic poems*. In this ſenſe, *heroic poem* coincides with epic *poem*.

HERON, in ornithology, the Engliſh name of the genus *Ardea*. Linnæus ranks it as the 42d genus, and of the order of *Grallæ*. But Latham, in his improved arrangement, makes it the 7th order called *Waders*, and the 95th genus. For the generic and ſpecific characters, ſee Ardea; for the claſſification, ſee the Syſtem; for the repreſentation, ſee Plate IV.

HERRING, *Harengus*, in ichthyology, a ſpecies of the genus *Clupea*. For the claſſification, ſee the Syſtem; for a full account of the Herring-fiſhery and the methods of curing and pickling them, ſee the article Fishery.

HESPER, in aſtronomy, the *evening ſtar*; an appellation given to Venus when ſhe follows, or ſets after the ſun. See Syſtem of Astronomy, Sect. VIII.

HETERODOX, in polemical theology, ſomething that is contrary to the faith or doctrine eſtabliſhed in the true church. The word is formed of the Greek ἑτεροδοξος, a compound of ἑτερος, *alter*, and δοξα *opinion*. Thus, we ſay, a *heterodox* opinion, a *heterodox* divine, &c. The word ſtands in oppoſition to *orthodox*.

Heterodox, *Heterodoxi*, in botany, that ſet of ſyſtematical writers on this ſcience, who formed their diſtributions and claſſes of the plants on wrong foundations, not on the diviſions made by nature in the different ſtructure of the parts of fructification in the different claſſes, but on the ſhape of their leaves, or roots; or who ranged them by their common names, according to the letters of the alphabet. Linnæi Fund. Bot. p. 2.

HETEROGENEITY, in phyſics, the quality, or diſpoſition, which denominates a thing *heterogeneous*. The word is alſo uſed for the *heterogeneous* parts themſelves. In which ſenſe, the *heterogeneities* of a body are the ſame thing with the *impurities* thereof.

HETEROGENEOUS, or Heterogeneal, literally imports ſomething of a different nature, or that conſiſts of parts of different, or diſſimilar kinds: in oppoſition to Homogeneous. The word is Greek, formed of ετερος, *alter, different*, and γενος, *genus, kind*; q. d. compoſed of different kinds of parts. But ſo far as the term may be made uſe of, to convey any diſtinct ſignification, it muſt be by conſidering natural bodies under different ſortments, according as they are diverſified by figure, bulk, motion, and their more ſenſible properties; ſo that thoſe of different ſortments are *heterogeneous* to one another, and the parts of the ſame ſortment are homogeneous. Thus the diviſion chymiſtry makes of bodies into oils, ſalts, ſpirits, &c. may be reckoned, with reſpect to one another, *heterogeneous*; though the parts of each diviſion are among themſelves homogeneous.

Heterogeneous is particularly applied, in mechanics, to thoſe bodies, whoſe denſity is unequal in different parts of their bulk. Or, *heterogeneous* bodies are ſuch, whoſe gravities in different parts are not proportionable to the bulks thereof. Bodies equally denſe, or ſolid in every part, or whoſe gravity is proportionable to their bulk, are ſaid to be homogeneous.

Heterogeneous *Light*, is that which conſiſts of parts or rays of different refrangibility, reflexibility, and colour.

HETEROSCII, in geography, a term of relation, denoting ſuch inhabitants of the earth as have their ſhadows falling but one way, as thoſe who live between the tropics and polar circles; whoſe ſhadows at noon in north latitude are always to the northward, and in ſouth latitude to the ſouthward.

HEXAGON, formed of ἑξ, *ſix*, and γωνια *angle*, in geometry, a figure of ſix ſides and as many angles. If theſe ſides and angles be equal, it is called a *regular hexagon*. See the Syſtem, Part I. Section I.

Hexagon, in fortification, is a fortreſs with ſix baſtions. See the Syſtem, under the reſpective methods of *Vauban* and *Muller*.

HEXAMETER, compoſed of ἑξ, *ſix*, and μετρον, *meaſure, foot*, in the Ancient Poetry, a verſe uſed by Greek and Latin writers, conſiſting of ſix feet. The firſt four feet of an *hexameter* may be indifferently either dactyls, or ſpondees; but the laſt foot, in ſtrictneſs, is always to be a ſpondee, and the laſt but one a dactyl. Such is that of Homer.

> Εις υδωρ μ' ἐῤῥιψας, εχει Θεος ενδικον ομμα.

And that of Virgil.

> *Diſcite juſtitiam moniti, & non temnere divos.*

Hexameter verſes are divided into *heroic*; which are to be grave and majeſtical, ſuitable to the dignity of heroic poetry; and *ſatirical*, which may be more looſe and negligent, as thoſe of the epiſtles of Horace.

HEXANDRIA, in botany, the ſixth claſs of plants with hermaphrodite flowers, and ſix ſtamina or male parts in each, which are in ſome plants all of the ſame length, and in others alternately one and another longer. The word is derived from the Greek ἑξ, *ſix*, and ἀνηρ, *male*. For the Orders belonging to this Claſs, ſee the Syſtem; Sect. V. for their repreſentation, ſee Plate IV.

HIERARCY is uſed for the ſubordination between prelates and other eccleſiaſtics. See Priest, &c.

Archbiſhops, biſhops, prieſts, and deacons, compoſe the *hierarchy* of the church of England. In that of Rome, the pope has likewiſe a place at the head of the *heirarchy*.

HIEROGLYPHICS, in antiquity, myſtical characters, or ſymbols, in uſe among the Egyptians, and that as well in their writings as inſcriptions; being the figures of various animals; the parts of human bodies, and mechanical inſtruments. The word is compoſed of the Greek ιερος, *ſacer*, "holy," and γλυφειν, *ſculpere*, "to engrave;" it being the cuſtom to have the walls, doors, &c. of their temples, obeliſks, &c. engraven with ſuch figures. After Hermes, and the Egyptian prieſts who ſucceeded, had, by long ſtudy and ſpeculation, formed a ſyſtem of theology, and natural philoſophy, in which God, the ſupreme cauſe of all, was the univerſal ſoul diffuſed through the whole creation, they endeavoured to expreſs the divine attributes and operations of the Deity, in the works of nature, by the properties and powers of living animals, and other natural productions, as the proper ſymbols of ſuch amazing cauſes. In order to chooſe the moſt proper ſymbols, and, at the ſame time, the moſt expreſſive of the divine attributes, and of the effects of Divine Providence in every part of the univerſe, they ſtudied with great application and care, not only the peculiar properties of thoſe animals, birds, and fiſhes, herbs and plants, which Egypt produced, but alſo the geometrical properties of lines and figures: and by a regular connection of theſe in various orders, attitudes, and compoſitions, they formed the whole ſyſtem of their theology and philoſophy, which was hidden under hieroglyphic figures and characters, known only to themſelves, and to thoſe who were initiated into their myſteries.

In this ſyſtem their principal hero-gods, Oſiris and Iſis, theologically repreſented the Supreme Being, and univerſal nature; and phyſically ſignified the two great celeſtial luminaries, the ſun and moon, by whoſe influence all nature was actuated. In like manner, the inferior heroes repreſented the ſubordinate gods, who were the miniſters of the ſupreme ſpirit; and phyſically they denoted the inferior mundane elements and powers. Their ſymbols repreſented, and comprehended under them, the natural productions of the Deity; and the various beneficial effects of Divine Providence, in the works of creation; and alſo the order and harmony, the powers and mutual influence of the ſeveral parts of the univerſal ſyſtem. This is the ſum and ſubſtance of the Egyptian learning, ſo famed in ancient times throughout the world. And in this general ſyſtem, the particular hiſtory of their hero-gods was contained, and applied to phyſical cauſes, and theological ſcience. The hieroglyphic ſyſtem was compoſed with great art and ſagacity; and was ſo univerſally eſteemed and admired, that the moſt learned philoſophers of other nations came into Egypt on purpoſe to be inſtructed in it, and to learn the philoſophy and theology conveyed by theſe oppoſite ſymbols.

In this hieroglyphic ſyſtem the hero-gods not only repreſented, and were ſymbols of, the ſupreme God, and ſubordinate deities; but they had each their animal ſymbol, to repreſent their peculiar powers, energy, and adminiſtration: and their figures were compounded of one part or other of their ſymbols, to expreſs more ſenſibly the natural effects of divine energy attributed to them. Thus Oſiris, when he repreſented the power and all-ſeeing providence of the Supreme Being, had a human body with a hawk's head, and a ſceptre in his hand, and decorated with the other regalia or enſigns of royality. Under the ſame form alſo he repreſented the ſun, the great luminary; and, as it were, the ſoul of the world. The univerſal ſoul itſelf was beautifully repreſented by a winged globe, with a ſerpent emerging from it. The globe denoted the infinite divine eſſence, whoſe centre, to uſe the expreſſion in the Hermetic writings, was every where, and circumference no where. The wings of the hawk repreſented the divine all-comprehenſive intellect; and the ſerpent denoted the vivifying power of God, by which life and exiſtence are given to all things.

Upon the whole, almoſt all the Egyptian deities and ſymbols centered in two, namely, Oſiris and Iſis; who repreſented, under various hieroglyphic forms, both the celeſtial and terreſtrial ſyſtem, together with all the divine attributes, operations, and energy, which created, animated, and preſerved them. The Egyptians likewiſe concealed their moral philoſophy under hieroglyphic ſymbols; but theſe were not the ſubjects of the hieroglyphics delineated on obeliſks. And as hieroglyphic and ſymbolical figures were very ancient in Egypt, and firſt invented, at leaſt formed into a ſyſtem, there; ſo they were thence carried into other countries, and imitated in religious myſteries as well as in political and moral ſcience. This hieroglyphic ſyſtem was, in its beginning more ſimple, and and leſs compounded, than afterwards; for it had been improving for ſeveral ages before it appeared on the obeliſks of the temples. And hence we may infer the time of the firſt Egyptian hieroglyphic ſymbols; for, in all probability, they were not older than the time of the famous Hermes, who flouriſhed in the reign, and ſome time after the death of Oſiris. The hieroglyphic ſymbols were carried into Greece; and gave the firſt occaſion to the fables of the poets, with regard to the metamorphoſes of the gods, which they improved from inventions of their own; and from the knowledge of them, the Greeks aſcribed peculiar arts and inventions to their gods, whoſe names they received from Egypt. But beſides the hieroglyphics in common uſe among the people, the Egyptian prieſts had certain myſtical characters, in which they wrapped up and concealed their doctrines from the vulgar. It is ſaid that theſe ſomething reſembled the Chineſe characters, and that they were alſo the invention of Hermes. Sir John Marſham conjectures, that the uſe of theſe hieroglyphical figures of animals introduced the ſtrange worſhip paid them by that nation: for as theſe figures were made choice of according to the reſpective qualities of each animal, to expreſs the qualities and dignity of the perſons repreſented by them, who were generally their gods, princes, and great men, and being placed in their temples as the images of their deities, hence they came to pay a ſuperſtitious veneration to the animals themſelves.

HIGH, a term of relation, importing one thing's being ſuperior or above another: thus we ſay, *high* chancellor, *high* church, *high* conſtable, *high* court of parliament, *high* Dutch, *high* treaſon, *high* treaſurer. See the Articles *Chancellor*, *Church*, *Conſtable*, *Parliament*, *Teutonic*, *Treaſon*, *and Treaſurer*.

HIGH-*way men*, are robbers on the *high-way*; for the apprehending and taking of whom, a reward of 40*l.* is given by the ſtatute of 4 and 5 W. & M. to be paid within a month after conviction by the ſheriff of the county; to which the ſtatute 8 Geo. II. cap. 16, ſuperadds 10*l.* to be paid by the hundred indemnified by ſuch taking.

HIGHNESS, a quality, or title of honour, given to princes. The kings of England and Spain had formerly no other title but that of *highneſs*; the firſt, till the time of Henry VIII. and the ſecond, till that of Charles V. See KING. The petty princes of Italy began firſt to be complimented with the title of *highneſs* in the year 1630. And the duke of Orleans aſſumed the title of *royal highneſs*, in the year 1631, to diſtinguiſh himſelf from the other princes of France. The duke of Savoy, afterward king of Sardinia, bore the title of *royal highneſs*, on account of his pretenſions to the kingdom of Cyprus. It is ſaid that the duke only took the title of *royal highneſs*, to put himſelf above the duke of Florence, who was called *great duke*; but the great duke has ſince aſſumed the title of *royal highneſs*, to put himſelf on a level with the duke of Savoy. The prince of Conde firſt took the title of *moſt ſerene highneſs*, leaving that of ſimple *highneſs* to the natural princes. At preſent all the ſons of crowned heads are ſtyled *royal highneſs*, as the electors of Germany are called *electoral highneſs*.

HIPPOCAMPUS, the name of a ſmall ſea-animal caught in the Mediterranean; it is a ſpecies of the Syngnathus in the Linnæan ſyſtem. See SYNGNATHUS.

HIPPOCRATISM, in medicine, denotes the philoſophy of Hippocrates, applied to the ſcience of medicine; or the doctrine of Hippocrates conſidered with regard to the means of prolonging life, of preventing and counteracting the effects of accidents that tend to abridge it, and of maintaining that ſtate of the animal body, which will preſerve it from immature diſſolution. Hippocrates who has been juſtly venerated for more than twenty centuries, as the inſtitutor, and, in a degree, the inventor of the art of healing. Hippocrates firſt joined reaſoning to experience in treating of the medicinal art; and on this account he has been always held in veneration as the father of rational medicine. To him we owe the diſcovery of that principle of the animal œconomy, which he calls nature, the knowledge of which is ſo eſſential to the right conduct of a phyſician in every branch of his office. Nature, according to him, is the true phyſician that heals all diſeaſes, and that preſerves health. This ſhould be invariably conſulted in the adminiſtration of all remedies; its operations ſhould be aided, and all obſtacles removed. Without particular attention to nature, and without recovering its active powers, all remedies are not only uſeleſs, but commonly injurious. On theſe principles Hippocrates applied himſelf principally to examine the progreſs of nature in the courſe of different diſeaſes, as appears from his books De Morbis, & De Affectionibus; and to deſcribe their ſymptoms and their prognoſtics and diagnoſtics, in ſuch a manner, that they might be known to others as well as to himſelf.

HIPPOPOTAMUS, the RIVER-HORSE; a genus of quadrupeds, belonging to the order of belluæ; the characters of which are theſe; it has ſix fore-teeth in the upper jaw, diſpoſed in pairs at a diſtance from each other; and four prominent fore-teeth in the under jaw, the intermediate ones being longeſt: the dog-teeth are ſolitary and obliquely truncated; and the feet are hoofed on the edges. There is but one ſpecies of hippopotamus, viz. the amphibius, or river-horſe. The hiſtory of this quadruped, though next to the elephant in magnitude, is far from being ſufficiently delineated. With ſuch powerful arms, and ſuch a prodigious ſtrength of body, the hippopotamus might render himſelf formidable to every other animal. But he is naturally of a mild diſpoſition; and beſides, his body is ſo heavy, and his motions ſo ſlow, that he cannot overtake any other quadruped. He ſwims ſwifter than he runs, and preys upon fiſhes. He dives in the water, and can ſtay very long under. He has no membrane betwixt his toes, as the caſtor or the otter; and he only ſwims eaſily in conſequence of the great bulk of his belly, which makes him nearly of an equal ſpecific gravity with the water. Moreover, he often keeps himſelf at the bottom, and walks upon the channel with the ſame freedom as upon dry land. Beſides preying upon fiſhes, crocodiles, &c. he frequently goes out of the water, and feeds upon ſugar-canes, ruſhes, millet, rice, roots, &c. Theſe he devours in large quantities, and often does great damage in the cultivated field. But as he is more timid on land than in the water, he is eaſily driven away. His legs are ſo ſhort, that he cannot eſcape by flight when at a diſtance from the river. He generally flies when approached by people in boats; but, if they wound him, he returns with fury, attacks the boats with his teeth, and frequently overſets them. This animal ſeems to be confined principally to the rivers of Africa. The male and female generally go together, and the female is ſaid to produce but one at a time.

The river-horſe is an inveterate enemy to the crocodile, and kills it whenever he meets it. This, with ſome other reaſons, contributes much to the extirpation of the crocodile; which, otherwiſe, conſidering the many eggs they would lay, would utterly deſtroy Egypt. The Egyptians have a curious manner of freeing themſelves, in ſome meaſure, from this deſtructive animal. They remark the places he frequents moſt, and there lay a large quantity of peaſe; when the beaſt comes on ſhore, hungry and voracious, he falls to eating what is neareſt him; and filling his belly with the peaſe, they occaſion an inſupportable thirſt; he then returns immediately into the river, and drinks upon theſe dry peaſe large draughts of water, which ſuddenly cauſes his death; for the peaſe ſoon begin to ſwell with the water; and not long after the Egyptians find him dead on theſhore, blown up, as if killed with the ſtrongeſt poiſon. For the claſſification of this animal, ſee Syſtem of Quadrupeds; for the repreſentation ſee the Plates.

HIRUNDO, in ornithology, a genus of birds of the order of paſſeres. There are twelve ſpecies, chiefly diſtinguiſhed by their colour. According to the Linnæan Syſtem it is the 77th genus, and of the 6th order, paſſeres: but Latham in his improved arrangement makes it the 44th genus and of the ſame order. For the claſſification, ſee the Syſtem; for the repreſentation, ſee Plate III.

HISTORIOGRAPHER, compoſed of ἱςορια, *hiſtory*, and γραφω, *I write*, a profeſſed hiſtorian, or writer of hiſtory; or a perſon who applies himſelf peculiarly to it.

HISTORY, a recital or deſcription of things as they are, or have been, in a continued orderly narration of the principal facts and circumſtances thereof. See ANNALS. The word is Greek, ἱςορια, *hiſtoria*; and literally denotes a ſearch of curious things, or a deſire of knowing, or even a rehearſal of things we have ſeen; being formed of the verb ἱςορειν, which properly ſignifies to know a thing by having ſeen it: though the idea appropriated to the term *hiſtory* is now much more extenſive, and we apply it to a narration of divers memorable things, even though the relater only takes them from the report of others. The origin of the word is from the verb ισημι, *I know*; and hence it is, that among the ancients ſeveral of their great men were called *polyhiſtores*, q. d. perſons of various and general knowledge. *Hiſtory* is divided, with regard to its ſubject, into the *hiſtory of Nature* and the *hiſtory of Actions*.

HISTORY *of Nature*, or *Natural* HISTORY, is a deſcription of natural bodies; whether terreſtrial, as animals, vegetables, foſſils, fire, water, air, meteors, &c. or celeſtial, as the ſtars, planets, comets, &c. See *Natural* HISTORY. *Natural hiſtory* is much the ſame with what we otherwiſe call PHYSIOLOGY.

HISTORY, with regard to actions, is a continued relation of a ſeries of memorable events in the affairs either of a ſingle perſon, a nation, or ſeveral perſons and nations, and whether included in a great or little ſpace of time; or, it is a narrative of ſuch facts as are fit to be tranſmitted to poſterity for the uſe of mankind and the better conduct of human life. Cicero calls *hiſtory* the miſtreſs of life, as it teaches us both what we ought to purſue and what we ought to avoid.

Hiſtory, with reſpect to time, is divided into *ancient* and *modern*, diſtinguiſhed into ſeveral epochs, periods, and intervals. The three periods of time into which *hiſtory* has been derived are the following: viz. the firſt, from the creation to the deluge, which age is reckoned uncertain, becauſe we know no more than the ſhort account given of it in the holy ſcriptures; the ſecond, from the deluge to the firſt Olympiad, which from the many feigned ſtories related in it, is called the fabulous age; the third, from the firſt

Olympiad to our own times, is called hiſtorical, becauſe the actions done in that period are recorded by writers of true *hiſtory*.

Sacred HISTORY is that which lays before us the myſteries and ceremonies of religion, viſions or appearances of the deity, &c. miracles, and other ſupernatural things, whereof God alone is the author. Such are the book of Geneſis, the Goſpels, Apocalypſe, &c. See MIRACLES, PROPHECY, REVELATION, &c. *Eccleſiaſtical hiſtory* gives an account of the riſe and eſtabliſhment of the ſeveral religions and churches, of the riſe and progreſs of various opinions, ſects, &c.

Natural HISTORY is a deſcription of the ſingularities of nature, its irregularities and prodigies, and the alterations it undergoes in the birth, progreſs, end, and uſe of things. Such is Ariſtotle's *Hiſtory* of Animals, Theophraſtus's *Hiſtory* of Plants, and the entire body of the Natural *Hiſtory* by Pliny; ſuch alſo are Acoſta's Natural *Hiſtory* of the Indies, Plott's *Hiſtory* of Staffordſhire, &c.

Civil HISTORY is that of people, ſtates, republics, communities, cities, &c. Such are thoſe of Thucydides, Halicarnaſſeus, Livy, Polybius, Mezeray, F. Daniel, Milton, Buchanan, &c. *Civil hiſtory* may be again ſubdivided into *particular* and *general*; the former conſiſts of a number of facts relating to the ſame ſtate, ſuitably connected and laid together in a proper ſeries. *General Hiſtory*, is made up of ſeveral particular *hiſtories*, whoſe ſeparate tranſactions within the ſame period of time, or part of it, ſhould be ſo diſtinctly related as to cauſe no confuſion. *Civil hiſtory*, in its more unlimited extent, is denominated *univerſal hiſtory*.

HOARSENESS, *Raucedo*, in medicine, a diminution of the voice, ſometimes attended with a preternatural aſperity or roughneſs thereof. The part here affected is the *aſpera arteria*, and particularly its head or the *larynx*. This diſtemper differs in degree, being milder when from external cauſes, and much more obſtinate and troubleſome when from internal. See the Syſtem.

HOBSON'*s-Choice*, a vulgar proverbial expreſſion, applied to that kind of choice in which there is no alternative. It is ſaid to be derived from the name of a carrier at Cambridge, who let out hackney horſes, and obliged each cuſtomer to take in his turn, that horſe which ſtood next the ſtable door.

HOE, or HOW, a huſbandman's tool, made like a cooper's adz, to cut up weeds in gardens, fields, &c. *Horſe*-HOE, is a large kind of *hoe* drawn by horſes, and uſed to ſtir the intervals in the new Huſbandry, and clear the corn from weeds. For a repreſentation of the Rev. J. Cooke's new invented Patent Drill Machine, that may be converted into a Horſe-Hoe, ſee Syſtem of AGRICULTURE, PLATE II. *fig*. 4.

HOEING, in huſbandry, is the breaking or dividing the ſoil by tillage, while the corn or other plants are growing thereon. It differs from common tillage, which is always performed before the corn or plants are ſown or planted in the time of performing it; and it is much more beneficial to the crops than any other tillage. This ſort of tillage is performed various ways, and by means of different inſtruments. For copious directions reſpecting Hoeing, ſee the Rev. James Cooke's obſervations on Practical Drilling and Horſe-hoeing in the Syſtem of AGRICULTURE, Sect. XXX.

HOG, in zoology, *ſus*. See SUS. For the uſes of Hog's dung as a manure, ſee a full account in the Syſtem of AGRICULTURE, Sect. II.

Hedge HOG, the Engliſh name of the genus Erinaceus. See ERINACEUS.

HOGSHEAD, a meaſure, or veſſel, of wine or oil; containing the fourth part of a tun, or ſixty-three gallons. Two of theſe *hogſheads* make a pipe or but. See MEASURE. The diſtillers weigh their veſſels when full, and for a *hogſhead* allow four hundred weight, two quarters, and twenty-two pounds, caſk and liquor.

HOLE, in anatomy, denotes ſuch a cavity of a bone as penetrates from one ſide to the other. *Black* HOLE, at Calcutta, denotes a place of confinement, eighteen feet by eighteen feet, containing three hundred and twenty-four ſquare feet, in which a hundred and forty-ſix perſons were ſhut up by order of the viceroy; ſo that there was a ſquare for each perſon of twenty-ſix inches and a half by twelve inches, which was juſt ſufficient to hold them, without preſſing violently upon each other. To this dungeon there was only one ſmall grated window; and the weather being very ſultry, the air within could neither circulate nor be changed. In leſs than an hour after their being incloſed, many of the unhappy people were ſeized with extreme difficulty of breathing, ſeveral were delirious, and the place was filled with incoherent ravings, and exclamations of diſtreſs; the cry of *water! water!* was predominant. This was handed to them by the centinels, but had no effect in allaying their thirſt. In leſs than four hours, many were ſuffocated, or died in violent deliriums. In an hour more, the ſurvivors, except a few at the grate, were to the higheſt degree phrenitic and outrageous. At length thoſe at the grate became ſo inſenſible, that we have no account of what happened, till they were releaſed at ſix o'clock next morning, having been confined from ſeven the preceding evening. Such were the effects of animal effluvia in a cloſe and unventilated place, in the ſpace of eleven hours, that out of a hundred and forty-ſix perſons, no more than twenty-three came out alive, and thoſe in a high putrid fever, of which, however, by freſh air, &c. they gradually recovered.

HOLINESS, or SANCTITY; the quality which conſtitutes or denominates a perſon or thing *holy*; i. e. pure, or exempt from ſin. The word is alſo uſed in reſpect of perſons and things that are ſacred, *i. e.* ſet apart to the ſervice of God, and the uſes of religion.

HOLINESS, is alſo a title or quality attributed to the pope; as that of *majeſty* is to kings. Even kings, when writing to the pope, addreſs him under the venerable appellation of *Your Holineſs*, or, *Holy Father*; in Latin, *Sanctiſſime* or *Beatiſſime Pater*. Anciently the ſame title was given to all biſhops. The Greek emperors alſo were addreſſed under the title of *Holineſs*, in regard of their being anointed with holy oil at their coronation. De Cange adds, that ſome of the kings of England have had the ſame attribute; and that the orientals have frequenly refuſed it to the pope.

HOLY-GHOST, one of the perſons of the holy Trinity. See GOD and TRINITY.

Order of the HOLY-GHOST, the principal military order in France, inſtituted by Henry III. in 1569. It conſiſts of 100 knights, who are to make proof of their nobility for three deſcents. The king is the grand-maſter, or ſovereign; and as ſuch, takes an oath, on his coronation-day, to maintain the dignity of the order. The knights wear a golden-croſs, hung about their necks by a blue ſilk ribbon, or collar. But before they receive the order of the Holy-ghoſt, that of St. Michael is conferred as a neceſſary degree; and for this reaſon their arms are ſurrounded with a double collar.

HOMICIDE, of *homo*, *man*, and *cædo*, *I kill*, in common law, the killing of a man. *Homicide* is divided into involuntary and caſual.

Caſual HOMICIDE, is either *merely caſual*, or *mixed*. *Merely caſual* is when a perſon kills another by pure miſchance, being about his lawful occaſions; as in the caſe of an ax ſlipping out of a man's hand, or falling off the helve while he is felling a tree. It is accounted *mixed*, when there is a negligence, or ſome other unwarrantable circumſtance, attending the action. See MANSLAUGHTER.

Voluntary HOMICIDE, is that which is deliberate, and committed with a ſet purpoſe, and mind to kill; and is either with a precedent malice, or without. The former is murder, which is a felonious killing, with malice prepenſe, any perſon in the realm, living under the king's protection. See MURDER. Judge Blackſtone has diſtinguiſhed *homicide* into three kinds; viz. *juſtifiable*, *excuſable*, and *felonious*. *Juſtifiable homicide* is ſuch as is owing unto ſome unavoidable neceſſity, without any intention or negligence in the perſon that kills, and, therefore, without any ſhadow of blame. Of this kind is the act of a magiſtrate or officer, who puts a malefactor to death, in obedience to the law, and in the execution of public juſtice.

Excuſable Homicide is ſuch as the law excuſes from the guilt of felony, though it implies ſome degree of fault and blame. This is either *per infortuniam*, by miſadventure, (ſee *Caſual* HOMICIDE, above) or *ſe defendendo*, upon a principle of ſelf-preſervation in a ſudden affray. *Felonious homicide* is the act of killing a human creature, without juſtification or excuſe. This is either ſelf-murder (ſee FELO *de ſe*); or the killing of another man, which is divided into MANSLAUGHTER and MURDER. Blackſt. Com. book iv. cap. 14.

HOMILY, in eccleſiaſtical writers, a ſermon, or diſcourſe, upon ſome point of religion, delivered in a plain manner, ſo as to be eaſily underſtood by the common people. The word is Greek, *ομιλια*; formed of *ομιλος*, *cætus*, "aſſembly, or council." At the time of the reformation, there were ſeveral of theſe homilies made and printed, and ordered to be read in ſuch churches as were not provided with a ſufficiently learned miniſter, in order to prevent unſound doctrine being taught in remote country places. In the primitive church, homily rather meant a conference or converſation by way of queſtion and anſwer, which made part of the office of a biſhop, till the 5th century, when the learned prieſts were allowed to preach, catechiſe, &c. in the ſame manner as the biſhops uſed to do.

HOMO, MAN, is ranked by Linnæus under the order of primates; and characteriſed by having four parallel foreteeth both in the upper and lower jaw, and two mammæ on the breaſt. The ſpecies, according to this author, are two, viz. the homo ſapiens, and the homo troglodytes. He ſubdivides the homo ſapiens into five varieties, viz. the American, the European, the Aſiatic, the African, and what he calls the monſtrous. See MAN.

The troglodytes, or orang outang, is a native of Ethiopia, Java, and Amboina. His body is white; he walks erect; and is about one half the ordinary human ſize. He generally lives about 25 years. He conceals himſelf in caves during the day, and ſearches for his prey in the night. He is ſaid to be exceedingly ſagacious, but is not endowed with the faculty of ſpeech. See TROGLODYTES, ORANG OUTANG, and SIMIA.

HOMOGENEOUS, HOMOGENEAL, compoſed of the Greek *ομος*, *like*, and *γενος*, *kind*, is a term applied to various ſubjects, to denote, that they conſiſt of ſimilar parts, or of parts of the ſame nature and kind; in contradiſtinction to heterogeneous, where the parts are of different natures, &c. Natural bodies are generally compoſed of *homogeneous* parts; as a diamond, a metal, &c. Artificial bodies, on the contrary, are aſſemblages of heterogeneous parts, or parts of different qualities; as a building of ſtone, wood, &c.

HONEY, *mel*, is a ſweet vegetable juice, collected by the BEE from the flowers of different plants, and depoſited in the cells of the combs. It has been long known, that the bees collect their *honey* as well as their WAX from the flowers of plants; but former writers had no diſtinct knowledge of the ſeveral parts of the flowers which furniſhed theſe induſtrions inſects with two ſuch different ſubſtances. It is now known, that the *honey* is procured from thoſe parts of the flowers which were firſt diſcovered by Linnæus, and to which he has given the name of *nectaria:* theſe are certain veſicles or glands ſituated near the baſis of every petal, and continually ſecreting a nectareous or melleous juice. It is not yet aſcertained from what part of the flower or plant the bees collect the WAX: ſome have ſuppoſed that it is furniſhed by the farina contained in the apices of the flowers; but Mr. Polhill, an ingenious friend of the editor, of whoſe extenſive and accurate acquaintance with the œconomy of the bees he has availed himſelf in articles pertaining to this ſubject, aſſures him, that this is not the caſe; and that it is ſtill undiſcovered from whence they procure the WAX. *Honey* and WAX form ſo conſiderable an article in the riches of a kingdom, that M. Reaumur ſtrongly recommended to the court of France the encouragement of thoſe who raiſe ſwarms of bees, by deducting ſomething from their taxes in proportion to every hive of bees kept by them above a certain number. And as bees are ſo eaſily raiſed, and kept with ſo little expence and trouble, it is a wonder that they are not more generally propagated in this kingdom. One great means of preſerving and multiplying the bees would be the aboliſhing of that barbarous as well as prejudicial cuſtom, which has hitherto very generally prevailed, of deſtroying the whole hive of bees in order to obtain the *honey*. Reaumur's Hiſt. Inſ. vol. x. p. 89, &c. The *honey* taken out of the hives in the beginning of ſummer is preferable to that gathered in autumn, ſince the firſt is the ſeaſon in which the bees are moſt vigorous, and the plants in their flowering ſtate. We have two kinds of *honey*, the *white* and *yellow*.

HONEY *Comb*, a waxen ſtructure, full of cells, framed by the bees to depoſit their *honey*, eggs, &c. in. The conſtruction of the *honey-comb* ſeems one of the moſt ſurpriſing parts of the works of inſects, and the materials of which it is compoſed, which though evidently collected from flowers of plants, yet do not, that we know of, exiſt in them in that form, have given great cauſe of ſpeculation to the curious. The regular ſtructure of the comb is alſo equally wonderful. When the ſeveral cells in it are examined, it ſhould ſeem that the niceſt rules of geometry had been conſulted for its compoſition, and all the advantages that could be wiſhed or deſired in a thing of that kind are evidently found in it. The bees, in the ſtructure of this receptacle of their *honey*, ſeem to have reſolved a geometrical problem, far from an eaſy one, and indeed clogged with ſo many conditions, that it might have puzzled able proficients in that ſcience.

HONOUR, a teſtimony of eſteem or ſubmiſſion, expreſſed by words, actions, and an exterior behaviour, by which we make known the veneration and reſpect we entertain for any one on account of his dignity or merit. The word *honour* is alſo uſed in general for the eſteem due to virtue, glory, and reputation. It is alſo uſed for *virtue* and *probity* themſelves, and for an exactneſs in performing whatever we have promiſed; and in this laſt ſenſe we uſe the term, *a man of honour*. But *honour* is more particularly applied to two different kinds of virtue; bravery in men, and chaſtity in women. Virtue and Honour were deified among the ancient Greeks and Romans, and had a joint temple conſecrated to them at Rome; but afterwards each of them had ſeparate temples, which were ſo placed, that no one could enter the temple of Honour, without paſſing through that of Virtue; by which the Romans were continually put in mind, that virtue is the only direct path to true glory. Plutarch tells us, that the Romans, contrary to their uſual cuſtom, ſacrificed to Honour uncovered; perhaps to denote, that wherever honour is, it wants no covering, but ſhews itſelf openly to the world.

HONOUR, or *Rank*. The degrees of honour which are obſerved in Britain, may be comprehended under theſe two heads, viz. *nobiles majores*, and *nobiles minores*. Thoſe included under the firſt rank are, archbiſhops, dukes, marquiſes, earls, viſcounts, biſhops, and barons; which are all diſtinguiſhed by the reſpective ornaments of their eſcutcheons: and thoſe of the laſt are baronets, knights, eſquires, and gentlemen. There are ſome authors who will have baronets to be the laſt under the firſt rank: and their reaſon is, becauſe their honour is hereditary, and by patent, as that of the nobility. See the Articles COMMONALTY and NOBILITY.

HONOURARY, or HONORARY, is underſtood of a perſon who bears or poſſeſſes ſome quality or title, only for the name's ſake, without doing any of the functions thereto belonging, or receiving any of the advantages thereof.

HOOPOE, in ornithology, the Engliſh name of the genus Upupa. See UPUPA.

HOP, *lupulus*, or *humulus*, in botany, a genus of the *dioecia pentandria* claſs.. For the nature and cultivation of *hops*, ſee a full account in the Syſtem of AGRICULTURE, Sect. XVI.

HOPE, in ethics, is the deſire of ſome good, attended with a belief of the poſſibility, at leaſt, of obtaining it, and enlivened with joy, greater or leſs, according to the greater or leſs probability of our poſſeſſing the object of our hope.

HORARY *Circles*, or *Lines*, in dialling, are the lines or circles which mark the hours on *ſun dials*. HORARY *Motion of the Earth*, is the arc it deſcribes in the ſpace of an hour. This is nearly fifteen degrees; for the earth completes its revolution through 360° in a day, or twenty-four hours, and the twenty-fourth part of 360 is 15; though this is not the exact meaſure of the *horary* arc, becauſe the earth moves with different velocity, according to its greater or leſſer diſtance from the ſun; but it is near enough for ordinary computations.

HORDEUM, *Barley*, in botany, a genus of the triandria digynia claſs. The involucrum conſiſts of ſix leaves, and contains three flowers. There are eight ſpecies; only one of which, viz. the murinum, or wall-barley-graſs, is a native of Britain. The native place of the vulgare or common barley cultivated in our fields, is not known. For the cultivation of Barley, ſee Syſtem of AGRICULTURE, Sect. IV.

HORIZON, or HORISON, in geography and aſtronomy, a great circle of the ſphere, dividing the world into two parts or hemiſpheres; the one upper and viſible, the other lower and hid. The word is pure Greek, οριζων, which literally ſignifies "bounding or terminating the ſight;" being formed of οριζω, *termino, definio,* "I bound, I limit;" whence it is alſo called *finitor*, "finiſher." The horizon is either *rational* or *ſenſible*.

Rational, *true*, or *aſtronomical* HORIZON, which is alſo called ſimply and abſolutely *the horizon*, is a great circle, whoſe plane paſſes through the centre of the earth, and whoſe poles are the zenith and nadir. It divides the ſphere into two equal parts, or hemiſpheres.

Senſible, *viſible*, or *apparent* HORIZON, is a leſſer circle of the ſphere, which divides the viſible part of the ſphere from the inviſible. Its poles, too, are the zenith and nadir: and conſequently the *ſenſible horizon* is parallel to the *rational*; and it is cut at right angles, and into two equal parts, by the verticals. The *ſenſible horizon* is divided into *eaſtern* and *weſtern*. The *eaſtern* or *ortive* horizon, is that part of the horizon wherein the heavenly bodies riſe. The *weſtern* or *occidual* horizon, is that wherein the ſtars ſet. The altitude or elevation of any point of the ſphere, is an arch of a vertical circle intercepted between it and the ſenſible horizon. By *ſenſible horizon* is alſo frequently meant a circle, which determines the ſegment of the ſurface of the earth, over which the eye can reach; called alſo the *phyſical horizon*. In this ſenſe we ſay, a ſpacious *horizon*, a narrow ſcanty *horizon*. See Treatiſe on the GLOBE.

HORIZONTAL, ſomething that relates to the horizon, is taken in the horizon, or on a level with the horizon. We ſay, an *horizontal plane*, *horizontal line*, &c.

HORIZONTAL *Dial*, is that drawn on a parallel to the horizon; having its gnomon, or ſtyle, elevated according to the altitude of the pole of the place it is deſigned for. Horizontal dials are, of all others, the moſt ſimple and eaſy. For a particular deſcription, ſee the Treatiſe of DIALLING.

HORIZONTAL *Line*, in perſpective, is a right line drawn through the principal point, parallel to the horizon, or, it is the interſection of the horizontal and perſpective planes. See PERSPECTIVE.

HORIZONTAL *Plane*, in perſpective, is a plane parallel to the horizon, paſſing through the eye, and cutting the perſpective plane at right angles.

HORN, *Cornu*, a hard, callous ſubſtance, growing on the head of divers animals, and ſerving them as weapons of offence and defence. It is laid down as a rule, by ſome naturaliſts, that no animals have *horns* but thoſe that are cloven-footed. The *horns* are uſually a double part; inſomuch that there is but one exception, which is in the rhinoceros. The *horns* of many animals, particularly of the deer kind, are caſt every year, and new ones grow up in their places. With us the deer drop them in March, and new *horns* are full grown by the July following. Voſſius very juſtly ranks this among the moſt wonderful phenomena of nature: he ſays, thet we have nothing analogous to the growth of ſuch hard and ſolid bodies of ſo great a bulk, in ſo ſhort a time. The growth and caſting of the *horns* of deer is a very ſingular circumſtance in the animal world. The luſty and well-fed ones caſt their *horns* firſt; the ſickly or weak ones ſometimes keep the old ones till the end of April. Theſe *horns* are faſtened to the bones of the ſkull, not to the ſkin of the head only, as ſome people would have it thought, who are for making the caſting of them the leſs wonderful. About ten days after the *horns* are caſt, the new or young *horns* begin to appear; they are ſoft and hairy at firſt, but they grow hard in about three months, and the ſtag then rubs off their hairy ſkin. The number of branches in the *horns* is proportioned to the age of the animal, the young ones always having but few, the old ones moſt. Six or ſeven branches are the common number, and in Tuſcany they have ſometimes eight or nine. But in Saxony, where theſe creatures are very long lived, they are ſometimes ſeen with fourteen or fifteen branches, and ſometimes more. The young *horns*, while yet ſoft, are full of blood-veſſels; and if cut off, eſpecially near the head, they are found to bleed very violently, and the creature will ſometimes even bleed to death at the wound. If a ſtag be caſtrated while he is ſo young as not to have *horns*, he will never have any at all; and if caſtrated afterwards, while his *horns* are on, he will never caſt them, but always retain the ſame pair which he had at the time of the operation. The *horns* of a deer are by huntſmen called his head. *Horns* make a conſiderable article in the arts and manufactures. Bullocks *horns*, ſoftened by the fire, ſerve to make lanthorns, combs, knives, inkhorns, tobacco-boxes, &c.

Horn is alſo a ſort of muſical inſtrument, of the wind kind; chiefly uſed in hunting, to animate and bring together the dogs, and the hunters. The term was anciently, wind a *horn*, all *horns* being in thoſe times compaſſed: but ſince ſtrait *horns* are come in faſhion, they ſay blow a *horn*; and ſometimes plainly, ſound a *horn*. There are various leſſons on a *horn:* as the recheat, double recheat, royal recheat, running or farewel recheat, &c. See Recheat. The French *horn* is no other than a wreathed or contorted trumpet. It labours under the ſame defects as the trumpet itſelf; but theſe have of late been ſo palliated, as to require no particular ſelection of keys for this inſtrument. In the beginning of the year 1773, a foreigner, named Spandau, played in a concert at the opera-houſe a concerto, part whereof was in the key of C, with the minor third; in the performance of which all the intervals ſeemed to be as perfect as in any wind-inſtrument. This improvement was effected by putting his right hand into the bottom or bell of the inſtrument, and attempering the ſounds by the application of his fingers to different parts of the tube.

Horn *Work*, in fortification, a ſort of out-work, advancing toward the field, to cover and defend a curtain, baſtion, or other place, ſuſpected to be weaker than the reſt: as alſo to poſſeſs a height, &c. See the Syſtem, Sect. I. Article Conſtruction of *Horn Works.*

Human Horns. In Dr. Charles Leigh's natural hiſtory of Lancaſhire, Cheſhire, and the Peak in Derbyſhire, is the print of a woman with two horns on her head. When ſhe was 28 years of age an excreſcence grew upon her head like a wen, which continued 30 years, and then grew into two horns. After four years ſhe caſt them, and in their place grew two others. After four years ſhe caſt theſe alſo; and the horns which were on her head in 1668 (the time when the account was written) were then looſe Her picture and one of her horns are in Aſhmole's muſeum. In the univerſity library at Edinburgh is preſerved a horn which was cut from the head of Elizabeth Love, in the 50th year of her age. It grew three inches above the ear, and was growing ſeven years.

HOROLOGIOGRAPHY, the art of making or conſtructing dials. See Treatiſe on Dialling.

HOROPTER, in optics, is a right line, drawn through the point where the two optic axes meet, parallel to that which joins the centers of the two eyes, or the two pupils. It is called *horopter*; as being found, by experience, to be the limit of diſtinct viſion. The *horopter* has ſeveral properties in optics, which are deſcribed at large in Aguillonius, Opt. lib. ii. Diſſ. 10. See the System.

HORROR, Horrour, ſtrictly ſignifies ſuch an exceſs of fear as makes a perſon tremble. It is a compound of admiration and fear, not without an occaſional mixture of pleaſure, from which, when predominant, it is denominated a pleaſing horror. For a repreſentation of horror from Le Brun's Paſſions, ſee Treatiſe on Drawing, Plate I.

In phyſic, it denotes ſuch a ſhuddering, or quivering, as precedes an ague fit; and is often joined with rigores, and lumbagines. See Ague, Fever, &c.

HORSE, *equus*, in zoology. For the generic and ſpecific characters, and technical deſcription of the parts, ſee Equus. For the oſteology, myology, &c. ſee the Plates in the Syſtem of Farriery. For the claſſification, ſee Mammalia. For repreſentation, ſee the Plates of Quadrupeds.

Horse is alſo uſed in the military language, to expreſs the cavalry; or the body of ſoldiers who ſerve on horſeback. See Treatiſe on Military Affairs.

Horse *Dung*, in agriculture and gardening. For the former, ſee *Manure*, Syſtem of Agriculture, Sect. II. For the latter, ſee Syſtem of Gardening, under the monthly calender of buſineſs to be done in the fruit and kitchen garden.

HORSEMANSHIP, the art of breaking, diſciplining, and managing horſes. *Horſemanſhip*, in its latitude, includes what relates to the knowlege of the make, colour, age, temper and qualities, of *horſes*; their reſpective countries and climates, with the manner of breeding, propagating, &c. the diſcovery of the uſes or ſervices they are fitted for; whether the wars, the race, the ſaddle, or labour; and forwarding and accommodating them for this purpoſe. In this general ſenſe, it alſo includes the knowledge of the defects and diſeaſes of *horſes*, and the remedies proper for the ſame, with the ſeveral operations requiſite thereto, as *docking*, *gelding*, *ſhoeing*, &c. and thus takes in the farrier's province. But the word is in a more peculiar manner underſtood of the art of riding, or of directing a horſe to advantage; not only in the ordinary motions, but more eſpecially in the managing, or making him work upon volts, airs, &c.

HORTAGILERS, in the grand ſeignior's court, are upholſterers, or tapeſtry hangers. There is no city better or more orderly regulated than the grand ſeignior's camp; and to have a notion of the magnificence of that prince, he muſt be ſeen in that equipage; as he is much better lodged and accommodated there, than at Conſtantinople, or any other city of his dominions. He has always two tents or pavilions, and two ſets of furniture entire; that, while he is in one, they may pitch or ſpread the other. In order to this, he has conſtantly four hundred *hortagilers*, or upholſterers, in his retinue, who go a day's journey before him to fix on a proper place. They firſt prepare the ſultan's tent, and then thoſe of the officers of the Porte; and the beglerbegs, according to their rank.

HORTUS *Siccus*, a dry garden, a name given to a collection of ſpecimens of plants, carefully dried and preſerved. For the method of drying and preſerving plants, ſee Syſtem of Botany, Sect. IX.

The value of ſuch a collection is very evident, ſince a thouſand minutiæ may be preſerved in the well-dried ſpecimens of plants, which the moſt accurate engraver would overlook.

HOSANNA, in the Hebrew ceremonies, a prayer which they rehearſed on the ſeveral days of the feaſt of tabernacles. It was thus called, becauſe there was frequent repetition therein of the word הושענא, *ſerva nunc*, or *ſerva precor*, i. e. ſave us now; or, ſave us, we pray. There are divers of theſe *hoſanna's*. The Jews call them *hoſchannoth*; i. e. the *hoſannas*. Some are rehearſed on the firſt day, others on the ſecond, &c. which they call *hoſanna* of the firſt day, *hoſanna* of the ſecond day, &c.

HOSEA, in Scripture hiſtory, a canonical book of the old Teſtament, ſo called from the prophet of that name, its author, who was the ſon of Beri; and firſt of the leſſer prophets. He lived in the kingdom of Samaria, and delivered his prophecies under the reign of Jeroboam II. and his ſucceſſors, kings of Iſrael; and under the reigns of Uzziah, Jotham, Ahaz, and Hezekiah, kings of Judah. His principal deſign is to publiſh the groſs idolatry of the people of Judah and Iſrael, to denounce the divine vengeance againſt them, and to foretel the captivity in Aſſyria.

HOSPITAL, a place or building erected, out of charity, for hte reception and ſupport of the poor, aged, infirm, ſick, and otherwiſe helpleſs. The word is formed of the Latin *hoſpes*, "hoſt, ſtranger."] See Host.

In the firſt ages of the church, the biſhop had the immediate charge of all the poor, both ſound and diſeaſed, as alſo of widows, orphans, ſtrangers, &c. When the churches came to have fixed revenues allotted them, it was decreed, that at leaſt one fourth part thereof ſhould go to the relief of the poor; and to provide for them the more commodiouſly, divers houſes of charity were built, which are ſince denominated *hoſpitals*. They were governed wholly by the prieſts and deacons, under the inſpection of the biſhop. In courſe of time, ſeparate revenues were aſſigned for the hoſpitals; and particular perſons, out of motives of piety and charity, gave lands and money for erecting of hoſpitals. When the church diſcipline began to relax, the prieſts, who till then had been the adminiſtrators of hoſpitals, converted them into a ſort of benefices, which they held at pleaſure, without giving account thereof to any body; reſerving the greateſt part of the income to their own uſe; ſo that the intentions of the founders were fruſtrated. To remove this abuſe, the council of Vienna expreſsly prohibited the giving any hoſpital to ſecular prieſts in the way of a benefice; and directed the adminiſtration thereof to be given to ſufficient and reſponſible laymen, who ſhould take an oath, like that of tutors, for the faithful diſcharge thereof, and be accountable to the ordinaries. This decree was executed and confirmed by the council of Trent.

In Britain, hoſpitals are buildings properly endowed, or otherwiſe ſupported by charitable contributions, for the reception and ſupport of the poor, aged, infirm, ſick, or helpleſs. A charitable foundation laid thus for the ſuſtenance and relief of the poor, is to continue for ever. Any perſon ſeized of an eſtate in fee, may, by deed inrolled in chancery, erect and found an hoſpital, and nominate ſuch heads and governors therein as he ſhall think fit; and this charitable foundation ſhall be incorporated, and ſubject to the inſpection and guidance of the heads and viſitors nominated by the founder. Likewiſe ſuch corporations ſhall have, take, and purchaſe lands, ſo as not to exceed 200l. a year, provided the ſame be not held of the king; and to make leaſes, reſerving the accuſtomed yearly rent.

HOSPITALITY, the practice of entertaining ſtrangers. Dr. Robertſon ſpeaking of the middle ages, ſays, "Among people whoſe manners are ſimple, and who are ſeldom viſited by ſtrangers, hoſpitality is a virtue of the firſt rank. This duty of hoſpitality was ſo neceſſary in that ſtate of ſociety which took place during the middle ages, that it was not conſidered as one of thoſe virtues which men may practice or not, according to the temper of their minds and the generoſity of their hearts. Hoſpitality was enforced by ſtatutes, and thoſe who neglected the duty were liable to puniſhment. The laws of the Slavi ordained that the moveables of an inhoſpitable perſon ſhould be confiſcated, and his houſe burnt. They were even ſo ſolicitous for the entertainment of ſtrangers, that they permitted the landlord to ſteal for the ſupport of his gueſt."

HOST, Hospes, a term of mutual relation, applied both to a perſon who lodges and entertains another, and to the perſon thus lodged, &c. The word is formed of the Latin *hoſpes*, which ſome will have thus called *quaſi hoſtium* or *oſtium petens*; for *oſtium* was anciently wrote with an aſpirate. Thus the inn-keeper ſays, he has a good *hoſt*, in ſpeaking of the traveller who lodges with him: and the traveller, again, ſays, he has a kind *hoſt*, in ſpeaking of his landlord. It muſt be obſerved then, that it was the cuſtom among the ancients, when any ſtranger aſked for lodging, for the maſter of the houſe, and the ſtranger, each of them to ſet a foot on their own ſide of the threſhold, and ſwear they would neither of them do any harm to the other. It was this ceremony that raiſed ſo much horror againſt thoſe who violated the law or right of hoſpitality on either ſide; inaſmuch as they were looked on as perjured. Inſtead of *hoſpes*, the ancient Latins called it *hoſtis*; as Cicero himſelf informs us: though in courſe of time, *hoſtis* came to ſignify an enemy; ſo much was the notion of hoſpitality altered.

Host, in the church of Rome, a name given to the elements uſed in the euchariſt, or rather to the conſecrated wafer; which they pretend to offer up every day, a new hoſt or ſacrifice for the ſins of mankind. They pay adoration to the hoſt, upon a falſe preſumption that the elements are no longer bread and wine, but tranſubſtantiated into the real body and blood of Chriſt. See Transubstantiation.

HOSTAGE, a perſon given up to an enemy as a ſecurity for the performance of the articles of a treaty.

Hot-*Beds*, in gardening, beds made with freſh horſe-dung, or tanner's bark, and covered with glaſſes to defend them from cold winds. By the ſkilful management of hot-beds, we may imitate the temperature of warmer climates; by which means, the ſeeds of plants brought from any of the countries within the torrid zone, may be made to flouriſh even under the poles. See Syſtem of Gardening, under the Article Kitchen Garden, month of January.

HOTEL, a French term, anciently ſignifying a houſe, or dwelling place. In France it is more commonly uſed for the palaces or houſes of the king, princes, and great lords. In this ſenſe they ſay, the *hotel de Conde*, *hotel de Conti*, *hotel du Louvre*, &c.

Hotel is likewiſe uſed for a large inn, alſo for a large lodging houſe ready furniſhed.

HOUGH and Houghing, in gardening. See Hoe and Hoeing.

To Hough *or cut the houghs*, is to ham-ſtring, or to diſable by cutting the ſinews of the ham.

Hough, *bony*, is a hard, round ſwelling, or tumor, growing upon the tip or elbow of the *hough*. It generally proceeds from ſome ſtroke or bruiſe; and if neglected till the ſubſtance of the ſwelling becomes hard, like glue, it proves difficult to cure.

HOUND. See Dog.

HOUR, in chronology, an aliquot part of a natural day, uſually a 24th, but ſometimes a 12th. The diviſion of the day into 24 hours, was not known to the Romans before the firſt Punic war. Till that time they only regulated their days by the riſing and ſetting of the ſun. They divided the 12 hours of their day into four, viz. *prime*, which commenced at ſix o' clock; *third*, at nine; *ſixth*, at twelve, and *nine*, at three. They alſo divided the night into four watches, each containing three hours. An hour, with us, is a meaſure or quantity of time, equal to the 24th part of the natural day, or nycthemeron; or the duration of the 24th part of the earth's diurnal rotation. Fifteen degrees of the equator anſwer to an hour; though not preciſely, but near enough for common uſe. It is divided into 60 minutes; the minute into 60 ſeconds, &c.

Hours, *Horæ*, in the *Romiſh Church*, are certain prayers performed at ſtated times of the day; as *matins*, *veſpers*, *lauds*, &c.

Hour-*Circles*, or Horary *Circles*, in aſtronomy, &c. are great circles, meeting in the poles of the world, and croſſing the equinoctial at right angles; the ſame as *meridians*. They are ſuppoſed to be drawn through every fifteenth degree of the equinoctial and equator, and on both globes are ſupplied by the meridian *hour-circle* and index. See Treatiſe on the Globes.

HOUSE, *habitation*; a place built with conveniences to live in; or a building wherein to ſhelter a man's perſon and goods from the inclemencies of the weather, and the injuries of ill diſpoſed perſons. We ſay a brick *houſe*, a ſtone *houſe*, a *houſe* of two ſtories, of three ſtories, a manor *houſe*, a farm *houſe*, &c. For the different modes of conſtruction, ſee the Syſtem of Architecture, on the principles of the art.

House is alſo uſed for one of the eſtates of the kingdom aſſembled in parliament. Thus we ſay, the *houſe* of lords, the *houſe* of commons, &c. See Commons, Parliament, and Peers.

House is alſo uſed for a noble family; or a race of illuſtrious perſons iſſued from the ſame ſtock. See Genealogy. In this ſenſe we ſay, the *houſe* or family of the Stuarts, the *houſe* of Bourbon, the *houſe* of Hanover, of Auſtria, of Lorrain, of Savoy, &c.

Difference of Houses, in heraldry. See the Syſtem, Sect. V.

House-*Breaking*, or *Robbing*, is the breaking into and robbing a houſe in the day-time; the ſame crime being termed *burglary*, when done by night: both are felony, without benefit of clergy.

HOUSEHOLD, the whole of a family conſidered collectively, including the miſtreſs, children, and ſervants. But the houſehold of a ſovereign prince includes only the officers and domeſtics belonging to his palace. The principal officers of his majeſty's houſehold are the lord ſteward, lord chamberlain of the houſehold, the groom of the ſtole, the maſter of the great wardrobe, and the maſter of the horſe.

The civil government of the king's houſe is under the care of the lord ſteward of the king's houſhold; who, as he is the chief officer, all his commands are obſerved and obeyed. His authority extends over all the other officers and ſervants, except thoſe of his majeſty's chapel, chamber, and ſtable, and he is the judge of all crimes committed either within the court or the verge. Under him are the treaſurer of the houſehold, the comptroller, cofferer, the maſter of the houſhold, the clerks of the green cloth, and the officers and ſervants belonging to the accounting-houſe, the marſhalſea, the verge, the king's kitchen, the houſehold kitchen, the acatery, bake-houſe, pantry, buttery, cellar, paſtry, &c. Next to the lord ſteward is the lord chamberlain of the houſhold, who has under him the vice chamberlain, the treaſurer, and comptroller of the chamber; 48 gentlemen of the privy chamber, 12 of whom wait quarterly, and two of them lie every night in the privy chamber; the gentleman uſher, the grooms of the great chamber, the pages of the preſence-chamber; the mace-bearers, cup-bearers, carvers, muſicians, &c. See *Lord* Chamberlain *of the Houſehold*.

The groom of the ſtole has under him the 11 other lords of the bed-chamber, who wait weekly in the bed-chamber, and by turns lie there a-nights on a pallet bed; and alſo the grooms of the bed-chamber, the pages of the bed-chamber and back-ſtairs, &c. See *Groom of the* Stole.

The maſter or keeper of the great wardrobe has under him, a deputy, comptroller, clerk of the robes, bruſher, &c. and a number of tradeſmen and artificers, who are all ſworn ſervants to the king. The maſter of the horſe has under his command the equerries, pages, footmen, grooms, coachmen, farriers, ſadlers, and all the other officers and tradeſmen employed in his majeſty's ſtables. Next to the civil liſt of the king's court, is the military, conſiſting of the band of gentlemen penſioners, the yeomen of the guard, and the troops of the houſehold; of which the two firſt guard the king above ſtairs. When the king dines in public, he is waited upon at table by his majeſty's cup-bearers, carvers, and gentlemen ſewers; the muſicians playing all the time. The dinner is brought up by the yeomen of the guard, and the gentlemen ſewers ſet the diſhes in order. The carvers cut for the king, and the cup-bearers ſerve him the drink with one knee on the ground, after he has firſt taſted it in the cover.

HOWITZES, in artillery, are a kind of mortars, of German invention, which are mounted upon carriages like travelling guncarriages, and have their trunnions placed nearly in the middle. *Howitzes* are capable of doing great execution, by firing ſhells and grapes of ſhots, in a ſiege where the diſtance is ſmall, and in the field, if they were placed in the flanks, or between the battalions. They are alſo more eaſily carried from one place to another than mortars. For the dimenſions of different *howitzes*, and remarks on their conſtruction, the reader may conſult Muller's Treatiſe of Artillery.

HUGUENOTS, an appellation given by way of contempt to the reformed or proteſtant Calviniſts of France. The perſecution which they underwent has ſcarce its parallel in the hiſtory of religion: though they obtained a peace from Henry III. in 1576, it was only of ſhort continuance; and their ſufferings, mitigated by the famous edict of Nantes, granted to them in 1598 by Henry IV. were again renewed, after the revocation of this edict, by Lewis XIV. in 1685.

HULL *of a Ship* is her main body, without any maſts, yards, ſails, or rigging. For a particular deſcription ſee Naval Architecture, Plate II.

HUMAN, ſomething that relates to man, or the nature of man. The *human* body is the ſubject of medicine. Epicurus and his followers deny that the gods concern themſelves with *human* affairs. See Epicureans. Faith is diſtinguiſhed into divine and human. See Faith.

HUMANITY, the nature of man, or that which denominates him human. Neſtorius would not allow the infirmities of *humanity* to be attributed to the Deity; nor the attributes of the Deity to *Humanity*.

HUMANITIES is uſed, plurally, for the *humaniores literæ*, i. e. the ſtudy of the Greek and Latin tongues, grammar, rhetoric, poetry, and the ancient poets, orators, and hiſtorians.

HUMERUS, or Os Humeri, in anatomy the uppermoſt bone of the arm, popularly called the *ſhoulder-bone*; extending from the ſcapula; or ſhoulder-blade, to the upper end of the cubitus, or elbow; For a particular deſcription, ſee the Syſtem, Part II. Sect. IV. For the repreſentation, ſee Plate I. *fig.* I. letter *c*.

HUMIDITY, that quality in bodies whereby they are capable of wetting other bodies. This differs very much from fluidity; and ſeems to be merely a relative thing, depending on the congruity of the component particles of the liquor to the pores of ſuch particular tular bodies as it is capable of adhering to, penetrating a little into or wetting. Thus, for inſtance, quick-ſilver is not a moiſt thing with regard to our hands or clothes; but may be called ſo in reference to gold, tin, or lead, to whoſe ſurfaces it will perfectly adhere, and render them ſoft and moiſt.

HUMMING *Bird*, *Trochilus*, in ornithology. For the generic character, ſee TROCHILUS; for the repreſentation, ſee Plate II. Order II. Genus 29.

HUMOUR, in medicine, is applied to any juice or fluid part of the body; as the chyle, blood, milk, fat, ſerum, lymph, ſpirits, bile, ſeed, ſalival and pancreatic juices, &c. See each of theſe under its proper head CHYLE, BLOOD, BILE, &c. The *four humours*, ſo much talked of by the ancient phyſicians, are four liquid ſubſtances, which they ſuppoſe to moiſten the whole body of all animals, and to be the cauſe of the divers temperaments thereof. Theſe are *phlegm*, *blood*, *bile*, and *melancholy*. But the moderns do not allow of theſe diviſions. The *humours* they rather chooſe to diſtinguiſh into *nutritious*, called alſo *elementary*; as chyle, and blood: thoſe ſeparated from the blood; as bile ſaliva, urine, &c. and thoſe returned into the blood. *Humours*, again, are diſtinguiſhed into *natural*, or ſalutary, and *morbid* or corrupted. To the former claſs belong all the juices ordinarily ſecreted for the uſes of the body. To the latter belong thoſe compound *humours*, which thickening and growing putrid, cauſe tumors, abſceſſes, obſtructions, and moſt diſeaſes. Theſe are diſtinguiſhed by various names; *malignant*, *aduſt*, *acrimonious*, *corroſive*, *crude*, *peccant*, &c.

HUMOUR is alſo uſed, in dramatic poetry, for a ſubordinate ſpecies of what the critics call *manners*. *Humour* is uſually looked on as peculiar to the Engliſh drama, at leaſt our comic poets have excelled therein, and carried it beyond thoſe of any other nation; and our's is, perhaps, the only language that has a name for it. A very good judge, the duke of Buckingham, makes *humour*, to be all in all; wit, according to him, ſhould never be uſed, but to add an agreeableneſs, to ſome proper and juſt ſentiment, which, without ſome ſuch turn, might paſs without its effect.

HUNGER, an uneaſy ſenſation occaſioned by long abſtinence from food when the body is in a healthy ſtate. Many ſpeculations and conjectures have been formed concerning the cauſe of this ſenſation, but none of them in any degree ſatisfactory. The moſt ingenious and plauſible is that of Dr. Haller, viz. that as the liver is not then ſuſtained by the ſtomach and inteſtines, it deſcends by its own weight, and, principally by means of its middle ligament, pulls the diaphragm along with it. It is in that place, therefore, that we have this uneaſy ſenſation, and not at the ſuperior orifice of the ſtomach as is generally thought. But if this was the caſe, an empty ſtomach would always be accompanied with hunger, which does not hold in fact: becauſe, in certain diſeaſes, people will often faſt a long time without any ſenſation of hunger; and on the contrary, there are caſes where ſcarce any degree of repletion of the ſtomach and inteſtines can extinguiſh the deſire of food. When animals die for want of food, their death is not directly the conſequence of hunger, i. e. it does not proceed from a deficiency of juices, but from a bad quality of them. The blood, being deprived of its uſual ſupplies of freſh chyle, contracts a putreſcent diſpoſition; from whence ariſes a fever of the putrid kind, and of a nature ſimilar to the jail or hoſpital fever. The Indians elude their *hunger*, by ſwallowing pills, made of tobacco-leaves and calcined ſhells. Theſe pills take away the appetite; both as the tobacco leaves gradually diminiſh the ſenſibility of the ſtomach; and as the calcined ſhells abſorb the ſalino-acid menſtruum. Thus alſo it is, that poor people frequently ſmoke tobacco to deceive their *hunger*, not to ſatisfy it; for tobacco affords no nutriment; but it occaſions a plentiful ſpitting, and by this means diſcharges the body of the acrid humour which cauſes *hunger*.

HUNTING, the art, or act, of purſuing and chaſing beaſts of *game*. In its general ſenſe, *hunting* includes the purſuit both of hairy and feathered game; but in its more proper and reſtrained ſignification, it is only applicable to beaſts of venery and chace. See GAME.

Hunting conſidered as an exerciſe, is perhaps the beſt that can poſſibly be contrived for ſtrengthening the general habit, and procuring health and vigour. The ſeaſon of the year, the time of the day deſtined for this amuſement, and the motion neceſſary on this occaſion, are all admirably adapted to the reſtoration and continuance of health. It is beſides of no ſmall importance to have the mind recreated at the time the body is exerciſed; for this admirably aſſiſts the due circulation of the fluids through the minute canals deſtined for their conveyance; and there are few people not utterly abandoned to idleneſs and debauchery of ſome kind or other, who do not perceive a ſpontaneous flow of ſpirits when they ride at or about the riſe of the ſun, when they reſpire the pureſt air, when variety of perpetually changing ſcenes preſent themſelves, and when the mind is agreeably agitated concerning the event of the chace.

Styles or Manners of HUNTING, are various, according to the country, the beaſt, and the means whereby he is to be caught. *Hunting*, as practiſed among us, is chiefly performed with dogs; of which we have various kinds, accommodated to the various kinds of game: as *hounds*, *grey-hounds*, *ſtaunch-hounds*, *blood-hounds*, *terriers*. In the kennels or packs, they generally rank them under the heads of *enterers*, *drivers*, *flyers*, *tyers*, &c. The uſual chaces among us are, the *hart*, *buck*, *roe*, *hare*, *fox*, *badger*, and *otter*. We ſhall here give ſomething of what relates to each of theſe. With regard to the ſeaſons of *hunting*, hart and buck *hunting* begins at the end of the fence-month, which is a fortnight after Midſummer, and laſts till Holy-rood-day. The hind and doe come in courſe on Holy-rood-day, and laſt till Candlemas. Fox *hunting* comes in at Chriſtmas, and holds till Annunciation. Roe *hunting* begins at Michaelmas, and ends at Candlemas. Hare *hunting* commences at Michaelmas, and goes out at the end of February.

The gentlemen, and maſters of the ſport, have framed a new ſet of terms, which may be called the *hunting language*: a little view or vocabulary whereof we ſhall here give the reader.

1. The terms, uſed for beaſts of venery and chace, as they are in company, are theſe: they ſay, a *herd* of harts, and all manner of deer; a *bevy* of roes; a *ſounder* of ſwine; a *rout* of wolves; a *richeſs* of martins; a *brace* or *leaſh* of bucks, foxes, or hares; a *couple* of rabbits or conies. 2. There are alſo terms for their lodging; a hart is ſaid to *harbour*; a buck *lodges*; a roe *beds*; a hare *ſeats*, or *forms*; a coney *ſits*; a fox *kennels*; a marten *trees*; an otter *watches*; a badger *earths*; a boar *couches*. Hence, to expreſs their diſlodging, they ſay, *unharbour* the hart; *rouſe* the buck; *ſtart* the hare; *bolt* the coney; *unkennel* the fox; *tree* the marten; *vent* the otter; *dig* the badger; *rear* the boar. 3. The terms for their noiſe at rutting time are as follows: a hart *belleth*; a buck *growns* or *troats*; a roe *bellows*; a hare *beats* or *taps*; an otter *whines*; a boar *freams*; a fox *barks*; a badger *ſhrieks*; a wolf *howls*; a goat *rattles*. 4. Terms for their copulation: a hart or buck goes to *rut*; a roe goes to *tourn*; a boar goes to *brim*; a hare or coney goes to *buck*; a fox goes to *clicketing*; a wolf goes to *match* or *make*; an otter *hunteth* for his kind. 5. Terms for the footing and treading: of a hart we ſay, the *ſlot*; of a buck, and all fallow deer, the *view*: of all deer, if on the graſs, and ſcarce viſible, the *foiling*; of a fox, the *print*; and of other the like virmin, the *footing*; of an otter, the *marks*; of a boar, the *track*; the hare, when in open fields, is ſaid to *ſore*; when ſhe winds about to deceive the hounds, ſhe *doubles*; when ſhe beats on the hard highway, and her footing comes to be perceived, ſhe *pricketh*: in ſnow it is called, the *trace* of the hare. 6. The tail of a hart, buck, or other deer, is called the *ſingle*: that of a boar, the *wreath*; of a fox, the *bruſh*, or *drag*; and the tip at the end, the *chape*; of a wolf, the *ſtern*; of a hare and coney, the *ſcut*. 7. The ordure or excrement of a hart, and all deer, is called *fewmets* or *fewmiſhing*; of a hare, *crotiles* or *crotiſing*; of a boar, *leſſes*; of a fox, the *billiting*; and of other the like vermin, the *fuants*; of an otter the *ſpraints*.

8. For the attrite or parts thereof, thoſe of a ſtag, if perfect, are, the *bur*, the *pearls*, the little *knobs* on it, the *beam*, the *gutters*, the *antler*, the *ſur-antler*, *royal*, *ſur-royal*, and all at top, the *croches*; of the buck, the *bur*, *beam*, *brow-antler*, *back-antler*, *advancer*, *palm*, and *ſpellers*. If the croches grow in the form of a man's hand, it is called a *palmed head*. Heads bearing not above three, or four, and the croches placed aloft, all of one height, are called *crowned heads*. Heads having double croches, are called *forked heads*, becauſe the croches are planted on the top of the like forks. 9. They ſay a *litter* of cubs; a *neſt* of rabbits; a ſquirrel's *dray*. 10. The terms uſed in reſpect to the dogs, &c. are as follow: of greyhounds, two make a *brace*; of hounds, a *couple*; of greyhounds, three make a *leaſh*; of hounds, a *couple* and *half*: they ſay, *let ſlip* a greyhound; and *caſt off* a hound: the ſtring wherein a greyhound is led is called a *leaſh*; and that of a hound a *lyome*: the greyhound has his *collar*, and the hound his *couples*: we ſay a *kennel*.

The following are the general terms, and phraſes, more immediately uſed in the progreſs of the ſport itſelf. When the hounds then being caſt off, and finding the ſcent of ſome game begin to open and cry, they are ſaid to *challenge*; when they are too buſy before the ſcent be good, they are ſaid to *babble*; when too buſy where the ſcent is good, to *bawl*; when they run it end-ways orderly, holding it together merrily, and making it good, they are ſaid to be in *full cry*; when they run along without opening at all, it is called *running mute*. When ſpaniels open in the ſtring, or a grey-hound in the courſe, they are ſaid to *lapſe*. When beagles bark and cry at their prey, they are ſaid to *yearn*. When the dogs hit the ſcent the contrary way, they are ſaid to *draw amiſs*. When then they take freſh ſcent, and quit the former chace for a new one, it is called *hunting change*. When they hunt the game by the heel or track, they are ſaid to *hunt counter*. When the chace goes off, and returns again, traverſing the ſame ground, it is called *hunting the foil*. When the dogs run at a whole herd of deer inſtead of a ſingle one, it is called *running riot*. Dogs ſet in readineſs where the game is expected to come by and caſt off after the other hounds are paſſed, are called a *relay*. If they be caſt off before the other dogs be come up, it is called a *vauntlay*. When, finding where the chace has been, they make a proffer to enter, but return, it is called a *blemiſh*. A leſſon on the horn to encourage the hounds, is named a *call* or *recheat*. That blown at the death of a deer, is called the *mort*. The part belonging to the dogs of any chace they have killed, is the *reward*. They ſay, *take off* a deer's ſkin; *ſtrip* or *caſe* a hare, fox, and all ſorts of vermin; which is done by beginning at the ſnout, and turning the ſkin over the ears, down the tail.

***Buck* HUNTING, or *hunting Fallow Deer*.** The female is called *doe*, or *doo*: the firſt year, a *fawn*; ſecond, a *tegg*; the third, a *doe*. This beaſt is common in moſt countries, being as corpulent as a hart, but in moſt things reſembling more a roe, except in colour; which is various, but moſt commonly branded, or ſandy on the back, having a black liſt all along the ridge, and the belly and ſides ſpotted with white. The male has horns not much differing from a hart, except in largeneſs, and they grow out of the head like fingers out of the hand; whence it is called *cervus palmatus*. The female is without horns. Leſs art and ſkill are required in lodging a buck than in harbouring a hart; nor does there need ſo much drawing after: it is ſufficient that you judge by the view, and mark what grove or covert he enters; for he does not wander and rove ſo often as a hart, nor ſo frequently change his layer. When hard hunted he uſually takes to ſome ſtrong hold or covert, with which he is acquainted; not flying far before the hounds, nor croſſing nor doubling, nor uſing any of the ſubtleties the hart is accuſtomed to. The buck will beat a brook, but ſeldom a great river as the hart; nor can he ſtay ſo long at ſoil. The greateſt ſubtlety a huntſman need uſe in *hunting* the buck is to beware of *hunting* counter or change, becauſe of the plenty of fallow deer, which uſe to come more directly upon the hounds than the red deer do. The buck herds more than the hart, and lies in the drieſt places; but if he be at large, unconfined in a park, he herds but little from May till Auguſt, becauſe the flies trouble him. He takes delight in hilly places, but chooſes the dales to feed in.

***Fox* HUNTING.** This animal, the firſt year, is called a *cub*; the ſecond, a *fox*; the third, an *old fox*. See FOX. His nature in many reſpects is like that of a wolf; and both bring the ſame number of cubs at a litter: but the fox litters deep under ground, which the wolf does not. A bitch fox is hard to take when bragged and with a cub, in regard ſhe lies near her burrow, into which ſhe runs upon hearing the leaſt noiſe: indeed it is no eaſy matter to take her at any time, as being a beaſt of exceeding ſubtlety. What makes *fox-hunting* the more entertaining is, the ſtrong hot ſcent this creature affords, which keeps up an excellent cry; but as his ſcent is hotter at hand, ſo it dies ſooner than that of a hare, &c. Add, that he never flies far before the hounds, as not truſting to his legs, or the champaign ground, but has recourſe to the ſtrongeſt coverts. When he can no longer ſtand up before the hounds, he takes earth, and muſt be dug out. When courſed by grey-hounds on a plain, his laſt refuge is, uſually to piſs on his tail, and flap it in their faces as they come near him; ſometimes ſquirting alſo his thicker excrement upon them, to make them give over their courſe. When a bitch fox goes a clicketing, and ſeeks the dog, ſhe cries with a hollow voice, not unlike the howling of a mad dog; and the like noiſe ſhe makes when ſhe miſſes any of her cubs: but ſhe never cries at all when ſhe is about to be killed, but defends herſelf in ſilence to the laſt gaſp.

The fox chuſes to earth in ground hard to dig; as in clay or ſtony ground, or amongſt the roots of trees; and his earth has commonly but one hole, which goes ſtrait along in, before it comes at their couch: he ſometimes by craft poſſeſſes himſelf of a badger's old burrow, which has variety of chambers, holes, and angles. Geſner relates, that he frequently cheats the badger of his habitation, by laying his excrement at the mouth of the other's burrow.

***Hare* HUNTING.** A hare the firſt year is called a *leveret*; the ſecond year, a *hare*; the third, a *great hare*. Thoſe of the mountains are the moſt ſwift, and thoſe of the marſhes the ſloweſt; the wandering hares are the moſt difficult and dangerous to follow. Each part and member of the hare is formed for celerity. The head is round and ſhort, of a convenient length; the ears long and lofty, to hear the enemy at a diſtance, and ſave itſelf in time; the lips continually move, ſleeping and waking; and the eye is too big and round for the lid to cover it, even when aſleep; ſo that the creature ſleeps as it were on the watch. The breaſt is capacious, and fitted to take more breath than that of any other beaſt. They feed abroad, to conceal their forms; and never drink, but content themſelves with the dew. The hares ears lead the way in her chaſe; for with one of them ſhe hearkeneth to the cry of the dogs, the other being ſtretched forth like a ſail to promote her courſe. The hares of the mountains often exerciſe themſelves in valleys and plains, and through practice grow acquainted with the neareſt way to their forms: thoſe which frequent buſhes and brakes, are not able to endure labour; nor are very ſwift, being tender-footed, and growing fat through diſcontinuance of exerciſe. When the hare has left the dogs far behind, ſhe goes to ſome hill or riſing ground, where, rearing on her hinder legs, ſhe obſerves at what diſtance her purſuers are. The ſcent is naturally ſtronger in wood-hares than field-hares; but in all ſorts it is ſtrongeſt when they feed on green corn. In winter mornings, the ſcent does not lie till the froſt be a little thawed; and it may be added, that a hare always leaves more ſcent when ſhe goes to relief, than when ſhe goes to form.

Having found where a hare hath relieved in ſome paſture, or corn-field; to find her form, the ſeaſon of the year and the ſtate of the weather are to be conſidered. In the ſpring, or ſummer, a hare will not ſit in the buſhes, becauſe frequently offended with piſmires, ſnakes, and adders; but will ſit in corn-fields, and open places. In winter they chooſe to ſit near towns and villages, in tufts of thorns and brambles, eſpecially when the wind is northerly or ſoutherly.

***Hart* HUNTING, or HUNTING *of Red Deer*.** This animal the firſt year is called a *calf*, or *hind-calf*; the ſecond year, a *knobber*: the third, a *brock*; the fourth a *ſtaggard*; the fifth a *ſtag*; the ſixth, a *hart*. The female is called a *hind*. The firſt year ſhe is a *calf*; the ſecond, a *hearſe*, and ſometimes a *brocket's ſiſter*; the third a *hind*. Terms occurring more eſpecially in *hunting* the hart, and not yet explained, are as follow. The print or impreſſion, where a deer has lain, is called a *layer*; if it be in covert, or a thicket, it is called his *harbour*; where a deer has paſſed into a thicket, leaving marks whereby his bulk may be gueſſed at, it is called an *entry*; when they caſt their heads, they are ſaid to *mew*; when they rub their heads againſt trees, to bring off the peels of their horns, they are ſaid to *fray*; when a deer, hard haunted, takes to ſwimming in the water, ſhe is ſaid to go to *ſoil*; when they turn head againſt the hounds, they are ſaid to *bay*; when the hounds touch the ſcent, and draw on till they put up the hart, they are ſaid *to draw on the ſlot*. As to the nature and qualities of the hart, it is to be obſerved that he is an excellent ſwimmer; there being inſtances, when ſore hunted, of his plunging in the ſea, and being killed by fiſhermen twelve miles from land. When in going to rut, they have occaſion to croſs a great river, or arm of the ſea, it is ſaid they aſſemble in great herds: the ſtrongeſt goes in firſt, and the next of ſtrength follows; and ſo one after the other, relieving themſelves by ſtaying their heads on the buttocks of each other.

The taking of this beaſt requires great art and attention. When the hunter goes for ſport, he is firſt to encompaſs the beaſt *en ſong giſte*, in her own layer, and thus unharbour her in the view of the dogs, ſo they may never loſe her ſlot or footing. But note, a deal of choice and diſcretion is here required; for he may not ſet off upon every one, either of the herd, or thoſe which wander ſolitary: the young, the ſmall, &c. are to be paſſed over; and partly by ſight, and partly by the footing, fewmets, the largeneſs of the layer, &c. he muſt make judgement of the game, ſingling out for that purpoſe the largeſt head in the whole herd. There are divers means for knowing an old hart; viz. by the *ſlot*, the *entries*, the *abatures*, and *foils*, the *fumets*, *gait* and *walks*, *fraying-ſtocks*, and the *head* and *branches*.

Having found out the game, the *hunters* diſcouple and caſt off the dogs; and ſome on horſeback, others on foot, follow the cry with the utmoſt art, obſervation, and ſpeed, remembering and preventing the ſubtle turning and headings of the hart; ſtanding with dexterity and intrepidity to leap hedge, pales, ditch, &c. The utmoſt addreſs and circumſpection are to be uſed to keep to the beaſt firſt attempted, and to prevent the dogs from purſuing any other: this, in effect, makes one of the principal difficulties and glories of the chace; the beaſt having a hundred devices to put off ſome other head for his own: ſometimes he will ſend forth ſome other little deer in his ſtead into the dogs way, laying cloſe the while himſelf; on which occaſion the huntſman is to ſound a retreat, and break off the dogs, and take in leam, till the game be recovered. Sometimes he will purpoſely ſeek out other deer at layer, and rouſe them to make the hounds hunt change, himſelf lying down flat in ſome of their layers upon his belly, to make the hounds over ſhoot him: add, that they may neither ſcent nor vent him, he will gather up his fore-feet under his belly, and blow or breath on ſome moiſt place of the ground, ſo that the hounds ſhall paſs within a yard, without apprehending him. He will break into one thicket after another, to find deer, rouſing, gathering them together, and herding with them, and even beating ſome of them into his treads, that he may the more eaſily eſcape. Finding himſelf ſpent, he will break herd, and fall to doubling and croſſing in ſome hard beaten highway, always running againſt the wind, not only to cool himſelf, but the better to hear the voice of his purſuers. The hart being killed, the huntſman with his horn windeth the fall of the beaſt; upon which every one approaches: the ſkilfulleſt opens the beaſt, rewarding the hounds with what properly belongs to them; the huntſman, at the ſame time, dipping bread in the ſkin and blood of the beaſt to give the hounds their full ſatisfaction.

The hart is known to be ſpent by his running ſtiff, high and lampering, by his mouth being black and dry, without foam on it, and his tongue hanging out; though he will ſometimes cloſe his mouth to deceive the ſpectators, and by his ſlot, for he will ſometimes cloſe his claws together, as if he went at leiſure, and ſtrait again open them wide, making great glidings, and hitting his dewlaps upon the ground, &c. When quite ſpent, and cloſe beſet, or intercepted on all ſides, the hart uſually takes to bay, and makes force with his head againſt the firſt man or dog that cloſes in upon him, unleſs prevented with a ſpear, ſword, or the like. Hence it is very dangerous going in to a hart at bay, eſpecially at rutting time, for then they are more than ordinarily fierce. The hart being killed, his death is ſolemnized with great ceremony. The firſt thing, when the huntſmen come in, is to cry, *Ware haunch*, that the hounds may not break into the deer: having ſecured this, they cut his throat, and blood the younger hounds, to make them love deer, and learn to leap at his throat; then having blown the mort, and all the company being come in, the moſt diſtinguiſhed perſon, who has not taken *ſay* before, takes up the knife, and lays it acroſs the belly of the deer (ſome of the aſſiſtants holding by the fore-legs, and at the ſame time the huntſman drawing down the pizzle) and thus he draws the knife along the middle of the belly, beginning near the briſket, cutting deep enough, to diſcover how fat he is. Then the moſt ſkilful perſon breaks up the deer, by firſt ſlitting the ſkin from the cutting of the throat downwards, making the arber, that the ordure may not break forth, and then paunching him and rewarding the hounds therewith. Laſtly, the perſon that took the *ſay*, cuts off the head; which done, and the hounds rewarded therewith, the concluding ceremony, if a buck, is a double; if a ſtag a treble mort blown by one, and a recheat in concert by all that have horns: the whole is then concluded with a general *whoo whoop*.

Laws relating to HUNTING. See GAME. Notwithſtanding all the game laws, and the various qualifications for *hunting* pointed out by ſtatutes, which imply a power for perſons ſo qualified to *hunt*, yet according to Judge Blackſtone, no man but he who has a chace, or free-warren by grant of the crown or preſcription, which ſuppoſes one, can juſtify hunting or ſporting upon another man's ſoil; nor indeed, in thorough ſtrictneſs of common law, either *hunting* or ſporting at all. Perſons ſo *hunting* are liable to actions of treſpaſs by the poſſeſſors of the land. Comment. vol. ii. p. 418. and vol. iv. p. 174.

HURRICANE, a furious ſtorm of wind, rain, thunder, and lightning, attended with a great ſwelling of the ſea, and ſometimes with an earthquake; and, in ſhort, with every circumſtance which the elements can aſſemble that is terrible and deſtructive. *Hurricanes* are frequent in the Eaſt and Weſt Indies, making terrible ravages in the iſlands thereof; blowing down houſes, rooting up trees, and even whole woods, making caverns in the earth, and ſcattering earth, bricks, ſtones, timber, &c. to a great diſtance, in every direction. Great quantities of water have been left, or raiſed by them, ſo as to make a kind of deluge; and they have been always attended with a prodigious rumbling noiſe. As a prelude to the enſuing havock, whole fields of ſugar-canes are ſeen whirled into the air, and ſcattered over the face of the country; the ſtrongeſt trees of the foreſt are torn up by the roots, and driven about like ſtubble; their wind-mills are ſwept away in a moment, their works, their fixtures, the ponderous copper boilers and ſtills, of ſeveral hundred weight, are wrenched from the ground, and battered to pieces; the roofs of their houſes are torn off at one blaſt, whilſt the rain, which in an hour riſes five feet, ruſhes in upon them with an irreſiſtable violence.

They uſually begin in the north, ſome ſay the weſt, but turn round; and in a little time veer through all points of the compaſs. Great miſchiefs are done to our veſſels about the Caribbee iſlands, and elſewhere, by means of the *hurricanes*, and at the time of year when they are moſt frequent, which is in the midſt of ſummer, principally in the month of Auguſt, more rarely in July and September. It is the cuſtom for the French and Engliſh inhabitants in the Caribbee iſlands, to ſend every year about June to the native Caribbees of St. Dominico and St. Vincent, to know whether there will be any *hurricanes* that year; and about ten or twelve days before any *hurricane* come, they conſtantly ſend them word.

The prognoſtics thoſe people go by, are given us by captain Langford, who, in 1697, engaged one of them, by civilities, to reveal them to him. It is one of their principles, that all *hurricanes* come either on the day of the full, or of the change, or quarter of the moon; each of which is diſcovered by a number of phenomena in the preceding quarters, as a turbulent ſky, ſun red, univerſal calm, the ſtars appearing red, larger than uſual, and ſurrounded with a ſort of burs, noiſes in hollows or cavities of the earth, ſtrong ſwell of the ſea, which riſes into large waves, a ſettled weſterly wind, blowing with intermiſſions violently and irregularly, for about two hours at a time; and at the full of the moon, the moon itſelf is ſurrounded with a great bur, and ſometimes the ſun has the ſame appearance. That author aſſures us, he received this benefit from the information, that whereas *hurricanes* are ſo dreadful, that all ſhips are afraid to put out to ſea while they laſt, and choſe rather to periſh at anchor in the roads, yet, with good management, he found, that a veſſel may lie out at ſea, in theſe, as ſafely as in other ſtorms, by taking care the ports are well barred and caulked, the top-maſts and tops taken down, the yards a-port faſt, and the doors and windows ſecured. With theſe precautions that experienced navigator preſerved his veſſel in two great *hurricanes*, and taught others how to do the ſame, by putting out from port, where they would inevitably have periſhed. And from the prognoſtics above, he foretold ſeveral *hurricanes* at land. He adds, that all *hurricanes* begin from the north, and turn to the weſtward, till arriving at the ſouth eaſt, their force is ſpent. The cauſe he ſuggeſts to be the ſun's leaving the zenith of thoſe places, and going back towards the ſouth; and the repelling or bounding back of the wind, occaſioned by the calming of the general trade-wind. Phil. Tranſ. N° 246. The wind during the *hurricane* is ſo ſtrong, and varies ſo faſt between the north and the north-eaſt point, that it is impoſſible for any ſhip to anſwer the veerings of it; it is hence that all the art of the ſailors often cannot prevent the backs of the veſſels from being broken, and the maſts being carried by the board. The main-maſt of a ſhip of four hundred ton will be in an inſtant wreathed like a withe, and borne by the board before they can hand a ſail. Phil. Tranſ. N° 36.

Swiſſerland is ſubject to very violent *hurricanes*, which do great miſchief, and that in a very ſingular manner. Thunder and lightning are frequent with them in winter as well as in ſummer; and the more violent ſtorms of theſe, are ſometimes attended with whirlwinds and *hurricanes*, which will raiſe the water of ſome lakes in form of a thick pillar up to the cloud, and carrying on before the wind this vaſt body of water, will ſometimes fall in other places on dry land and drown the houſes and gardens where it chances to fall. Theſe are all phenomena of electrical origin, and depend on the ſame general cauſes. See ELECTRICITY, LIGHTNING, and SPOUT.

HURTS, in heraldry, by ſome wrote *Heurts*, and by others *Huerts*, are azure or blue rundles.

HUSBANDRY, the buſineſs or employment of a farmer, or perſon who cultivates land. See the Syſtem of AGRICULTURE.

It was the intention of the Author of the Syſtem of Agriculture to have expatiated more largely upon ſeveral articles under this head; but the Editors conſidering the Syſtem ſo very comprehenſive, and that to ſay more on the ſubject, would exceed the œconomy of the work; therefore when any thing new, or of an important nature ſhall occur, it will be noticed under the Alphabet.

HYÆNA, or HIÆNA, in zoology, a ſpecies of the genus CANIS. It is a ſolitary unſociable animal, and inhabits the chaſms of rocks. Theſe animals have a moſt malevolent aſpect; and they are in their nature cruel, fierce, and untameable.

HYDRA *of Lerna*, in mythology, a terrible monſter, born of Typhon and Echidne, according to Heſiod; which was deſtroyed by Hercules. The poets repreſent it ſometimes as a ſerpent, branched out into ſeveral other ſerpents, and ſometimes with a human head, bearing ſerpents inſtead of hair; and they add, that when one of the ſerpents heads were cut off, a double head ſprouted in its place.

HYDRA, in aſtronomy, a ſouthern conſtellation, conſiſting of a number of ſtars, imagined to repreſent a water ſerpent. See Syſtem of ASTRONOMY, Sect. VIII.

HYDRA, in the Linnæan ſyſtem, is a genus of zoophytes, comprehending ſeven different ſpecies. See POLYPE.

HYDRAULICS, that part of ſtatics which conſiders the motion of fluids, and particularly water; with the application thereof in artificial water-works. To *hydraulics* belong not only the conducting and raiſing of water, with the conſtructing of engines for thoſe purpoſes; but alſo the laws of the motion of fluid bodies, the nature of ſprings, the theory of the tides, &c. Hydroſtatics explain the equilibrium of fluids, or the gravitation of fluids at reſt: upon removing that equilibrium, motion enſues; and here *hydraulics* commence. *Hydraulics*, therefore ſuppoſe hydroſtatics; and the generality of writers, from the immediate relation between the two, join them together, and call them both either *hydraulics*, or *hydroſtatics*. See Syſtem of HYDROSTATICS.

HYDROGRAPHICAL *Maps*, more uſually called *ſea charts*, are projections of ſome part of the ſea, in plano, for the uſe of navigation. In theſe are laid down all the rhumbs, or points, of the compaſs, the meridians, parallels, &c. with the coaſts, capes, iſlands, rocks, ſhoals, ſhallows, &c. in their proper places, proportions, &c. Chriſtopher Columbus, the firſt great diſcoverer of America, was a man than earned his living by making and ſelling *hydrographical maps*. He happened to be heir to the memories or journals of a noted pilot, one Alonzo Sanchez de Huelva, captain of a ſhip, who, by chance, had been driven by a ſtorm to the iſland of St. Domingo, and died at Columbus's houſe ſoon after his return. This gave Columbus the firſt hint to attempt a diſcovery of the Weſt Indies, in which he ſucceeded.

HYDROGRAPHY, compounded of ὑδωρ, *aqua*, *water*, and γϱαφω, *I deſcribe*, that part of geography which conſiders the ſea; principally, as it is navigable.

Hydrography teaches how to deſcribe and meaſure the ſea; it gives an account of its tides, counter-tides, currents, ſoundings, bays, gulfs, &c. as alſo of its rocks, ſhelves, ſands, ſhallows, promontories, harbours, diſtances, &c. from port to port; with all that is remarkable, either out at ſea, or on the coaſt. Some of the beſt authors uſe the term in a more extenſive ſenſe; ſo as to denote the ſame with *navigation*. In this ſenſe *hydrography* includes the doctrine of ſailing; the art of making ſea charts, with the uſes thereof; and every thing neceſſary to be known, in order to the ſafeſt and moſt expeditious performance of a voyage. *Hydrography* is the moſt perfect of all the mathematical ſciences; there being ſcarce any thing wanting to its perfection, but the diſcovery of the longitude.

HYDROMETER, compound of ὑδωρ, *water*, and μέτϱον, *meaſure*, an inſtrument wherewith to meaſure the gravity, denſity, velocity, force, or other properties of water. That wherewith the ſpecific gravity of water is determined, is often called an aerometer, or water poiſe. See Syſtem of HYDROSTATICS.

HYDROPHOBIA, Ὑδϱυφοϐια, compounded of ὑδωρ, *water* and φοβος, *fear*, in medicine, an averſion or dread of water, a ſymptom ariſing in perſons bitten by a mad dog, or other animal. This diſeaſe is alſo called *rabies canina*. Some have obſerved that this kind of madneſs ſcarcely ever appears in any animals except dogs, foxes, and wolves, unleſs by contagion. See Syſtem of MEDICINE.

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Elementary Principles of Hydrostatics, with various Hydraulic Engines, as Syphons, Pumps &c. See the System of Hydrostatics & Hydraulics.

Fig. 13.

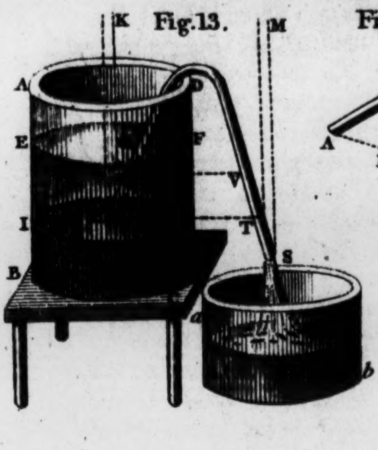
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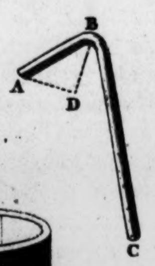
Fig. 12.



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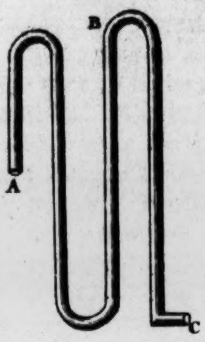

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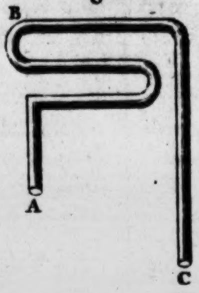

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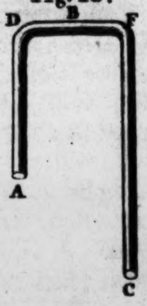

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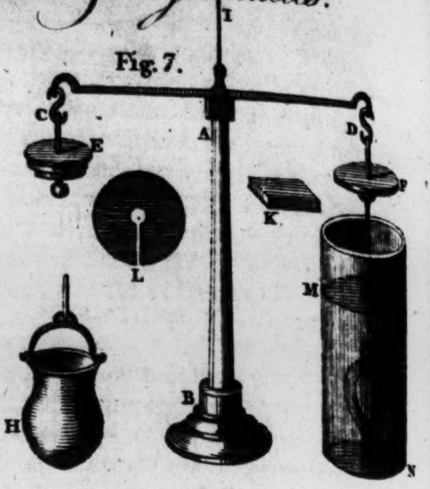
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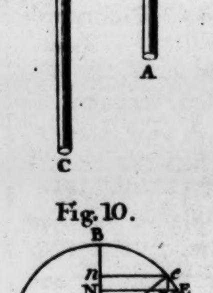

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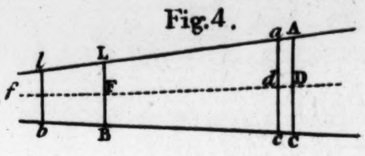
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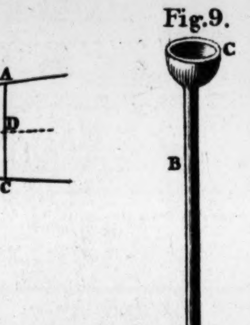

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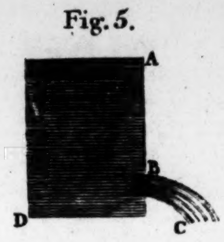

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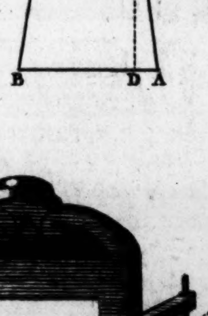

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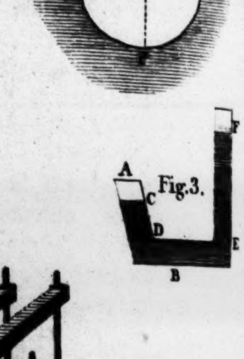

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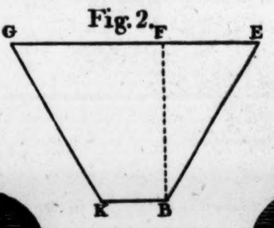

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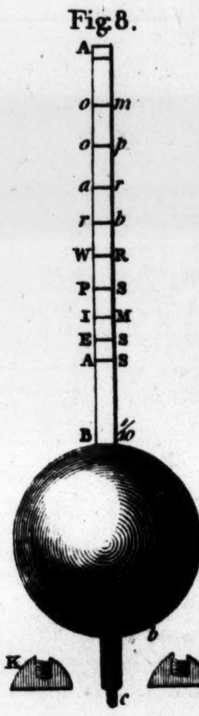
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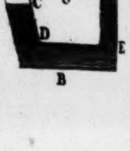
Fig. 3.



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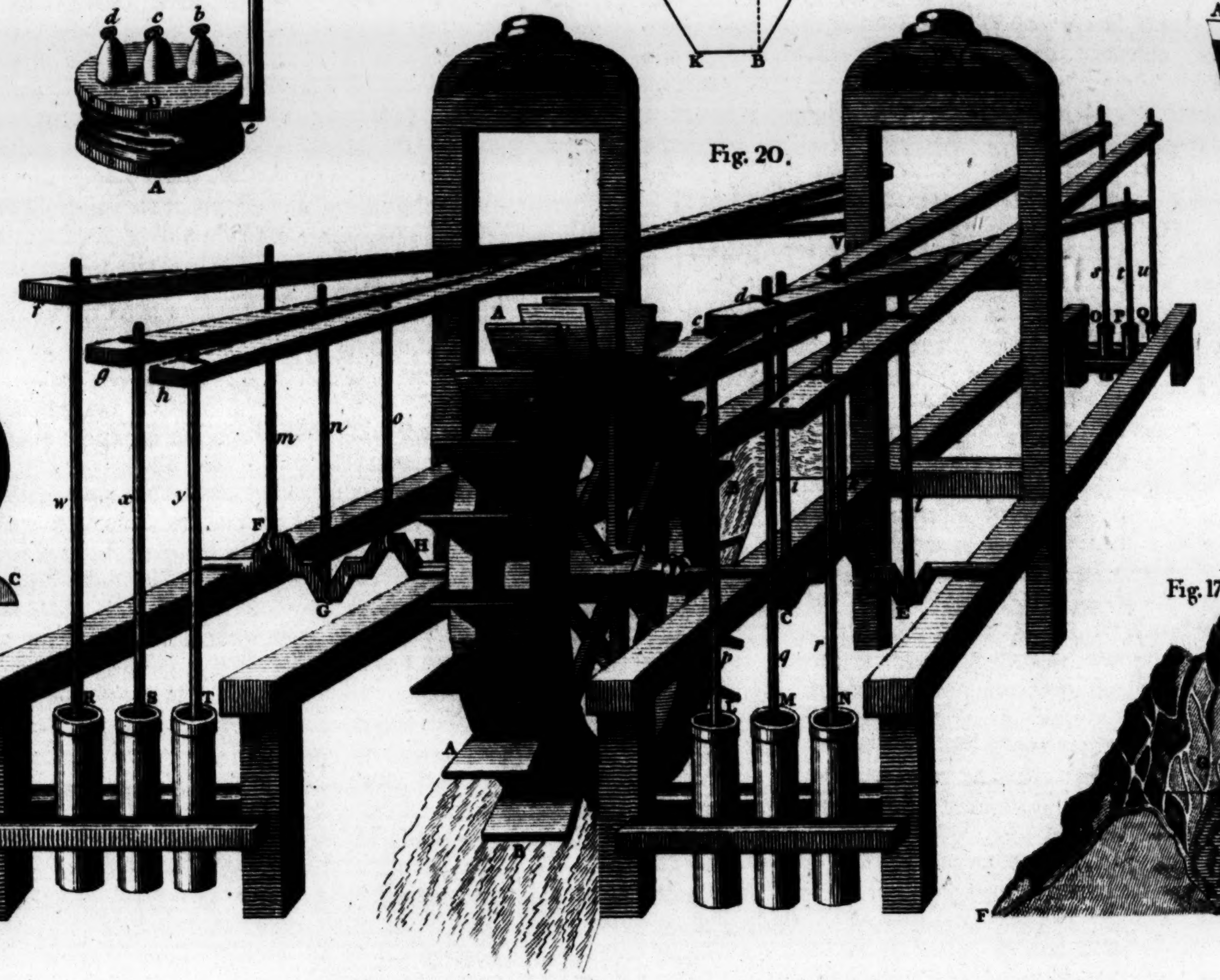
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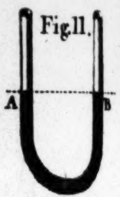
Fig. 11.



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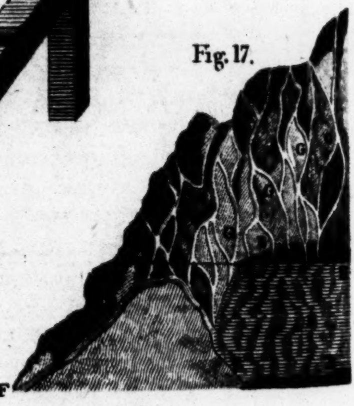

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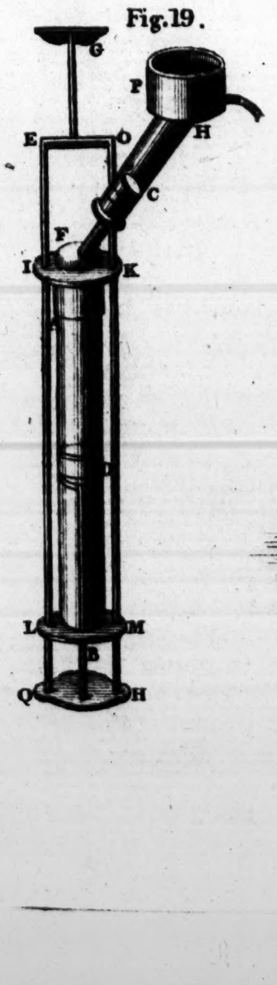
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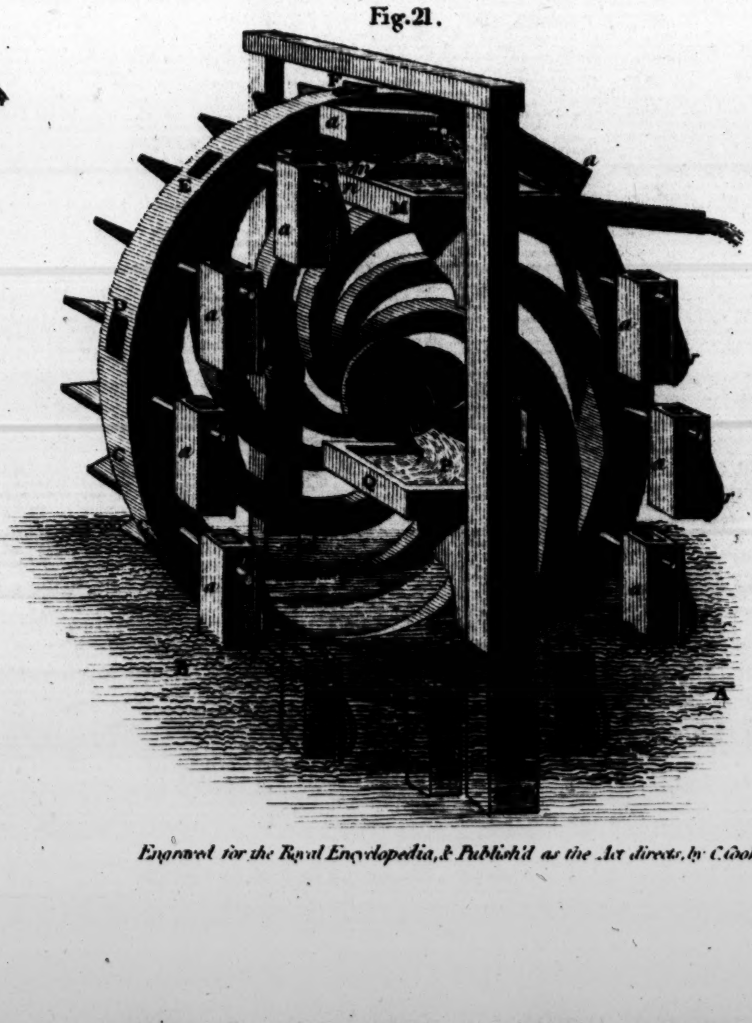

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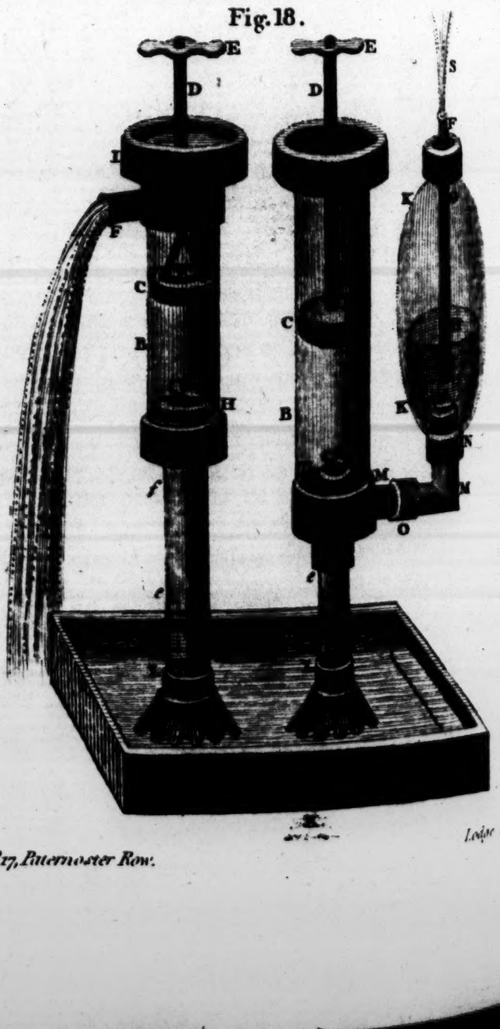
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SYSTEM OF HYDROSTATICS AND HYDRAULICS.

PART I. HYDROSTATICS.

SECTION I.

The Nature and Properties of Fluids, their Preſſure, &c.

HYDROSTATICS is a Science which treats of the *weight*, *motion*, and *equilibria* of liquid bodies. A fluid is a body yielding to any force impreſſed, and which hath its parts very eaſily moved one among another. A perfect fluid is that whoſe parts are put into motion by the leaſt force imaginable; an imperfect fluid is that whoſe parts yield to a ſmall force, not the leaſt. This definition ſuppoſes the motion produced by a partial preſſure; for under a total or an equal preſſure, it would be impoſſible that the yielding body ſhould move. It appears from the beſt experiments and niceſt inveſtigation of fluids, that the original and conſtituent parts are particles ſmall, ſmooth, hard, and ſpherical; every particle being of itſelf a ſolid, or a fixed body; and, when conſidered ſingly, is no fluid, but becomes ſo only by being joined with other particles of the ſame kind. That fluids have vacuities, is evident upon mixing ſalt with water, a certain quantity of which will be diſſolved, and thereby imbibed, without enlarging the dimenſions; alſo a fluid may ſtill receive a certain quantity of other diſſoluble bodies, the particles whereof are adapted to the vacancies remaining, without adding any thing to its bulk, though the abſolute weight of the whole fluid be thereby increaſed. This is demonſtrable, by weighing a phial of rain-water critically, with a nice balance: pour this water into a cup, and add ſalt to it; refund as much of the clear liquor as will again fill the phial; an increaſe of weight will be found under the ſame dimenſions, from a repletion of the vacuities of the freſh water with the ſaline particles; after which it will receive a certain quantity of ſugar; and after that, a certain quantity of alum, and perhaps other diſſoluble bodies, and not increaſe its firſt dimenſion. Sir Iſaac Newton held all matter to be originally homogeneous; and that from the different modifications and texture of it alone, all bodies receive their various ſtructure, compoſition, and form: and, in the beginning of his *Principia*, he ſpeaks of ſand and powders as of imperfect fluids. From his experiments, and thoſe made by others, it is now held that no fluids, (the air excepted) is either compreſſible or elaſtic. It is *alſo* probable that there is not in nature any perfect fluid except elementary fire. The moſt eſſential elementary principles of Hydroſtatics are contained in the following propoſitions.

Prop. I. If one part of a fluid be higher than another, the higher parts will continually deſcend to the lower, and will not be at reſt, till the ſurface thereof is quite level. For the parts of a fluid being moveable every way, if any part is above the reſt it will deſcend by its own gravity as low as poſſible; and afterwards other parts that are then become higher, will deſcend as the other did, till at laſt they will all be reduced to a level or horizontal plane. Hence waters or other fluids that have a communication by means of a channel or pipe will ſettle in the ſame horizontal plane. It follows alſo that if a fluid gravitates towards a centre, it will diſpoſe of itſelf into a ſpherical figure, for its ſurface will be equally diſtant from the centre.

Prop. II. If a fluid be at reſt in a veſſel whoſe baſe is parallel to the horizon, equal parts of the baſe will be equally preſſed by it: for each part ſupports an equal column of the fluid, and all the columns being of equal weight, they muſt preſs the baſe equally; or equal parts of the baſe will ſuſtain an equal preſſure.

Cor. I. Hence all parts of the fluid preſs equally at the ſame depth; for ſuppoſe a plane drawn through the fluid parallel to the horizon, then the preſſure will be the ſame in any part of that plane, which proves the inference.

Cor. II. From this propoſition it alſo follows that the preſſure of a fluid at any depth, is as the depth of the fluid. For the preſſure is as the weight, and the weight is as the height of a column of the fluid.

Prop. III. If a fluid is compreſſed by its weight, or otherwiſe, then at any point it preſſes equally in all manner of directions. This ariſes from the nature of fluidity, which cauſes it to yield to any force in any direction. If it cannot give way to any force applied, it will preſs againſt other parts of the fluid in direction of that force: and the preſſure in all directions will be the ſame; for if one force was leſs, the fluid would move that way till the preſſure became every way equal. Hence in any veſſel containing a fluid, the preſſure is the ſame againſt the bottom, as againſt the ſides, or even upwards, at the ſame depth.

Prop. IV. The preſſure of a fluid upon the baſe of the containing veſſel is as the baſe and perpendicular altitude, whatever be the figure of the veſſel that contains it. For let ABIC, and EGKH, Plate I, *fig.* 1 and 2, be two veſſels, then by Prop. II, Cor. 2. the preſſure upon an inch on the baſe AB = height CD × 1 inch, and the preſſure upon an inch upon the baſe HK = height FH × 1 inch: alſo by Prop. II, equal parts of the baſes are equally preſſed, therefore the preſſure on the baſe AB is CD × number of inches in AB; and the preſſure on the baſe HK is FH × number of inches in HK, that is, the preſſure on AB, on HK, as baſe AB × height CD, to baſe HK × height FH.

Cor. I. Hence if the heights be equal, the preſſures are as the baſes; and if both the heights and baſes are equal, the preſſures in each are equal, though their contents be ever ſo different. For the reaſon that the wider veſſel EK has no greater preſſure at the bottom, is becauſe the oblique ſides EH, and GK, take off part of the weight. And in the narrower veſſel CB, the ſides CA, IB, react againſt the preſſure of the water, which is all alike at the ſame depth; and by this re-action the preſſure is increaſed at the bottom, ſo as to become the ſame every where.

Cor. II. The preſſure againſt the baſe of any veſſel is the ſame as of a cylinder of equal baſe, and height.

Cor. III. If there be a recurve tube ABF (Plate I, *fig.* 3.) in which are two different fluids CD and EF, then their heights in the two legs CD, and EF, will be reciprocally as their ſpecific gravities when they are at reſt. For if the fluid EF be twice or thrice as light as CD, it muſt have twice or thrice the height to have an equal preſſure to counterbalance the other.

Prop. V. If a body of the ſame ſpecific gravity of a fluid be immerſed in the fluid, it will reſt in any place of it. A body of greater denſity will ſink, and one of leſs denſity will ſwim. For let the three bodies be denoted by A, B, and C; the ſpecific gravity of A being lighter than that of the fluid, that of B, equal to the ſpecific gravity of the fluid, and that of C, greater than B. Now the body B, being equal in weight to a like portion of the fluid it will preſs the fluid under it juſt as much as if the ſpace it occupies was filled with the fluid, and conſequently the preſſure will be the very ſame all around it as though the fluid was there, and hence there will be no force to put it out of its place. But if the body be lighter, the preſſure downwards being leſs than before, or than in other places of the fluid at the ſame depth, the leſs force muſt conſequently give way, and the body will riſe to the top. If the body be heavier, the like preſſure being greater than in the former caſes, or greater than in other parts of the fluid, ſuch preſſure will prevail, and ſo the body will deſcend to the bottom of the fluid.

Cor. I. Hence if ſeveral bodies of different ſpecific gravities be immerſed in a fluid higher than they, the heavieſt will deſcend the faſteſt, and get the loweſt.

Cor. II. A body immerſed in a fluid, loſes as much weight, as an equal quantity of the fluid weighs; and the fluid gains it.

Cor. III. All bodies of equal magnitudes loſe equal weights in the ſame fluid; and bodies of different magnitudes loſe weights proportional to the magnitudes.

Cor. IV. The weights loſt in different fluids, by immerſion of the ſame body, are as the ſpecific gravities of the fluids; and bodies of equal weight, loſe weights in the ſame fluid reciprocally as the ſpecific gravities of the bodies.

Cor. V. The weight of a body ſwimming in a fluid is equal to the weight of as much of the fluid as the immerſed part of the body takes up; and hence a body will ſink deeper in a lighter fluid than in a heavier.

Prop. VI. If a fluid runs through a pipe ſo as to leave no vacuities, the velocity of the fluid in different parts of it will be reciprocally as the tranſverſe ſections in theſe parts. Let AC, LB be the ſections at A, and L (*fig.* 4.) and let the part of the fluid ACBL come to the place *acbl*: then will the ſolid ACBL = ſolid *acbl*, and taking away the part *ac*, BL, common to both, we have AC*ca* = LB*bl*. Now in equal ſolids, the baſes and the heights are reciprocally proportional. Likewiſe if D*f* be the axis of the pipe, the heights D*d*, F*f*, paſſed through in equal times, will be as the velocities, and therefore the ſection AC : ſection LB : : velocity along F*f* : velocity along D*d*.

Prop. VII. If AD (*fig.* 5.) is a veſſel of water, or any other fluid, B a hole in the bottom or ſide, then (if the veſſel be always kept full) in the time that a heavy body falls through half the height of the water above the hole AB, a cylinder of water will flow out of the hole, whoſe height is AB, and baſe the area of the hole. For the preſſure of the water againſt the hole B, by which the motion is generated, is equal to the height of a column of water, whoſe height is AB, and baſe the area B, by Cor. II. Prop. IV. But equal forces generate equal motions; and ſince a cylinder of water falling through half AB, acquires by its gravity ſuch a motion as would carry it through the whole height AB in that time, therefore in that time the water running out muſt acquire the ſame motion: and that the effluent water may have the ſame motion, a cylinder muſt run out, whoſe length is AB; and then the ſpace deſcribed by the water in that time will alſo be AB, for that ſpace is the length of the cylinder run out. Therefore this is the quantity run out in that time.

Cor. I. The quantity run out in any time is equal to a cylinder or priſm, whoſe length is the ſpace deſcribed in that time with the velocity acquired, by falling through half the height, and whoſe baſe is the hole.

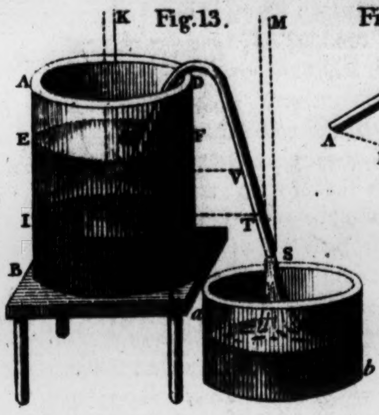
Cor. II. The velocity a little without the hole is greater than in the hole, and is nearly equal to the velocity of a body falling through the whole height AB. For without the hole the ſtream is contracted by the waters converging from all ſides to the centre of the hole. And this makes the velocity greater by about the ratio of 1 to $\sqrt{2}$.

Cor. III. The water ſpouts out with the ſame velocity, whether it be downwards or ſideways, or upwards; and therefore if it be upwards it aſcends nearly to the height of the water above the hole.

Cor. IV. The velocities, and likewiſe the quantities of ſpouting water at different depths, will be as the ſquare roots of the depths.

Elementary Principles of Hydrostatics, with various Hydraulic Engines, as Syphons, Pumps &c. See the System of Hydrostatics & Hydraulics.

Fig.13.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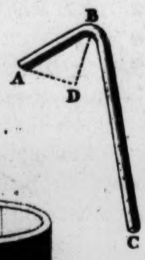

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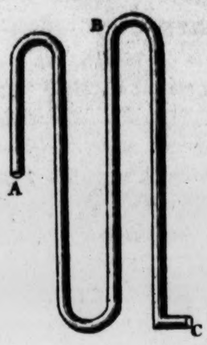


Fig.15.

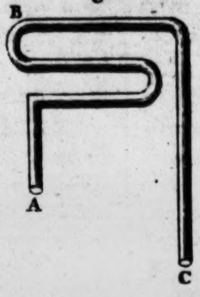
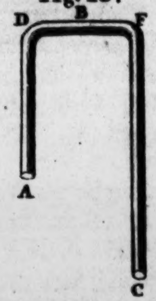


Fig.16.



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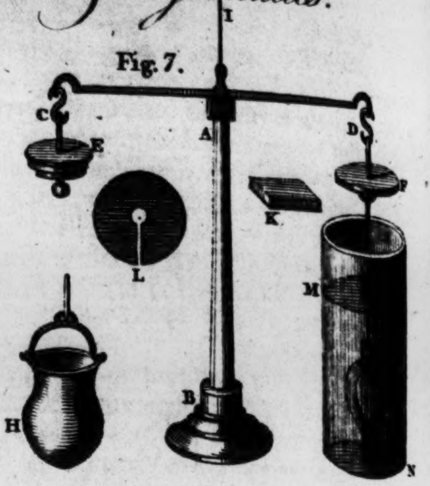
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Fig.10.

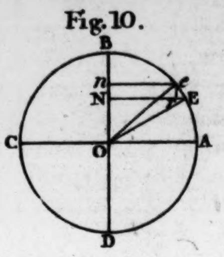

Fig.4.

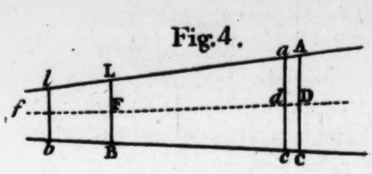
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Fig.9.

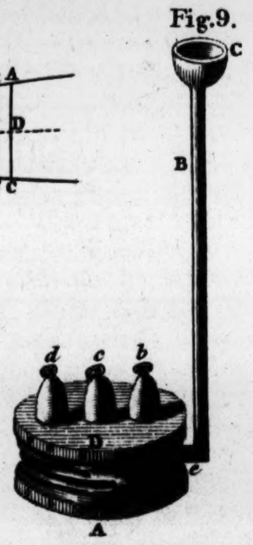


Fig.5.

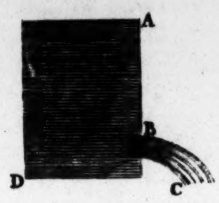
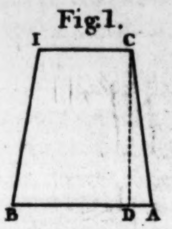


Fig.1.



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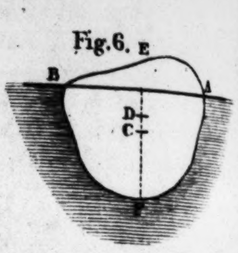


Fig.2.

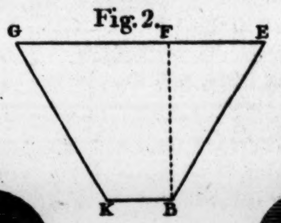
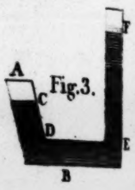


Fig.3.



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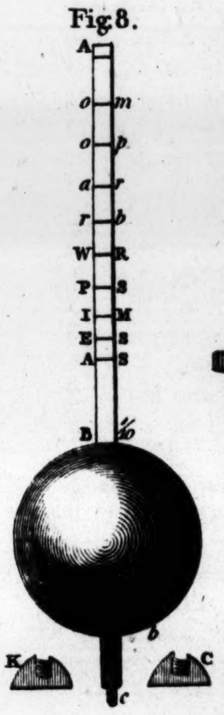
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Fig. 20.

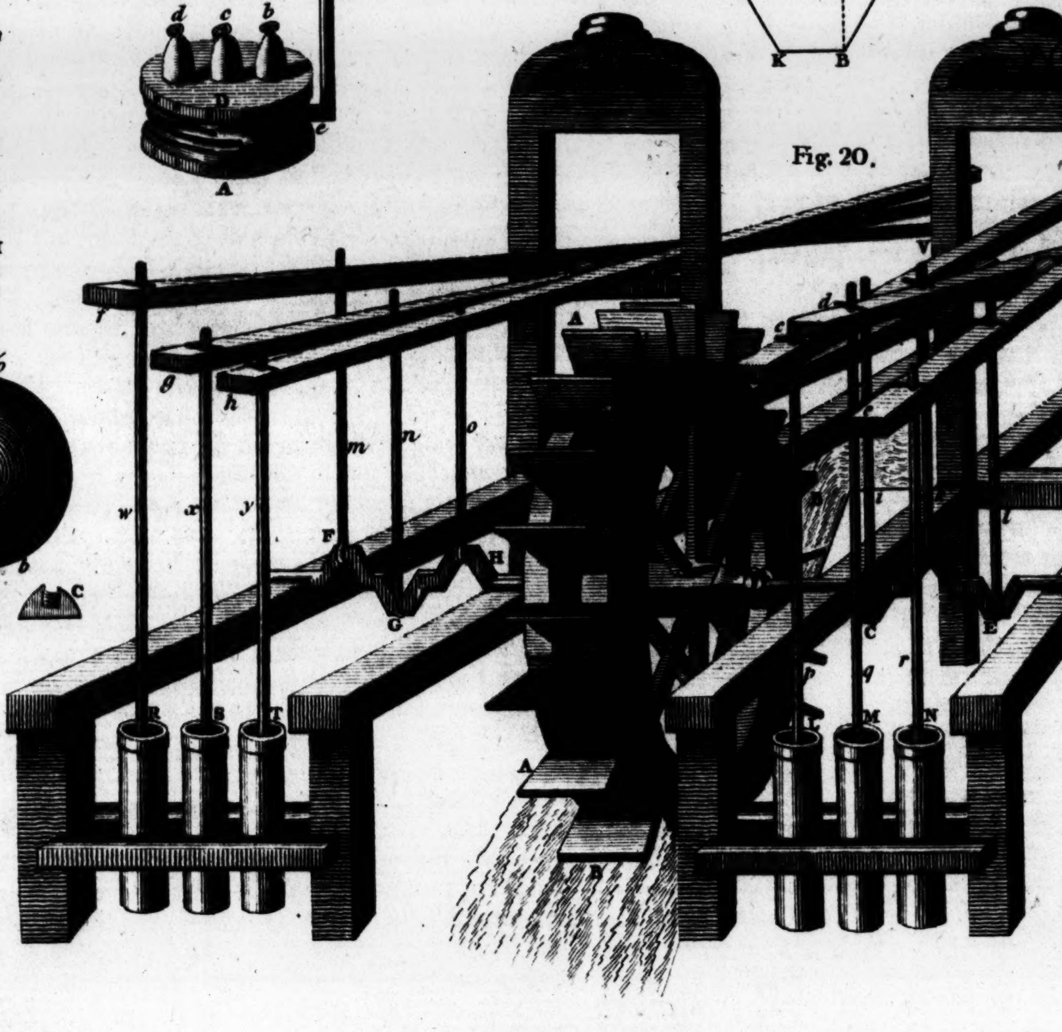
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Fig.11.

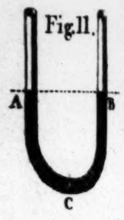
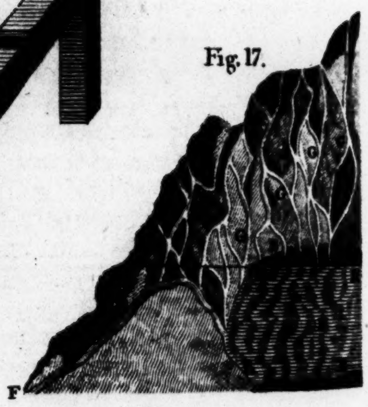


Fig.17.



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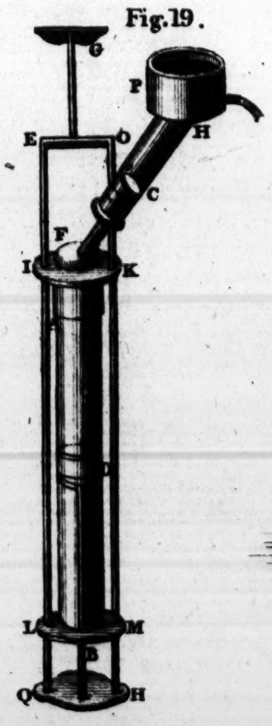
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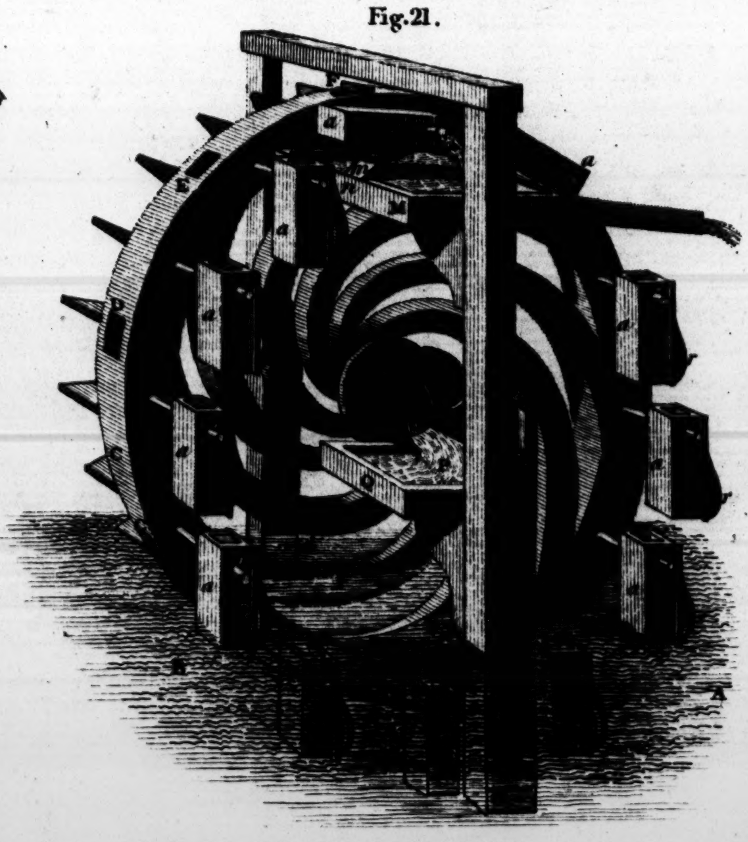
Fig.21.



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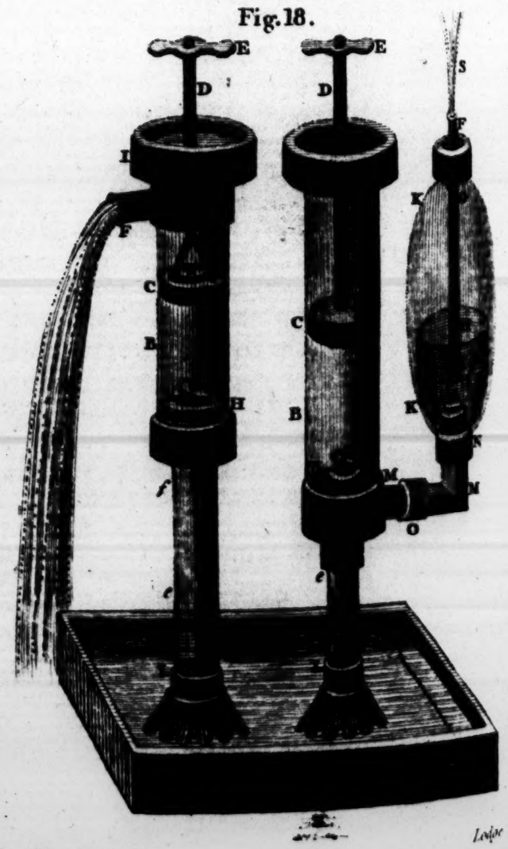
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Lodge sculp.

SYSTEM OF HYDROSTATICS AND HYDRAULICS.

PART I. HYDROSTATICS.

SECTION I.

The Nature and Properties of Fluids, their Preſſure, &c.

HYDROSTATICS is a Science which treats of the *weight*, *motion*, and *equilibria* of liquid bodies. A fluid is a body yielding to any force impreſſed, and which hath its parts very eaſily moved one among another. A perfect fluid is that whoſe parts are put into motion by the leaſt force imaginable; an imperfect fluid is that whoſe parts yield to a ſmall force, not the leaſt. This definition ſuppoſes the motion produced by a partial preſſure; for under a total or an equal preſſure, it would be impoſſible that the yielding body ſhould move. It appears from the beſt experiments and niceſt inveſtigation of fluids, that the original and conſtituent parts are particles ſmall, ſmooth, hard, and ſpherical; every particle being of itſelf a ſolid, or a fixed body; and, when conſidered ſingly, is no fluid, but becomes ſo only by being joined with other particles of the ſame kind. That fluids have vacuities, is evident upon mixing ſalt with water, a certain quantity of which will be diſſolved, and thereby imbibed, without enlarging the dimenſions; alſo a fluid may ſtill receive a certain quantity of other diſſoluble bodies, the particles whereof are adapted to the vacancies remaining, without adding any thing to its bulk, though the abſolute weight of the whole fluid be thereby increaſed. This is demonſtrable, by weighing a phial of rain-water critically, with a nice balance: pour this water into a cup, and add ſalt to it; refund as much of the clear liquor as will again fill the phial; an increaſe of weight will be found under the ſame dimenſions, from a repletion of the vacuities of the freſh water with the ſaline particles; after which it will receive a certain quantity of ſugar; and after that, a certain quantity of alum, and perhaps other diſſoluble bodies, and not increaſe its firſt dimenſion. Sir Iſaac Newton held all matter to be originally homogeneous; and that from the different modifications and texture of it alone, all bodies receive their various ſtructure, compoſition, and form: and, in the beginning of his *Principia*, he ſpeaks of ſand and powders as of imperfect fluids. From his experiments, and thoſe made by others, it is now held that no fluids, (the air excepted) is either compreſſible or elaſtic. It is *alſo* probable that there is not in nature any perfect fluid except elementary fire. The moſt eſſential elementary principles of Hydroſtatics are contained in the following propoſitions.

Prop. I. If one part of a fluid be higher than another, the higher parts will continually deſcend to the lower, and will not be at reſt, till the ſurface thereof is quite level. For the parts of a fluid being moveable every way, if any part is above the reſt it will deſcend by its own gravity as low as poſſible; and afterwards other parts that are then become higher, will deſcend as the other did, till at laſt they will all be reduced to a level or horizontal plane. Hence waters or other fluids that have a communication by means of a channel or pipe will ſettle in the ſame horizontal plane. It follows alſo that if a fluid gravitates towards a centre, it will diſpoſe of itſelf into a ſpherical figure, for its ſurface will be equally diſtant from the centre.

Prop. II. If a fluid be at reſt in a veſſel whoſe baſe is parallel to the horizon, equal parts of the baſe will be equally preſſed by it: for each part ſupports an equal column of the fluid, and all the columns being of equal weight, they muſt preſs the baſe equally; or equal parts of the baſe will ſuſtain an equal preſſure.

Cor. I. Hence all parts of the fluid preſs equally at the ſame depth; for ſuppoſe a plane drawn through the fluid parallel to the horizon, then the preſſure will be the ſame in any part of that plane, which proves the inference.

Cor. II. From this propoſition it alſo follows that the preſſure of a fluid at any depth, is as the depth of the fluid. For the preſſure is as the weight, and the weight is as the height of a column of the fluid.

Prop. III. If a fluid is compreſſed by its weight, or otherwiſe, then at any point it preſſes equally in all manner of directions. This ariſes from the nature of fluidity, which cauſes it to yield to any force in any direction. If it cannot give way to any force applied, it will preſs againſt other parts of the fluid in direction of that force: and the preſſure in all directions will be the ſame; for if one force was leſs, the fluid would move that way till the preſſure became every way equal. Hence in any veſſel containing a fluid, the preſſure is the ſame againſt the bottom, as againſt the ſides, or even upwards, at the ſame depth.

Prop. IV. The preſſure of a fluid upon the baſe of the containing veſſel is as the baſe and perpendicular altitude, whatever be the figure of the veſſel that contains it. For let ABIC, and EGKH, Plate I, *fig.* 1 and 2, be two veſſels, then by Prop. II, Cor. 2. the preſſure upon an inch on the baſe AB = height CD × 1 inch, and the preſſure upon an inch upon the baſe HK = height FH × 1 inch: alſo by Prop. II, equal parts of the baſes are equally preſſed, therefore the preſſure on the baſe AB is CD × number of inches in AB; and the preſſure on the baſe HK is FH × number of inches in HK, that is, the preſſure on AB, on HK, as baſe AB × height CD, to baſe HK × height FH.

Cor. I. Hence if the heights be equal, the preſſures are as the baſes; and if both the heights and baſes are equal, the preſſures in each are equal, though their contents be ever ſo different. For the reaſon that the wider veſſel EK has no greater preſſure at the bottom, is becauſe the oblique ſides EH, and GK, take off part of the weight. And in the narrower veſſel CB, the ſides CA, IB, re-act againſt the preſſure of the water, which is all alike at the ſame depth; and by this re-action the preſſure is increaſed at the bottom, ſo as to become the ſame every where.

Cor. II. The preſſure againſt the baſe of any veſſel is the ſame as of a cylinder of equal baſe, and height.

Cor. III. If there be a recurve tube ABF (Plate I, *fig.* 3.) in which are two different fluids CD and EF, then their heights in the two legs CD, and EF, will be reciprocally as their ſpecific gravities when they are at reſt. For if the fluid EF be twice or thrice as light as CD, it muſt have twice or thrice the height to have an equal preſſure to counterbalance the other.

Prop. V. If a body of the ſame ſpecific gravity of a fluid be immerſed in the fluid, it will reſt in any place of it. A body of greater denſity will ſink, and one of leſs denſity will ſwim. For let the three bodies be denoted by A, B, and C; the ſpecific gravity of A being lighter than that of the fluid, that of B, equal to the ſpecific gravity of the fluid, and that of C, greater than B. Now the body B, being equal in weight to a like portion of the fluid it will preſs the fluid under it juſt as much as if the ſpace it occupies was filled with the fluid, and conſequently the preſſure will be the very ſame all around it as though the fluid was there, and hence there will be no force to put it out of its place. But if the body be lighter, the preſſure downwards being leſs than before, or than in other places of the fluid at the ſame depth, the leſs force muſt conſequently give way, and the body will riſe to the top. If the body be heavier, the like preſſure being greater than in the former caſes, or greater than in other parts of the fluid, ſuch preſſure will prevail, and ſo the body will deſcend to the bottom of the fluid.

Cor. I. Hence if ſeveral bodies of different ſpecific gravities be immerſed in a fluid higher than they, the heavieſt will deſcend the faſteſt, and get the loweſt.

Cor. II. A body immerſed in a fluid, loſes as much weight, as an equal quantity of the fluid weighs; and the fluid gains it.

Cor. III. All bodies of equal magnitudes loſe equal weights in the ſame fluid; and bodies of different magnitudes loſe weights proportional to the magnitudes.

Cor. IV. The weights loſt in different fluids, by immerſion of the ſame body, are as the ſpecific gravities of the fluids; and bodies of equal weight, loſe weights in the ſame fluid reciprocally as the ſpecific gravities of the bodies.

Cor. V. The weight of a body ſwimming in a fluid is equal to the weight of as much of the fluid as the immerſed part of the body takes up; and hence a body will ſink deeper in a lighter fluid than in a heavier.

Prop. VI. If a fluid runs through a pipe ſo as to leave no vacuities, the velocity of the fluid in different parts of it will be reciprocally as the tranſverſe ſections in theſe parts. Let AC, LB be the ſections at A, and L (*fig.* 4.) and let the part of the fluid ACBL come to the place *acbl*: then will the ſolid ACBL = ſolid *acbl*, and taking away the part *ac*, BL, common to both, we have AC*ca* = LB*bl*. Now in equal ſolids, the baſes and the heights are reciprocally proportional. Likewiſe if D*f* be the axis of the pipe, the heights D*d*, F*f*, paſſed through in equal times, will be as the velocities, and therefore the ſection AC : ſection LB : : velocity along F*f* : velocity along D*d*.

Prop. VII. If AD (*fig.* 5.) is a veſſel of water, or any other fluid, B a hole in the bottom or ſide, then (if the veſſel be always kept full) in the time that a heavy body falls through half the height of the water above the hole AB, a cylinder of water will flow out of the hole, whoſe height is AB, and baſe the area of the hole. For the preſſure of the water againſt the hole B, by which the motion is generated, is equal to the height of a column of water, whoſe height is AB, and baſe the area B, by Cor. II. Prop. IV. But equal forces generate equal motions; and ſince a cylinder of water falling through half AB, acquires by its gravity ſuch a motion as would carry it through the whole height AB in that time, therefore in that time the water running out muſt acquire the ſame motion: and that the effluent water may have the ſame motion, a cylinder muſt run out, whoſe length is AB; and then the ſpace deſcribed by the water in that time will alſo be AB, for that ſpace is the length of the cylinder run out. Therefore this is the quantity run out in that time.

Cor. I. The quantity run out in any time is equal to a cylinder or priſm, whoſe length is the ſpace deſcribed in that time with the velocity acquired, by falling through half the height, and whoſe baſe is the hole.

Cor. II. The velocity a little without the hole is greater than in the hole, and is nearly equal to the velocity of a body falling through the whole height AB. For without the hole the ſtream is contracted by the waters converging from all ſides to the centre of the hole. And this makes the velocity greater by about the ratio of 1 to $\sqrt{2}$.

Cor. III. The water ſpouts out with the ſame velocity, whether it be downwards or ſideways, or upwards; and therefore if it be upwards it aſcends nearly to the height of the water above the hole.

Cor. IV. The velocities, and likewiſe the quantities of ſpouting ing water at different depths, will be as the ſquare roots of the depths.

Prop. VIII. If a floating body AFBE (*fig.* 6.) or ſyſtem of bodies, be at reſt in a fluid, and D be the centre of gravity of the whole body, and C the centre of gravity of the fluid AFB, equal to the immerſed part of the body, then will the line CD be perpendicular to the horizon. For C being the centre of gravity of the fluid AFB, it is the centre of all the forces or weights of the parts of the water in AFB, tending downwards, but becauſe the body is at reſt, the ſame point C is alſo the centre of all the preſſures of the fluid underneath tending upwards, by which the weight of the fluid AFB or of the body AFBE, which is equal to it, is ſuſtained; therefore the ſum of all the forces tending upwards to C, is equal, and contrary to the ſum of all the forces tending downwards from D, becauſe that preſſure ſuſtains the body. But the weight of the body tending from D is perpendicular to the horizon, therefore CD is perpendicular to the horizon.

Cor. If the whole body be as heavy, or heavier than water, and be immerſed in it, the centre of gravity will be the loweſt, and deſcend the foremoſt.

SECT. II.

THE SPECIFIC GRAVITIES OF BODIES.

Prob. To find the Specific Gravities of Bodies.

Case I. *If it be a ſolid heavier than water,* weigh it exactly firſt in air, and then in water, or ſome fluid whoſe ſpecific gravity you know; and let the abſolute weight of the body $= A$, the weight in water, &c. $= B$; the ſpecific gravity of the water, &c. $= C$, and the ſpecific gravity of the body $= D$; then will $D = \frac{A}{A-B}C$, the ſpecific gravity of the body.

Case II. For a ſolid lighter than water. Take a piece of metal and tie it to a piece of the light body, ſo that the compound may ſink in water, and putting ACD, as in Caſe I, and $E =$ weight of metal in water, $F =$ weight of the compound in water; then $D = \frac{AC}{A+E-F}$, the ſpecific gravity of the light body.

Case III. For a fluid. Take a ſolid body of known ſpecific gravity which will ſink in the fluid, and putting the ſame letters as in Caſe I, then will $C = \frac{A-B}{A}D$, the ſpecific gravity of the fluid.

But for murcury, powders, durſt, or ſmall fragments of bodies, you muſt uſe a glaſs or metal bucket, obſerving to ballance its weight both in air and water; and for bodies that will diſſolve in water, weigh them in oil of turpentine inſtead of water. When the body is weighed in the fluid it muſt be ſuſpended by a horſe hair or fine ſilk thread. The hydroſtatic balance however does this with greater eaſe; the deſcription of which inſtrument is as follows:

The Hydroſtatic Balance.—The conſtruction is thus, AB (plate I. *fig.* 7.) is the ſtand and pedeſtal, having at the top two cheeks of ſteel on which the beam CD is ſuſpended, which is like the beam of a pair of ſcales, and muſt play freely and be exactly in equilibrio. To this belong the glaſs bubble G, and the glaſs bucket, H, and four other parts EFIL. To theſe are loops faſtened to hang them by, and the weights of all theſe are ſo adjuſted that $E = F +$ the bubble in water, or $= I +$ the bucket out of water, or $I + L +$ the bucket in water; whence $L =$ difference of the weights of the bucket in and out of water. And if you may alſo have a weight K, ſo that $K +$ bubble in water $=$ bubble out of water or elſe find it in grains. The piece L has a ſlit in it to ſlip it upon the ſhank of I. It is plain the weight $K =$ weight of water as big as the bubble, or a water bubble. Then to find the ſpecific gravity of a ſolid, hang E at one end of the balance, and I and the bucket with the ſolid in it at the other end, and find what weight is a balance to it. Next ſlip L upon I, and immerſe the bucket and ſolid in the water, and find again what weight balances it. Then the firſt weight, divided by the difference of the weights, is the ſpecific gravity of the body; that of water being 1 or unity. To find the ſpecific gravity of fluids, hang E at one end, and F with the bubble at the other, plunge the bubble into the fluid in the veſſel MN. Then find the weight P, which makes a ballance, and the ſpecific gravity of the fluid will be $= \frac{K+P}{K}$, when P is laid on F; or, $= \frac{K-P}{K}$, when P is laid on E.

Cor. I. Hence if a piece of metal or any ſort of matter is offered to know of what kind it is, find its ſpecific gravity as above, which ſeek in the following table, and the neareſt to it gives the name of the body, or ſhews what kind it is of.

Cor. II. To find the ſolid content of a ſmall body heavier than water. Weigh it in air and water, and the difference of the weights reduced to grains, and divided by 256 (the grains in a cubic inch of water) the quotient is the cubic inches it contains.

Cor. III. Hence alſo the ſolidity of a body being known, the weight may be found, and the contrary. Thus put $n = 0.5275$ ounces troy, or 0.5787 ounces averdupois, (the weight of a cubic inch of water) and $D =$ ſpecific gravity of the body, according to the following table. Then as $1 : nD ::$ ſolid content in inches : weight in ounces; and the contrary, for one being given, the other is found by this proportion either direct as it now ſtands; or inverted if the ſolid content is to be found.

N B. Mr. Ward makes a cubic inch of water to weigh .578697 oz. averdupois, or .527458 oz. troy. Some make a cubic foot of water to weigh 76 lb. troy or 62½ averdupois, which is but 254 grains to an inch.—The weight of water being accurately determined, the weight and ſpecific gravities of other bodies will be determined with ſufficient accuracy from the following table, taken from Mr. Emerſon's treatiſe on mechanics.

TABLE of the Specific Gravities or Relative Weights of Bodies.

SOLIDS.

Names.	Relative Denſity.	Names.	Relative Denſity.	Names.	Relative Denſity.
Fine Gold	19.640	Pearl	2.630	Jet	1.238
Standard Gold	18.888	Glaſs	2.600	Coral	1.210
Lead	11.340	Flint	2.570	Ebony	1.177
Fine Silver	11.092	Onyx Stone	2.510	Pitch	1.150
Standard Silver	10.536	Common Stone	2.500	Rozin	1.100
Copper	9.000	Glauber Salt	2.250	Mahogany	1.063
Copper-halfpence	8.915	Cryſtal	2.210	Amber	1.040
Fine Braſs	8.350	Oyſterſhells	2.092	Brazil Wood	1.031
Caſt Braſs	8.100	Brick	2.000	Box Wood	1.030
Steel	7 850	Earth	1.984	Common Water	1.000
Iron	7.644	Nitre	1.900	Bees Wax	.955
Pewter	7.471	Vitriol	1.880	Butter	.940
Tin	7.320	Alabaſter	1.874	Logwood	.913
Caſt Iron	7.300	Horn	1.840	Ice	.908
Lead Oar	6.200	Ivory	1.820	Aſh (dry)	.838
Copper Oar	5.167	Brimſtone	1.800	Plum-tree (dry)	.826
Lapis Calaminaris	5.000	Chalk	1.793	Elm (dry)	.801
Load Stone	4.930	Borax	1.717	Oak (dry)	.800
Crude Antimony	4.000	Alum	1.714	Yew	.760
Diamond	3.517	Clay	1.712	Crab-tree	.700
White Lead	3.160	Drybone	1.660	Beech (dry)	.700
Iſland Cryſtal	2.720	Human Calculus	1.542	Walnut-tree (dry)	.650
Marble	2.707	Sand	1.520	Cedar	.613
Pebble Stone	2.700	Gum Arabic	1.400	Fir	.580
Coral	2.700	Opium	1.350	Cork	.238
Jaſper	2.666	Lignum Vitæ	1.327		
Rock Cryſtal	2.650	Coal	1.250		

FLUIDS.

Names.	Relative Denſity.	Names.	Relative Denſity.	Names.	Relative Denſity.
Quick Silver	14.000	Sack	1.033	Diſtilled Waters	.993
Oil of Vitriol	1.700	Urine	1.032	Red Wine	.990
Oil of Tartar	1.550	Milk	1.031	Linſeed Oil	.932
Honey	1.450	Sea-Water	1 030	Brandy	.927
Spirit of Nitre	1.315	Serum of Human Blood	1.030	Oil Olive	.913
Aqua Fortis	1.300			Spirit of Turpentine	.874
Treacle	1.290	Ale	1.028		
Aqua Regia	1.234	Vinegar	1.026	Spirit of Wine	.866
Spirit of Wine	1.120	Tar	1.015	Oil of Turpentine	.810
Human Blood	1.054	Water	1.000	Common Air	.0012

The uſe of this table illuſtrated by an example, Suppoſe a cubic foot of water weighs 76 troy, and it is required to determine the weight of a like quantity of quickſilver. By the table, I find the relative ſpecific gravities of water and quickſilver are as 1 and 14. Therefore 76 lb. × 14 = 1064 lb. troy, the weight of a cubic foot of quickſilver.

Deſcription of the Hydrometer.

The ſpecific gravity of fluids, eſpecially ſpirits, is determined with the greateſt accuracy by mean of an hydrometer. An hydrometer is an inſtrument which ſerves to meaſure the lightneſs or weight of different fluids. For that liquors weigh very differently from each other is found by experience. The hydrometer (*fig.* 8.) ſhould be made of copper: for ivory imbibes ſpirituous liquors, and thereby alters their gravity; and glaſs requires an attention that is incompatible with expedition. The moſt ſimple hydrometer conſiſts of a copper ball B*b*, to which is ſoldered a braſs wire AB, one quarter of an inch thick. The upper part of this wire being filed flat, is marked ***proof***, at *m*, becauſe it ſinks exactly to that mark in proof-ſpirits. There are two other marks at A and B, to ſhew whether the liquor be one-tenth above or below proof, according as the hydrometer ſinks to A, or emerges to B, when a braſs weight, as C or K, is ſcrewed to its bottom *c*. There are other weights to ſcrew on, which ſhew the ſpecific gravity of different fluids, quite down to common water.

The round part of the wire above the ball may be marked ſo as to repreſent river-water when it ſinks to RW, the weight which anſwers to that water being then ſcrewed on; and when put into ſpring-water, mineral-water, ſea-water, and water of ſalt ſprings, it will gradually riſe to the marks SP, MI, SE, SA. On the contrary, when it is put into Briſtol water, rain-water, port-wine, and mountain-wine, it will ſucceſſively ſink to the marks ***br, ra, po, mo.*** Inſtruments of this kind are ſometimes called ***areometers.*** It muſt however be obſerved that the ſame fluid will alter in its ſpecific gravity according to the variation made in the temperature of the circumambient air; for as the air becomes hotter or colder, the fluid will expand or concentrate itſelf, and ſo its ſpecific gravity will be proportionally leſſened or increaſed; and therefore, in order to determine the ſtrength of ſpirits exactly, the temperature of the air muſt firſt be taken by a thermometer. The Hydrometers uſed by the revenue officers, have a variety of weights ſuited to all temperatures, whereby they can at all times determine the ſtrength of ſpirits with the greateſt accuracy. For the deſcription of the Thermometer, ſee Syſtem of Pneumatics.

Proof-ſpirit conſiſts of half water and half pure ſpirit, that is, ſuch as, when poured on gun-powder, and ſet on fire, will burn all away; and permits the powder to take fire and flaſh, as in open air. But if the ſpirit he not ſo higly rectified, there will remain ſome water, which will make the powder wet, and unfit to take fire. Proof-ſpirit of any kind weighs ſeven pounds twelve ounces per gallon. The common method of ſhaking the ſpirits in a phial, and raiſing a head of bubbles, to judge by their manner of riſing or breaking whether the ſpirit be proof, or near it, is very fallacious. There is no way ſo certain, and at the ſame time ſo eaſy and expeditious, as this by the hydrometer.

Deſcription of the Hydroſtatic Bellows.

The Hydroſtatic Bellows, *fig.* 9. is a machine for demonſtrating the upper preſſure of fluids, conſiſting of two thick oval boards A, each about ſixteen inches broad, and eighteen inches long, covered with leather to open and ſhut like a common bellows, but without valves, only a pipe B, about three feet high, is fixed into the bellows at *e*; let water be poured into the pipe at C, which will run into the bellows, and ſeparate the boards a little. Then lay three weights, *b*, *c*, *d*, each weighing an hundred pounds, upon the upper board; and pour more water into the pipe B, which will run into the bellows, and raiſe up the board D with all the weights upon it, and if the pipe be kept full until the weights are raiſed as high as the leather which covers the bellows will allow, the water will remain in the pipe and ſupport all the weights upon it, even though it ſhould weigh no more than a quarter of a pound, and theſe three hundred pounds; nor will all their force be able to cauſe them to deſcend, and force the water out of the top of the pipe. The reaſon of this will appear, if we conſider that if a hole be made in the upper board, and a tube be put into it, the water will riſe in the tube to the ſame height as it riſes in the pipe, and would riſe as high by ſupplying the pipe in as many tubes as the board could contain holes. Now, ſuppoſe only one hole to be made in any part of the board of an equal diameter, with the bore of the pipe B, and that the pipe holds juſt a quarter of a pound of water; if a perſon puts his finger upon the hole, and the pipe be filled with water, he will find his finger to be preſſed up, and with a force equal to that of a quarter of a pound. As the ſame preſſure is equal upon all equal parts of the board, each part, whoſe area is equal to the area of the whole, will be puſhed upwards with a force equal to that of a quarter of a pound: the ſum of all which preſſures againſt the under ſide of an oval board, ſixteen inches broad and eighteen inches long, will amount to three hundred pounds; and therefore ſo much weight will be raiſed up and ſupported by a quarter of a pound of water in the pipe. Hence if a man ſtands upon the upper board, and blows into the bellows through the pipe B, he will raiſe himſelf upon the board, and the ſmaller the bore of the pipe is the eaſier he will be able to raiſe himſelf; and then by putting his finger upon the top of the pipe, he can ſupport himſelf as long as he pleaſes, provided that the bellows be air tight.

SECT. III. THE RESISTANCE OF FLUIDS.

Prop. I. The reſiſtance any body meets with in moving through a fluid, is as the ſquare of the velocity; for the reſiſtance of *fluids* is as the number of particles ſtruck, and the velocity with which one particle is ſtruck. But the number of particles ſtruck in any time is as the velocity of the body. Therefore the whole reſiſtance is as the ſquare of the velocity.

Cor. I. If a ſtream of water whoſe diameter is given, ſtrike againſt an obſtacle at reſt, the force againſt it will be as the ſquare of the velocity of the ſtream.

Cor. II. The reſiſtance of ſimilar bodies moving in any fluids are as the ſquares of their diameters, the ſquare of their velocities, and the denſities of the fluids.

Prop. II. The force of a ſtream of water againſt the plane of any obſtacle at reſt, is equal to the weight of a column of water, whoſe baſe is the ſection of the ſtream, and height the ſpace deſcended through by a falling body to acquire that velocity. For let there be a reſervoir whoſe height is equal to the ſpace ſo fallen through; Then the water (by Cor. II. Prop. VI. Sect. I.) flowing out of the reſervatory, has the ſame motion as the ſtream; but this is generated by the weight of that column of water, which is the force producing it; and that ſame motion is deſtroyed by the obſtacle, therefore the force againſt is the very ſame, for there is required as much force to deſtroy as to generate any motion.

Prop. III. In any pipe whoſe ſection is ABCD, (plate I. *fig.* 10.) the ſtreſs or force to ſplit any part of the pipe at B is equal to half the preſſure of the fluid upon the plane BD, drawn perpendicular to the curve in B, and of the ſame length as that part of the pipe. Let E*e* be any ſmall part of the ſurface; draw EO perpendicular to the curve E*e*. Draw EN and *en* perpendicular to BO, and *er* perpendicular to EN: and let OE repreſent the preſſure of a particle of the fluid; then $EO \times Ee =$ preſſure upon E*e*. The force OE may be divided into the two ON, NE, of which ON tends only to ſplit the tube at A, but that in direction NE is the force to ſeparate the parts at B. Therefore $EN \times Ee$ is the ſtreſs at B. But the triangles E*er*, EON, are ſimilar, and $Ee \times EN = EO \times er$, or $Eo \times Nn$, that is = the preſſure upon the plane N*n*. Conſequently the ſtreſs ariſing from the preſſure on BA = preſſure on BO. And the ſtreſs at D by the preſſure on AD = preſſure on OD. We alſo ſuppoſe the ſame forces acting in the ſemicircle BCD, but theſe ſerve only to keep the forces acting upon BAD in equilibrio.

Cor. I. The ſtreſs on any part of a pipe full of water is as the diameter of the pipe, and the perpendicular height of the water above that place; conſequently the thickneſs of the metal ought to be in that ratio.

Cor. II. In any concave ſurface, caſk or veſſel, generated by revolving round an axis, and filled with a fluid, the ſtreſs as to ſplitting is equal to half the preſſure upon the plane paſſing through the axis: and the ſtreſs on both ſides at B and D, equal to the whole preſſure on that plane.

Prop. IV. The centre of reſiſtance of any plane moving directly forward in a fluid, is the ſame as the centre of gravity.

Definition. The centre of reſiſtance is that point to which if a contrary force be applied, it ſhall juſt ſuſtain the reſiſtance. Now the reſiſtance is equal upon all equal parts of the plane, and therefore the reſiſtance acts upon the plane, after the ſame manner, and with the ſame forces as gravity does; conſequently the centre of both the reſiſtance and gravity muſt be the ſame.

Cor. I. In any body moving through a fluid, the line of direction of its motion will paſs through the centre of reſiſtance, and centre of gravity of the body. For if it do not, the forces ariſing from the weight and reſiſtance will not balance one another, which will cauſe the body to librate, or oſcillate in the fluid, till by degrees the ſituation of theſe two centres will fall into the line of their motion.

Prop. V. If a ſtream of any fluid, as water, flows directly againſt any plane ſurface, its force againſt that plane is equal to the weight of a column of the fluid, whoſe baſe is the ſection of the ſtream, and its length twice the height, that a falling body muſt deſcend to acquire the velocity of the fluid. Let $s = 16\frac{1}{12}$ feet, the height deſcended by a falling body in 1 ſecond, $v =$ velocity of the fluid, or ſpace it deſcribes in 1 ſecond, B = baſe of the cylinder, or column of water. Then $2s =$ velocity generated by gravity in falling through s, therefore by the laws of falling bodies $4ss : s :: vv : \frac{vv}{4s} =$ height fallen to gain the velocity v; and $\frac{vv}{2s} =$ twice that height. Now the motion which the cylinder's weight will gain in 1 ſecond is $2s \times \frac{vv}{2s} B$, or vvB, the motion being as the body × by the velocity. Alſo the force of the fluid againſt the plane is equal to the reſiſtance of the plane: and the motion deſtroyed in 1 ſecond by the reſiſtance of the plane is $v \times Bv$, or vvB, which was alſo the motion generated by the weight of the cylinder $\frac{vv}{2s} B$, in the ſame time. But equal forces in the ſame time generate or deſtroy equal motions. Therefore the weight of the cylinder $\frac{vv}{2s} B =$ force of the fluid againſt the plane.

PART II. HYDRAULICS.

Hydraulics, as has been obſerved in the alphabet, is that part of Statics, which conſiders the motion of fluids in the raiſing and conveying water; making artificial water-works, water-engines, &c.

Art. I. *How Water may be conveyed over Hills and Vallies.*

Fluids by their preſſure may be conveyed over hills and vallies in bended pipes, to any height not greater than the level of the ſprings from whence they flow. This is what the ancients were ignorant of; and therefore they uſually built Aqueducts (vaſt rows of arches one above another, between two hills, at a vaſt expence of money, time, and labour,) in order to convey water over them, acroſs the valley, in a common channel. This is now done to equal advantage, and at much leſs expence, by a range of pipes laid down one hill and up the other. An inſtance whereof may be given by a bent tube or crane; into one of the equal legs whereof if water be poured, it will riſe to the ſame level exactly in the other. The reaſon is obvious: In the leg A, (*fig.* 11.) there are, ſuppoſe, two ounces of water endeavouring by the power of gravity to deſcend with the force of 2; theſe will thruſt forward, buoy up, and ſupport an equal quantity of a like fluid in B; and the bottom of the machine C, againſt which both ſides equally bear, will of conſequence ſuſtain a double preſſure, or that of four ounces: and in the preſent caſe will pretty well repreſent the prop or fixed point of a balance-beam; as the equal fluid-columns AC, and BC, may be admitted to denote equal weights, ſuſpended on the balance-arms, counterpoiſing each other. So that the riſe of fluids to their firſt level, thus conſidered, is a caſe truly ſtatical; and all their other motions proceed only from weight added.

Art. II. *The Siphon.*

A crooked tube, one leg or branch whereof is longer than the other; uſed in the raiſing of fluids, emptying of veſſels, and in various hydroſtatical experiments. But the moſt uſeful and celebrated *ſiphon* is that which follows: a crooked tube ABC, *fig.* 12. is provided of ſuch a length, and with ſuch an angle, or ſo bent at the vertex, as that when the orifice A is placed on an horizontal plane, the height of AB may not exceed thirty-two or thirty-three feet. For common uſes a foot or half a foot high ſuffices. If, now, the leſs arm AB be immerged in water, or any other liquid, and the air be ſucked out of it by the aperture C, till the liquor follow; the liquor will continue to flow out of the veſſel, through the tube BC, as long as the aperture A is under the ſurface of the liquor. Note, inſtead of ſucking out the air, the event will be the ſame, if the *ſiphon* be at firſt filled with the fluid, and the aperture C ſtopped with the finger, till the aperture A be immerged. The truth of the phenomenon is known by abundance of experiments; nor is the reaſon of part of it far to ſeek. In ſucking, the air in the tube is rarefied, and the equilibrium deſtroyed: conſequently the water muſt be raiſed into the leſſer leg, AB, by the preponderating preſſure of the atmoſphere. The *ſiphon* being thus filled, the atmoſphere preſſes equally on each extremity thereof, ſo as to ſuſtain an equal quantity of water in each leg; but the air not being able to ſuſtain all the water in the longer leg, and being more than able to ſuſtain that in the ſhorter leg; with the exceſs of force, therefore, it will raiſe new water into the ſhorter leg, and this new water cannot make its way, but by protruding the firſt before it; by this means is the water continually driven out at the longer leg, as it is continually raiſed by the ſhorter. The cauſe of the *ſiphon*'s running may be otherwiſe explained in the following manner; the air which paſſes into the veſſel ABCD, (*fig.* 13.) repreſented by the column KL, ſuſtains the column of water LD in the ſhort leg of the *ſiphon*, preſſing againſt that air with its perpendicular height DF; whilſt the column of air MS preſſing upwards againſt the hole of the long or iſſuing leg DS, which acts according to the height DC, muſt yield and ſuffer the water to run out as long as the leg DS is longer, or rather perpendicularly higher than DG. For ſince K and M are ſuppoſed to be at the top of the atmoſphere, the columns KL and MS are equal in height and preſſure (for the height of L above S is of no account with reſpect to the whole height of the atmoſphere), as long as MS is acted upon by the deſcending water DS, whoſe height is from D to S, (e. g. fifteen inches) an height ſuperior to that of the column DG (e. g. ſeven inches) ſupported by the column of air KL, the column MS muſt yield to the water iſſuing out at S; and however the ſurface of the water EF deſcends, the column KL, by its preſſure, will always overcome the reſiſtance of the column MS, becauſe it has a leſs height of water to ſuſtain than MS has. If the mouth of the iſſuing leg had been at T, the water would hang *in equilibrio*, filling both legs of the *ſiphon*, when the water is come down in the upper veſſel to IHT; becauſe then the two columns of air KL and MS will be acted againſt by an equal height of water in the legs of the *ſiphon*; but if you raiſe the iſſuing end of the *ſiphon* (now ſuppoſed at T) up to the level of *u* V above IH, the water will run back up from V to D, and ſo out at H in the upper veſſel; becauſe then the column MS, having only the height VD to ſuſtain, will be acted againſt with leſs force than the column KL, which is preſſed againſt by the whole height DH ſuperior to VD. Since, therefore, the preſſure of the air is the cauſe of the water being puſhed up into the *ſiphon*, and the difference of its preſſure (as one column is acted againſt by the water in the ſhort leg more weakly than another column of air is acted upon by the water in the long leg) is the cauſe of its running continually from one veſſel into another, when once ſet a-going; it follows, that the bend D of the upper part of the *ſiphon* muſt not be above thirty-two feet higher than the water in the upper veſſel, becauſe the air cannot ſuſtain a column of water, whoſe height exceeds 32 feet. The figure of the *ſiphon* may be varied at pleaſure (ſee *fig.* 14, 15, 16,) provided only the orifice C be below the level of the ſurface of the water to be drawn up; but ſtill the farther it is diſtant from it, the faſter will the fluid be carried off. And if, in the courſe of the flux, the orifice A be drawn out of the fluid, all the liquor in the *ſiphon* will go out at the lower orifice C; that in the leg CB dragging, as it were, that in the ſhorter leg AB after it. If a filled *ſiphon* be ſo diſpoſed, as that both orifices A and C, be in the ſame horizontal line, the fluid will remain pendant in each leg, how unequal ſoever the length of the legs may be. Fluids, therefore, in *ſiphons*, ſeem, as it were, to form one continued body; ſo that the heavier part deſcending like a chain, pulls the lighter after it. Upon the principle of the *ſiphon* depend the experiments of Tantalus's cup, the fountain at command, and the inverted drinking glaſs.

ART. III. THE INVERTED DRINKING GLASS.

If the paper is put dry on the empty glaſs, it will ſink in the air, and fall away even by its own gravity; and if put on wet, it were to be doubted whether a very ſmall weight added thereto would not ſeparate it from the glaſs, ſo inconſiderable would the tenacity of the water be in this caſe. The paper therefore cannot be ſuppoſed to ſupport the incumbent weight of water; and the true cauſe thereof muſt be this: The bottom and ſides of the inverted glaſs-veſſel being rigid, keep off the preſſure of the air from the fluid above, whereas it hath liberty of acceſs and freely acts thereon below; and that it does ſo, will in part appear to an obſerver by the concavity of the paper underneath. Could the air's preſſure in this caſe be any-how admitted through the foot of the veſſel inverted, without doubt the whole column would deſcend together.

Again, ſhould a veſſel be but part filled with water, the ſame effect will follow to a certain degree. For inſtance, ſuppoſe we fill a long glaſs half with water, cover it with paper, and turn it down as before. Six inches ſuppoſe of water, endeavouring to deſcend, will by its weight rarefy the air in the glaſs above it, perhaps a 60th part or more. The denſer air without will then overpoiſe the air rarefied within; and therefore a certain quantity of water, equal to the difference of the two preſſures, will in this caſe be thereby buoyed up and ſupported. But the air within the glaſs being dilated as aforeſaid, the water ſuſpended muſt be expected to hang ſomething below the mouth of it; though not enough, perhaps, to overcome the tenacity of water, and make it all deſcend.

ART. IV. *Intermitting Springs.*

Upon the principle of the ſiphon alſo we may eaſily account for *intermitting* or *reciprocating ſprings.* Let AA, *fig.* 17. be part of a hill, within which there is a cavity BB, and from this cavity a vein or channel running in the direction of BCDE. The rain that falls upon the ſide of the hill will ſink and ſtrain through the ſmall pores and crannies G, G, G, G, and fill the cavity K with water. When the water riſes to the level HHC, the vein BCDE will be filled to C, and the water will run through CDF as through a ſiphon; which running will continue until the cavity be emptied, and then it will ſtop until the cavity be filled again.

ART. V. *Pumps.*

THE pump is at once the moſt common and moſt uſeful of all the hydraulic inſtruments. It was firſt invented by Cteſebes, a mathematician of Alexandria, 120 B. C. When the air's preſſure came afterwards to be known, it was much improved, and it is now brought to a great degree of perfection. Of this machine there are ſimply three kinds, viz. the ſucking, the forcing, and the lifting-pump. By the two laſt water may be raiſed to any height, with adequate apparatus and ſufficient power: by the former it may, by the general preſſure of the atmoſphere on the ſurface of the well-water, be raiſed no more than 33 feet, though in practice it is ſeldom applied to the raiſing it much above 28; becauſe from the variations obſerved on the barometer, it is apprehended that the air may, on certain occaſions, be ſomething lighter than 33 feet of water; and whenever that ſhall happen, for want of the due counterpoiſe, this pump may fail in its performance.

I. *The Common Pump.*

The *common ſucking Pump*, with which we draw water out of wells, is an engine both pneumatic and hydraulic. It conſiſts of a pipe open at both ends, in which is a moveable piſton, bucket, or ſucker, as big as the bore of the pipe in that part wherein it works; and is leathered round, ſo as to fit the bore exactly; and may be moved up and down, without ſuffering any air to come between it and the pipe or pump-barrel.

We ſhall explain the conſtruction of this and the forcing-pump by pictures of glaſs models, in which both the action of the piſtons and motion of the valves are ſeen. Hold the model DCBL, *fig.* 18. upright in the veſſel of water K, the water being deep enough to riſe at leaſt as high as from A to I. The valve *a* on the moveable bucket G, and the valve *b* on the fixed box H, (which box quite fills the bore of the pipe or barrel at H) will each lie cloſe, by its own weight, upon the hole in the bucket and box, until the engine begins to work. The valves are made of braſs, and covered underneath with leather for cloſing the holes the more exactly: and the bucket G is raiſed and depreſſed alternately by the handle E and rod D*d*, the bucket being ſuppoſed at B before the working begins. Take hold of the handle E, and thereby draw up the bucket from B to C, which will make room for the air in the pump all the way below the bucket to dilate itſelf, by which its ſpring is weakened, and then its force is not equivalent to the weight or preſſure of the outward air upon the water in the veſſel K: and therefore, at the firſt ſtroke, the outward air will preſs up the water through the notched foot A, into the lower pipe, about as far as *e*: this will condenſe the rarefied air in the pipe between *e* and C to the ſame ſtate it was in before; and then, as its ſpring within the pipe is equal to the force or preſſure of the outward air, the water will riſe no higher by the firſt ſtroke; and the valve *b*, which was raiſed a little by the dilatation of the air in the pipe, will fall, and ſtop the hole in the box H; and the ſurface of the water will ſtand at *e*. Then depreſs the piſton or bucket from C to B; and as the air in the part B cannot get back again through the valve *b*, it will (as the bucket deſcends) raiſe the valve *a*, and ſo make its way through the upper part of the barrel *d* into the open air. But upon raiſing the bucket G a ſecond time, the air between it and the water in the lower pipe at *a* will be again left at liberty to fill a larger ſpace; and ſo its ſpring being again weakened, the preſſure of the outward air on the water in the veſſel K will force more water up into the lower pipe from *e* to *f*; and when the bucket is at its greateſt height C, the lower valve *b* will fall, and ſtop the hole in the box H as before. At the next ſtroke of the bucket or piſton, the water will riſe through the box H towards B; and then the valve *b*, which was raiſed by it, will fall when the bucket G is at its greateſt height. Upon depreſſing the bucket again, the water cannot be puſhed back through the valve *b*, which keeps cloſe upon the hole whilſt the piſton deſcends. And upon raiſing the piſton again, the outward preſſure of the air will force the water up through H, where it will raiſe the valve, and follow the bucket to C. Upon the next depreſſion of the bucket G, it will go down into the water in the barrel B; and as the water cannot be driven back through the now cloſe valve *b*, it will raiſe the valve *a* as the bucket deſcends, and will be lifted up by the bucket when it is next raiſed. And now, the whole ſpace below the bucket being full, the water above it cannot ſink when it is next depreſſed; but upon its depreſſion, the valve *a* will riſe to let the bucket go down; and when it is quite down, the valve *a* will fall by its weight, and ſtop the hole in the bucket. When the bucket is next raiſed, all the water above it will be lifted up, and begin to run off by the pipe F. And thus, by raiſing and depreſſing the bucket alternately, there is ſtill more water raiſed by it; which getting above the pipe F, into the wide top I, will ſupply the pipe, and make it run with a continued ſtream. So, at every time the bucket is raiſed, the valve *b* riſes, and the valve *a* falls; and at every time the bucket is depreſſed, the valve *b* falls, and *a* riſes. As it is the preſſure of the air or atmoſphere which cauſes the water to riſe and follow the piſton or bucket G as it is drawn up, and ſince a column of water 33 feet high is of equal weight with as thick a column of the atmoſphere from the earth to the very top of the air, therefore, the perpendicular height of the piſton or bucket from the ſurface of the water in the well muſt always be leſs than 33 feet; otherwiſe the water will never get above the bucket. But, when the height is leſs, the preſſure of the atmoſphere will be greater than the weight of the water in the pump, and will therefore raiſe it above the bucker; and when the water has once got above the bucket, it may be lifted thereby to any height, if the rod D be made long enough, and a ſufficient degree of ſtrength be employed to raiſe it with the weight of the water above the bucket.

The force required to work a pump, will be as the height to which the water is raiſed, and as the ſquare of the diameter of the pump-bore in that part where the piſton works. So that, if two pumps be of equal heights, and one of them be twice as wide in the bore as the other, the wideſt will raiſe four times as much water as the narroweſt; and will therefore require four times as much ſtrength to work it. The wideneſs or narrowneſs of the pump, in any other part beſides that in which the piſton works, does not make the pump either more or leſs difficult to work, except what difference may ariſe from the friction of the water in the bore; which is always greater in a narrow bore than in a wide one, becauſe of the greater velocity of the water.

The pump-rod is never raiſed directly by ſuch a handle as E at the top, but by means of a lever, whoſe longer arm (at the end of which the power is applied) generally exceeds the length of the ſhorter arm five or ſix times; and, by that means, it gives five or ſix times as much advantage to the power. Upon theſe principles, it will be eaſy to find the dimenſions of a pump that ſhall work with a given force, and draw water from any given depth.

II. *The Forcing-Pump.*

The *forcing-pump* raiſes water through the box H in the ſame manner as the ſucking-pump does, when the plunger or piſton *g* is lifted up by the rod D *d*. But this plunger has no hole through it, to let the water in the barrel BC get above it, when it is depreſſed to B, and the valve *b* (which roſe by the aſcent of the water through the box H when the plunger *g* was drawn up) falls down and ſtops the hole in H, the moment that the plunger is raiſed to its greateſt height. Therefore, as the water between the plunger *g* and box H can neither get through the plunger upon its deſcent, nor back again into the lower part of the pump L *e*, but has a free paſſage by the cavity around H into the pipe MM, which opens into the air-veſſel KK at P; the water is forced through the pipe MM by the deſcent of the plunger, and driven into the air-veſſel; and in running up through the pipe at P, it opens the valve *a*; which ſhuts at the moment the plunger begins to be raiſed, becauſe the action of the water againſt the under ſide of the valve then ceaſes. The water, being thus forced into the air-veſſel KK by repeated ſtrokes of the plunger, gets above the lower end of the pipe GHI, and then begins to condenſe the air in the veſſel KK. For, as the pipe GH is fixed air-tight into the veſſel below F, and the air has no way to get out of the veſſel but through the mouth of the pipe at I, and cannot get out when the mouth I is covered with water, and is more and more condenſed as the water riſes upon the pipe, the air then begins to act forcibly by its ſpring againſt the ſurface of the water at H: and this action drives the water up through the pipe IHGF, from whence it ſpouts in a jet S to a great height; and is ſupplied by alternately raiſing and depreſſing of the plunger *g*, which conſtantly forces the water that raiſes through the valve H along the pipe MM, into the air-veſſel KK.

The higher that the ſurface of the water H is raiſed in the air veſſel, the leſs ſpace will the air be condenſed into which before filled that veſſel; and therefore the force of its ſpring will be ſo much the ſtronger upon the water, and will drive it with the greater force through the pipe at F: and as the ſpring of the air continues whilſt the plunger *g* is riſing, the ſtream or jet S will be uniform, as long as the action of the plunger continues; and when the valve *b* opens, to let the water follow the plunger upward, the valve *a* ſhuts, to hinder the water, which is forced into the air veſſel, from running back by the pipe MM into the barrel of the pump. If there was no air veſſel to this engine, the pipe GHI would be joined to the pipe MMN at P; and then, the jet S would ſtop every time the plunger is raiſed, and run only when the plunger is depreſſed.

III. *Lifting Pumps.*

There are ſeveral ſorts; the moſt common is conſtructed, (as in *fig.* 19.) AB is the barrel, fixed in the frame KILM; which is alſo fixed immoveable, with the lower part in the water that is to be pumped up. GEQHO is a frame with two ſtrong iron rods, moveable through holes in the upper and lower parts of the pump, IK and LM. In the bottom of this frame is fixed an inverted piſton BD, with its bucket and valve uppermoſt at D. From the top of the barrel there goes off a part KH, either fixed to the barrel, or moveable by a ball and ſocket (as here repreſented at F); but in either caſe ſo very exact and tight, that no water or air can poſſibly get into the barrel, as that would prevent the effect of the pump. In this part, at C, is fixed a valve opening upward.

When the piſton frame is thruſt down into the water, the piſton D will deſcend, and the water beneath it ruſh up through the valve at D, and get above the piſton; where, upon the frame's being lifted up, the piſton will force the water through the valve C, into the ciſtern P, there to run off by the ſpout. It is to be remembered, that this ſort of pump muſt be ſet ſo far in the water, that the piſton may play below its ſurface. It appears by the above deſcription, that this is only a different manner of conſtructing a forcing pump.

By means of forcing-pumps, water may be raiſed to any height above the level of a river or ſpring; and machines may be contrived to work theſe pumps, either by a running ſtream, or a fall of water. An inſtance in each ſort will be ſufficient to ſhew the method.

Art. VI. *A Pump Engine to go by Water.*

Let AA, *fig.* 20. be a wheel, turned by the fall of water BB; and having any number of cranks (ſuppoſe ſix) as C,D,E,F,G,H, on its axis, according to the ſtrength of the fall of water, and the height to which the water is intended to be raiſed by the engine. As the wheel turns round, theſe cranks move the levers, *c*, *d*, *e*, *f*, *g*, *h*, up and down, by the iron rods *i*, *k*, *l*, *m*, *n*, *o*; which alternately raiſe and depreſs the piſtons by the other iron rods *p*, *q*, *r*, *ſ*, *t*, *u*, *w*, *x*, *y*, in 12 pumps; nine whereof, as L, M, N, O, P, Q, R, S, T, appear in the plate; the other three being hid behind the works at V. And as pipes may go from all theſe pumps, to convey the water (drawn up by them to a ſmall height) into a cloſe ciſtern, from which the main pipe proceeds, the water will be forced into this ciſtern by the deſcent of the piſtons. And as each pipe, going from its reſpective pump into the ciſtern, has a valve at its end in the ciſtern, theſe valves will hinder the return of the water by the pipes; and therefore, when the ciſtern is once full, each piſton upon its deſcent will force the water (conveyed into the ciſtern by a former ſtroke) up the main pipe, to the height the engine was intended to raiſe it: which height depends upon the quantity raiſed, and the power that turns the wheel. When the power upon the wheel is leſſened by any defect of the quantity of water turning it, a proportionable number of the pumps may be laid aſide, by diſengaging their rods from the vibrating levers.

This figure is a repreſentation of the engine erected at Blenheim for the duke of Marlborough, by the late ingenious Mr. Alderſea. The water-wheel is 7½ feet in diameter, according to Mr. Switzer's account in his Hydraulics. When ſuch a machine is placed in a ſtream that runs upon a ſmall declivity, the motion of the levers and action of the pumps will be but ſlow; ſince the wheel muſt go once round for each of the pumps. But, when there is a large body of ſlow running water, a cog or ſpur wheel may be placed upon each ſide of the water-wheel AA, upon its axis, to turn a trundle upon each ſide; the cranks being upon the axis of the trundle. And by proportioning the cog-wheels to the trundles, the motion of the pumps may be made quicker, according to the quantity and ſtrength of the water upon the firſt wheel; which may be as great as the workman pleaſes, according to the length and breadth of the float boards or wings of the wheel. In this manner, the engine for raiſing water at London-Bridge is conſtructed, in which the water-wheel is 20 feet diameter, and the floats 14 feet long.

Under the article Steam-*Engine*, the reader will find a particular account of that uſeful invention, with a correct deſcription and plates of it in its improved ſtate.

Art. VII. *The Perſian Wheel.*

This engine, repreſented in *Fig.* 21, raiſes water by means of a ſtream AB, turning a wheel CDE, according to the order of the letters, with buckets *a*, *a*, *a*, *a*, &c. hung upon the wheel by ſtrong pins *b*, *b*, *b*, *b*, &c. fixed in the ſide of the rim: but the wheel muſt be made as high as the water is intended to be raiſed above the level of that part of the ſtream in which the wheel is placed. As the wheel turns, the buckets on the right hand go down into the water, and are thereby filled, and go up full on the left hand, until they come to the top at K, where they ſtrike againſt the end *n* of the fixed trough M, and are thereby overſet, and empty the water into the trough; from which it may be conveyed in pipes to the place which it is deſigned for: and as each bucket gets over the trough, it falls into a perpendicular poſition again, and goes down empty, until it comes to the water at A, where it is filled as before. On each bucket is a ſpring *r*, which, going over the top or crown of the bar *m*, (fixed to the trough M), raiſes the bottom of the bucket above the level of its mouth, and ſo cauſes it to empty all its water into the trough.

Sometimes this wheel is made to raiſe water no higher than its axis; and then, inſtead of buckets hung upon it, its ſpokes, C, *d*, *e*, *f*, *g*, *h*, are made of a bent form, and hollow within; theſe hollows opening into the holes C, D, E, F, in the outſide of the wheel, and alſo into thoſe at O in the box N upon the axis. So that as the holes CD, &c. dip into the water, it runs into them; and as the wheel turns the water riſes in the hollow ſpokes *c d*, &c. and runs out in a ſtream P from the holes at O, and falls into the trough O, from whence it is conveyed by pipes. And this is a very eaſy way of raiſing water, becauſe the engine requires neither men nor horſes to turn it.

ART. VIII. *Fire Engine.*

ENGINES for extinguiſhing fire are either forcing or lifting-pumps; and being made to raiſe water with great velocity, their execution in great meaſure depends upon the length of their levers, and the force wherewith they are wrought. *Fig.* 22. This figure is repreſented as tranſparent and in a different form from thoſe uſually made in order to ſhew more clearly the manner of it's operation. All the Fire Engines now conſtructed diſcharge a continual ſtream.

In doing which it is not to be underſtood that they really throw out more water than do the ſquirting ones of the ſame ſize and dimenſions with themſelves; but that the velocity of the water, and of courſe the friction of all the parts, being leſs violent, the ſtream is more even and manageable, and may be directed hither or thither with greater eaſe and certainty than if it came forth only by fits and ſtarts: the machine, thus improved, is therefore generally better adapted to the purpoſe intended, eſpecially in the beginning of theſe calamitous accidents.

The ſtream is made continual from the ſpring of air confined in a ſtrong metal veſſel CC, in the fire-engine AB, fixed between the two forcing-pumps D and E, wrought with a common double lever FF moving on the centre H. The piſtons in D and E both ſuck and force alternately, and are here repreſented in their different actions; as are alſo the reſpective valves at IK and LM.

The water to ſupply this engine, if there be no opportunity of putting the end of a ſucking pipe, occaſionally to be ſcrewed on, into a moat or canal, which would ſpare much hurry and labour in caſe of fire, is alſo poured into the veſſel AB; and being ſtrained through the wire grate N, is, by the preſſure of the atmoſphere, raiſed through the valves K and M into the barrels of D or E, when either of their forces aſcend; whence again it will be powerfully forced when they deſcend into the air-veſſel CC, through the valves I and L by turns: by the force whereof the common air between the water and the top of the air veſſel O will from time to time be forcibly crowded into leſs room, and much compreſſed; and the air being a body naturally endowed with a ſtrong and lively ſpring, and always endeavouring to dilate itſelf every way alike in ſuch a circumſtance, bears ſtrongly both againſt the ſides of the veſſel wherein it is confined, and the ſurface of the water thus injected; and ſo makes a conſtant regular ſtream to riſe through the metal pipe P into the leather one Q, ſcrewed thereon; which being flexible, may be led about into rooms and entries, as the caſe may require.

Should the air contained in this veſſel be compreſſed into half the ſpace it took up in its natural ſtate, the ſpring thereof will be much about doubled; and as before it equalled and was able to ſuſtain the preſſure of a ſingle atmoſphere, it having now a double force, by the power of that ſpring alone, will throw water into air, of the common degree of denſity, about thirty feet high. And ſhould this compreſſure be ſtill augmented, and the quantity of air which at firſt filled the whole veſſel be reduced into one-third of that ſpace, its ſpring will be then able to reſiſt, and conſequently to raiſe the weight of a treble atmoſphere; in which caſe, it will throw up a jet of water ſixty feet high. And ſhould ſo much water again be forced into the veſſel as to fill three parts of the capacity, it will be able to throw it up about ninety feet high: and wherever the ſervice ſhall require a ſtill greater riſe of water, more water muſt be thruſt into this veſſel; and the air therein being thus driven by main force into a ſtill narrower compaſs, at each exploſion, the gradual reſtitution thereof to its firſt dimenſions is what regularly carries on the ſtream between the ſtrokes, and renders it continual during the operation of the machine. This experiment, in little, may be either made on the lifting or forcing pump, the noſels of which may be left large, on purpoſe for the reception of the ſmall pipe F, reaching nearly to the valve at E, and occaſionally to be ſcrewed in. Between this pipe and the ſides and top of the noſel H, a quantity of air will neceſſarily be lodged, which, when the forcer acts, will be compreſſed at every ſtroke by the riſe of the water; more whereof will be puſhed through E than can immediately get away through the pipe F, which is to be always leſs in diameter than the opening of the valve at E. The degree of which condenſation, and reſtitution to its natural ſtate of denſity, may be obſerved through the glaſs-machines to ſatisfaction.

ART. IX. *Archimedes's Screw, or the Spiral Pump.*

The ſtructure and uſe of this machine for raiſing of water firſt invented by Archimedes, will be fully underſtood by the following deſcription of it. ABCD (*fig.* 23.) is a wheel, which is turned round, according to the order of the letters, by the fall of water EF, which need not be more than three feet. The axle G of the wheel is elevated ſo as to make an angle of about 44° with the horizon; and on the top of that axle is a wheel H, which turns ſuch another wheel I of the ſame number of teeth; the axle K of this laſt wheel being thus paralled to the axle G of the two former wheels. The axle G is cut into a double-threaded *ſcrew* (as in *fig.* 24.) exactly reſembling the *ſcrew* on the axis of the fly of a common jack, which muſt be (what is called) a right-handed *ſcrew*, like the wood *ſcrews*, if the firſt wheel turns in the direction ABCD; but muſt be a left-handed *ſcrew*, if the ſtream turns the wheel the contrary way; and the *ſcrew* on the axle G muſt be cut in a contrary way to that on the axle K, becauſe theſe axles turn in contrary directions. Theſe *ſcrews* muſt be covered cloſe over with boards, like thoſe of a cylindrical caſk; and then they will be ſpiral tubes. Or, they may be made of tubes of ſtiff leather, and wrapt round the axles in ſhallow grooves cut therein, as in *fig.* 25. The lower end of the axle G turns conſtantly in the ſtream that turns the wheel, and the lower ends of the ſpiral tubes are open into the water. So that, as the wheel and axle are turned round, the water riſes in the ſpiral tubes, and runs out at L through the holes M, N, as they come about below the axle. Theſe holes, of which there may be any number, as four or ſix, are in a broad cloſe ring on the top of the axle, into which ring the water is delivered from the upper open ends of the *ſcrew* tubes, and falls into the open box N. The lower end of the axle K turns on a gudgeon, in the water in N; and the ſpiral tubes in that axle take up the water from N, and deliver it into another ſuch box under the top of K; on which there may be ſuch another wheel as I, to turn a third axle by ſuch a wheel upon it. And in this manner water may be raiſed to any given height, when there is a ſtream ſufficient for that purpoſe to act on the broad float-boards of the firſt wheel. Ferguſon's Mechanics, Supplement, p. 22.

ART. X. *The Hydraulic Scoop.*

This machine conſiſts of five pieces of board, forming a ſort of ſcoop, as B, *fig.* 26. The handle C is ſuſpended by a rope faſtened to three poles, placed in a triangle, and tied together at A. The working of this machine conſiſts entirely in balancing the ſcoop that contains the water, and directing it in ſuch a manner that the water may be thrown in any given direction. It is evident that the operation of this machine is ſo very eaſy, that it may rather be conſidered as an agreeable and ſalutary recreation than hard labour. With this machine a man of moderate ſtrength, by two ſtrokes in four ſeconds, can draw half a cubic foot of water, that is, more than four hundred cubic feet in an hour. This machine is frequently uſed by the Dutch in emptying the water from the dikes.

ART. IX. *Dr. Halley's Diving Bell.*

This engine is moſt conveniently made in form of a truncated cone, the ſmalleſt baſe being cloſed, and the larger open. It is to be cloſed with lead, and ſo ſuſpended, that it may ſink full of air, with its open baſis downward, and as near as may be in a ſituation parallel to the horizon, ſo as to cloſe with the ſurface of the water all at once. Under this covercle the *diver* ſitting, ſinks down with the included air, to the depth deſired; and if the cavity of the veſſel can contain a ton of water, a ſingle man may remain a full hour, without much inconvenience, at the depth of five or ſix fathoms. But the lower you go, ſtill the more the included air contracts itſelf, according to the weight of the water that compreſſes it: ſo that at the depth of thirty-three feet the bell becomes half full of water; the preſſure of the incumbent water being then equal to that of the atmoſphere; and at all other depths, the ſpace occupied by the compreſſed air in the upper part of the bell, will be to the under part of its capacity filled with water, as thirty-three feet to the depth of the ſurface of the water in the bell below the common ſurface thereof. And this condenſed air, being taken in with the breath, ſoon inſinuates itſelf into all the cavities of the body, and has no ill effect, provided the bell be permitted to deſcend ſo ſlowly as to allow time for that purpoſe.

One inconvenience that attends it, is found in the ears, within which there are cavities which open only outwards, and that by pores ſo ſmall, as not to give admiſſion even to the air itſelf, unleſs they be dilated and diſtended by a conſiderable force. Hence, on the firſt deſcent of the bell, a preſſure begins to fall on each ear, which, by degrees, grows painful, till the force overwhelming the obſtacle, what conſtringes theſe pores, yields to the preſſure, and letting ſome condenſed air ſlip in, preſently eaſe iſſues. The bell deſcending lower, the pain is renewed, and afterwards it is again eaſed in the ſame manner. But the greateſt inconvenience of this engine is, that the water entering in, contracts the bulk of air into ſo ſmall a compaſs, that it ſoon heats, and becomes unfit for reſpiration: ſo that there is a neceſſity for its being drawn up to recruit it; beſides the uncomfortable abiding of the *diver*, who is almoſt covered with water. To obviate the difficulties of the *diving-bell*, Dr. Halley, to whom we owe the preceding account, contrived ſome farther apparatus, whereby not only to recruit and refreſh the air from time to time, but alſo to keep the water wholly out of it at any depth; which he effected after the following manner. His *diving-bell*, (*fig.* 27.) was of wood, three feet wide at top, five feet at bottom, and eight feet high, containing about ſixty-three cubic feet in its concavity, coated externally with lead ſo heavy, that it would ſink empty: a particular weight being diſtributed about its bottom R, to make it deſcend perpendicularly, and no otherwiſe. In the top was fixed a meniſcus glaſs D, concave downwards, like a window, to let in light from above; with a cock, as at B, to let out the hot air; and a circular ſeat, as at LM, for the *divers* to ſit on: and, below, about a yard under the *bell*, was a ſtage ſuſpended

BRITISH 18 MR 63 MUSEUM

Hydraulic Engines, with various entertaining Experiments;
See System of Hydrostatics & Hydraulics.

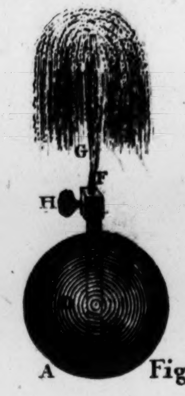


Fig. 37.

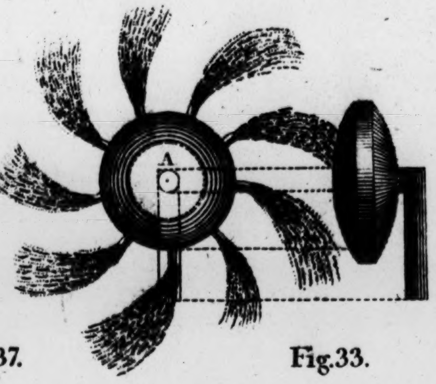


Fig. 33.

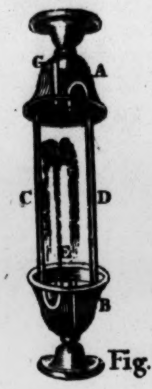
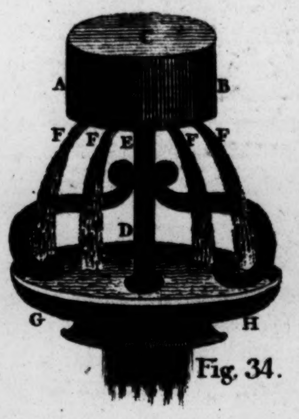


Fig. 28.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B
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Fig. 34.

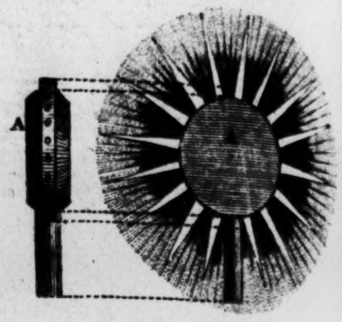


Fig. 32.

Fig. 35.

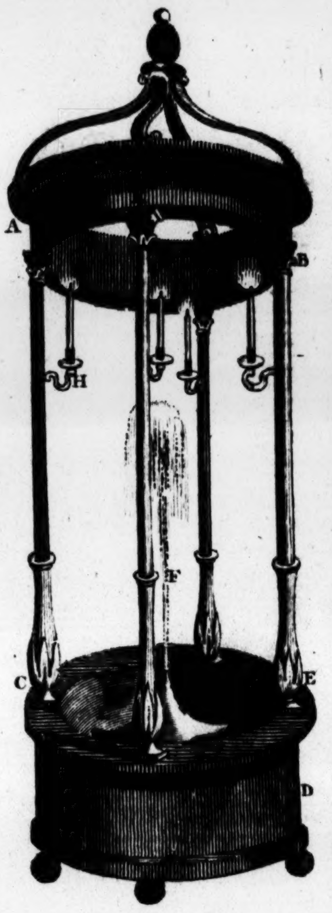


Fig. 27.

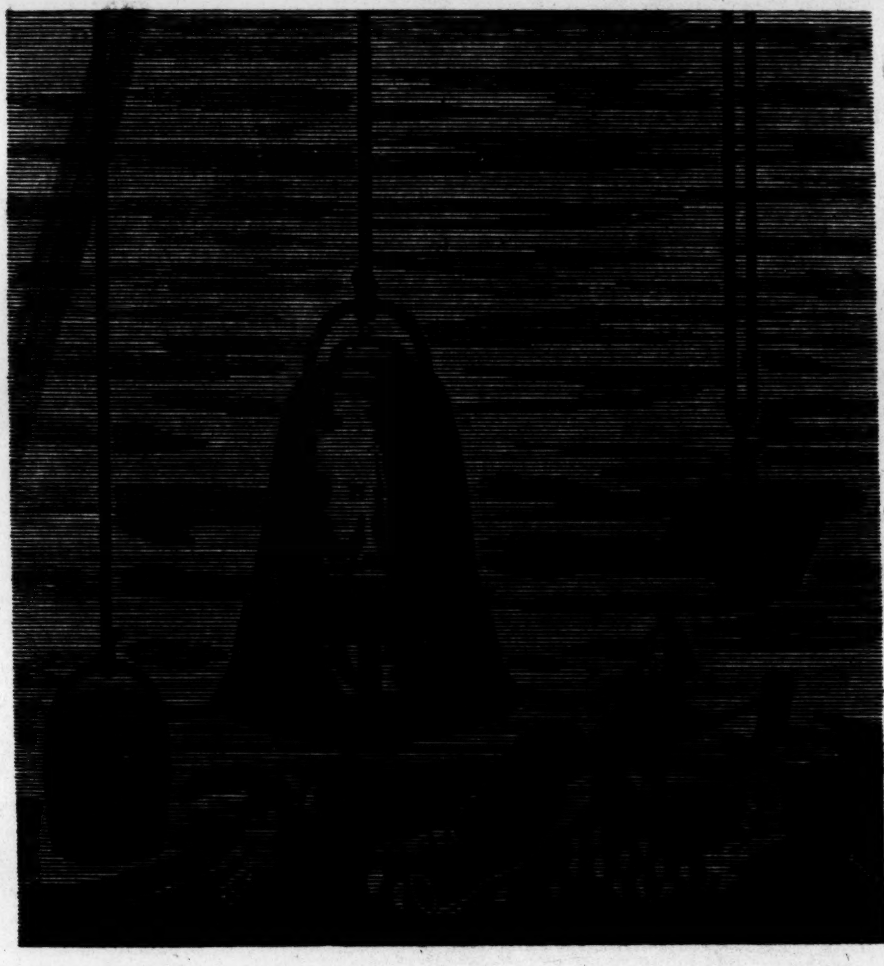
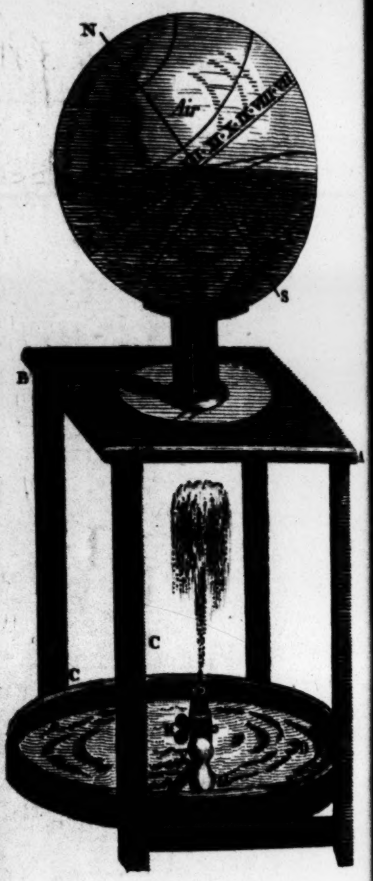
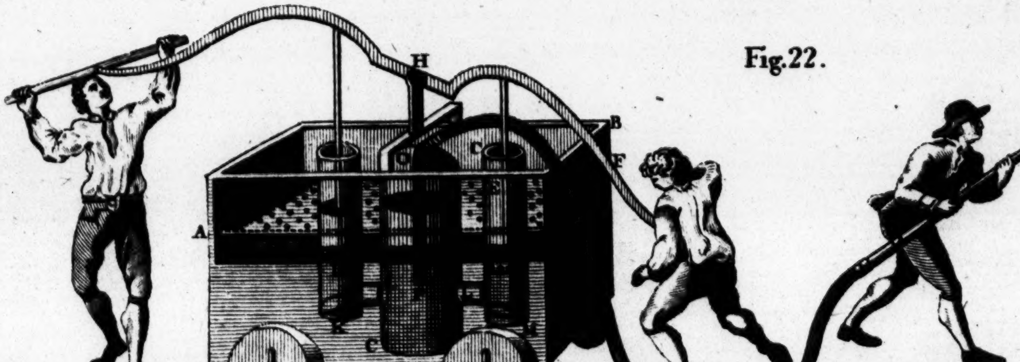


Fig. 36.





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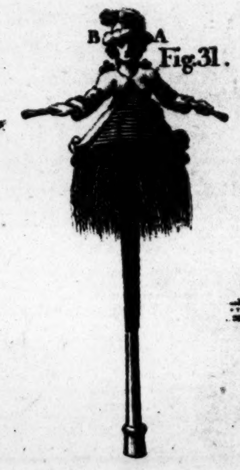


Fig. 31.

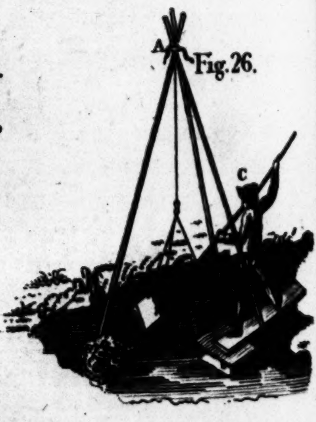
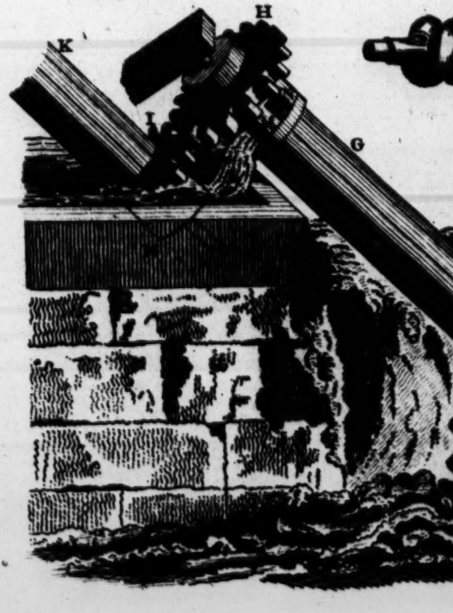


Fig. 26.

Fig. 23.



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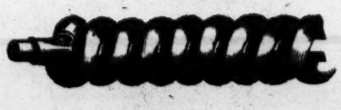

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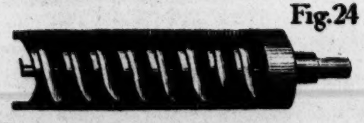
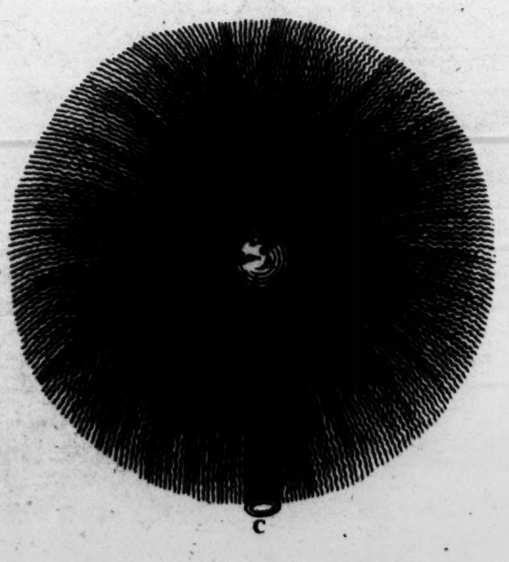


Fig. 30.



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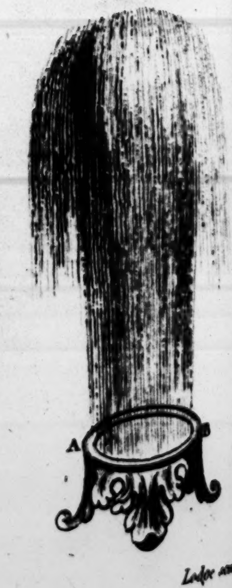

Lodge sculp

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from it by three ropes, each charged with a hundred weight, to keep it ſteady, and for the *divers* to ſtand upon to do their buſineſs. The machine was ſuſpended from the maſt of a ſhip by a ſprit, which was ſecured by ſtays to the maſt-head, and was directed by braces to carry it over-board clear of the ſide of the ſhip, and to bring it in again.

To ſupply air to this *bell* when under water, he had a couple of barrels, as C, holding thirty-ſix gallons each, caſed with lead, ſo as to ſink empty, each having a bung-hole at bottom, to let in the water as they deſcended, and let it out again as they were drawn up again. In the top of the barrels was another hole, to which was fixed a leathern pipe, or hoſe, well prepared with bees-wax and oil, long enough to hang below the bung-hole; being kept down by a weight appended. So that the air driven to the upper part of the barrel by the encroachment of the water, in the deſcent, could not eſcape up this pipe, unleſs the lower end were lifted up.

Theſe air-barrels were fitted with tackle, to make them riſe and fall alternately, like two buckets; being directed in their deſcent by lines faſtened to the under edge of the *bell*; ſo that they came readily to the hand of a man placed on the ſtage to receive them; and who taking up the ends of the pipe as ſoon as they came above the ſurface of the water in the barrels, all the air included in the upper part thereof was blown forcible into the *bell*; the water taking its place. One barrel thus received and emptied; upon a ſignal given, it was drawn up, and at the ſame time the other let down; by which alternate ſucceſſion freſh air was furniſhed ſo plentifully, that the learned doctor himſelf was one of five, who were all together in nine or ten fathoms depth of water for above an hour and a half, without the leaſt inconvenience; the whole cavity of the *bell* being perfectly dry.

All the precaution he obſerved was, to be let down gradually about twelve feet at a time, and then to ſtop, and drive out the water that had entered, by taking in three or four barrels of freſh air, before he deſcended farther. And, being arrived at the depth intended, he let out as much of the hot air that had been breathed, as each barrel would replace with cold, by means of the cock B, at the top of the bell, through whoſe aperture, though very ſmall, the air will ruſh with ſo much violence, as to make the ſurface of the ſea boil. Thus, he found any thing could be done that was required to be done underneath. And by taking off the ſtage, he could, for a ſpace as wide as the circuit of the bell, lay the bottom of the ſea ſo far dry as not to be over-ſhoes therein. Beſides, that by the glaſs window ſo much light was tranſmitted, that, when the ſea was clear, and eſpecially when the ſun ſhone, he could ſee perfectly well to write or read, much more to faſten, or lay hold of any thing under him that was to be taken up. And by the return of the air barrel he often ſent up orders written with an iron pen on a plate of lead, directing how he would be moved from place to place. At other times, when the water was troubled and thick, it would be as dark as night below; but in ſuch caſes he was able to keep a candle burning in the *bell*. Dr. Halley obſerves, that they were ſubject to one inconvenience in this *bell*; they felt at firſt a ſmall pain in their ears, as if the end of a tobacco-pipe were thruſt into them; but after a little while there was a ſmall puff of air, with a little noiſe, and they were eaſy. This he ſuppoſes to be occaſioned by the condenſed air ſhutting up a valve leading from ſome cavity in the ear, full of common air; but when the condenſed air preſſed harder, it forced the valve to yield, and filled every cavity. One of the *divers*, in order to prevent this preſſure, ſtopped his ear with a pledget of paper; which was puſhed in ſo far, that a ſurgeon could not extract it without great difficulty.

The ſame author intimates, that by an additional contrivance he has found it practicable for a *diver* to go out of the *bell* to a good diſtance from it; the air being conveyed to him in a continued ſtream by ſmall flexible pipes, which ſerve him as a clue to direct him back again to the *bell*. For this purpoſe, one end of one of theſe pipes, kept open againſt the preſſure of the ſea, by a ſmall ſpiral wire, and made tight without by painted leather, and ſheep's guts drawn over it, being open, was faſtened in the *bell*, as at P, to receive air, and the other end was fixed to a leaden cap on the man's head, reaching down below his ſhoulders, open at bottom, to ſerve him as a little *bell*, full of air, for him to breathe at his work, which would keep out the water from him when at the level of the great *bell*, becauſe of the ſame denſity as the air in the great *bell*. But when he ſtooped down lower than the level of the great bell, he ſhut the cock F, to cut off the communication between the two *bells*. Phil. Tranſ. ab. vol. iv. part ii. p. 188, &c. vol. iv, p. 550, &c.

The air in this *bell* would ſerve for a minute or two; and he might inſtantly change it, by raiſing himſelf above the great *bell*, and opening the cock F. The *diver* was furniſhed with a girdle of large leaden weights, and clogs of lead for the feet, which, with the weight of the leaden cap, kept him firm on the ground; he was alſo well clothed with thick flannels, which being firſt made wet, and then warmed in the *bell* by the heat of his body, kept off the chill of the cold water for a conſiderable time, when he was out of the *bell*.

Art. XI. *Jets d'Eau, or Spouting Fountains.*

We have ſeen that fluids paſſing through pipes, will always riſe to the level of the reſervoir whence they are ſupplied; the riſing column being puſhed forward, and raiſed by another equally heavy, at the ſame time endeavouring to deſcend. A like effect might be expected from jets of water thus impelled, did not friction againſt the ſides of the machines, and the reſiſtance of the air, both lateral and perpendicular, generally prove an abatement, and prevent its riſing ſo high as the head. Where jets are executed in the beſt manner, and the friction ſpoken of is as much as poſſible removed, the impediment of the air only, through which they needs muſt beat in their riſe, will cauſe them, according to experiment, to fall ſhort of the height of the reſervoirs, in the following proportions, viz.

Jet.	Reservoir.			Jet.	Reservoir.		
Feet.	Feet.		Inches.	Feet.	Feet.		Inches.
5	5	:	1	55	65	:	1
10	10	:	4	60	72	:	0
15	15	:	9	65	79	:	1
20	21	:	4	70	86	:	4
25	27	:	1	75	93	:	9
30	33	:	0	80	101	:	4
35	39	:	1	85	109	:	1
40	45	:	4	90	117	:	0
45	51	:	9	95	125	:	1
50	58	:	4	100	133	:	4

Whence in general it may be obſerved: *That as often as a five-foot jet* (to be taken in theſe matters as a ſtandard,) *ſhall be contained in the height of any jet propoſed; by ſo many inches multiplied into themſelves, or ſquared; the ſurface of the water in the reſervatory which ſupplies it, ought to exceed that jet in height.* Thus, to obtain a jet of 30 feet, which contains five feet ſix times, the reſervoir ought to be 36 inches, or a yard higher; and a jet of 60 feet may be had from a head higher by four times that difference, 144 inches, or four yards. So that *jets done in the beſt manner fall ſhort of the heights of their reſervatories, in a kind of ſubduplicate ratio of the heights to which they riſe.*

This great diſproportion in the riſe of jets muſt in general be owing to the reſiſtance of the air they are made to move through; which has been ſhewn to be in proportion to the ſquares of their celerities reſpectively: nor can the acceleration of the falling water in the pipe, or the retardment of the riſing ſtream by the action of gravity, be concerned at all in it; ſince theſe are probably adequate, and counterbalance each other every where in the ſame level. The air's reſiſtance being thus conſiderable, it will always be found neceſſary to increaſe the bore of the adjutage or ſpouting pipe with the height of the reſervatory: for if it be too ſmall, the riſing ſtream will want ſufficient weight and power to divide the air; which being denſeſt near the earth, a ſmall ſtream of water, endeavouring to mount to a great height, will be daſhed againſt it with ſo great violence, as to fall away in a miſt and be wholly loſt. And it may be obſerved, that the weightier any body is, the greater force it will have when in motion: ſince an ounce-ball fired from a muſquet, will go much farther, and do greater execution, than will an equal weight of ſhot; and theſe again may be projected farther than ſo much lead raſped into powder and fired off. A charge of water fired from a piſtol would ſcarce wet a paper at the diſtance of ſix feet. Accordingly, ſhould a caſk of water be any where pierced with holes of two, four, ſix, eight, and twelve lines over, all in the ſame level, the larger bore will always be found to throw the water fartheſt.

SECT. IV. ENTERTAINING EXPERIMENTS.

Art. I. *Portable Fountain and Clepſydra.*

Fig. 28. repreſents a very pretty portable fountain, which, being charged with water, and inverted, will play a jet nearly as high as the reſervoir, till the fluid is exhauſted; and then turned up on the other end, the ſame thing will happen, and a real clepſydra, or water clock, be thereby formed. This device conſiſts of two hollow veſſels, A and B, communicating with each other only by the recurved tubes C and D; at the ends of which, E and F, are placed ſmall adjutages to direct the jet. G and H are two open tubes, ſoldered into the bottom of the baſons belonging to A and B, through which the water flows in, and fills thoſe veſſels to a certain height, that is, according to their length. They by their diſpoſition alſo prevent the return of the water the ſame way, when the machine is turned upſide down.

Art. II. *A Fountain which ſpouts Water in Form of a Shower.*

To the tube *fig.* 29, wherein the water is to riſe, fit a ſpherical or lenticular head, AB, made of a plate of metal, and perforated at top with a great number of little holes. The water riſing with vehemence towards AB, will be there divided into innumerable little threads, and afterwards broke, and diſperſed into the fineſt drops.

Art. III. *The Globular Fountain.*

Make a hollow globe A, *fig.* 30, of copper or lead, and of a ſize adapted to the quantity of water that comes from the pipe to which it is to be placed. Pierce a number of ſmall holes through this globe, that all tend towards its centre; obſerving, however, that the diameters of all theſe holes, taken together, muſt not exceed that of the pipe at the part from whence the water flows. Annex to it a pipe B, of ſuch height as you think convenient; and let it be ſcrewed at C, to the pipe from whence the jet flows. The water that comes from the jet ruſhing with violence into the globe, will be forced out at the holes, with the direction in which they are made, and will produce a very pleaſing ſphere of water.

Art. IV. *The Hydraulic Dancer.*

Procure a little figure made of cork, as AB, *fig.* 31, which you may paint, or dreſs in a light ſtuff, after your own fancy. In this figure you are to place the ſmall hollow cone C, made of thin leaf braſs. When the figure is placed on the jet-d'eau that plays in a perpendicular direction, it will remain ſuſpended on the top of the water, and perform a great variety of motions. If a hollow ball of copper, of an inch diameter, and very light, be placed on a ſimilar jet, it will, in like manner, remain ſuſpended, revolving on its centre, and ſpreading the water all round it. But note, that as it is neceſſary the ball, &c. when on the deſcent, ſhould keep the ſame preciſe perpendicular wherein it roſe (ſince otherwiſe it would miſs the ſtream and fall downright,) ſuch a fountain ſhould only be played in a place free from wind.

Art. V. *The Water Sun.*

Let there be two portions of a hollow ſphere, that are very ſhallow, as in *fig.* 32. and let them be ſo joined together, that the circular ſpace between them may be very narrow. Fix them vertically to a pipe from whence a jet proceeds. In that part by which the portions of the ſphere are joined, there muſt be made a number of holes; then the water ruſhing into the narrow cavity will be forced out from the holes, and produce a regular figure of the ſun as in the plate. This piece requires a large quantity and force of water to make it appear to advantage. Several pieces of this ſort may be placed over each other, in a horizontal direction, and ſo that the ſame pipe may ſupply them all with water. It is proper to obſerve, that the diameter of theſe pieces muſt continually diminiſh, in proportion to their diſtance from the bottom.

Art. VI. *The revolving Water Sun.*

Make a hollow circle A, as in *fig.* 33, the ſides of which are to be pierced with 12 or 15 holes, made in an inclined direction: or you may place the like number of ſmall tubes round the circle. Fix this circle on the top of a jet, in ſuch manner that it may turn freely round. The water ruſhing violently into the hollow circle will keep it in continual motion; and at the ſame time forcing out of the holes or ſmall tubes, will form a revolving figure with rays in different directions, as in the plate.

Art. VII. *The Magical Caſcade.*

Procure a tin veſſel ABC, *fig.* 34. five inches high and four in diameter; and let it be cloſed at top. To the bottom of this veſſel let there be ſoldered the pipe DE, of ten inches length and half an inch in diameter: this pipe muſt be open at each end, and the upper end muſt be above the water in the veſſel. To the bottom alſo fix five or ſix ſmall tubes F, about one-eighth of an inch diameter. By theſe pipes the water contained in the veſſel is to run ſlowly out.

Place this machine on a ſort of tin baſon GH, in the middle of which is a hole of one quarter of an inch diameter. To the tube DE, fix ſome pieces that may ſupport the veſſel over the baſon; and obſerve that the end D, of the tube DE, muſt be little more than one quarter of an inch from the baſon. There muſt be alſo another veſſel placed under the baſon, to receive the water that runs from it. Now, the ſmall pipes diſcharging more water into the baſon than can run out at the hole in its centre, the water will riſe in the baſon, above the lower end of the pipe DE, and prevent the air from getting into the veſſel AB; and conſequently the water will ceaſe to flow from the ſmall pipes. But the water continuing to flow from the baſon, the air will have liberty again to enter the veſſel AB, by the tube DE, and the water will again flow from the ſmall pipes. Thus they will alternately ſtop and flow, as long as any water remains in the veſſel AB.

Art. VIII. *The Hydraulic Divers.*

There is a pretty contrivance, by which the ſpecific gravity of the body is ſo altered, that it riſes and ſinks in water at our pleaſure. Let little images of men, about an inch high, of coloured glaſs, be beſpoke at a glaſs-houſe; and let them be made ſo as to be hollow within, but ſo as to have a ſmall opening into this hollow, either at the ſole of the foot or elſewhere. Let them be ſet afloat in a clear glaſs phial of water, filled within about an inch of the mouth of the bottle; then let the bottle have its mouth cloſed with a bladder, cloſely tied round its neck, ſo as to let no air eſcape one way or the other. The images themſelves are nearly of the ſame ſpecific gravity with water, or rather a little more light, and conſequently float near the ſurface. Now when we preſs down the bladder, tied on at the top, into the mouth of the bottle, and thus preſs the air upon the ſurface of the water in the bottle; the water being preſſed will force into the hollow of the image through the little opening: thus the air within the images will be preſſed more cloſely together, and being alſo more filled with water now than before, the images will become more heavy, and will conſequently deſcend to the bottom; but upon taking off the preſſure from above, the air within them will again drive out the water, and they will riſe to the ſame heights as before. If the cavities in ſome of the images be greater than thoſe in others, they will riſe and fall differently, which makes the experiment more amuſing.

Art. IX. *The Illuminated Fountain.*

This *fountain* begins to play upon the lighting of candles, and ceaſes as they go out.—Provide two cylindrical veſſels, AB and CD, *fig.* 35. connect them by tubes, open at both ends KL, BE, &c. ſo that the air may deſcend out of the higher into the lower: to the tubes ſolder candleſticks, H, &c. and to the hollow cover of the lower veſſel, CE, fit a little tube, or jet, FG, furniſhed with a cock G, and reaching almoſt to the bottom of the veſſel. In G let there be an aperture, furniſhed with a ſcrew, whereby water may be poured into CD. Then, upon lighting the candles H, &c. the air in the contiguous tubes becoming rarefied thereby, the water will begin to ſpout through GF. By the ſame contrivance may a ſtatue be made to ſhed tears upon the preſence of the ſun, or on the lighting of a candle, &c. all here required being only to lay tubes from the cavity wherein the air is rarefied, to ſome other cavities placed near the eyes, full of water.

Art. X. *Deſaguliers's Dial Fountain.*

This fountain is contrived to play by the ſpring of the air, increaſed by the heat of the ſun, and ſerves alſo for a dial at the ſame time. GNS, *fig.* 36. is a hollow globe of thin copper, eighteen inches in diameter, ſupported by a ſmall inverted baſon, reſting on a frame ABC, with four legs, between which there is a large baſon of two feet diameter. In the leg C there is a concealed pipe, proceeding from G, the bottom of the inſide of the globe, along HV, and joining an upright pipe *u* I, for making a jet at I. The ſhort pipe I *u*, going to the bottom of the baſon, has a valve at *u* under the horizontal part HV, and another valve at V above it, and under the cock. At the north pole N, there is a ſcrew for opening a hole, through which the globe is ſupplied with water. When the globe is half filled, let the machine be ſet in a garden, and, as the ſun heats the copper and rarefies the included air, the air will preſs upon the water, which, deſcending through the pipe GCHV, will lift up the valve V, and ſhut the valve *u*, and the cock being open, ſpout out at I, and continue to do ſo for a long time, if the ſun ſhines, and the ajutage be ſmall. At night, as the air condenſes again by the cold, the outward air, preſſing into the ajutage I, will ſhut the valve V, but, by its preſſure on the baſon D *u* H, puſh up the water, which has been played in the day time, through the valve *u*, and the pipe *u* HG into the globe, ſo as to fill it up again, to the ſame height which it had at firſt, and the next ſun-ſhine will cauſe the *fountain* to play again, &c. The uſe of the cock is to keep the *fountain* from playing till you think proper: a ſmall jet will play ſix or eight hours. If the globe be ſet for the latitude of the place, and rectified before it be fixed, with the hour-lines or meridians drawn upon it, the hours marked, and the countries painted upon it, as in the common globe, it will be a good dial: the ſun ſhining upon the ſame places in this globe, as it does upon the earth itſelf. Deſaguliers, Exper. Phil. vol. ii. lect. 9. p. 205.

The compreſſed Jet d'Eau.

Provide a copper veſſel A, *fig.* 37. of ſuch figure as you think convenient, in which ſolder a pipe BE, of the ſame metal. Let there be a cock at H, which muſt be made ſo tight that no air can paſs by it. The pipe BE muſt go very near the bottom of the veſſel, but not touch it. There muſt be another pipe F, at whoſe extremity G there is a very ſmall hole: this pipe muſt be ſcrewed into the former. The veſſel being thus diſpoſed, take a good ſyringe; and placing the end of it in the hole at G, open the cock, and force the air into the veſſel; then turn the cock and take out the ſyringe. Repeat this operation ſeveral times, till the air in the veſſel be ſtrongly condenſed. Then fill the ſyringe with water, and force it into the veſſel, in the ſame manner as you did the air; and repeat this operation till you can force no more water into the veſſel; then ſhut the cock. This veſſel will be always ready to perform an extempore jet d'eau; for, on turning the cock, the ſpring of the compreſſed air will force out the water with great violence, and the jet will continue, though conſtantly decreaſing in force, till the water is all exhauſted, or the air within the veſſel is come to the ſame denſity with that without.

This Syſtem is ſelected from the moſt reſpectable and eſteemed Treatiſes on Hydroſtatics that I could procure, particularly thoſe of Meſſrs. Emerſon, Ferguſon, Switzer, Deſaguliers, Helſham, Cotes, &c. in the compiling of which, due care has been taken to introduce ſo much of the Elementary Part as ſeemed eſſential to the ſubject, as well as to enlarge on thoſe experimental and practical matters, which are of a more novel and entertaining nature. It is therefore hoped that the choice I have made will be found judicious, pleaſing, and inſtructive.

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HYGROMETER, or Notiometer, compounded of ὑγρος, *moiſt*, and μέτρεω, *I meaſure*, a machine, or inſtrument, whereby to meaſure the degrees of drineſs, or moiſture, of the air. There are divers kinds of *hygrometers*; for whatever body either ſwells or ſhrinks by drineſs or moiſture, is capable of being formed into an *hygrometer*. Such are woods of moſt kinds, particularly aſh, deal, poplar, &c. Such alſo is cat-gut, the beard of a wild goat, &c. For a repreſentation, ſee Syſtem of Pnuematics. Plate I. *Fig.* 16.

HYMEN, Ύμην, in anatomy, a thin membrane or ſkin, ſometimes circular, of different breadths, more or leſs ſmooth, and ſometimes ſemilunar, formed by the union of the internal membrane of the great canal with that of the inſide o the alæ, reſembling a piece of fine parchment. This membrane is ſuppoſed to be ſtretched in the neck of the womb of virgins, below the nymphæ, leaving in ſome ſubjects a very ſmall opening, in others a larger, and in all rendering the external orifice narrower than the reſt of the cavity, and to be broke when they are deflowered; an effuſion of blood following the breach. This membranous circle may likewiſe ſuffer ſome diſorder by too great a flux of the menſes, by imprudence, levity, and other particular accidents. This membrane, like moſt others, does, probably, grow more diſtinct, as well as firm, by age. That it not only exiſts, but is ſometimes very ſtrong and impervious, may be collected, from the hiſtory of a caſe reported by Mr. Cowper. In a married woman, twenty years of age, whoſe *hymen* was found altogether impervious, ſo as to detain the menſes, and to be driven out, by the preſſure thereof, beyond the labia of the pudendum, not unlike a prolapſus of the uterus; on dividing it, at leaſt a gallon of grumous blood came forth. It ſeems the huſband, being denied a paſſage that way, had found another through the meatus urinarius; which was found very open, and its ſides extruded like the anus of a cock. Upon a rupture of the *hymen*, after the conſummation of marriage, and eſpecially delivery, its parts, ſhrinking up, are ſuppoſed to form thoſe little fleſhy knots, called Carunculæ *myrtiformes*.

Hymen, in mythology and poetry, a term of invocation. *Hymen*, or *Hymenæus*, is properly a fabulous divinity, ſuppoſed by the ancients to preſide over marriages; and who accordingly was invoked in epithalamiums, and other matrimonial ceremonies, under the formula, *Hymen o Hymenæe!* The poets generally crown this deity with a chaplet, ſometimes of roſes, at other times of ſweet marjoram; and repreſent him, as it were, diſſolved and enervated with pleaſures; dreſſed in a yellow robe, and ſhoes of the ſame colour, with a torch in his right-hand, and a flame-coloured veil in his left It was for this reaſon, that the new married couple bore garlands of flowers on the wedding-day; which cuſtom alſo obtained among the Hebrews, and even among the Chriſtians during the firſt ages of the church, as appears from Tertullian, De Corona Militari, where he ſays, *Coronant & nuptæ ſponſos.* St. Chryſoſtom likewiſe mentions theſe crowns of flowers; and to this day the Greeks call marriages ςεφανωμα, in reſpect of this crown or garland.

HYMENOPTERA, in entomology, derived from ὑμην, *membrane*, and πτερον, *wing*, in the Linnæan ſyſtem of *Natural Hiſtory*, is an order of inſects, having four membranaceous wings, and the tails of the females are furniſhed with ſtings, which in ſome are uſed for inſtilling poiſon, and in others for merely piercing the bark and leaves of trees, and the bodies of other animals, in which they depoſit their eggs. To this claſs belong ten genera, viz. *cynips*, *tenthredo*, *ſirex*, *ichneumon*, *ſphex*, *chryſis*, *veſpa*, or the *waſp*, *apis*, or *bee*, *formica*, or *ant*, and *mutilla*, comprehending a great number of families. See the System, Part II. Order V.

HYOGLOSSUS, in anatomy, a muſcle of the tongue, which ſome divide into three, calling them basio *gloſſum*, gerato-*gloſſum*, and chondro-*gloſſum*. For its origin, inſertion, and uſe, ſee the System, Part III. Sect. II.

HYOIDES, 'Υοειδες, in anatomy. The *os hyoides*, called alſo *bicorne*, is a bone ſituate in the middle ſpace between the angles of the lower jaw, or at the root of the tongue, making as it were, the baſis or foundation thereof; ſee the System, Part III. Sect. X.

HYOTHYROIDÆ, compounded of *hyoides*, and *thyroides*, in anatomy, a pair of muſcles of the larynx; for their origin, inſertion and uſe, ſee the System, Part III. Sect. II.

HYPERBOLA, in geometry, one of the curve lines, formed by the ſection of a cone. For a variety of Corollaries and Problems, ſee the Syſtem, Article *Conic* Sections, Sect. III.

HYPERBOLE, in rhetoric, a figure, whereby the truth and reality of things are exceſſively enlarged or diminiſhed. An object uncommon with reſpect to ſize, either very great of its kind or very little, ſtrikes us with ſurpriſe; and this emotion forces upon the mind a momentary conviction that the object is greater or leſs than it is in reality: the ſame effect, preciſely, attends figurative grandeur, or littleneſs: and hence the hyperbole, which expreſſes this momentary conviction. A writer, taking advantage of this natural deluſion, enriches his deſcription greatly by the hyperbole; and the reader, even in his cooleſt moments, reliſhes the figure, being ſenſible that it is the operation of nature upon a warm fancy. It cannot have eſcaped obſervation, that a writer is generally more ſucceſsful in magnifying by a hyperbole than in diminiſhing. The reaſon is, that a minute object contracts the mind, and fetters its powers of imagination: but that the mind, dilated and inflamed with a grand object, moulds objects for its gratification with great facility. Longinus, with reſpect to a diminiſhing hyperbole, cites the following ludicrous thought from a comic poet: "He was owner of a bit of ground not larger than a Lacedemonian letter." But, for the reaſon now given, the hyperpole has by far the greater force in magnifying objects; of which take the following examples:" For all the land which thou ſeeſt, to thee will I give it, and to thy ſeed for ever. And I will make thy ſeed as the duſt of the earth: ſo that if a man can number the duſt of the earth, then ſhall thy ſeed alſo be numbered." *Gen.* xiii. 15. 16.

It is a capital fault, to introduce an hyperbole in the deſcription of an ordinary object or event; for in ſuch a caſe, it is altogether unnatural, being deſtitute of ſurpriſe, its only foundation. Take the following inſtance, where the ſubject is extremely familiar, viz. ſwimming to gain the ſhore after a ſhipwreck.

> I ſaw him beat the ſurges under him,
> And ride upon their backs: he trod the water;
> Whoſe enmity he flung aſide, and breaſted
> The ſurge moſt ſwoln that met him: his bold head
> 'Bove the contentious waves he kept, and oar'd
> Himſelf with his good arms, in luſty ſtrokes
> To th' *ſhore*, that o'er his wave-born baſis bow'd,
> As ſtooping to relieve him. *Tempeſt, act* 2. *ſc.* 1.

The niceſt point of all, is to aſcertain the natural limits of an hyperbole, beyond which being overſtrained it has a bad effect. Longinus, (chap. iii.) with great propriety of thought, enters a caveat againſt an hyperbole of this kind: he compares it to a bowſtring, which relaxes by overſtraining, and produceth an effect directly oppoſite to what is intended. To aſcertain any preciſe boundary, would be difficult, if not impracticable. We ſhall therefore only give a ſpecimen of what may be reckoned overſtrained hyperboles. No fault is more common among writers of inferior rank; and inſtances are found even among thoſe of the fineſt taſte; witneſs the following hyperbole, too bold even for an Hotſpur. Speaking of Henry V.

> England ne'er had a king until his time.
> Virtue he had, deſerving to command:
> His brandiſh'd ſword did blind men with its beams:
> His arms ſpread wider than a dragon's wings:
> His ſparkling eyes, replete with awful fire,
> More dazzled, and drove back his enemies,
> Than mid-day ſun fierce bent againſt their faces.
> What ſhould I ſay? his deeds exceed all ſpeech:
> He never lifted up his hand, but conquer'd.
> *Firſt Part, Henry* IV. *act* 1. *ſc.* 1.

An hyperbole, after it is introduced with all advantages, ought to be comprehended within the feweſt words poſſible. There is in Chaucer a thought expreſſed in a ſingle line, which ſets young beauty in a more advantageous light than the whole of this much laboured poem:

> Up roſe the ſun, and up roſe Emelie.

HYPOCHONDRIA, 'Υπονουδρια, compoſed of the prepoſition ὑπο, *under*, and χονδρος, *cartilage*; q. d. *cartilagini ſubjacens*, or under the cartilages of the ribs, &c. in anatomy, a ſpace on each ſide the epigaſtric region, or upper part of the lower belly. For Deſcription, ſee the System, Part V. Sect I.

HYPOCHONDRIAC *Affection*, or *Paſſion*, in medicine, a diſeaſe, otherwiſe called the *ſpleen*, *vapours*, &c. is a ſpaſmodico-flatulent affection of the ſtomach and inteſtines, ariſing from an irregularity of the periſtaltic motion cauſed by the ſtagnation of the blood and vital fluids, between the nervous and muſcular coats of the inteſtines. The *hypochondriac* is a very comprehenſive diſeaſe: it is variouſly denominated, according to the various ſymptoms it is attended with, and the various parts where it is ſuppoſed to be ſeated, or in which it ariſes. When conceived as ſituate in the *hypochondriac* regions, or ariſing from ſome diſorder of the parts contained therein, viz. the ſpleen, liver, &c. it is properly called the *hypochondriacal diſeaſe*, *ſpleen*, &c. When conceived as owing to ſome diſorder of the womb, it is called the Hysteric *Affection*, &c. And laſtly, when the flatulent rumblings in the inteſtines, belchings, &c. are conſidered, it is called the varours.

HYPOGASTRIUM, formed of ὑπο, *under*, and γαςηρ, *belly*, in anatomy, the lower part of the abdomen, or lower venter; commencing from two or three inches below the navel, and extending to the os pubis. See the Syſtem, Part V. Sect. I.

HYPOSTASIS, 'Υποςασις, compounded of ὑπο, *nnder*, and ιςημι, *I ſtand, I exiſt*, q. d. *ſubſiſtentia*, a Greek, term, literally ſignifying *ſubſtance*, or *ſubſiſtence*; it is uſed in theology for *perſon*. Thus ſome have held, that there is but one nature or eſſence in God, but three *hypoſtaſes*, or perſons.

HYPOSTATICAL, in theology, is a term uſed in ſpeaking of the myſtery of the incarnation. *Hypoſtatical union*, is a phraſe uſed by ſome divines for the union of the human nature with the divine in the perſon of Jeſus Chriſt.

HYPOTHENUSE, or rather Hypotenuse, ὑπoτεινυσα, *ſubtendens*, formed of ὑποτεινω, *ſubtendo*, *I ſubtend*, in geometry, is the longeſt ſide of a right-angled triangle; or that ſide which ſubtends, or is oppoſite to, the right angle. See the Syſtem, Part I. Sect. I.

HYPOTHESIS, ὑποθεσις, formed of ὑπο, *under*, and θεσις, *poſitio*,

ſitio, of τιθημι, *pono, I put,* in logic, is a propoſition or principle which we ſuppoſe, or take for granted, in order to draw concluſions for the proof of a point in queſtion. See the Syſtem.

HYPOTHESIS, in phyſics, &c. denotes a kind of ſyſtem laid down from our own imagination, whereby to account for ſome phenomenon or appearance of nature. Thus we have *hypotheſes* to account for the *tides*, for *gravity*, for *magnetiſm*, for the *deluge*, &c. The real and ſcientific cauſes of natural things generally lie very deep: obſervation and experiment, the proper means of arriving at them, are in moſt caſes extremely ſlow; and the human mind is very impatient: hence we are frequently driven to feign or invent ſomething that may ſeem like the cauſe, and which is calculated to anſwer the ſeveral phenomena, ſo that it may poſſibly be the true cauſe.

HYSTERIC *Affection* or *Paſſion*, from ὑϛερα, *womb*, a diſeaſe in women, called alſo *ſuffocation of the womb*, and vulgarly *fits of the mother*. It is a ſpaſmodico-convulſive affection of the nervous ſyſtem, proceeding from the womb, and cauſed by the retenſion and corruption of the blood and lymph in its veſſels; and more or leſs infeſting the nervous parts of the whole body, by means of the nerves of the os ſacrum, the loins, and the whole ſpinal narrow. *Hyſteric affection*, is generally uſed by authors promiſcuouſly with *hypochondriac affection:* the two diſeaſes being ſuppoſed to be in reality the ſame. They only differ indeed in point of relation and circumſtance. The *hyſteric* is properly a ſpecies or branch of the hypochondriac, peculiar to women, and ſuppoſed to ariſe from ſome diſorder of the womb.

HYSTRIX, in zoology, a genus of quadrupeds belonging to the order of glires, the characters of which are theſe: They have two fore-teeth, obliquely divided both in the upper and under jaw, beſides eight grinders; and the body is covered with quills or prickles. There are four ſpecies. The *criſtata*, or creſted porcupine, has four toes on the fore-feet, five toes on the hind feet, a creſted head, a ſhort tail, and the upper lip is divided like that of a hare. The length of the body is about two feet, and the height about two feet and a half. The porcupine is covered with prickles, ſome of them nine or ten inches long, and about ¼ of an inch think. Like the hedge-hog, he rolls himſelf up in a globular form, in which poſition he is proof againſt the attacks of the moſt rapacious animals. The prickles are exceedingly ſharp, and each of them has five large black and has many white rings, which ſucceed one another, alternately from the root to the point. Theſe quills the animal can erect or let down at pleaſure; when irritated, he beats the ground with his hind-feet, erects his quills, ſhakes his tail, and makes a conſiderable rattling noiſe with his quills. For the claſſification, ſee MAMMALIA.

I.

I, Or *i*, the ninth letter and third vowel of the alphabet, is pronounced by throwing the breath ſuddenly againſt the palate, as it comes out of the larynx, with a ſmall hollowing of the tongue, and nearly the ſame opening of the lips and talk as in pronouncing *a* or *e*. Its ſound varies: in ſome words it is long, as *high*, *mind*, &c.; in others ſhort, as *bid*, *hid*, *ſin*, &c.; in others, again, it is pronounced like *y*, as in *collier*, *onion*, &c.; and in few, it ſounds like *ee*, as in *machine*, *magazine*, &c. No Engliſh word ends in *i*, *e* being either added to it, or elſe the *i* turned into *y*. But beſides the vowel, there is the *jod* conſonant; which, becauſe of its different pronunciation, has likewiſe a different form, thus J, j. In Engliſh, it has the ſoft ſound of *g*; nor is uſed, but when *g* ſoft is required before vowels, where *g* is uſually hard: thus we ſay, *jack*, *jet*, *join*, &c. inſtead of *gack*, *get*, *goin*, &c. which would be contrary to the genius of the Engliſh language.

JACK-DAW, in ornithology, a ſpecies of the genus CORVUS or crow; being the *corvus monedula* of Linnæus. See CORVUS.

JACKALL, in zooloy, the name of a creature of the dog-kind, the CANIS *aureus* of Linnæus, called by authors *lupus aureus*, the *gold-coloured wolf*, and by the modern Greeks *ſquilachi*. It is ſmaller than the wolf and of a very beautiful yellow colour. Theſe animals are always ſeen in large flocks together, not unfrequently to the number of two hundred in a flock; and hunt like hounds in full cry from evening till morning. It is a very thieviſh animal, and will ſteal peoples things away while they ſleep, not ſparing ſuch as can be of no uſe to it, as their hats, ſhoes, or the like. There is ſcarce an animal which the *jackall* with leave unmoleſted: in want of living prey, it will feed on roots, fruits, and carrion; greedily diſinter the dead, and feed on the putrid corpſes. Their howles in the purſuit of caravans and armies are dreadful. It is a very common creature in Cilicia, and is heard barking all night long.

JACOBITES, is a term of reproach beſtowed on ſuch perſons as diſallowed of the revolution by king William, aſſerted the rights, and adhered to the intereſts of the abdicated king James, and his line, now extinct.

JALAP, in medicine, ſo called from the name of the country, viz. Chalapa, or Xalapa, a province in New Spain, between La Vera Cruz and Mexico, whence it is brought, the root of a ſpecies of the CONVOLVULUS, or the *convolvulus* with variable leaves, foot-ſtalks with ſingle flowers, and a tuberous root. As *jalap* does not appear to have been known to the ancients, it has its place in medicine only ſince thoſe parts of America, which produce it, have been traded to by the Europeans.

JAMES, ST. *Epiſtle of*, a canonical book of the New Teſtament, being the firſt of the *catholic* or *general* epiſtles; which are ſo called, as not being written to one but to ſeveral Chriſtian churches. This general epiſtle is addreſſed partly to the believing and partly to the infidel Jews; and is deſigned to correct the errors, ſoften the ungoverned zeal, and reform the indecent behaviour of the latter; and to comfort the former under the great hardſhips they then did, or ſhortly were to ſuffer, for the ſake of Chriſtianity.

JANIZARIES, an order of infantry in the Turkiſh armies; reputed the grand ſeignor's foot-guards.

JANUARY, the name of the firſt month of the year, according to the computation now uſed in the Weſt. The word is derived from the Latin *Januarius*, a name given it by the Romans, from *Janus*, one of their divinities, to whom they attributed two faces; becauſe on the one ſide the firſt of January looked towards the new year; and, on the other, towards the old one. *January* and *February* were introduced into the year by Numa Pompilius; Romulus's year beginning in the month of March. The Chriſtians heretofore faſted on the firſt day of *January*, by way of oppoſition to the ſuperſtition of the Heathens, who in honour of Janus, obſerved this day with feaſtings, dancings, maſquerades, &c.

JANUS, *Temple of*, in ancient hiſtory, a ſquare building at Rome (as ſome ſay) of an entire braſs, erected by Romulus, and ſo large as to contain a ſtatue of Janus five feet high, with brazen gates on each ſide, which were always kept open in the time of war, and ſhut in the time of peace. But the Romans were ſo much engaged in war, that this temple was ſhut only twice from the foundation of Rome till the reign of Auguſtus, and ſix times afterwards.

JAPAN *Earth*, ſee CATECHU. The tree or plant from which the *Japan earth* is extracted is a ſpecies of the MIMOSA of Linnæus, and is very common on the uncultivated mountains of Hindoſtan, in the province of Bahar, weſtward of Bengal.

JAPANNING, the art of varniſhing and drawing figures on wood, in the ſame manner as is done by the natives of Japan in the Eaſt Indies. The ſubſtances which admit of being japanned are almoſt every kind that are dry and rigid, or not too flexible; as wood, metals, leather, and paper prepared. Wood and metals do not require any other preparation, but to have their ſurface perfectly even and clean: but leather ſhould be ſecurely ſtrained either on frames, or on boards; as its bending or forming folds would otherwiſe crack and force off the coats of varniſh: and paper ſhould be treated in the ſame manner, and have a previous ſtrong coat of ſome kind of ſize; but it is rarely made the ſubject of japanning till it is converted into *papier machè*, or wrought by other means into ſuch form, that its original ſtate, particularly with reſpect to flexibility, is loſt.

One principal variation from the method formerly uſed in japanning is, the uſing or omitting any priming or undercoat on the work to be japanned. In the older practice, ſuch priming was always uſed; and is at preſent retained in the French manner of japanning coaches and ſnuff-boxes of the *papier machè:* but in the Birmingham manufacture here, it has been always rejected. The advantage of uſing ſuch priming or undercoat is, that it makes a ſaving in the quantity of varniſh uſed; becauſe the matter of which the priming is compoſed fills up the inequalities of the body to be varniſhed; and makes it eaſy, by means of rubbing and water-poliſhing, to gain an even ſurface for the varniſh: and this was therefore ſuch a convenience in the caſe of wood, as the giving a hardneſs and firmneſs to the ground was alſo in the caſe of leather, that it became an eſtabliſhed method; and is therefore retained even in the inſtance of the *papier machè*, by the French, who applied the received method of japanning to that kind of work on its introduction. There is nevertheleſs this inconvenience always attending the uſe of an under-coat of ſize, that the japan coats of varniſh and colour will be conſtantly liable to be cracked and peeled off by any violence, and will not endure near ſo long as the bodies japanned in the ſame manner, but without any ſuch priming; as may be eaſily obſerved in comparing the ware of the Paris and Birmingham ſnuff boxes; which latter, when good of their kind, never peel or crack, or ſuffer any damage, unleſs by great violence, and ſuch a continued rubbing as waſtes away the ſubſtance of the varniſh; whilethe japan coats of the Pariſian crack and fly off in flakes, whenever any knock or fall, particularly near the edges, expoſes them to be injured. But the Birmingham manufacturers, who originally practiſed the japanning only on metals, to which the reaſon above given for the uſe of priming did not extend, and who took up this art of themſelves as an invention, of courſe omitted at firſt the uſe of any ſuch undercoat; and not finding it more neceſſary in the inſtance of *papier machè*, than on metals, continue ſtill to reject it. On which account, the boxes of their manufacture are, with regard to the wear, greatly better than the French. The laying on the colours in gum-water, inſtead of varniſh, is alſo another variation from the method of japanning formerly practiſed: but the much greater ſtrength of the work, where they are laid on in varniſh or oil, has occaſioned this way to be exploded with the greateſt reaſon in all regular manufactures: however, they who may practiſe japanning on cabinets, or other ſuch pieces, as are not expoſed to much wear and violence, for their amuſement only, and conſequently may not find it worth their while to encumber themſelves with the preparations neceſſary for the other methods; may paint with water-colours on an undercoat laid on the wood, or other ſubſtance of which the piece to be japanned is formed; and then finiſh with the proper coats of varniſh, and if the colours are tempered with the ſtrongeſt iſinglaſs, ſize and honey, inſtead of gum-water, and laid on very flat and even, the work will not be much inferior in appearance to that done by the other method, and will laſt as long as the old japan.

JAUNDICE, derived from the French, *jauneſſe*, yellowneſs, of *jaune*, yellow, in medicine, a diſeaſe conſiſting in a ſuffuſion of the bile, and a rejection thereof to the ſurface of the body, whereby the whole exterior habit is diſcoloured. Dr. Maclurg is of opinion that the bile returns into the circulation of this diſorder by the courſe of the lymphatics. Of this there are three kinds; the firſt, properly called *jaundice* or *yellow-jaundice*, is owing to the yellow bile, which, in this caſe, is too exalted, or too abundant in the maſs of blood; or perhaps to an obſtruction of the glands of the liver, which prevents the gall's being duly ſeparated from the blood: or finally, to a ſtoppage of the porus biliarius, or the like means, whereby the mixture of that fluid with the aliment in the inteſtines is prevented. The ſecond, called the *black jaundice*, is owing to the ſame biles being mingled with acids. The third, bordering on *green*, takes its riſe alſo from a different mixture of bile with an acid. This is uſually called the *chloroſis*, or green ſickneſs; and is a diſtemper pretty common in young women.

JAW *Locked* is a ſpaſmodic contraction of the lower *jaw*, commonly produced by ſome external injury affecting the tendons or ligaments, and belonging to the claſs of diſtempers called EMPROSTHOTONOS, OPISTHOTONOS, and TETANUS.

JAY, in ornithology, is the Engliſh name of the CORVUS *glandarius* of Linnæus, and a ſpecies of the genus corvus. See Corvus.

ICE, in phyſiology, a ſolid, tranſparent, and brittle body, formed of ſome fluid, particularly water, by means of cold. An eminent naturaliſt obſerves, that ice is only a re-eſtabliſhment of the parts of water in their natural ſtate; that the mere abſence of fire is ſufficient to account for this re-eſtabliſhment; and that the fluidity of water is a real fuſion, like that of metals expoſed to the fire; differing only in this, that a greater quantity of fire is neceſſary to the one than the other. Gallileo was the firſt that obſerved ice to be lighter than the water which compoſed it: and hence it happens, that ice floats upon water, its ſpecific gravity being to that of water as eight to nine. This rarefaction of ice ſeems to be owing to the air-bubbles produced in water by freezing; and which, being conſiderably large in proportion to the water frozen, render the body ſo much ſpecifically lighter: theſe air-bubbles, during their production, acquire a great expanſive power, ſo as to burſt the containing veſſels, though ever ſo ſtrong.

In the mountains of Swiſſerland there are immenſe maſſes of ice, which, by the tradition and hiſtories of the country, muſt have lain there many centuries. At certain times there happen cracks in theſe, and by theſe cracks the vaſt thickneſs of the maſſes may in ſome meaſure be gueſſed at; ſome of them being three or four hundred ells deep, and yet none of them ever having gone through the whole thickneſs. The vaſt bodies of ice met with in the northern ſeas near Hudſon's Bay, are ſurprizing; ſome of them being immerſed a hundred fathoms or more under the ſurface of the ocean, and a fifth or ſixth part above, and three or four miles in circumference. See Phil. Tranſ. N° 465, Sect. II.

Theſe floating mountains of ice owe their vaſt bigneſs and durable nature to a cauſe not conſidered by many; that is, to their not being common ice, but the ice of ſea-water; many experiments proving, that in acid and ſpirituous liquors, when the froſt has power over them, the watery parts only are affected, and the ice is taſteleſs, while the liquor remains concentrated, and much ſtronger than before at the bottom, or in the centre. It was generally ſuppoſed that the ſaline liquors, and conſequently ſea-water, were affected by freezing in the ſame manner; that is, its watery part alone was frozen, and the ſalt ſeparated from the part ſo congealed: but Dr. Liſter has proved, that the ice formed of ſea-water is really ſalt, and does contain ſea-ſalt, and finally that it is, by means of this ſalt contained in it, rendered more durable than common ice. If a phial of ſalt water be expoſed to the air in froſty weather till flakes of ice are found in it, and then brought into a warm room, thoſe flakes will remain even in that place a long time undiſſolved; and if they are taken out and expoſed at a ſmall diſtance to the fire, they will not run into water as common ice would, but they will by degrees evaporate, and there will be left only a little white ſalt. See Congelation, Cold, Frost, &c.

Ice-*Houſe*, a building contrived to preſerve ice for the uſe of a family in the ſummer ſeaſon. Ice-houſes are more generally uſed in warm countries than with us; particularly in Italy, where the meaneſt perſon who rents a houſe, has his vault or cellar for ice. As to the ſituation, it ought to be placed upon a dry ſpot of ground; becauſe wherever there is moiſture, the ice will melt: therefore in all ſtrong lands which retain the wet, too much pains cannot be taken to make drains all round them. The place ſhould alſo be elevated, and as much expoſed to the ſun and air as poſſible.

Great uſe is made of chaff in ſome places of Italy to preſerve *ice*: the *ice houſe* for this purpoſe need only be a deep hole dug in the ground on the ſide of a hill, from the bottom of which they can eaſily carry out a drain, to let out the water which is ſeparated at any time from the *ice*, that it may not melt and ſpoil the reſt. If the ground is tolerably dry, they do not line the ſides with any thing, but leave them naked, and only make a covering of thatch over the top of the hole: this pit they fill either with pure ſnow, or elſe with ice taken from the pureſt and cleareſt water; becauſe they do not uſe it as we do in England, to ſet the bottles in, but really mix it with the wine. They firſt cover the bottom of the hole with chaff, and then lay in the *ice*, not letting it any where touch the ſides, but ramming in a large bed of chaff all the way between: they thus carry on the filling to the top, and then cover the ſurface with chaff, and in this manner it will keep as long as they pleaſe. When they take any of it out for uſe, they wrap the lump up in chaff, and it may then be carried to any diſtant place, without waſte or running. Phil. Tranſ. N° 8. See Ice.

ICH-DIEN, the motto of the arms of the prince of Wales, ſignifying in High Dutch, *I ſerve*. See the Syſtem of Heraldry. Sect. VII. Art. II.

ICHNEUMON, in zoology, a ſpecies of the genus Viverra. For deſcription, See Viverra.

Ichneumon, in entomology, a genus of the Hymenoptera claſs. For the generic characters and claſſification, ſee the Syſtem, Order V, Genus 56.

ICHNOGRAPHY, in perſpective, the view of any thing cut off by a plane parallel to the horizon, juſt at the baſe or bottom of it.

ICHOR, Ιχωρ, ſignifying any humour, or humidity, properly denotes a thin, watery humour, like ſerum; but is ſometimes alſo uſed for a thicker kind, flowing from ulcers; called alſo Sanies.

ICHTHYOCOLLA, Isinglass, a preparation from the fiſh known by the name of *huſo*. The word is Greek, formed of ιχθυς, *fiſh*, and κολλα, *glue*. The method of making Iſinglaſs was long a ſecret in the hands of the Ruſſians; but hath lately been diſcovered, and the following account of it publiſhed by Humphrey Jackſon, Eſq. in the 63d volume of the Philoſophical Tranſactions. "All authors who have hitherto delivered proceſſes for making ichthyocolla, fiſh-glue, or iſinglaſs, have greatly miſtaken both its conſtituent matter and preparation. To prove this aſſertion, it may not be improper to recite what Pomet erroneouſly ſays upon the ſubject, as he appears to be the principal author whom the reſt have copied. After deſcribing the fiſh, and referring to a cut engraved from an original in his cuſtody, he ſays: 'As to the manner of making the iſinglaſs, the ſinewy parts of the fiſh are boiled in water, till all of them be diſſolved that will diſſolve; then the gluey liquor is ſtrained, and ſet to cool. Being cold, the fat is carefully taken off, and the liquor itſelf boiled to a juſt conſiſtency, then cut to pieces, and made into a twiſt, bent in form of a creſcent, as commonly ſold, then hung upon a ſtring, and carefully dried.' From this account, it might be rationally concluded, that every ſpecies of fiſh which contained gelatinous principles would yield iſinglaſs: and this parity of reaſoning ſeems to have given riſe to the haſty concluſions of thoſe, who ſtrenuouſly vouch for the extraction of iſinglaſs from ſturgeon; but as that fiſh is eaſily procurable, the negligence of aſcertaining the fact by experiment ſeems inexcuſable.

"In my firſt attempt to diſcover the conſtituent parts and manufacture of iſinglaſs, relying too much upon the authority of ſome chymical authors, whoſe veracity I had experienced in many other inſtances, I found myſelf conſtantly diſappointed. Glue, not iſinglaſs, was the reſult of every proceſs; and although in the ſame view, a journey to Ruſſia proved fruitleſs, yet a ſteady perſeverance in the reſearch proved not only ſucceſsful as to this object, but, in the purſuit, to diſcover a reſinous matter plentifully procurable in the Britiſh fiſheries, which has been found by ample experience to anſwer ſimilar purpoſes. It is now no longer a ſecret, that our lakes and rivers in North America are ſtocked with immenſe quantities of fiſh, ſaid to be the ſame ſpecies with thoſe in Muſcovy, and yielding the fineſt iſinglaſs, the fiſheries whereof, under due encouragement, would doubtleſs ſupply all Europe with this valuable article.

"No artificial heat is neceſſary to the production of iſinglaſs, neither is the matter diſſolved for this purpoſe; for, as the continuity of its fibres would be deſtroyed by ſolution, the maſs would become brittle in drying, and ſnap ſhort aſunder, which is always the caſe with glue, but never with iſinglaſs. The latter, indeed, may be reſolved into glue with boiling water; but its fibrous recompoſition would be found impracticable afterwards, and a fibrous texture is one of the moſt diſtinguiſhing characteriſtics of genuine iſinglaſs. A due conſideration that an imperfect ſolution of iſinglaſs, called *fining* by the brewers, poſſeſſed a peculiar property of clarifying malt-lipuors, induced me to attempt its analyſis in cold ſubacid menſtruums. One ounce and a half of good iſinglaſs, ſteeped a few days in a gallon of ſtale beer, was converted into good fining, of a remarkable thick conſiſtence: the ſame quantity of glue, under ſimilar treatment, yielded only a mucilaginous liquor, reſembling diluted gum-water, which, inſtead of clarifying beer, increaſed both its tenacity and turbidneſs, and communicated other properties in no reſpect correſponding with thoſe of genuine fining. On commixing three ſpoonſful of the ſolution of iſinglaſs with a gallon of malt liquor, in a tall cylindrical glaſs, a vaſt number of curdly maſſes became preſently formed, by the reciprocal attraction of the particles of iſinglaſs, and the feculencies of the beer, which, increaſing in magnitude and ſpecific gravity, arranged themſelves accordingly, and fell in a combined ſtate to the bottom, through the well-known laws of gravitation; for, in this caſe, there is no elective attraction, as ſome have imagined, which bears the leaſt affinity with what frequently occurs in chymical decompoſitions. If what is commercially termed *long* or *ſhort ſtapled iſinglaſs* be ſteeped a few hours in fair cold water, the entwiſted membranes will expand, and reaſſume their original beautiful hue, and, by a dexterous addreſs, may be perfectly unfolded. By this ſimple operation, we find that iſinglaſs is nothing more than certain membranous parts of fiſhes, diveſted of their native mucoſity, rolled and twiſted into the forms abovementioned, and dried in the open air. The ſounds, or air bladders, of freſh water-fiſh in general, are preferred for this purpoſe, as being the moſt tranſparent, flexible, delicate ſubſtances. Theſe conſtitute the fineſt ſorts of iſinglaſs; thoſe called *book* and *ordinary ſtaple*, are made of the inteſtines, and probably of the peritonæum of the fiſh. The belluga yields the greateſt quantity, as being the largeſt and moſt plentiful fiſh in the Muſcovy rivers; but the ſounds of all freſh water fiſh yield, more or leſs, fine iſinglaſs, particularly the ſmaller ſorts, found in prodigious quantities in the Caſpian Sea, and ſeveral hundred miles beyond Aſtracan, in the Wolga, Yaik, Don, and even as far as Siberia, where it is called *kle* or *kla* by the natives, which implies a glutinous matter; it is the baſis of the Ruſſian glue, which is preferred to all other kinds for its ſtrength.

" The ſounds, which yield the finer iſinglaſs, conſiſt of parallel fibres, and are eaſily rent longitudinally; but the ordinary ſorts are found compoſed of double membranes, whoſe fibres croſs each other obliquely, reſembling the coats of a bladder: hence the former are more readily pervaded and divided with ſubacid liquors; but the latter, through a peculiar kind of interwoven texture, are with great difficulty torn aſunder, and long reſiſt the power of the ſame menſtruum; yet, when duly reſolved, are found to act with equal energy in clarifying liquors. Iſinglaſs receives its different ſhapes in the following manner: The parts of which it is compoſed, particularly the ſounds, are taken from the fiſh while ſweet and freſh, ſlit open, waſhed from their ſlimy *ſordes*, diveſted of every thin membrane which invelopes the ſound, and then expoſed to ſtiffen a little in the air. In this ſtate, they are formed into rolls about the thickneſs of a finger, and in length according to the intended ſize of the ſtaple: a thin membrane is generally ſelected for the centre of the roll, round which the reſt are folded alternately, and about half an inch of each extremity of the roll is turned inwards. The due dimenſions being thus obtained, the two ends of what is called *ſhort-ſtaple* are pinned together with a ſmall wooden peg; the middle of the roll is then preſſed a little downwards, which gives it the reſemblance of a heart ſhape; and thus it is laid on boards, or hung up in the air to dry. The ſounds, which compoſe the long-ſtaple, are larger than the former; but the operator lengthens this ſort at pleaſure, by interfolding the ends of one or more pieces of the ſound with each other. The extremities are faſtened with a peg, like the former; but the middle part of the roll is bent more conſiderably downwards; and, in order to preſerve the ſhape of the three obtuſe angles thus formed, a piece of round ſtick, about a quarter of an inch diameter, is faſtened in each angle with ſmall wooden pegs, in the ſame manner as the ends. In this ſtate, it is permitted to dry long enough to retain its form, when the pegs and ſticks are taken out, and the drying completed; laſtly, the pieces of iſinglaſs are colligated in rows, by running packthread through the peg-holes, for convenience of package and exportation.

" The membranes of the book ſort, being thick and refractory, will not admit a ſimilar formation with the preceding: the pieces therefore, after their ſides are folded inwardly, are bent in the centre, in ſuch manner that the oppoſite ſides reſemble the cover of a book, from whence its name; a peg being run acroſs the middle, faſtens the ſides together, and thus it is dried like the former. This ſort is interleaved, and the pegs run acroſs the ends, the better to prevent its unfolding. That called *cake-iſinglaſs*, is formed of the bits and fragments of the ſtaple ſorts, put into a flat metalline pan, with a very little water, and heated juſt enough to make the parts cohere like a pancake, when it is dried; but frequently it is overheated, and ſuch pieces, as before obſerved, are uſeleſs in the buſineſs of fining. Experience has taught the conſumers to reject them when overheated. Iſinglaſs is beſt made in the ſummer, as froſt gives it a diſagreeable colour, deprives it of weight, and impairs its gelatinous principles; its faſhionable forms are unneceſſary, and frequently injurious to its native qualities. It is common to find oily putrid matter, and *exuviæ* of inſects, between the implicated membranes, which, through the inattention of the cellarman, often contaminate wines and malt liquors in the act of clarification. Theſe peculiar ſhapes might, probably, be introduced originally with a view to conceal and diſguiſe the real ſubſtance of iſinglaſs, and preſerve the monopoly; but, as the maſk is now taken off, it cannot be doubted to anſwer every purpoſe more effectually in its native ſtate, without any ſubſequent manufacture whatever, eſpecially to the principal conſumers, who hence will be enabled to procure ſufficient ſupply from the Britiſh colonies. Until this laudable end can be fully accompliſhed, and as a ſpecies of iſinglaſs, more eaſily produceable from the marine fiſheries, may probably be more immediately encouraged, it may be manufactured as follows:

" The ſounds of cod and ling bear great analogy with thoſe of the *accipenſer* genus of Linnæus and Artedi; and are in general ſo well known, as to require no particular deſcription. The Newfoundland and Iceland fiſhermen ſplit open the fiſh, as ſoon as taken, and throw the back bones, with the ſounds annexed, in a heap; but previous to incipient putrefaction, the ſounds are cut out, waſhed from their ſlimes, and ſalted for uſe. In cutting out the ſounds, the intercoſtal parts are left behind, which are much the beſt; the Iceland fiſhermen are ſo ſenſible of this, that they beat the bone upon a block with a thick ſtick, till the pockets, as they term them, come out eaſily, and thus preſerve the ſound entire. If the ſounds have been cured with ſalt, that muſt be diſſolved by ſteeping them in water, before they are prepared for iſinglaſs; the freſh ſound muſt then be laid upon a block of wood, whoſe ſurface is a little elliptical, to the end of which a ſmall hair bruſh is nailed, and with a ſaw knife the membranes on each ſide of the ſound muſt be ſcraped off. The knife is rubbed upon the bruſh occaſionally, to clear its teeth; the pockets are cut open with ſciſſars, and perfectly cleanſed of the mucous matter with a coarſe cloth; the ſounds are afterwards waſhed a few minutes in lime-water in order to abſorb their oily principle, and laſtly in clear water. They are then laid upon nets, to dry in the air; but if intended to reſemble the foreign iſinglaſs, the ſounds of cod will only admit of that called *book*, but thoſe of ling both ſhapes. The thicker the ſounds are, the better the iſinglaſs, colour excepted; but that is immaterial to the brewer, who is its chief conſumer. This iſinglaſs reſolves into fining, like the other ſorts, in ſubacid liquors, as ſtale beer, cyder, old hock, &c. and in equal quantities produces ſimilar effects upon turbid liquors, except that it falls ſpeedier and cloſer to the bottom of the veſſel, as may be demonſtrated in tall cylindrical glaſſes; but foreign iſinglaſs retains the conſiſtency of fining preferably in warm weather, owing to the greater tenacity of its native mucilage.

" Vegetable acids are, in every reſpect, beſt adapted to fining: the mineral acids are too corroſive, and even inſalubrious, in common beverage. It is remarkable, that during the converſion of iſinglaſs into fining, the acidity of the menſtruum ſeems greatly diminiſhed, at leaſt to taſte, not on account of any alkaline property in the iſinglaſs, probably, but by its inveloping the acid particles. It is likewiſe reducible into jelly with alkaline liquors, which indeed are ſolvents of all animal-matters; even cold lime-water diſſolves it into a pulpous *magma*. Notwithſtanding this jelly is inadmiſſible as fining, on account of the menſtruum, it produces admirable effects in other reſpects: for, on commixture with compoſitions of plaſter, lime, &c. for ornamenting walls expoſed to viciſſitudes of weather, it adds firmneſs and permanency to the cement; and if common brick mortar be worked up with this jelly, it ſoon becomes almoſt as hard as the brick itſelf: but, for this purpoſe, it is more commodiouſly prepared by diſſolving it in cold water, acidulated with vitriolic acid; in which caſe, the acid quits the jelly, and forms with the lime a *ſelenitic* maſs, while, at the ſame time, the jelly being deprived in ſome meaſure of its moiſture, through the formation of an indiſſoluble concrete amongſt its parts, ſoon dries, and hardens into a firm body; whence its ſuperior ſtrength and durability are eaſily comprehended. It has long been a prevalent opinion, that ſturgeon, on account of its cartilaginous nature, would yield great quantities of iſinglaſs; but, on examination, no part of this fiſh, except the inner coat of the ſound, promiſed the leaſt ſucceſs. This being full of *rugæ*, adheres ſo firmly to the external membrane, which is uſeleſs, that the labour of ſeparating them ſuperſedes the advantage. The inteſtines, however, which in the largeſt fiſh extend ſeveral yards in length, being cleanſed from their mucus, and dried, were found ſurpriſingly ſtrong and elaſtic, reſembling cords made with the inteſtines of other animals, commonly called *cat-gut*, and, from ſome trials, promiſed ſuperior advantages when applied to mechanic operations."

Iſinglaſs is ſometimes uſed in medicine: and may be given in a thin acrimonious ſtate of the juices, after the ſame manner as the vegetable gums and mucilages, regard being had to their different diſpoſition to putreſcence.

ICHTHYOLOGY, of ιχθυς, *fiſh*, and λογος, *diſcourſe*, or *art*, the ſcience which treats of fiſh. The proper objects of this ſtudy are aquatic animals, which have fins, and have no feet. The buſineſs of *ichthyology* is, firſt, to diſtinguiſh all the parts of fiſh by their ſeveral proper names; then to adapt to each fiſh its proper generical and ſpecific names. See the following Syſtem.

SYSTEM OF ICHTHYOLOGY.

SECT. I. INTRODUCTION.

THIS Science comprehends all thoſe animals included in the 4th claſs of Linnæus's Syſtem of zoology, and which he has named *piſces* or fiſhes. It is however neceſſary to obſerve that under the term fiſh, we do not include all the inhabitants of the watery element which in general bear that title; for lobſters, crabs, &c. univerſally called ſhell fiſh, we have proved to be really inſects; [ſee, Syſtem of Entomology,] and oyſters, muſcles, cockles, &c. have been deſcribed in our Syſtem of Conchology as forming a part of the *vermes teſtacea* or 6th claſs of our author, who has alſo removed the genus ceti or whales into his Mammalia or firſt claſs; but the Nantes which he has in the laſt edition of the Syſtema Naturæ placed in his 3d claſs called Amphibia, we have again brought back to the *piſces* or fiſh, making a new order of them.

The ſcientific deſcription annexed will we hope clearly and ſatisfactorily explain what is meant by the term *piſces* or fiſh. This claſs of animals, like every other part of the creation, exhibits a variety of wonders; although if we conſider the immenſity of the ocean, its unfathonable depth, and the few opportunities we have of exploring it, we may reaſonably conclude that it is leſs known than moſt other parts of animated nature. It is true that numbers of ſhips are conſtantly paſſing and repaſſing over the ſurface of that immenſe and extenſive bulk of water called the ſea; but their paſſage is moſtly confined to one narrow tract, and the perſons on board are in general too much occupied in other matters to attend to the wonders it contains; ſo that we are inclined to view with aſtoniſhment what has already been done, rather than expreſs our ſurprize that more has not been effected.

Fiſh exhibit as great variety in the formation of their bodies and mode of living as any other claſs of animals, and their exiſtence under water is no leſs wonderful, than the curious mechaniſm of their frame, ſo totally differing from all other created beings whatever; deprived of legs which would be an incumbrance to them, they are furniſhed with fins, admirably contrived and elegantly conſtructed to move them with amazing velocity through that element in which they are deſtined to live. The ſtructure of their bones, form of the body, and exquiſite covering, differing according to the ſpecies, manifeſt the ſtupendous wiſdom and infinite ſkill of the divine architect who has formed them. The long ſlender make, and ſmooth, ſleek, ſlippery ſkin of the eel is well adapted to its mode of living, and enables it to paſs, with much celerity, through the mud; the imbricated ſcales with which many others are covered, are an excellent defence to thoſe who either ſeek their food or retire to ſpawn in ſhallow waters, whoſe bottoms are rocky or gravelly. The fiſh of deep waters, and that ſeldom or ever viſit the rivers, have ſcales more delicate and a ſkin more tender; others again have only a ſoft and delicate ſkin, that appears unable to defend them from any external injury.

Fiſh are either gregarious or ſolitary, voracious or harmleſs, but in general they prey on animal food; the ſmaller becoming victims to the rapacity of the larger, they appear to have this property in ſome meaſure peculiar, that of ſwallowing their food whole, which muſt be evident to every one who has been accuſtomed to angle, with a line and hook; for though many of them are furniſhed with teeth, they do not appear to uſe them for maſtication like the four footed animals. The mouths of fiſh are certainly larger in proportion to the bulk of the body than of moſt other animals. They are alſo migratory, and, like many ſpecies of birds, frequent particular places only at certain ſeaſons; and the gregarious fiſh are ſubject to change their ſituations and deſert their haunts for a number of years, and then return to them again. The all-wiſe author of Nature has ſo ordained that the moſt uſeful and delicious kinds ſhall at certain periods aſſemble in immenſe ſhoals on the ſhores and coaſts, inviting us to a luxurious banquet. It is worthy of remark that they always continue near the ſhore while in high perfection, and conſtantly quit it when out of ſeaſon; it is alſo wiſely ordained that a ſucceſſion ſhall invariably take place, and that each ſucceeding quarter of the year ſhall have its peculiar benefits and advantages.

The writers on fiſh have been very numerous, but we ſhall only mention ſome of the moſt valuable; Ariſtotle in this, as in every other branch of natural hiſtory, ſtands the firſt; he divided them into three claſſes, the cetaceous, cartilaginous, and bony. Bellonius, Rondeletius, Salvian, Geſner, Willoughby and Ray among the old authors, and Seba, Artedi, Linnæus, Dr. Garden, Block, and Dr. Bruſſonet among the later writers, are all excellent in their way. Willoughby's work is ſtill an admirable book, and was reckoned, even by Artedi, to be the beſt then extant. It is very ſingular that neither of theſe valuable men lived to complete their own works, and adapt them for the public eye, though both were equally happy to have them finiſhed and prepared for the preſs by two ſuch excellent men as the juſtly celebrated Ray, and the immortal Linnæus, who have not only done juſtice to the merits of their reſpective friends, but each of them improved on their labours; as the Syſtem annexed will fully teſtify.

SECT. II.

ADVANTAGES DERIVED FROM FISH.

If we conſider fiſh as an article of commerce, their importance in this iſland is almoſt beyond deſcription; the various branches of the fiſheries form a moſt excellent nurſery for ſeamen, raiſing and employing an amazing number of boys annually; the cod fiſhery alone is ſufficient to employ 15 thouſand Britiſh ſeamen; to which, if we add the herring, pilchard, mackrel, haddock, whiting, and other kinds caught on our own coaſt, and include the men, women, and children employed in ſettling, waſhing, cleanſing, &c. with the various trades dependant on it, ſuch as boat builders, coopers, net makers, packthread ſpinners, &c. &c. together with the emoluments that accrue by their exportation, it is a matter of ſo much real national importance as to engage the attention of the legiſlature in framing various laws for its protection.

Mr. Pennant relates that the caſh received for pilchards, exported in the county of Cornwall, amounts, at a medium, annually to near fifty thouſand pounds. If we take a view of fiſh as an article of food, we ſhall find them ſerved up at the tables of the rich as the higheſt of all luxuries, and gradually deſcending to the tables of the poor as a ſubſtantial, wholeſome, delicate, and nouriſhing food; which when copiouſly ſupplied in the particular inſtances of the mackerel, the herring and the ſprat, at the ſtated ſeaſons, tend greatly to the reduction of the prices of other proviſions, and render them of great national importance. The readineſs with which many of them take the ſalt enhances their value and encreaſes their worth; they are thereby tranſported to diſtant countries, become delicious eating in hot climates, and add a charming variety to the food of the ſailor in long voyages. If we examine ſtill further into their uſe we ſhall find the dark, weariſome and lengthened winter evenings enlightened by the oil that is extracted from them in ſuch profuſion. To the delicate ſcales of ſome ſpecies the ladies are indebted for the elegant and beautiful little beads that ſo nearly reſemble pearl. Iſinglaſs is alſo a very uſeful drug, and made from various parts of theſe delicate animals. See ICHTHYOCOLLA.

If we attend to them as an article of amuſement, we ſhall find the angler cloſely engaged in watching his float, and baiting his hook for days together, while the more dexterous ſportſman, who fiſhes with a fly, ſhall relate in the evening a pleaſing tale of his dexterity in whipping for trout, how he played with his fiſh, and the number of ingenious and well contrived manœuvres he practiſed, before he could land his priſoner. The fund of pleaſure here offered, and the field of ingenuity which it opens, in weaving lines, adjuſting rods, and inventing a variety of artificial baits, have made a number of converts to this elegant amuſement.

SECT. III.

PECULIARITIES OF FISH.

Many of theſe aquatic animals are very tenacious of life, and although water is their natural element they will live a very conſiderable time out of it, particularly carp, which may be kept in a net with wet moſs and fed with bread and milk ſeveral days. Eels even after they are ſkinned exhibit ſigns of life for a conſiderable time; it is likewiſe ſaid that theſe fiſh quit the water in the night, and croſs the meadows feeding on ſnails, ſlugs, &c. and moſt of the flat fiſh will live many hours after they are taken out of the water.

Though fiſhes are formed for living entirely in the water, yet they cannot ſubſiſt without air. On this ſubject Mr. Hawkſbee made ſeveral experiments, which are recorded in the Philoſophical Tranſactions. The fiſhes he employed were gudgeons; a ſpecies that are very lively in the water, and can live a conſiderable time out of it. Three of them were put into a glaſs veſſel with about three pints of freſh water, which was deſigned as a ſtandard to compare the others by. Into another glaſs, to a like quantity of water, were put three more gudgeons, and thus the water filled the glaſs to the very brim. Upon this he ſcrewed down a braſs plate with a leather below, to prevent any communication between the water and the external air; and, that it might the better reſemble a pond frozen over, he ſuffered as little air as poſſible to remain on the ſurface of the water. A third glaſs had the ſame quantity of water put into it; which, firſt by boiling, and then by continuing it a whole night *in vacuo*, was purged of its air as well as poſſible; and into this alſo were put three gudgeons. In about half an hour, the fiſhes in the water from whence the air had been exhauſted, began to diſcover ſome ſigns of uneaſineſs by a more than ordinary motion in their mouths and gills. Thoſe who had no communication with the external air, would at this time alſo frequently aſcend to the top, and ſuddenly ſwim down again: and in this ſtate they continued for a conſiderable time, without any ſenſible alteration. About five hours after this obſervation, the fiſhes in the exhauſted water were not ſo active as before, upon ſhaking the glaſs which contained them. In three hours more, the included fiſhes lay all at the bottom of the glaſs with their bellies upwards; nor could they be made to ſhake their fins or tail by any motion given to the glaſs. They had a motion with their mouths, however, which ſhewed that they were not perfectly dead. On uncovering the veſſel which contained them, they revived in two or three hours, and were perfectly well next morning; at which time thoſe in the exhauſted water were alſo recovered. The veſſel containing theſe laſt being put under the receiver of an air pump, and the air exhauſted, they all inſtantly died. They continued at top while the air remained exhauſted, but ſunk to the bottom on the admiſſion of the atmoſphere.

The uſe of air to fiſhes is very difficult to be explained; and indeed their method of obtaining the ſupply of which they ſtand conſtantly in need, is not eaſily accounted for. The motion of the gills in fiſhes is certainly analogous to our breathing, and ſeems to be the operation by which they ſeparate the air from the water. Their manner of breathing is as follows. The fiſh firſt takes a quantity of water by the mouth, which is driven to the gills; theſe cloſe, and keep the water which is ſwallowed from returning by the mouth; while the bony covering of the gills prevents it from going through them till the animal has drawn the proper quantity of air from it: then the bony covers open, and give it a free paſſage; by which means alſo the gills are again opened, and admit a freſh quantity of water. If the fiſh is prevented from the free play of its gills, it ſoon falls into convulſions, and dies. But though this is a pretty plauſible explanation of the reſpiration of fiſhes, it remains a difficulty not eaſily ſolved, what is done with this air. There ſeems to be no receptacle for containing it, except the air-bladder, or ſwim; which, by the generality of modern philoſophers, is deſtined not to anſwer any vital purpoſe, but only to enable the fiſh to riſe or ſink at pleaſure.

The air bladder is a bag filled with air, compoſed ſometimes of one, ſometimes of two, and ſometimes of three diviſions, ſituated towards the back of the fiſh, and opening into the maw or the gullet. The uſe of this in raiſing or depreſſing the fiſh, is proved by the following experiment. A carp being put into the air pump, and the air exhauſted, the bladder is ſaid to burſt by the expanſion of the air contained in it; after which, the fiſh can no more riſe to the top, but ever afterwards crawls at the bottom. The ſame thing alſo happens when the air-bladder is pricked or wounded in ſuch a manner as to let the air out; in theſe caſes alſo the fiſh continues at the bottom, without a poſſibility of riſing to the top. From this it is inferred, that the air of the bladder is, by ſwelling at the will of the animal, to increaſe the ſurface of the fiſh's body, and thence diminiſhing its ſpecific gravity, to enable it to riſe at the top of the water, and to keep there at pleaſure. On the contrary, when the fiſh wants to deſcend, it is thought to contract the air bladder; and being thus rendered ſpecifically heavier, it deſcends to the bottom.

The ancients were of opinion, that the air bladder in fiſhes ſerved for ſome purpoſes eſſentially neceſſary to life; and Dr. Prieſtley alſo conjectures, that the raiſing or depreſſing the fiſh is not the only uſe of theſe air-bladders, but that they alſo may ſerve ſome other purpoſes in the œconomy of fiſhes. There are many arguments indeed to be uſed on this ſide of the queſtion; the moſt concluſive of which is, that all the cartilaginous kind of fiſhes want air-bladders, and yet they riſe to the top, or ſink to the bottom, of the water, without any difficulty; and though moſt of the eel-kind have air-bladders, yet they cannot raiſe themſelves in the water without great difficulty.

Fiſh appear to differ in their outward form as much as any other kind of animals, ſome being almoſt globular, others cylindrical, ſome very large at the head and tapering down to a very ſmall ſize at the tail; ſome are very large at the head, and appear cut ſhort off in the middle; others again ſlender round, and nearly of an equal thickneſs throughout; not a ſmall number are almoſt flat, ſome of which are of great depth from the dorſal to the pectoral fins, others again are much narrower; but one great ſingularity in fiſh, and which ought not to be omitted is, that in many ſpecies the eyes are placed both on one ſide the head, as in the turbot, ſoal, &c. this ſeems intended to preſerve them from injury when the fiſh is at reſt, and lays at the bottom of the ſea or rivers, flat on one ſide, which we preſume it does, from one ſide being always white, a property that invariably appears when that part is removed from the light; theſe fiſh do not ſwim horizontally, as their appearance would indicate, but vertically though rather obliquely. The hammer ſhark, which has the head extended on each ſide ſomething like the head of a hammer, has the eyes fixed at each extremity.

The cloathing or outward covering of fiſh is both various and beautiful, ſome being of a hard and horny texture, others tender, delicate and ſoft, many covered with beautiful ſcales, deciduous or eaſily wiped off, others ſtronger, more fixed and permanent, ſome, as in the firſt order, are covered as it were with a coat of mail or armed with ſpines, which are either fixed or moveable, ſome again are furniſhed with a kind of triagonal or hexagonal horn like ſcales, but all connected or united and not imbricated or lying one over the other as in the generality of fiſh. Others again are ſtudded as it were with pearls, as in ſome ſpecies of the ray, with which they make caſes for ſmelling bottles, ſpectacles, &c.

The teeth of fiſh is very variable, ſome being hard, ſtrong, bony and prominent, ſomething like the beak of a bird, as in the genus diodon, and tetrodon, in the firſt order; others again, weak, ſlender, pointed or blunt. Their ſituation alſo is extraordinary, and differs from moſt other animals, being placed not only in the jaws but on the tongue, palate, and gullet. The horn of the unicorn fiſh, and the prominent and extended jaw of the ſaw fiſh, are both very remarkable productions, and threaten inſtant death to thoſe that oppoſe them; and yet theſe animals have each their peculiar enemy: the ſmaller orders of fiſh are rapidly and greedily devoured by the larger.

Birds are alſo great deſtroyers of fiſh, and the gulls and albatroſs wait with eager eye to ſeize the poor flying fiſh the moment he is driven from his natural element by the dorados and other fiſh that purſue him. The ſhark, a moſt deſtructive animal, is rendered leſs ſo, by being obliged to turn on his back to ſeize his prey, by which means numbers are enabled to eſcape him that would otherwiſe fall victims to his inſatiable appetite. Among river fiſh the pike and perch appear the moſt voracious. Mr. Pennant relates an inſtance of a pike that was choaked by ſwallowing one of its own ſpecies: they will, he obſerves, devour young ducks, and deſtroy the water rat, and one of them even ſeized the head of a ſwan, and both animals periſhed: ſmall fiſh appear as much afraid of it, as birds do of an owl.

There are many things in the œconomy of fiſh, of which we are totally ignorant, or at beſt but little acquainted with, particularly their mode of propagation; for it appears doubtful in what manner the ovarium of the female becomes impregnated by the ſperm of the males. It is ſaid that the female ſalmon, aſſiſted by the male make a large hole in ſhallow water with their tails, where ſhe depoſits her roe, which the male immediately covers, by ejecting his milt over it, and that then they replace the earth, and leave it to be hatched by the ſun. That this may be the caſe with many oviparous fiſh ſeems highly probable, but with thoſe that are viviparous, and bring forth their young alive, it cannot be the caſe; for there the impregnation muſt take place in the body of the mother, but by what means we have no ſatisfactory account; the one given by Linnæus, of the female ſwallowing the male ſemen, not appearing probable.

The ſame care and attention for the preſervation of their ſpawn, and the ſecurity of the young fry, is as manifeſt among the inhabitants of the watery element, as with the terreſtrial and aerial animals; ſome depoſit their ſpawn in ſoft oozy ground at the mouth of rivers; others again go far up the rivers and leave their eggs in holes under the gravel; ſome make larger holes and cover them over, others again depoſit them in the crevices or hollows of rocks, and not a few in the open ſea. Aquatic birds are ſuppoſed to aſſiſt in the propagation of fiſh, by carrying the ſpawn into very remote places.

Fiſh in number perhaps exceed all other animals, inſects not excepted; for the weight of ſpawn is frequently heavier than the fiſh itſelf, and the immenſity of their numbers at particular ſeaſons of the year is almoſt incredible. In the Tweed 700 ſalmon have been drawn out at one hawl, and in that river only 208000 of that large fiſh are taken one year with another. At Cranna, on the river Ban in Ireland, 320 tons were caught in the year 1760. On the 5th of October 1767, there was at one time incloſed in St. Ives's bay 7000 hogſheads of pilchards, each containing 35000 fiſh, in all 245000000; and at Spalding in Lincolnſhire, once in 7 or 8 years the ſtickle-backs, a ſmall fiſh about 2 inches long, come up the Welland in the form of a vaſt column. And a man employed by the farmers to take them has got, for a conſiderable time, 4s. per day by ſelling them at a halfpenny a buſhel to manure the land, which amounts to 96 buſhels per day. The immenſe quantity of cod, taken on the banks of Newfoundland, has been mentioned under the article Cod; and were we to ſtate the particulars of each ſpecies of gregarious fiſh, it would far exceed our limits. Thoſe however who would wiſh to be more inti- intimately acquainted with the fiſh of this country, may conſult Mr. Pennant's Britiſh zoology, where they will find abundant information.

Fiſhes are remarkable for their longevity. "Moſt of the diſorders incident to mankind (ſays Bacon) ariſe from the changes and alterations in the atmoſphere; but fiſhes reſide in an element little ſubject to change; their's is an uniform exiſtence; their movements are without effort, and their life without labour. Their bones, alſo which are united by cartilages, admit of indefinite extenſion: and the different ſizes of animals of the ſame kind among fiſhes, is very various. They ſtill keep growing: their bodies, inſtead of ſuffering the rigidity of age, which is the cauſe of the natural decay of land animals, ſtill continue increaſing with freſh-ſupplies; and as the body grows, the conduits of life furniſh their ſtores in greater abundance. How long a fiſh, that ſeems to have ſcarce any bounds put to its growth, continues to live, is not aſcertained; perhaps the life of a man would not be ſufficient to meaſure that of the ſmalleſt."

There have been two methods fallen upon for determining the age of fiſhes; the one is by the circles of the ſcales, the other by the tranſverſe ſection of the back bone. When a fiſh's ſcale is examined by a microſcope, it is found to conſiſt of a number of circles one within another, in ſome meaſure reſembling thoſe which appear on the tranſverſe ſection of a tree, and is ſuppoſed to give the ſame information. For, as in trees we can tell their age by the number of their circles; ſo, in fiſhes, we can tell theirs by the number of circles in every ſcale, reckoning one ring for every year of the animal's exiſtence. The age of fiſhes that want ſcales may be known by the other method, namely, by ſeparating the joints of the back bone, and then minutely obſerving the number of rings which the ſurface, where it was joined, exhibits.

SECT. IV.

SCIENTIFIC DESCRIPTION.

The firſt order, or Nantes, differ eſſentially from the other four orders of fiſh, in being cartilaginous and not bony, and from their breathing, as it has been ſuppoſed, by means of lungs, as well as gills. But this ſeems a diſputed point at preſent, and therefore, as their outward appearance, mode of life, their breathing through gills that lie concealed by means of ſpiracula, or little holes inſtead of an operculum, their conſtant habitation being in the water, and many other circumſtances, which connect them with fiſh rather than amphibia, we have brought them back to their former ſituation, making a diſtinct order of them. But as the difference between them is ſufficiently deſcribed in the particular characters of each genus, we have been more explicit in the deſcription and characters of the other four orders, which appear much more difficult to be defined.

Fiſh are ſaid by Linnæus to be mute and deaf; their blood is cold and red, they reſpire through gills connected by an arch of bone; they ſwim by means of radiated fins, and are cloathed with cartilaginous ſcales. They are furniſhed with head, thorax, abdomen, tail and fins, brain, ſpiral marrow, heart with one auricle, and one ventricle, gills, diaphragm, liver and gall bladders, ſpleen, pancreas, kidney and urinary veſſels, ſeminal bladder or ovaria, inteſtinum cœcum, nictitating membrane; and for the moſt part a ſwimming bladder. Deſtitute of eyelids, ears, and outward flaps, neck, limbs, arms, and feet, penis, and womb. For a complete anatomical deſcription of Fish, ſee Syſtem of Anatomy, ſect. III.

The external part of the body is divided into head, trunk, and fins.

The *head* is either compreſſed or depreſſed, that is preſſed together ſideways or flattened, naked, ſcaly, ſmooth, ſpinous, or without ſpines.

Mouth, lips fleſhy or bony.

Teeth, often in the jaws, palate, tongue, and gullet.

Eyes, two, naked, nictitating membrane; pupil, globoſe, and chryſtalline.

Nostrils, broken, two in pairs, a little prominent.

Cirri, thread-ſhaped, ſoft, often inſerted in the lips, ſpreading.

Aperture of the gills, opening through the gills into the mouth, furniſhed with an operculum or gill fins.

Opercula, cover the fins, by cloſing the aperture.

Gills, without breathing, ſhut or ſtopped, often four arched bony radii, connected, radii free and pectinated.

Trunk, long and round, compreſſed, depreſſed; ſcaly or ſmooth, mucoſe; oblong, the hinder part narrowing into a tail: the ſcales for the moſt part cartilaginous, rarely ciliated, ſomething bony, growing on ſome fiſh like a coat of mail.

Lateral Line, one on each ſide, diſtinct from the interſtitial line, often from glandular points, rarely loricated, either ſtrait or curved; in ſome conſtituting on each ſide a keel ſhaped ridge to the tail.

Thorax, incloſes a heart within its own pericardium.

Abdomen, incloſing viſcera, inteſtines, air bladder, and ovaria.

Anus, terminates the abdomen.

Tail, at the end of the trunk behind the anus, ſolid, and muſcular.

Fins, membranaceous, unfolding by cartilaginous rays, which are *ſpinous*, hard, bony, ſimple, pungent; *without ſpines*, flexible, tendinous, branched.

Gill Fins, ſituate under the opening of the gills, equal, folded a radiated membrane.

Dorsal Fins, placed longitudinally along the back, unequal, often one, ſometimes two, very rarely three.

Adipose, ſpurious back fin, deſtitute of rays and unequal.

Pectoral Fin, placed at the ſide of the thorax, equal.

Ventral Fins, fixed under the body between the head and anus.

Anal Fin, behind the anus, near the tail, longitudinal, unequal.

Tail, terminal, perpendicular, unequal, round, intire, forked, or lunular, wedged ſhaped.

SECT. V.

CLASSIFICATION.

The grand work or foundation of this valuable Syſtem was laid by the firm friend and fellow ſtudent of Linnæus, the celebrated Artedi, whoſe premature death muſt be univerſally lamented by the lovers of this branch of ſcience. The perfection he gave to Ichthyology has ſince been extended by Linnæus through all the animal kingdom; his method of arrangement, and valuable obſervations, were publiſhed by his friend; who had much difficulty after his death to procure his papers, in an octavo volume printed at Leyden in 1738, under the title of *Petri Artedi, Sueci Medici,* Ichthyologia: *ſive opera omnia de piſcibus, ſcilicet Bibliotheca Ichthyologica; Philoſophica Ichthyologica; Genera Piſcium: Synonymia Specierum; Deſcriptiones Specierum. Omnia in hoc genere perfectiora quam antea ulla. Poſthuma vindicavit, recognovit, cooptavit, et edidit, Carolus* Linnæus. In this valuable work fiſhes are arranged in an entire new method, and this method Linnæus adopted with little variation in all his former editions of the *Syſtema Naturæ*, but in the latter he removed the *cetaceous* order into the claſs mammalia, and the *nantes* to the amphibia; quitting the diſtinctions ariſing from the bony and cartilaginous texture of the fins, he formed them on the ſituation of the ventral fins, which he conſidered as analogous to the feet of other animals, as they are placed either before, underneath, or behind the ventral fins, he therefore formed four orders, viz. Apodes, Jugulares, Thoracici, and Abdominales. We have however ventured to differ from that great man, and have reſtored the Nantes (or thoſe fiſh known by the old writers as cartilaginous) to the claſs of fiſhes, making five orders, viz.

1. Nantes, or ſuch as have branchial holes on each ſide.
2. Apodes, thoſe which have no ventral fins.
2 Jugulares, ventral fins placed before the pectoral ones.
4. Thoracici, ventral fins placed under the pectoral ones.
5. Abdominales, ventral fins placed in the abdomen, behind the pectoral ones.

ORDER I. NANTES.

Gills and lungs alſo; breathing arbitrarily; gills concealed; an operculum to the branchiæ; rays of the fins cartilaginous.

Genus 1. PETROMYZON. Seven Spiracula or holes on each ſide of the neck, no gills. Aperture on the top of the head, communicating with the lungs. No pectoral or ventral fins.

Genus 2. RAJA. Single ſpiraculum on each ſide in the upper part, and five ſpiracula under the neck. Body depreſſed or flattened. Mouth under the head. This genus is divided into two families. 1. Sharp teeth. 2. Blunt teeth. The torpedo is of this genus.

Genus 3. SQUALUS. Five ſpiracula on each ſide of the neck. Body oblong and ſlender; cylindrical. Mouth in the fore part of the head. There are three families of this genus. 1. Back ſpinous, with no anal fin. 2. Back ſmooth, ſharp teeth with an anal fin. 3. With grinding teeth.

Genus 4. CHIMÆRA. Spiracula ſolitary, of four parts under the neck. The ſuperior lip of the mouth of five parts. The firſt teeth are inciſores or cutting, two above and below.

Genus 5. LOPHIUS. Spiraculum one, behind the fins. Teeth numerous and very ſmall. Fins pectoral, brachiis inſidentés. Three gills only.

Genus 6. ACCIPENSER. Spiracula one on each ſide, linear, mouth under the head, retractile, without teeth. Cirri under the beak, before the mouth.

Genus 7. BALISTES. Head compreſſed. Eight teeth, on each ſide, the two firſt of which are the longeſt. Aperture above the pectoral fins. Body compreſſed, ſcales leathery and connected. Abdomen carinated.

Genus 8. OSTRACION. Head, teeth 10 porrected ſlender, aperture linear. Body bony, entirely loricated; no ventral fins.

Genus 9. TETRAODON. Jaws bony and porrected, apex of two parts. Aperture linear or narrow. Body underneath muricated, no ventral fins.

Genus 10. DIODON. Jaws bony, porrected; undivided; aperture linear; body covered all over with moveable acute ſpines; ventral fins none.

Genus 11. CYCLOPTERUS. Head obtuſe; teeth in the jaws; gill, membrane, compoſed of four radii; ventral fins united in a globular form.

Genus 12. CENTRISCUS. Head lengthened out into a narrow beak; aperture repanded; abdomen carinated; ventral fins united.

Genus 13. SYNGNATHUS. Roſtrum nearly cylindrical, mouth, an operculum in the inferior jaw; aperture of the gills ſhut with an operculum; breathing by a valve in the neck; body cataphractum; no ventral fins.

Genus 14. PEGASUS. Mouth, a proboſcis drawn back, ſuperior jaw with little teeth; under the beak ſwordſhaped, linear; aperture of the gills before the pectoral fins; body articulated with divided bones; cataphractum; ventral fins at the abdomen.

ORDER II. APODES.

No Ventral Fins.

Genus 15. MURÆNA. Head ſmooth, noſtrils tubular; gill membrane, with ten rays; eyes covered with a membrane; body long, ſlender and ſlippery; fins united on the back with the tail; and on the belly with the anus; apertures of the gills behind the head or pectoral fins; ſeven ſpecies.

Genus 16. GYMNOTUS. Head, with a lateral operculum tentacula, two, to the ſuperior lip; eyes covered with a membrane; gill membrane with five rays; body compreſſed, no fin on the back; a carinated fin underneath; five ſpecies.

Genus 17. TRICHIURUS. Head extended, openings on the ſides; teeth, ſword ſhaped; the apex nearly arrow ſhaped; the fore teeth larger than the reſt; gill membrane with ſeven rays; body compreſſed and ſword ſhaped; tail, awl ſhaped, without any fin.

Genus 18. ANARHICHAS. Head a little obtuſe; fore teeth above and below conic, diverging, ſix or more grinding teeth rounded; gill membrane ſix rays; body long and ſlender, tail fin diſtinct.

Genus 19. AMMODYTES. Head compreſſed and narrower than the body; ſuperior lip double, inferior mandible narrow and ſharp; teeth, aceroſi; gill membrane ſeven rays; body, long and ſlender, ſcales ſcarcely conſpicuous; tail diſtinct.

Genus 20. OPHIDIUM. Head nearly naked; teeth in the jaws, palate, and fauces; gill membrane with ſeven rays ſpreading, body ſword ſhaped.

Genus 21. STROMATEUS. Head compreſſed, teeth in jaws and palate; gill membrane no rays; body ovate, ſlippery; tail bifid; two ſpecies.

Genus 22. XIPHIAS. Head, ſuperior jaw, terminating in a ſword ſhaped beak; mouth without teeth; gill membrane with eight rays; body long and ſlender, alepidotum.

ORDER III. JUGULARES.

Ventral Fins placed before the Pectoral ones.

Genus 23. CALLIONYMUS. Head, ſuperior lip double; eyes nearly together; gill membrane ſix rays; aperture of the gills in the neck; opercula ſhut; body naked, ventral fins remote; three ſpecies.

Genus 24. URANOSCOPUS. Head depreſſed, very rough; mouth flat; the ſuperior jaw the ſhorteſt; gill membrane with five rays, papilloſo-dentata; operculum, a ciliated membrane; body; anus in the middle.

Genus 25. TRACHINUS. Head not ſmooth, compreſſed; gill fins with ſix rays; the lamina of the inferior ones ſerrated; body; anus near the breaſt.

Genus 26. GADUS. Head ſmooth, rays of the gill membrane ſeven and ſlender; body oblong; ſcales deciduous; all the fins covered with a common ſkin; more dorſal than anal; rays not prickly; pectoral fins ending in a point; ſeventeen ſpecies. This genus is divided into four families.

1. With three dorſal fins, and a cirrus or beard from the lower jaw; as in the haddock, cod, &c. which belong to this family. 2. Three dorſal fins, mouth, and no cirrus or beard, as in the whiting. 3. Two dorſal fins. 4. One dorſal fin only; of this family Linnæus gives but one ſpecies.

Genus 27. BLENNIUS. Head bending downwards, covered; gill membrane ſix rays; body lanceolate; ventral fins of two rays, anal fin diſtinct. This genus is divided into two families. 1. Head criſtated. 2d. Head without a creſt. Thirteen ſpecies.

ORDER IV. THORACICI.

Ventral Fins placed under the Thorax.

Genus 28. CEPOLA. Head nearly round, compreſſed; mouth flat, opening upwards. Teeth curved, in ſimple rows; gill membrane ſix rays; body ſwordſhaped, naked, abdomen ſcarce longer than the head; two ſpecies.

Genus 29. ECHENEIS. Head fat, naked, depreſſed: top flat, marginated, tranſverſly ſulcated, and ſerrated; gill membrane ten rays; body naked; two ſpecies.

Genus 30. CORYPHÆNA. Head very obtuſe or truncated, and declining downwards, gill membrane with five rays; body, dorſal fin the length of the back; twelve ſpecies.

Genus 31. GOBIUS. Eyes very near each other, with two ſmall punctures between; rays of the gill membrane four; ventral fins united in one ovate one; eight ſpecies.

Genus 32. COTTUS. Head broader than the body, and ſpinous; gill membrane, with ſix rays; ſix ſpecies.

Genus 33. SCORPÆNA. Head large, and ſet with prickles; eyes near together; teeth, in the jaws, palate and fauces, rays of the gill membrane ſeven.

Genus 34. ZEUS. Head and body remarkably compreſſed and bent downwards; ſuperior lip incloſed in a tranſverſe membrane; tongue awl ſhaped; gill membrane, ſeven perpendicular rays; the laſt tranſverſe; four ſpecies.

Genus 35. PLEURONECTES. Both eyes on one ſide of the head; body extremely compreſſed; gill fin from four to ſeven rays; this genus is divided into two families. 1. Eyes on the right ſide; as in the plaiſe, flounder, &c. 2. Eyes on the left ſide, as in the turbot; ſeventeen ſpecies.

Genus 36. CHÆTODON. Teeth ſetaceous, thick ſet, numerous and flexile; gill membrane ſix rays; body ſpotted; dorſal and anal fin, with fleſhy ſcales; twenty three ſpecies.

Genus 37. SPARUS. Fore or cutting teeth very ſtrong, grinders cloſe ſet and obtuſe; lips double; gill membrane five rays; operculum ſcaly; body compreſſed, the lateral line curved behind; pectoral fins round. This genus is divided into four families. 1. marked with black ſpots. 2. Rubri, red. 3. Linear marked with lines. 4. Varii, variegated; twenty ſix ſpecies.

Genus 38. LABRUS. Teeth ſharp, lips ſimple; gill membrane with ſix rays. Operculum ſcaly, body; connecting membrane of the dorſal fin, extending beyond the extremity of each ray, in the form of filaments, pectoral fins ſharp, lateral line ſtrait; this genus is divided into three families. 1. *Caudu bifurca*, or two forks. 2. *Cauda integra*; tail intire, enumerated according to the dorſal ſpines 3. *Cauda integra*; tail intire, dorſal ſpines hitherto unknown; forty one ſpecies.

Genus 39. SCIÆNA. Gill membrane ſix rays; operculum and the whole head ſcaly. A groove in the back to receive the dorſal fin; five ſpecies.

Genus 40. PERCA. Operculum ſcaly, and ſerrated; gill membrane, ſeven rays; fins ſpinous; three families. 1. Two diſtinct dorſal fins. 2. Two fins united, tail undivided. 3. Dorſal fins united, tail bifid; thirty-ſix ſpecies.

Genus 41. GASTEROSTEUS. Gill membrane, three rays; body, the tail carinated on each ſide; a diſtinct ſpine before the dorſal fin. Ventral fins behind the pectoral, but above the ſternum; eleven ſpecies.

Genus 42. SCOMBER. Head compreſſed and ſmooth; gill membrane, ſeven rays; body ſmooth, the lateral line carinated near the tail; ſpurious fins near the tail; divided into two families. 1. Spurious fins diſtinct, as in the mackrel. 2. Spurious fins connected as in the horſe mackrel or ſcad; ten ſpecies.

Genus 43. MULLUS. Head compreſſed, and bent downwards; head and body covered with large ſcales, eaſily deciduous; gill membrane three rays.

Genus 44. TRIGLA. Head armed with rough lines; gill membrane ſeven rays; diſtinct digiti, or appendages, to the pectoral fin; nine ſpecies.

ORDER V. ABDOMINALES.

Ventral Fins ſituate in the Abdomen behind the Thorax.

Genus 45. COBITIS. Eyes in the upper part of the head; gill membrane, four to ſix rays; opercula ſhut underneath; body nearly of an equal width quite to the tail; five ſpecies.

Genus 46. AMIA. Head, bony, naked, rough, with a conſpicuous ſuture; teeth in the mandibles, and palate, ſharp and thick ſet; two naſal cirri; gill membrane, twelve rays; body ſcaly.

Genus 47. SILURUS. Head naked; gill membrane four to fourteen rays; the firſt ray of the dorſal or pectoral fins are ſpinous and dentated; twenty one ſpecies.

Genus 48. TEUTHIS. Fore part of the head flat as if cut off; gill membrane five rays; teeth a ſimple row, rigid and cloſe ſet; two ſpecies.

Genus 49. LORICARIA. Head ſmooth depreſſed; mouth toothleſs and retractile; gill membrane ſix rays; body inveſted with a ſhelly cruſt; two ſpecies.

Genus 50. SALMO. Head ſmooth; teeth in the jaws and on the tongue; gill membrane, four to ten rays; poſterior dorſal; fins adipoſe, and without rays; ventral fins with many radii; this genus is divided into four families. 1. Truttæ or trouts; body variegated; teeth manifeſt. 2. Oſmeri or ſmelts; dorſal and anal fin oppoſite. 3. Coregoni; teeth ſcarce viſible. 4. Caracini; gill membrane, with only four rays; twenty-nine ſpecies.

Genus 51. FISTULARIA. Cylindrical beak or mandible, with the mouth at the end; gill membrane ſeven rays.

Genus 52. ESOX. Head above a little flat; inferior mandible longer than the upper and punctuated; teeth in the jaw and tongue; body long; gill membrane, fourteen rays; nine ſpecies.

Genus 53. ELOPS. Head ſmooth, teeth rough in the margin of the jaws and palate; gill membrane with thirty rays, beſides the exterior one which is armed with five teeth in the middle.

Genus 54. ARGENTINA. Teeth in the jaws and tongue; gill membrane, eight rays; vent very near the tail; ventral fin, many radii; two ſpecies.

Genus 55. ATHERINA. Superior jaw planiſh; ſix rays in the gill membrane; the lateral line ſilvery; two ſpecies.

Genus 56. MUGIL. Lips membranous, inferior mandible carinated inwards, no teeth; ſeven rays to the gill membrane; opercula ſmooth and round; body white.

Genus 57. EXOCOETUS. Head ſcaly; mouth without teeth; maxillis utroque latere connexis; gill membrane, ten rays; body whitiſh; abdomen angulate; pectoral fins nearly the length of the body, like wings; firſt rays carinated; two ſpecies.

Genus 58. POLYNEMUS. Head compreſſed, and covered all over with ſcales, beak obtuſe and prominent, gill membrane, five, or ſeven, ſeveral diſtinct appendages, placed with the pectoral fins; three ſpecies.

Genus 59. MORMYRUS. Head ſmooth, teeth many and margined, branchial aperture linear, and not covering to the gill; gill membrane, one ray, body ſcaley.

Genus 60. CLUPEA. Superior jaws, myſtacibus ſerratis, gill membrane, eight rays, gills within ſetaceous, belly ſharp, or keel form, and ſerrated, ventral fins often nine radii; eleven ſpecies.

Genus 61. CYPRINUS. No teeth, rays of the gill membrane three, body ſmooth and white, ventral fins, often nine rays; this genus conſiſts of four families. 1. Jaw bearded or cirroſe. 2. Tail fin entire. 3. Tail fin trifid. 4. Tail fin bifid; thirty-one ſpecies.

Having gone through the Syſtem of Fiſh, we think it may be proper to acquaint the curious reader, with the mode of preſerving them for the cabinet. If the ſpecies are ſuppoſed to be rare and new, there is no method ſo good as weak ſpirits; care being taken to note the colours exactly, leſt they ſhould change. In this mode, all the parts of the animal are preſerved for examination: another method is to take off nearly half the fiſh on one ſide, carefully leaving half the head, tail, the dorſal, ventral, and anal fins perfect; then take out all the fleſh, and fill the ſkin, thus prepared with plaiſter of Paris; when it is quite dry, the ſkin muſt be nicely varniſhed, and it has a very good effect: the ſame method may be obſerved, with only pinning out the ſkin on a board, and drying it without the plaiſter; in this laſt method, a large collection may be preſerved between paper, like a hortus ſiccus; but theſe ſhould alſo be varniſhed.

In the courſe of this Syſtem, I have taken the liberty of deviating from the method adopted by Linnæus in his Claſſification, and inſtead of four orders, according to his arrangement, have reſtored the Nantes, *(or thoſe Fiſh known by the old writers as Cartilaginous) to the Claſs of* Piſces, *and thereby formed them into the five orders ſpecified in the Section compriſing the Claſſification.*

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ICOSANDRIA, in botany, the twelfth claſs of plants with hermaphrodite flowers, and a large number of ſtamina or male parts in each, comprehending five orders. For the claſſification, ſee the Syſtem, Sect. V. For repreſentation of the ſeveral orders, ſee Plate V.

IDEA, Ἰδέα, the image or reſemblance of a thing, which, though not ſeen, is conceived by the mind.

IDEA, in phyſiology, denotes the immediate object of the mind about which we are employed, when we perceive or think of any thing; and this definition of Mr. Locke's is much leſs exceptionable than that of ſome other logicians, who define an *idea* to be a pattern or copy of a thing in the mind.

Dr. Price, in his inquiry into the original of our *ideas*, has taken occaſion to remark, that the ſyſtem of Mr. Locke, which aſcribes all our *ideas* to ſenſation and reflection, is materially defective; for, if by ſenſation we underſtand the effects ariſing from the impreſſions made on our minds by external objects, and by reflection the notice which the mind takes of its own operations, it will be impoſſible to derive ſome of the moſt important of our *ideas* from them. This excellent reaſoner obſerves, that the power within us that underſtands, the intuition of the mind, or the faculty in it that diſcerns truth, that views, compares, and judges of all *ideas* and things, is a ſpring of new ſimple *ideas*, or original, primary, and uncompounded perceptions of the mind. To this ſource he refers our *ideas* of the impenetrability and *vis inertiæ* of matter, ſubſtance, duration, ſpace, infinity, neceſſity, contingency, poſſibility, impoſſibility, power, cauſation, &c. all all our abſtract *ideas*, (ſee ABSTRACTION) and alſo our *ideas* of moral right and wrong, and of moral obligation. It is, he ſays, of the eſſence of theſe *ideas* to imply ſomething true or falſe of an object, and that they by no means denote the manner in which we are affected by it; ſo that they cannot with any propriety be referred to that part of our conſtitution, which has been diſtinguiſhed by the appellation of ſenſe. Accordingly, our ideas may be divided, firſt into thoſe implying nothing real without the mind, or nothing real and true, beſides its own affections and paſſions; to which claſs we may refer the immediate effects of impreſſions on the bodily ſenſes, without ſuppoſing any previous *ideas*, as all taſtes, ſmells, colours, &c. and thoſe that ariſe upon occaſion only of other *ideas*; as the effects in us of conſidering order, happineſs, the beauties of poetry, painting, &c. Secondly, into thoſe which are images of ſomething diſtinct from ſenſation, or which imply real, independent exiſtence and truth; which may be ſubdivided into ſuch as denote the real properties of external objects, and the actions and paſſions of the mind; and thoſe which are derived immediately from intelligence. By the notices conveyed to the mind through the organs of the body, or its obſervation of the neceſſary attendants and concomitants of certain ſenſations and impreſſions, it perceives the figure, extenſion, motion, and other primary qualities of material ſubſtances; by contemplating itſelf, it perceives the properties of ſpiritual ſubſtances, volition, conſciouſneſs, memory, &c. To all theſe *ideas* it is eſſential that they have real, certain, invariable archetypes, actually exiſting, to which they are referred, and to which they are conformable. Theſe *ideas* again become objects or archetypes to the intellective faculty; from whence ariſes a new ſet of *ideas*, which are the perceptions of this faculty, and repreſent not the mind's own affections, but neceſſary truth. Antecedently to theſe, whatever other *ideas* we may be furniſhed with, nothing is underſtood; whatever ſeeds or ſubjects of knowledge may be in the mind, nothing is known. Price's Review, &c. of Morals, ſect. 2, and 3.

Thoſe who wiſh to be farther acquainted with the controverſy relating to the nature and origin of our *ideas*, muſt be referred to Hume's Treatiſe of Human Nature, vol. i. p. 123, &c. 282, &c. 434. &c. Reid's Inquiry into the Human Mind, paſſim. Beattie's Eſſay on Truth, part ii. chap. 2. Prieſtley's Examination of Reid, Beattie, &c. paſſim.

Ideas, according to Mr. Locke, are divided into *ſimple* and *complex*. *Simple* IDEAS include all thoſe which come into the mind by ſenſation; and though the qualities of bodies that affect our ſenſes, are in the things themſelves ſo mixed and united, that there is no ſeparation between them, yet the *ideas* they produce in the mind are ſimple and unmixed. Again, ſome of theſe *ideas* we acquire purely by means of one ſenſe; as the *ideas* of colours, only by the eye; of ſounds, by the ear, of heat, by the touch, &c. Other *ideas* we gain by ſeveral ſenſes, as of ſpace, extenſion, figure, reſt, motion, &c. for theſe have their effect, both on the ſight and the touch. Others, again, are had from reflection only; ſuch as thoſe of perception and willing. There are other ſimple *ideas*, again, formed in the mind, both by ſenſation and reflection, jointly; as thoſe of pleaſure, pain, power, exiſtence, unity, ſucceſſion, &c. And ſome of theſe kinds of *ideas* are all, or at leaſt the moſt conſiderable, of thoſe ſimple *ideas* which the mind hath, and out of which is made all its other knowledge. The mind has ſeveral faculties of managing theſe ſimple *ideas*, which are worthy of notice: as, 1. That of diſcerning juſtly, and diſtinguiſhing rightly, between one and another; in which conſiſts the accuracy of judgment. 2. That of comparing them one with another, in reſpect to extent, degree, time, place, or any other circumſtances of relation or dependence, one on another. 3. That of compounding, or putting together, the ſimple *ideas* received by ſenſation and reflection, in order to make complex ones. 4. Children, by repeated ſenſations, having got ſome *ideas* fixed in their memories, by degrees learn the uſe of ſigns; and when they can ſpeak articulately, they make uſe of words, to ſigify their *ideas* to others.

Hence the uſe of the words being, to ſtand as outward marks of our internal *ideas*, and thoſe *ideas* being taken from particular things, if every particular *idea* that we take in ſhould have a particular name affixed to it, names would become endleſs. To prevent this inconvenience, the mind has another faculty, whereby it can make the particular *ideas* received from ſuch objects, become general; which is done by conſidering them as they are in the mind, ſuch appearances, ſeparate from all other exiſtences, and circumſtances of exiſtence, as time, place, and other concomitant *ideas*; and this is called Abſtraction.

Complex IDEAS, though their number be infinite, and their variety endleſs, yet may all be reduced to theſe three heads; viz. *modes*, *ſubſtances*, and *relations*. *Modes* are ſuch complex *ideas*, as, however compounded, are not ſuppoſed to exiſt by themſelves, but are conſidered as dependencies on, or affections of, ſubſtances: ſuch are the *ideas* ſignified by the words *triangle*, *gratitude*, *murder*, &c. Theſe are of two kinds: 1. Such as are only variations, or different combinations, of the ſame ſimple *idea*, without the mixture of any other; as a dozen, a ſcore, &c. which may be called *ſimple modes*. 2. There are others, compounded of ſimple *ideas*, of ſeveral ſorts put together to make one complex one; as *beauty*, *theft*, &c.

IDES, IDUS, in the Roman calendar, a denomination given to eight days in each month; commencing in the months of March, May, July, and October, on the fifteenth day; and in the other months on the thirteenth day; and reckoned backward, ſo as in the four months above ſpecified to terminate on the eighth day, and in the reſt on the ſixth.

IDIOM, Ιδιωμα, *propriety*, of ιδιος, *proper*, *own*, is ſometimes uſed for the peculiarities of a language; ſometimes for a dialect, or the language of ſome particular province; differing, in ſome reſpects, from the language of the nation in general, whence it is derived.

IDOL, in pagan theology, an image, or fancied repreſentation of any of the heathen gods.—This image, of whatever materials it conſiſted, was, by certain ceremonies called *conſecration*, converted into a god. While under the artificer's hands, it was only a mere ſtatue. Three things were neceſſary to turn it into a god; proper ornaments, conſecration, and oration. The ornaments were various, and wholly deſigned to blind the eyes of the ignorant and ſtupid multitude, who are chiefly taken with ſhew and pageantry. Then followed the conſecration and oration, which were performed with great ſolemnity among the Romans.

IDOLATRY, or the worſhip of idols, may be diſtinguiſhed into two ſorts. By the firſt, men adore the works of God, the ſun, the moon, the ſtars, angels, dæmons, men and animals; by the ſecond, men worſhip the work of their own hands, as ſtatues, pictures, and the like: and to theſe may be added a third, that by which men have worſhipped the true God under ſenſible figures and repreſentations. This indeed may have been the caſe with reſpect to each of the above kinds of idolatry; and thus the Iſraelites adored God under the figure of a calf. The ſtars were the firſt objects of idolatrous worſhip, on account of their beauty, their influence on their productions of the earth, and the regularity of their motions, particularly the ſun and moon, which are conſidered as the moſt glorious and reſplendent images of the Deity: afterwards, as their ſentiments became more corrupted, they began to form images, and to entertain the opinion, that by virtue of conſecration, the gods were called down to inhabit or dwell in their ſtatues. Hence Arnobius takes occaſion to rally the pagans for guarding ſo carefully the ſtatues of their gods, who, if they were really preſent in their images, might ſave their worſhippers the trouble of ſecuring them from thieves and robbers. As to the adoration which the ancient pagans paid to the ſtatues of their gods, it is certain, that the wiſer and more ſenſible heathens conſidered them only as ſimple repreſentations or figures deſigned to recal to their minds the memory of their gods. This was the opinion of Varro and Seneca: and the ſame ſentiment is clearly laid down in Plato, who maintains, that images are inanimate, and that all the honour paid to them has reſpect to the gods whom they repreſent. But as to the vulgar, they are ſtupid enough to believe the ſtatues themſelves to be gods, and to pay divine worſhip to ſtocks and ſtones.

Soon after the flood, idolatry ſeems to have been the prevailing religion of all the world; for wherever we caſt our eyes at the time of Abraham, we ſcarcely ſee any thing but falſe worſhip and idolatry. And it appears from Scripture, that Abraham's foreſathers, and even Abraham himſelf, were for a time idolaters. The Hebrews were indeed expreſsly forbidden to make any repreſentation of God; they were not ſo much as to look upon an idol: and from the time of the Maccabees to the deſtruction of Jeruſalem, the Jews extended this precept to the making the figure of any man: by the law of Moſes, they were obliged to deſtroy all the images they found, and were forbidden to apply any of the gold or ſilver to their own uſe, that no one might receive the leaſt profit from any thing belonging to an idol. Of this the Jews, after they had ſmarted for their idolatry, were ſo ſenſible, that they thought it unlawful to uſe any veſſel that had been employed in ſacrificing to a falſe god, to warm themſelves with the wood of a grove after it was cut down, or to ſhelter themſelves under its ſhade. But the preaching of the Chriſtian religion, where-ever it prevailed, entirely rooted out idolatry; as did alſo that of Mahomet, which is built on the worſhip of one God. It muſt not, however, be forgotten, that the Proteſtant Chriſtians charge thoſe of the church of Rome with paying an idolatrous kind of worſhip to the pictures or images of ſaints and martyrs: before theſe, they burn lamps and wax-candles; before theſe, they burn incenſe, and, kneeling, offer up their vows and petitions: they, like the Pagans, believe that the ſaint to whom the image is dedicated, preſides in a particular manner about its ſhrine, and works miracles by the intervention of its image; and that if the image was deſtroyed or taken away, the ſaint would no longer perform any miracle in that place.

IDYLLION, in poetry, a little poem, containing the deſcription or narration of ſome adventures. The word is derived from the Greek *ειδυλλιον*, diminutive of *ειδος, figure, repreſentation*; becauſe this poetry conſiſts in a natural lively image, or repreſentation of things. Theocritus is the oldeſt author who has written *idyllions*. The Italians imitate him, and have brought the *idyllion* into modern uſe.

JEALOUSY, in ethics, is that peculiar uneaſineſs which ariſes from the fear that ſome rival may rob us of the affection of one whom we greatly love, or ſuſpicion that he has already done it. The firſt ſort of *jealouſy* is inſeparable from love, before it is in poſſeſſion of its object; the latter is often unjuſt, generally miſchievous, always troubleſome. For repreſentation of the paſſion; ſee Treatiſe on DRAWING, Plate I.

JEHOVAH, in theology, one of the ſcripture names of God; ſignifying the being who is ſelf-exiſtent, and who gives exiſtence to others; ſee GOD. So great a veneration had the Jews for this name, that they left off the cuſtom of pronouncing it; whereby its true pronunciation was forgotten. They call it TETRAGRAMMATON, or the name with four letters; and believe that whoever knows the true pronunciation of it, cannot fail to be heard by God.

JEJUNUM, the ſecond of the ſmall guts; thus called from the Latin *jejunus*, *hungry*; becauſe always found empty. See Syſtem of ANATOMY, Part V. Sect. VI.

JEREMIAH, in Scripture Hiſtory, a canonical book of the Old Teſtament. This divine writer was of the race of the prieſts; the ſon of Hilkiah of Anathoth, in the tribe of Benjamin. He was called when very young to the prophetic office, about the thirteenth of Joſiah; and continued in the diſcharge of it above forty years. He is ſaid by St. Jerom, &c. to have been ſtoned to death by the Jews for preaching againſt their idolatry; but it is moſt likely that he died in Egypt, much advanced in years, and broken by the calamities which happened to himſelf and his country. There were ſeveral collections of *Jeremiah*'s prophecies; one made by God's command in the fourth year of Jehoiakim, chap. xxxvi. 2. This contained all the prophecies he had publiſhed to that time, as well againſt the other nations as the Jews. The former of theſe in the preſent collection are put by themſelves at the end of the book from chap. xlvi. to the end of the laſt. But in the preſent copies of the Septuagint they follow immediately after the thirteenth verſe of the twenty-fifth chapter. Another collection of theſe prophecies, mentioned chap. i. 3. comprehends all thoſe which *Jeremiah* had uttered to the time of the captivity, and were probably collected by Baruch, his amanuenſis, and are put together without any regard to the order of time. To this was added another collection of prophecies, publiſhed about the time of his going down into Egypt, contained in chap. xlii. xliii. xliv. at the end of which Ezra, or ſome others, after the captivity, added theſe prophecies which *Jeremiah* delivered againſt the Gentiles. The fifty-ſecond chapter was probably added by Ezra, and is chiefly taken out of the latter part of the ſecond book of Kings, with additions, which Ezra might ſupply out of the public records. The book of *Jeremiah* is altogether written in Hebrew, except the eleventh verſe of the tenth chapter which is Chaldee. St. Jerom has obſerved upon this prophet, that his ſtyle is more eaſy than that of Iſaiah and Hoſea; that he retains ſomething of the ruſticity of the village where he was born; but that he is very learned and majeſtic, and equal to thoſe two prophets in the ſenſe of this prophecy.

JESTING, or *conciſe wit*, as diſtinguiſhed from continued wit or HUMOUR, lies either in the thought, or the language, or both. In the firſt caſe it does not depend upon any particular words or turn of the expreſſion. But the greateſt fund of jeſts lies in the language, i. e. in tropes or verbal figures; thoſe afforded by tropes conſiſt in the metaphorical ſenſe of the words, and thoſe of verbal figures principally turn upon a double ſenſe of the ſame word, or a ſimilitude of ſound in different words. The third kind of jokes, which lies both in the ſenſe and language, ariſes from figures of ſentences, where the figure itſelf conſiſts in the ſenſe, but the WIT turns upon the choice of the words. Ward's Orat. vol. ii. Lect. 40.

JESUITS, an order of religious, founded by Ignatius Loyola, a Biſcayan military gentleman, of a fanatical and ambitious ſpirit, called alſo *the Society of Jeſus*. This order, which was the moſt political and beſt regulated of all the monaſtic orders, and from which mankind have derived more advantages, and received greater hurt, than from any other of theſe religious fraternities, has rendered itſelf very conſiderable by its miſſions into the Indies, and by its other employments relating to the ſtudy of the ſciences, and the education of youth. The council of Trent calls them, *Regular Clerks of the Company of Jeſus*.

Foundation of the Order. In the year 1538, Ignatius, having aſſembled ten of his companions at Rome, choſen moſtly out of the univerſity of Paris, propoſed to them to make a new order. After this, he preſented the plan of his inſtitution, ſuggeſted as he gave out, and his followers ſtill teach, by the immediate inſpiration of heaven to Paul III. who appointed a committee of cardinals to examine it; upon whoſe report, that the eſtabliſhment was unneceſſary as well as dangerous, Paul refuſed to approve it. This oppoſition was principally urged by the learned and worthy cardinal Guidiccioni. This oppoſition was vanquiſhed by the dexterity of Ignatius, who propoſed, that beſides the three vows of poverty, chaſtity, and monaſtic obedience, the members of this ſociety ſhould take a fourth vow of obedience to the pope; binding themſelves to go whitherſoever he ſhould command, for the ſervice of religion, and without requiring any thing from the holy ſee for their ſupport. However, Ignatius and his company in the ſame charter of their order in which they declare their implicit and blind allegiance to the court of Rome, promiſe a like implicit and unlimited allegiance to the general of their ſociety.

Confirmed by the Pope, and from what Motives. The pontiff, perceiving this inſtitution to be an object of conſequence, confirmed it, under the name of the *Company of Jeſus*, by a bull in 1540; and appointed Ignatius Loyola to be the firſt general of the order. Loyola was originally an illiterate ſoldier, and is ſuppoſed by many to have been only a flexible inſtrument in the hands of able and ingenious men who made uſe of his fortitude and fanaticiſm to anſwer their purpoſes, and perſons much more learned were employed to compoſe the writings which bear his name. Geddes's Tracts, vol. iii. p. 429. By this bull, their number was reſtrained to ſixty; but that reſtriction was taken away, two years afterwards, by another bull. The order has ſince been confirmed by ſeveral ſucceeding popes, who have added many new rights and privileges to it. In leſs than half a century after its inſtitution, the ſociety obtained eſtabliſhments in every country that adhered to the Roman Catholic church; in the year 1608, the number of *Jeſuits* had increaſed to 10581. In the year 1710, the order poſſeſſed 24 profeſſed houſes; 59 houſes of probation; 340 reſidencies; 612 colleges; 200 miſſions; 150 ſeminaries and boarding-ſchools; and conſiſted of 19,998 *Jeſuits*.

Eſtabliſhment of the Conſtitution and Laws of the Society with their Progreſs and Influence. The conſtitution and laws of the Society, were perfected by Laynez, and Aquaviva, the two generals who ſucceeded Loyola, men far ſuperior to their maſter in abilities, and in the ſcience of government. Several circumſtances concurred to the progreſs and extenſive influence of the *Jeſuits*. They were taught to conſider themſelves as formed for action, and bound to exert themſelves continually, as ſoldiers, in the ſervice of God and of the pope, his vicar on earth. And that they might have full leiſure for this active ſervice, they were totally exempted from thoſe functions, the performance of which is the chief buſineſs of other monks. They were required to attend to all the tranſactions of the world; to ſtudy the diſpoſitions of perſons in high rank, and to cultivate their friendſhip; and by the conſtitution as well as genius of the order, a ſpirit of action and intrigue was infuſed into all its members. Beſides, the form of government of this order was peculiar: Loyola, full of the ideas of implicit obedience, which he had derived from his military profeſſion, appointed that the government of this order ſhould be purely monarchical. A general, choſen for life by deputies from the ſeveral provinces, poſſeſſed power that was ſupreme and independent, extending to every perſon and to every caſe. He, by his ſole authority, nominated provincials, rectors, and every other officer employed in the government of the ſociety, and could remove them at pleaſure. In him was veſted the ſovereign adminiſtration of the revenues and funds of the order. Every member belonging to it was at his diſpoſal; and by his uncontrolable mandate, he could impoſe upon them any taſk, or employ them in whatſoever ſervice he pleaſed. To his commands they were required to yield not only outward obedience, but to reſign to him the inclinations of their own wills, and the ſentiments of their own underſtandings. There is not in the annals of mankind any example of ſuch a perfect deſpotiſm, exerciſed not over monks ſhut up in the cells of a convent, but over men diſperſed among all the nations of the earth.

The general alſo receives, by the conſtitution of the order, an account of the civil affairs of the country where his ſubjects reſide; ſo that he is furniſhed with full information concerning the tranſactions of every prince and ſtate in the world. The *Jeſuits*, from their firſt inſtitution, conſidered the education of youth as their peculiar province; and before the expiration of the 16th century, they had obtained the chief direction of this buſineſs in every catholic country in Europe. They had alſo become the confeſſors of almoſt all its monarchs; they were the ſpiritual guides of almoſt every perſon eminent for rank or power; and they poſſeſſed the higheſt degree of confidence and intereſt with the papal court, as the moſt zealous and able champions for its authority. The order, notwithſtanding the vow of poverty which they contrived to elude, acquired ample poſſeſſions in every catholic country. Beſides the ſources of wealth common to all the regular clergy, they obtained, under a pretext of promoting the ſucceſs of their miſſions, and of facilitating the ſupport of their miſſionaries, a ſpecial licence from the court of Rome to trade with the nations which they laboured to convert. In conſequence of this, they engaged in an extenſive and lucrative commerce, both in the Eaſt and Weſt Indies: they alſo aimed at obtaining ſettlements; and accordingly acquired poſſeſſion of a large and fertile province in the ſouthern continent of America, and reigned as ſovereigns over ſome hundred thouſand ſubjects. The progreſs and influence of the *Jeſuits* have been likewiſe much promoted by their mutual union for the good of the common cauſe; by their reputation for learning and ſcience, in which they excel all the other orders, though M. d'Alembert ſays, that the order has never produced one man, whoſe mind was ſo much enlightened with ſound knowledge as to merit the name of a philoſopher; by the ſeverity of their diſcipline and regularity of their conduct and manners; by propagating a ſyſtem of relaxed and pliant morality, which accommodates itſelf to the paſſions of men, juſtifies their vices, tolerates their imperfections, and authorizes almoſt every action, which the moſt audacious or crafty politician would wiſh to perpetrate. So that abbé Boileau ſays of them, they are a people who lengthen the creed and ſhorten the decalogue; by extending the juriſdiction and abſolute power of the court of Rome; and by the zeal which they have manifeſted in combating the opinions and checking the progreſs of the proteſtants. The end principally propoſed by this order is, to gain converts to the Romiſh church; with which view they diſperſe themſelves in every country and nation, and with amazing induſtry and addreſs purſue the end of their inſtitution. No difficulty ſo great that they cannot ſurmount, no danger ſo imminent that they will not undergo; and as ſome ſay, no crimes ſo ſhocking that have not been perpetrated by them for the ſervice of their cauſe.

Settlement in Paraguay and amazing Opulence. About the beginning of the laſt century, the *Jeſuits* obtained admiſſion into the fertile province of Paraguay, in South America, where they found the inhabitants in a barbarous and ſavage ſtate: they began with inſtructing and civilizing them; cultivating amongſt them the arts and manufactures, and accuſtoming them to the bleſſings of ſociety, ſecurity and order. By this method they ſecured their eſteem and confidence; and a few *Jeſuits* preſided over ſome hundred thouſand Indians. However, it appears from the moſt credible relations, that they ſoon changed their views from the propagating of Chriſtianity, to ſchemes of inſatiable avarice and boundleſs ambition: and they have ſent yearly to the members of their order, in Europe, immenſe quantities of gold, drawn from ſeveral American provinces where they have power and property, but chiefly from Paraguay, which belongs to them only: and it is evident, from later diſcoveries, which have proved the ruin of the *Jeſuits* in Spain and Portugal, that they had eſtabliſhed an independent empire in this province, ſubject to their ſociety alone, and which, by the ſuperior excellence of its conſtitution and police, could ſcarcely have failed to extend its dominions over all the ſouthern continent of America. They cut off every kind of communication between the Spaniards and Portugueſe in the adjacent ſettlements, and the Indians; inſpired the latter with hatred and contempt of theſe nations; induſtriouſly avoided giving the Indians any knowledge of the Spaniſh, or other European language; inſtructed them in the art of war; formed them into bodies of cavalry and infantry, and provided them with artillery and magazines ſtored with all the implements of war. Such was the ſtate of things, when, in the year 1750, the courts of Madrid and Liſbon entered into a treaty for fixing the limits of their dominions in South America. In the execution of the treaty, in the year 1752, the *Jeſuits* demurred; and a war enſued between the Spaniſh and Portugueſe on one ſide, and the Indians, animated by the *Jeſuits*, on the other; which was the real and original cauſe of the diſgrace of the *Jeſuits* at the court of Portugal.

The *Jeſuits* have been juſtly charged with inculcating the moſt licentious and dangerous maxims with regard to morality and religion: ſuch are the following extracted from their writings. That perſons truly wicked and void of the love of God, may expect to obtain eternal life in heaven, provided that they be impreſſed with a fear of the divine anger, and avoid all heinous and enormous crimes through the dread of future puniſhment: that thoſe perſons may tranſgreſs with ſafety, who have a probable reaſon for tranſgreſſing, i. e. any plauſible argument or authority in favour of the ſin they intend to commit: that actions intrinſically evil, and directly contrary to the divine laws, may be innocently performed, by thoſe who have ſo much power over their own minds, as to join, even ideally, a good end to this wicked action, or, to ſpeak in their ſtile, who are capable of directing their intention aright: that philoſophical ſin is of a very light and trivial nature, and does not deſerve the pain of hell; by philoſophical ſin they mean an action contrary to right reaſon, which is done by a perſon who is either abſolutely ignorant of God, or does not think of him during the time this action is committed: that the tranſgreſſions committed by a perſon blinded by the ſeduction of luſt, agitated by the impulſe of tumultuous paſſions, and deſtitute of all ſenſe and impreſſion of religion, however deteſtable and heinous they may be in themſelves, are not imputable to the tranſgreſſor before the tribunal of God; and that ſuch tranſgreſſions may often be as involuntary as the actions of a madman: and that the perſon who takes an oath, or enters into a contract, may, to elude the force of the one, and the obligation of the other, add to the form of words that expreſs them, certain mental additions and tacit reſervations. Some of theſe maxims were condemned by a public edict of pope Alexander VII. in 1659; and that relating to philoſophical ſin met with the ſame fate in 1690, under the pontificate of Alexander VIII. Neither of theſe bulls are to be found in the *Bullarium Pontificum*; but they are induſtriouſly preſerved by the Janſeniſts and Dominicans. The corrupt morality of the *Jeſuits* was humorouſly and learnedly attacked by the famous Paſcal, in his work entitled, Les Provinciales, ou Lettres écrits par Louis de Montalte, à un Provincial de ſes Amis et aux *Jeſuites*, ſur la Morale et la Politique de ces peres. The *Jeſuits*, however, obtained a ſentence againſt the *Provinciales*, by which they were condemned to be burnt publicly at Paris. Another excellent book, by Perrault, publiſhed at Mons, in 3 volumes 8vo. in the year 1702, entitled, La Morale, des *Jeſuites*, extrait fidelement de leurs Livres, imprimés avec la permiſſion et l'approbation des ſuperieurs de leur Compagnie, par un docteur de Sorbonne, was burnt at Paris, in the year 1670, at the requeſt of the *Jeſuits*. The famous Arnauld, with ſome of his Janſeniſt brethren, have undertaken to prove, that the *Jeſuits* reduced their pernicious maxims to practice, in a celebrated work, entitled, La Morale Pratique des *Jeſuites*, conſiſting of 8 volumes 8vo. the ſecond edition of which was publiſhed at Amſterdam, in the year 1742.

Particular Arrangements of the Order. The *Jeſuits* had no particular habit; but changed and accommodated it to times and occaſions. The order conſiſted of five different claſſes; *profeſſed fathers*, *ſpiritual coadjutors*, *approved ſcholars*, *lay brothers*, called alſo *temporal coadjutors*, and *novices*. Some writers make only three claſſes, viz. the *profeſſed members*, the *ſcholars*, and the *novices*. Some add a ſixth claſs, under the title of *adjuncts*, which they ſay is numerous, and is incorporated with the other claſſes, and diſguiſed under different ſorts of apparel.

The order was divided into *aſſiſtances*, the aſſiſtances into *provinces*, and the provinces into *houſes*. It was governed by a general, who is perpetual and abſolute. He reſided at Rome, and was elected by a general congregation of the order. He had with him five perſons, who were called *aſſiſtants*, and bore the name of the kingdom or country to which they belonged, and by which they were appointed; viz. of Italy, France, Spain, Germany, and Portugal. To theſe belonged the care of preparing the matters of their reſpective aſſiſtances, and of putting them in a method to facilitate their diſpatch. Each province had four kinds of *houſes*, viz. *profeſſed houſes*, which could have no lands belonging to them; *colleges*, where the ſciences were taught; *reſidences*, where were a number of workmen employed in ſuch offices, as had any immediate relation to preaching, confeſſion, miſſions, &c. and houſes of *novices*. Among the colleges, there were ſome called ſimply *colleges*, and others called *ſeminaries*. Theſe laſt were ſet apart for the young *Jeſuits* to go through their courſes of philoſophy and theology in; the others are for ſtrangers. Each province was governed by a *provincial*, and each houſe by a *ſuperior*; who was called *rector* in the colleges, and a *ſuperior* in the other houſes. Ignatius regulated the diſcipline of theſe houſes, and eſpecially of the colleges, by what he had obſerved in the Sorbonne, while he ſtudied at Paris. The profeſſed of this order renounced, by a ſolemn vow, all preferment, and eſpecially prelacy; and cannot receive any, unleſs enjoined thereto by the pope, under pain of ſin. This the pope ſometimes did; inſomuch that they have had eight cardinals of their order.

Total Suppreſſion. In the preceding part of this article we have given a brief account of the *Jeſuits*, as to their origin and influence, and the chief cauſes on which their influence depended, and the nature of their conſtitution; it remains to direct our views to their decline and actual ſuppreſſion, in ſome parts of Europe, where their credit, power and opulence had at one time arrived to a prodigious height. In France, the aſſaſſination of Henry IV. by Jean Chatel, one of their ſcholars, and the writings of the *Jeſuit* Guignard, in favour of regicide, induced ſeveral of the parliaments of the provinces to expel them, as a deteſtable and diabolical ſociety, the corruptors of youth, and enemies to the king and ſtate. But they were again favoured by Louis XIII. and Cardinal Richelieu, and alſo by Louis XIV. in whoſe reign they obtained the revocation of the edict of Nantes againſt the proteſtants. About this time, they refuſed, as it is ſaid, out of reſpect to the queen and dauphin, to undertake the ſpiritual guidance of La Pompadour, the miſtreſs of Louis XIV. and whilſt they offended the court by their ſcruples, they diſpleaſed it equally by their intrigues: laying ſnares for diſgracing perſons in place, whoſe only crime was a diſregard for their ſociety. They alſo offended men of letters by their violent declamations againſt the *Encyclopedie*, and by their abuſe of Voltaire, the author of the Henriade. In this ſituation of the *Jeſuits*, the war broke out between England and

France, which involved the ſociety in that famous law-ſuit, which directly brought on its deſtruction. Having carried on a conſiderable commerce in the iſland of Martinico, and ſuſtained ſome loſſes by the war, they wanted to compound their debts with their correſpondents in Lyons and Marſeilles. Theſe correſpondents, looking upon the ſociety in general to be anſwerable for their brethren in Martinico, addreſſed themſelves to a certain *Jeſuit* in France, demanding juſtice. This good father, and the *Jeſuits* in general, demurred, and ſtood trial before the grand-chamber of the Parliament of Paris, where they were caſt; and not only ſentenced to pay the immenſe ſums in litigation, but interdicted for the future all manner of commerce. This ſentence led into an examination of their conſtitution by their own books; which appeared to be contrary to the laws of the kingdom, the obedience due to the king, the ſafety of his perſon, and the peace of the ſtate. Beſides, the *Jeſuits* were grown rich, inſolent, and imperious; and though they profeſſed to have renounced the world, they were found to be tutors, courtiers, merchants, politicians, prieſts, and wanted nothing leſs than to be governors and rulers of the earth. Theſe were ſufficient motives for ſuppreſſing them: the attempt to aſſaſſinate the French king in 1757, was charged on the *Jeſuits*; and the actual aſſaſſination of the king of Portugal in the following year, which induced the Portugueſe miniſter to drive them all out of the kingdom, in 1759, increaſed the odium againſt them. The parliament of Paris having taken a whole ear to enquire into the nature of their inſtitution, and news of the capture of Martinico in the mean while arriving, the miniſter, as M. d'Alembert ſays, in order to cauſe a diverſion, thought on the expedient of proceeding againſt the *Jeſuits*; and the principal of their college was commanded to obey the arrets of parliament, and to ſhut up their ſchools on the firſt of April, 1762. On the ſixth of Auguſt following, their inſtitution was unanimouſly condemned by the parliament, without any oppoſition on the part of the ſovereign; the ſociety was of courſe diſſolved; and their poſſeſſions alienated and ſold; the other parliaments of the kingdom following ſooner or later the example of that of Paris; nay ſome of them acted with ſtill greater ſeverity, driving them out of their provinces without ſtanding upon forms of law.

Such were the laws, the policy, and the genius of this formidable order; of which, however, a perfect knowledge has only been attainable of late. Europe had obſerved, for two centuries, the ambition and power of the order. But while it felt many fatal effects of theſe, it could not fully diſcern the cauſes to which they were to be imputed. It was unacquainted with many of the ſingular regulations in the political conſtitution or government of the *Jeſuits*, which formed the enterpriſing ſpirit of intrigue that diſtinguiſhed its members, and elevated the body itſelf to ſuch a height of power. It was a fundamental maxim with the *Jeſuits*, from their firſt inſtitution, not to publiſh the rules of their order. Theſe they kept concealed as an impenetrable myſtery. They never communicated them to ſtrangers, not even to the greater part of their own members. They refuſed to produce them when required by courts of juſtice; and, by a ſtrange ſoleciſm in policy, the civil power in different countries authoriſed or connived at the eſtabliſhment of an order of men, whoſe conſtitution and laws were concealed with a ſolicitude which alone was a good reaſon for having excluded them. During the proſecutions carried on againſt them in Portugal and France, the *Jeſuits* have been ſo inconſiderate as to produce the myſterious volumes of their inſtitute. By the aid of theſe authentic records, the principles of their government may be delineated, and the ſources of their power inveſtigated with a degree of certainty and preciſion which, previous to that event, it was impoſſible to attain. The pernicious effects, however, of the ſpirit and conſtitution of this order, rendered it early obnoxious to ſome of the principal powers in Europe, and gradually brought on its downfal. The emperor Charles V. ſaw it expedient to check its progreſs in his dominions; it was expelled England by proclamation, 2 James I. in 1604; Venice, in 1606; Portugal, in 1759; France, in 1764; Spain and Sicily, in 1767; and totally ſuppreſſed and aboliſhed by the late Pope Clement XIV. in 1773. See on the ſubject of this article Moſheim's Eccl. Hiſt. vol. iii. p. 406, &c. 467, &c. vol. iv. p. 206, &c. 354, &c. Engliſh ed. 8vo. Robertſon's Hiſt. Ch. V. vol. iii. p. 304, &c. 8vo. D'Alembert's Account of the Deſtruction of the *Jeſuits*, paſſim.

JESUS CHRIST, the Son of God, and Saviour of mankind, deſcended from heaven, and took upon him the human nature in Judea, towards the concluſion of the reign of Herod the Great, king of that country. The place of his birth was Bethlehem, a flouriſhing city of Judah; but the year in which he was born is not preciſely aſcertained. The moſt general opinion is, that it happened about the year of Rome 748, or 749, and about 18 months before the death of Herod. Four inſpired writers have tranſmitted to us an account of the life of Jeſus Chriſt. They mention particularly his birth, lineage, family and parents, but ſay very little concerning his infancy and earlier youth. For a particular account of the tranſactions of our bleſſed Saviour, ſee ***Fleetwood's Life*** of ***Chriſt***.

JET D'EAU, a French word, ſignifying a fountain that caſts up water to any conſiderable height in the air. See Syſtem of HYDROSTATICS.

JEWS, a name derived from the patriarch Judah, and given to the deſcendants of Abraham by his eldeſt ſon Iſaac, who for a long time poſſeſſed the land of Paleſtine in Aſia, and are now diſperſed through all nations in the world. The hiſtory of this people, as it is the moſt ſingular, ſo is it alſo the moſt ancient in the world; and the greateſt part being before the beginning of profane hiſtory, depends entirely on the authenticity of the Old Teſtament, where it is only to be found. To repeat here what is ſaid in the ſacred writings would both be ſuperfluous and tedious, as thoſe writings are in every perſons hands, and may be conſulted at pleaſure. It ſeems moſt proper therefore to commence the hiſtory of the Jews from their return to Jeruſalem from Babylon, and the rebuilding of their city and temple under Ezra and Nehemiah, when the ſcripture leaves off any farther accounts, and profane hiſtorians begin to take notice of them. Thoſe who wiſh to be fully acquainted with the hiſtory of the Jews, are referred to ***Maynard's*** tranſlation of Joſephus, the moſt modern edition of the works of that celebrated Warrior and Hiſtorian; to which is added a continuation of their hiſtory, from the laſt accounts given by Joſephus, down to the preſent times.

IGNIS FATUUS, a kind of light, ſuppoſed to be of an electric nature, appearing frequently in mines, marſhy places, and near ſtagnatin waters. It was formerly thought, and is ſtill by the ſuperſtitious believed, to have ſomething ominous in its nature, and to preſage death and other misfortunes. There have been inſtances of people being decoyed by theſe lights into marſhy places, where they have periſhed; whence the names of *Ignis fatuus*, ***Will-with-a-wiſp***, and ***Jack-with-a-lanthorn***, as if this appearance was an evil ſpirit which took delight in doing miſchief of that kind. Signior Volta, in a letter to Dr. Prieſtley, informs him, that he fires inflammable air by the electric ſpark, even when the electricity is very moderate: and he ſuppoſes, that this experiment explains the inflammation of the ***ignes fatui***, provided they conſiſt of inflammable air iſſuing from marſhy ground by the help of the electricity of fogs, and by falling ſtars, which are very probably thought to have an electrical origin. Prieſtley's Obſ. on Air, vol. iii. Appendix, p. 382. The reader will find a particular account of various particulars relating to the ***ignis fatuus***, in the Phil. Tranſ. Abr. vol. vii. p. 147, &c. Dr. Shaw deſcribes an ***ignis fatuus***, which he ſaw in the Holy Land, that was ſometimes globular, or in the form of the flame of a candle; and immediately afterwards ſpread itſelf ſo much as to involve the whole company in a pale inoffenſive light, and then contract itſelf again, and ſuddenly diſappear. But in leſs than a minute it would become viſible as before; or, running along from one place to another, with a ſwift progreſſive motion, would expand itſelf, at certain intervals, over more than two or three acres of the adjacent mountains. The atmoſphere at this time had been thick and hazy, and the dew on their bridles was unuſually clammy and unctuous. In the ſame weather, he obſerved thoſe luminous appearances, which, at ſea, ſkip about the maſts and yards of ſhips, and which the ſailors call ***corpuſanſe*** by a corruption of the Spaniſh ***cuerpo ſanto***. Shaw's Travels, p. 363.

IGNITION, properly ſignifies the ſetting fire to any ſubſtance; but the ſenſe is commonly reſtrained to that kind of burning which is not accompanied with flame, ſuch as that of charcoal, cinders, metals, ſtones, and other ſolid ſubſtances. The effects of ignition are firſt to diſſipate what is called the ***phlogiſton*** of the ignited ſubſtance, after which it is reduced to aſhes. Vitrification next follows; and laſtly, the ſubſtance is totally diſſipated in vapour. All theſe effects, however, depend on the preſence of the air; for ***in vacuo*** the phlogiſton of any ſubſtance cannot be diſſipated. Neither can a body which is totally deſtitute of phlogiſton be ignited in ſuch a manner as thoſe which are not deprived of it: for as long as the phlogiſton remains, the heat is kept up in the body by the action of the external air upon it; but when the phlogiſton is totally gone, the air always deſtroys, inſtead of augmenting the heat. Philoſophers have therefore been greatly embarraſſed in explaining the phenomena of ignition. It hath been found a matter of no ſmall difficulty to determine how far the air, and how far the phlogiſton, is concerned in this operation; but as theſe enquiries cannot be entered into without firſt determining the nature of the phlogiſton, we muſt refer to that article for an account of the different theories of ignition.

IGNORANCE, the privation or abſence of knowledge. The cauſes of ignorance, according to Locke, are chiefly theſe three. 1. Want of ideas. 2. Want of a diſcoverable connection between the ideas we have. 3. Want of tracing and examining our ideas.

IGNORANCE, in law, is a want of knowledge of the laws; which will not excuſe a perſon from ſuffering the penalty annexed to the breach of them; becauſe every one is obliged, at his peril, to know the laws of the land.

ILIAD, Ιλιας, the name of an ancient epic poem, the firſt, and fineſt, of thoſe compoſed by Homer. The word is derived from the Greek ιλιας, of Ιλιον, *Ilium*, Troy, a famous city of Aſia, which the Greeks beſieged, for the ſpace of ten years, and at laſt deſtroyed, on account of the rape of Helena, which makes the ſubject of the work. The poet's deſign in the ***Iliad*** was, to ſhew the Greeks, who were divided into ſeveral little ſtates, how much it was their intereſt to preſerve an harmony and good underſtanding among them. In order to which, he ſets before their eyes the calamities that befel their anceſtors from the wrath of Achilles, and his miſunderſtanding with Agamemnon; and the advantages that afterwards accrued to them from their union. The *Iliad* is divided into twenty four books, which are marked with the letters of the alphabet. The Engliſh tranſlation of the *Iliad* by Mr. Pope, is well known.

IMAGE is uſed for the trace, or mark, which outward objects impreſs on the mind, by means of the organs of ſenſe.

IMAGE alſo ſignifies an artificial repreſentation performed by man; as in painting, ſculpture, and the like. In which ſenſe the word is now generally uſed in ſpeaking of things holy or imagined to be ſo. The noble Romans preſerved the *images* of their anceſtors with a great deal of care and concern, and had them carried in proceſſion at their funerals and triumphs. The Jews abſolutely condemn all *images*, and not ſo much as ſuffer any ſtatues or figures in their houſes, much leſs in their ſynagogues, or places of worſhip. The uſe and adoration of *images*, are things that have been a long time controverted in the world. It is plain from the practice of the primitive church, recorded by the earlier fathers, that Chriſtians, for the firſt three centuries after Chriſt, and the greater part of the fourth, neither worſhipped *images* nor uſed them in their worſhip. The cuſtom of admitting pictures or ſaints and martyrs into the churches, for this was the firſt ſource of *image* worſhip, was rare in the latter end of the fourth century; but became common in the fifth: however, they were ſtill conſidered only as ornaments; and even in this view, they met with very conſiderable oppoſition. In the following century the cuſtom of thus adorning churches became almoſt univerſal, both in the Eaſt and Weſt. Petovius expreſsly ſays, (de Incar. lib. xv. cap. 14.) that no ſtatues were yet allowed in the churches; becauſe they bore too near a reſemblance to the idols of the gentiles. Towards the cloſe of the fourth or beginning of the fifth century, *images*, which were introduced by way of ornament, and then uſed as an aid to devotion, began to be actually worſhipped. The Mahometans have a perfect averſion to *images*; which was what led them to deſtroy moſt of the beautiful monuments of antiquity, both ſacred and profane, at Conſtantinople.

IMAGE, in rhetoric, ſignifies a lively deſcription of any thing in a diſcourſe. *Images* in diſcourſe are defined, by Longinus, to be, in general, any thoughts proper to produce expreſſions, and which preſent a kind of picture to the mind. *Images* in rhetoric, have a very different uſe from what they have among the poets: the end principally propoſed in poetry is, aſtoniſhment and ſurprize; whereas the thing chiefly aimed at in proſe, is to paint things naturally, and to ſhew them clearly. They have this, however, in common, that they both tend to move, each in its kind. Theſe *images*, or *pictures*, are of vaſt uſe, to give weight, magnificence, and ſtrength, to a diſcourſe. They warm and animate it; and, when managed with art, according to Longinus, ſeem, as it were, to tame and ſubdue the hearer, and put him in the power of the ſpeaker.

IMAGINATION, a power or faculty of the ſoul whereby it conceives and forms ideas of things, by means of impreſſions made on the fibres of the brain, by ſenſation. This power depends on the memory. Ideas enter into the mind by the ſenſes; the memory retains them; and *imagination* compounds them. Some writers have diſtinguiſhed two ſorts of *imagination*; the one, which conſiſts in retaining the ſimple impreſſion of objects, is called the paſſive *imagination*; the other arranges the images that are received, and combines them in a thouſand ways, and is called the active *imaginatton*. The organs of our ſenſes are compoſed of fibrillæ, or little fibres, which, at one end, terminate in the outward parts of the body and ſkin, and the other in the middle of the brain. Theſe fibres may be moved two ways: either beginning at that end which terminates in the brain, or that which terminates without.

Since then the *imagination* only conſiſts in a power which the ſoul has of forming images of objects, by impreſſing them on the fibres of the brain, it follows that the larger and more diſtinct the veſtigia or tracks of the animal ſpirits, which are the lines or ſtrokes, as it were, of thoſe images, are; the more ſtrongly and diſtinctly the ſoul *imagines* thoſe objects. Now as the breadth, depth, and cleanneſs of the ſtrokes of a ſculpture depend on the force wherewith the graver acts, and the obedience which the copper yields, ſo the depth and cleanneſs of the tracks of the *imagination* depend on the force of the animal ſpirits, and the conſtitution of the fibres of the brain; and it is that variety which is found in thoſe two things, to which we owe almoſt all the vaſt difference which we obſerve in people's minds. On the one ſide are abundance and ſcarcity, briſkneſs and ſlowneſs, largeneſs and ſmallneſs, of the animal ſpirits; and on the other hand, delicacy or groſſneſs, humidity or dryneſs, ſtiffneſs or flexibility of the fibres of the brain; and laſtly, a particular relation which the animal ſpirits may have with thoſe fibres: from the various combinations of which things, will reſult a ſufficiently great variety, to account for all the different characters which appear in the minds of men: and from the ſame principle flows that difference which is obſerved in the ſame perſon's mind, at different times, and under different circumſtances, as in childhood, manhood, and old age, in ſickneſs, health, &c.

The hiſtories of monſtrous births, where the imperfection or deformity is aſcribed to the *imagination* of the mother, are numberleſs; and indeed ſo well authenticated, that an advocate for the power of *imagination* in pregnant women, will triumphantly exclaim, that facts are ſtubborn things; and that all reaſoning is ſophiſtry, when oppoſed to them. But the anſwer to this kind of argument is, that experience ſhews it to be difficult to aſcertain a fact; and that when we coolly and carefully examine the truth of reputed facts, they are often diſcovered to have been advanced through haſtineſs and credulity, and to have been perpetuated through ignorance and ſervility. The advocates for this opinion, if they mean any thing, muſt mean, that at the inſtant the mother received the impreſſions, the child was of the natural form, but that by the power of her *imagination* the ſtructure of the parts was that moment altered, and aſſumed the appearance, either gradually or ſuddenly, with which the child was born.

By expoſing the abſurdity of one example, it will appear that all the other wonderful ſtories of the ſame kind are equally abſurd. It has been alledged, for inſtance, that a lady advanced five or ſix months in her pregnancy, has been ſo terrified by a beggar thruſting the ſtumps of an amputated arm into the coach, that the child of which ſhe was afterwards delivered, was born with a ſtump of arm reſembling that of the beggar. Here let us pauſe a while, and conſider what an operation muſt be performed to work this effect. A child at the term of five or ſix months, is of conſiderable bulk, and the arm itſelf not ſmall. This arm muſt then drop off by the power of *imagination*: there muſt be no blood loſt to endanger the life of the child; and the wound muſt be healed before the birth. The mere ſtating of this poſition expoſes its ridiculouſneſs. But admitting that a limb could drop off by the force of fancy, it muſt ſtill remain with the mother until the delivery; and the bones at leaſt would not putrify and waſte away, though the fleſh would. But it never was pretended that in caſes of this nature, any part of the deficient limb was found by the midwife; and what is worth obſerving, that the ſtumps of all ſuch imperfect limbs, have a ſmooth ſkin, which plainly indicates they were from their firſt formation of the ſame figure: for had there been a wound, there would have been a ſcar, and ſcars are very diſtinguiſhable from ſound ſkin.

There is no defect more frequent than that of the hare lip, and it ſeldom happens that a woman who has a child with that deformity, does not endeavour to recollect ſhe either longed for a hare or was frightened by a hare, or ſaw ſomebody with a hare lip; it is no matter which. A woman already prepoſſeſſed that there muſt have been ſome ſuch cauſe, is not long at a loſs; her memory, or her prejudice, ſoon furniſhes her with a fact, and the inſtance of this child is added to the long catalogue of ſuch. It is not more than a century ſince ſome men of learning gave credit to the efficacy of ſympathetic medicines, which, like other charms, were to communicate their virtues to patients at a diſtance. Learning and good ſenſe have at length baniſhed this viſionary conceit; and in a century more, the notion of the *imagination* of the mother operating on the body of her unborn child, will meet with the ſame contempt. After all, the whole of this ſubject is not yet ſufficiently explained.

IMAGO, in natural hiſtory, is a name given by Linnæus to the third ſtate of inſects, when they appear in their proper ſhape and colours, and under no more tranſformation.

IMBECILITY. a ſtate of languor and decay; wherein the body is not able to perform its uſual exerciſes or functions.

IMITATION, in oratory, is an endeavour to reſemble a ſpeaker or writer in thoſe qualities, with regard to which we propoſe them to ourſelves as patterns. The firſt hiſtorians among the Romans, ſays Cicero, were very dry and jejune, till they began to imitate the Greeks, and then they became their rivals. It is well known how cloſely Virgil has imitated Homer in his Æneid, Heſiod in his Georgics, and Theocritus in his Eclogues. Terence copied after Menander; and Plautus after Epicarmus, as we learn from Horace, lib. ii. ep. ad Auguſt. who himſelf owes many of his beauties to the Greek lyric poets. Cicero appears, from many paſſages in his writings, to have imitated the Greek orators. Thus Quintilian ſays of him, that he has expreſſed the ſtrength and ſublimity of Demoſthenes, the copiouſneſs of Plato, and the delicacy of Iſocrates. Inſt. Or. lib. x. cap. 1.

The true art of *imitation* conſiſts in ſo diverſifying what we take from others, as if we can, to improve it, or at leaſt not ſuffer it to receive any detriment by our alteration. And this may be done, by ſo enlarging a thought, or expreſſion taken from another, as in a good meaſure to render it our own: by either abridging, or only taking a part of what another has ſaid before us; by keeping the thought, and applying it to a different ſubject; and finally, by preſerving the thoughts, and applying them to the ſame ſubject, but changing their order, and repreſenting them in a different dreſs. See Ward's Orat. vol. ii. ſect. 53 and 54.

IMMACULATE, *without ſtain*. A term much uſed among the Romaniſts; when ſpeaking of the conception of the bleſſed Virgin, they call it *immaculate*.

IMMEMORIAL, an epithet given to the time or duration of any thing whoſe beginning we know nothing of. In a legal ſenſe, a thing is ſaid to be of time *immemorial*, or time out of mind, that was before the reign of our king Edward II.

IMMENSE, that whoſe amplitude, or extenſion, no finite meaſure whatſoever, or how oft ſoever repeated, can equal.

IMMERSION, an act by which any thing is plunged into water, or ſome other fluid. In the firſt ages of Chriſtianity, baptiſm was performed by *immerſion*; by three *immerſions*. The cuſtom of *immerſion* is ſaid to be ſtill preſerved in Portugal, and among the Anabaptiſts in other parts.

IMMORTAL, that which will laſt to all eternity, as having in itſelf no principle of alteration, or corruption. Thus God and the human Soul are *immortal*.

IMMUNITY, a privilege or exemption from ſome office, duty, or impoſition. *Immunity* is more particularly underſtood of the liberties granted to cities and communities. The princes heretofore granted all kinds of *immunities* to eccleſiaſtics, exempting them from all impoſitions; but the eccleſiaſtics of thoſe days were not ſo rich as thoſe of ours: they gave all they had to the poor.

IMMUTABILITY, the condition of a thing that cannot change. *Immutability* is one of the divine attributes. See the article GOD.

IMPALED, in heraldry, is underſtood of a ſhield party per pale, or divided into two halves by a line drawn pale-wiſe through the middle, from the top to the bottom. See the Syſtem, Sect. II. and IX, and Plate II.

IMPEACHMENT, is the accuſation and proſecution of a perſon for treaſon, or other crimes and miſdemeanors. Any member of the lower houſe of parliament may impeach any one belonging either to that body, or the houſe of lords. The method of proceeding is to exhibit articles on the behalf of the commons, by whom managers are appointed to make good their charge. Theſe articles are carried to the lords, by whom every perſon impeached by the commons is tried; and if they find him guilty, no pardon under the great ſeal can be pleaded to ſuch an *impeachment*. 12 and 13 Will. III. c. 2. A commoner cannot, however, be impeached before the lords for any capital offence, but only for high miſdemeanors. A peer may be impeached for any crime; the articles of *impeachment* are a kind of bills of indictment, found by the houſe of commons, and afterwards tried by the lords, who, in caſes of miſdemeanors, are conſidered not only as their own peers, but as the peers of the whole nation.

IMPENETRABILITY, a quality whereby a thing becomes unable to be pierced or penetrated; or a property of body whereby it fills up certain ſpaces, ſo that there is no room in them for any other body. Dr. Harris defines *impenetrability*, the diſtinction of one extended ſubſtance from another, by means whereof the extenſion of one thing is different from that of another: ſo that two extended things cannot be in the ſame place, but muſt neceſſarily exclude each other.

IMPERATIVE, in grammar, is one of the moods or manners of conjugating a verb, ſerving to expreſs a commandment; as *go*, *come*, &c. See the Syſtem, Part I. Chap. II. Sect. I. alſo Part II. Chap. III. Art. V.

IMPERFECT *Tenſe*, in grammar, ſignifies an indefinite time between the preſent and the paſt; as, *I taught*, *I heard*. See the Syſtem, Part I. Chap. II. Sect. I. &c.

IMPERIAL, ſomething belonging to an emperor, or empire, Thus we ſay, his *imperial* MAJESTY, the *imperial* CROWN, *imperial* MEDALS, the *imperial* CHAMBER. *Imperial* cities, in Germany, are thoſe which own no other head but the emperor. Theſe are a kind of little commonwealths; the chief magiſtrate whereof does homage to the emperor, and pays him the Roman month; but in other reſpects, and in the adminiſtration of juſtice, the magiſtrate is ſovereign. The *imperial cities* have a right of coining money, and of keeping forces, and fortified places: their deputies aſſiſt at the *imperial* diets, where they are divided into two branches; that of the Rhine, and that of Suabia. There were formerly twenty-two in the former, and thirty-ſeven in the latter; but there are now only forty-nine in all; thirteen belonging to the former, and thirty-ſix to the latter. *Imperial Diet*, is an aſſembly or convention of all the ſtates of the empire. See DIET.

IMPERVIOUS, a thing not to be pervaded, or paſſed through; either by reaſon of the cloſeneſs of its pores, or the particular configuration of its parts.

IMPORTATION, the act of *importing* or bringing merchandiſe from foreign countries, in contradiſtinction to EXPORTATION.

IMPOSITION *of Hands*, an eccleſiaſtical action, by which a biſhop lays his hands on the head of a perſon, in ordination, confirmation, or in uttering a bleſſing. This practice is alſo frequently obſerved by the Diſſenters at the ordination of their miniſters, when all the miniſters preſent place their hands on the head of him whom they are ordaining, while one of them prays for a bleſſing on him and his future labours. This ſome of them retain as an ancient practice, juſtified by the example of the apoſtles, when no extraordinary gifts are conveyed. However, they are not agreed as to the propriety of this ceremony; nor do they conſider it as an eſſential part of ordination.

IMPOST, from *impono*, *I impoſe*, in law, properly denotes the tribute or tax appointed by a ſovereign to be paid for ſuch merchandize as is brought into any haven in his dominions from foreign nations. *Impoſt* is diſtinguiſhed from CUSTOM, in that cuſtom more properly ſignifies the duties paid to the king for goods ſhipped off or exported. But the two are frequently confounded together.

IMPOSTHUME, by corruption from *impoſtem* and *apoſtem abſceſs*, a collection of matter, or pus, in any part of the body, either owing to an obſtruction of the fluids in that part, which makes them change into ſuch a matter; or to a tranſlation of it from ſome other part where it was generated. See ABSCESS.

IMPOSTORS, *religious*, are ſuch as falſely pretend to an extraordinary commiſſion from Heaven, ſuch as Mahomet, and who terrify and abuſe the people with falſe denunciations of judgments. Theſe are puniſhable in the temporal courts, with fine, impriſonment, and infamous corporal puniſhment.

IMPOSTS, in architecture, the capitals of pillars, or pilaſters, which ſupport arches; ſee the SYSTEM on the orders of *Architecture* in general.

IMPOTENCE, or IMPOTENCY, a want of ſtrength, power, or means, to perform any thing; and is more particularly uſed for a natural inability to coition. In this ſenſe *impotency* is defined an inability or inſufficiency in the male to impregnate the female. We have inſtances of unfitneſs for generation in men, by an impediment to the ejection of the ſemen in coition, from a wrong direction, which the orifices of the verumontanum got, whereby the ſeed was thrown into the bladder. Mr. Petit cured one patient under ſuch a difficulty of emiſſion, by making an inciſion like to that commonly made in the great operation for the ſtone. See Mem. de l'Acad. de Chirurg. tom. i. *Impotence* may be cauſed by various accidents, but moſt frequently takes its riſe from early and immoderate venery; and often from the venereal diſeaſe.

IMPREGNATION, the emiſſion of the ſeed of the male in coition, by which the female conceives, or becomes with young. See GENERATION.

IMPREGNATION is alſo figuratively uſed in pharmacy, when a liquor imbibes the particles of ſome other body. Thus a menſtruum, is ſaid to be *impregnated* with a body diſſolved in it, as much as its pores are able to receive.

IMPRESSING *Seamen*. The power of impreſſing ſea-faring men for the ſea-ſervice by the king's commiſſion, has been a matter of ſome diſpute, and ſubmitted to with great reluctance; though it hath very clearly and learnedly been ſhewn by Sir Michael Foſter, that the practice of impreſſing, and granting powers to the admiralty for that purpoſe, is of very ancient date, and hath been uniformly continued by a regular ſeries of precedents to the preſent time: whence he concludes it to be part of the common law. The difficulty ariſes from hence, that no ſtatute has expreſsly declared this power to be in the crown, tho' many of them ſtrongly imply it. The ſtatute 2 Ric. II. c. 4. ſpeaks of mariners being arreſted and retained for the king's ſervice, as of a thing well known, and practiſed without diſpute; and provides a remedy againſt their running away. By a later ſtatute, if any waterman, who uſes the river Thames, ſhall hide himſelf during the execution of any commiſſion of preſſing for the king's ſervice, he is liable to heavy penalties. By another, (5 *Eliz.* c. 5.) no fiſherman ſhall be taken by the queen's commiſſion to ſerve as a mariner; but the commiſſion ſhall be firſt brought to two juſtices of the peace, inhabiting near the ſea-coaſt where the mariners are to be taken, to the intent that the juſtices may chooſe out and return ſuch a number of able-bodied men, as in the commiſſion are contained, to ſerve her majeſty. And, by others, eſpecial protections are allowed to ſeamen in particular circumſtances, to prevent them from being impreſſed. Ferrymen are alſo ſaid to be privileged from being impreſſed, at common law. All which do moſt evidently imply a power of impreſſing to reſide ſomewhere; and, if any where, it muſt, from the ſpirit of our conſtitution, as well as from the frequent mention of the king's commiſſion, reſide in the crown alone. After all, however, this method of manning the navy is to be conſidered as only defenſible from public neceſſity, to which all private conſiderations muſt give way. The following perſons are exempted from being impreſſed: Apprentices for three years; the maſter, mate, and carpenter, and one man for every 100 tons, of veſſels employed in the coal-trade; all under 18 years of age, and above 55; foreigners in merchant-ſhips and privateers; landmen betaking themſelves to ſea for two years; ſeamen in the Greenland fiſhery, and harpooners, employed, during the interval of the fiſhing ſeaſon, in the coal-trade, and giving ſecurity to go to the fiſhing next ſeaſon.

IMPRESSION, in philoſophy, is applied to the ſpecies of objects which are ſuppoſed to make ſome mark or *impreſſion* on the ſenſes, the mind, and the memory.

IMPRESSION is alſo frequently uſed in ſpeaking of the editions of a book, or of the number of times it has been printed. *Impreſſion*, however, differs from *edition*: the former, properly ſpeaking, takes in no more than what belongs to the printing, the letter, paper, margin, page, diſtances of the words and lines, and the diſpoſition of every thing that may have a good or bad effect upon the eye: the latter, beſides all this, takes in the care of the editor, who has reviſed the copy, corrected or augmented it, adding notes, tables, and other like things, which he judged might contribute towards making the book more uſeful and correct. Indeed very frequently the word *edition* only refers to this latter part; as when, in ſpeaking of the works of S. Auguſtine, we quote the edition of Eraſmus, the Lovaniſts, Benedictines, &c. where we have no regard to the printing part, but only to the care and pains of the editors.

IMPRISONMENT, the ſtate of a perſon reſtrained of his liberty, and detained under the cuſtody of another; and extends not only to a gaol, but to a houſe, ſtocks, or a man's being held in the ſtreet, &c. None ſhall be impriſoned but by the lawful judgment of his peers, or by the law of the land. Mag. Ch. 9 Hen. III. c. 2. 25 Edw. III. ſtat. 5. c. 4. No perſon is to be impriſoned, but as the law directs, either by command or order of the court of record, or by lawful warrant; or the king's proceſs on which one may be lawfully detained. And at common law a perſon could not be impriſoned unleſs he were guilty of ſome force or violence, for which his body was ſubject, as one of the higheſt executions. Where the law gives power to impriſon, in ſuch caſe it is juſtifiable, provided he that does it in purſuance of a ſtatute, exactly purſues the ſtatute in the manner of doing it, for otherwiſe it will be deemed falſe impriſonment, and in conſequence it is unjuſtifiable. Every warrant of commitment for impriſoning a perſon, ought to run "Till delivered by the due courſe of law," and not "Until farther order;" which has been held ill; and thus it alſo is, where one is impriſoned on a warrant, not mentioning any cauſe for which he is committed. A perſon being ſent to priſon by a warrant from a ſecretary of ſtate, without aſſigning any cauſe, &c. it was adjudged, that he ought to be diſcharged for that reaſon. Perſons may alſo, by bail or habeas corpus, be diſcharged from their impriſonment in any caſe bailable. See the articles HABEAS CORPUS, BAIL, PRISON, PRISONER and GAOL.

IMPROPRIATION, is a term uſed where the profits of an eccleſiaſtical benefice are in the hands of a layman. In which ſenſe it ſtands diſtinguiſhed from APPROPRIATION, which is where the profits of a benefice are in the hands of a biſhop, college, &c. though the two are now often uſed promiſcuouſly. There are ſaid to be 3845 *impropriations* in England.

IMPULSIVE, a term in philoſophy, applied to the action of the body which impels or puſhes another. Thus the arm is ſaid to give an impulſive motion to the ſtone that it throws. See PROJECTILE. In this ſenſe, *impulſive* ſtands contradiſtinguiſhed from *attractive* and *repulſive*. Sir Iſaac Newton ſuggeſts, that attraction itſelf may poſſibly be effected by an *impulſive* power.

INALIENABLE, that which cannot be validly alienated, or made over to another; ſee ALIENATION. Thus the dominions of the king, the church, minors, &c. are *inalienable*, otherwiſe than with a reſerve of the right of redemption for ever.

INANITY, the ſchool term for emptineſs, or abſolute vacuity, and implies the abſence of all body and matter whatſoever, ſo that nothing remains but mere ſpace.

INARCHING, in gardening, a particular ſort of grafting, called alſo by ſome grafting by approach. It is uſed when the ſtock intended to be grafted on, and the tree from which the graft is to be taken, ſtand ſo near one another, that they may be brought to touch; for general directions reſpecting grafting, ſee Syſtem of GARDENING, article *Fruit Garden*, month of *February*.

INAUGURATION, the coronation of an emperor, or king; or the CONSECRATION of a prelate, ſo called in imitation of the ceremonies uſed by the Romans, when they are received into the college of augurs.

INCARNATION, in theology, ſignifies the act whereby the Son of God aſſumed the human nature; or the myſtery by which Jeſus Chriſt, the eternal word, was made man, in order to accompliſh the work of our ſalvation. The æra uſed among Chriſtians, whence they number their years, is the time of the *incarnation*, that is, of Chriſt's conception in the virgin's womb.

INCENDIARY, *incendiarius*, in law, is applied to one who is guilty of maliciouſly ſetting fire to another's dwelling-houſe, and all out-houſes that are parcel thereof, though not contiguous to it, nor under the ſame roof, as barns and ſtables; ſee ARSON.

INCENSE, or FRANKINCENSE, in the materia medica, &c. a dry reſinous ſubſtance, known among authors by the names THUS and OLIBANUM. Incenſe is a rich perfume, with which the Pagans, and the Roman Catholics ſtill perfume their temples, altars, &c. The word comes from the Latin *incenſum*, q. d. *burnt*: as taking the effect for the thing itſelf. The burning of incenſe made part of the daily ſervice of the ancient Jewiſh church. The prieſts drew lots to know who ſhould offer it; the deſtined perſon took a large ſilver diſh, in which was a cenſer full of incenſe; and being accompanied by another prieſt carrying ſome live coals from the altar, went into the temple. One reaſon of this continual burning of incenſe might be, that the multitude of victims that were continually offered up, would have made the temple ſmell like a ſlaughter-houſe, and conſequently have inſpired the comers rather with diſguſt and averſion, than awe and reverence, had it not been overpowered by the agreeable fragrance of thoſe perfumes.

INCEST, the crime of venereal commerce between perſons who are related in a degree prohibited marriage by the laws of the country. Some are of opinion, that marriage ought to be permitted between kinsfolks, to the end that the affection, ſo neceſſary in marriage, might be heightened by this double tie; and yet the rules of the church have formerly extended this prohibition even to the ſeventh degree, but time has now brought it down to the third or fourth degree. Moſt nations look on *inceſt* with horror, Perſia and Egypt alone excepted. In the hiſtory of the ancient kings of thoſe countries we met with inſtances of the brother's marrying the ſiſter; the reaſon was, becauſe they thought it too mean to join in alliance with their own ſubjects: and ſtill more ſo to have married into the families of any foreign princes.

INCH, a known Engliſh meaſure, the twelfth part of a FOOT.

INCH *of Candle*, a manner of ſelling goods among merchants. The method of it is thus. Notice is uſually given upon the Exchange in writing and elſewhere, when the ſale is to begin; againſt which time the goods are divided into ſeveral parcels, called *lots*, and papers printed of the quantity of each, and of the conditions of ſale: as, that none ſhould bid leſs than a certain ſum more than another had bid before. During the time of the bidding a ſmall piece, of about an *inch*, of wax-candle, is burning; and the laſt bidder, when the candle goes out, has the lot or parcel expoſed to ſale.

INCIDENCE, in mechanics and optics, expreſſes the direction in which one body ſtrikes on another; otherwiſe called INCLINATION. See the SYSTEMS.

INCIDENT, in a poem, is an epiſode, or particular action, joined to the principal action, or depending on it. A good comedy is to be full of agreeable *incidents*, which divert the ſpectators, and form the intrigue. The poet ought always to make choice of ſuch *incidents* as are ſuſceptible of ornament ſuitable to the nature of his poem. The variety of *incidents* well conducted makes the beauty of an heroic poem, which ought always to take in a certain number of *incidents* to ſuſpend the cataſtrophe, that would otherwiſe break out too ſoon.

INCOGNITO, a term borrowed from the Italians, uſed when a perſon is in any place, where he would not be known; but it is more particularly applied to princes, or great men, who enter towns, or walk the ſtreets, without their ordinary train, or the uſual marks of their diſtinction and quality; or when they travel without their proper titles. The grandees in Italy make a common cuſtom of walking the ſtreets *incognito*; and always take it amiſs, on ſuch occaſion, when people pay their compliments to them. It is not barely to prevent their being known, that they take theſe meaſures; but becauſe they would not be treated with ceremony, nor receive the honours due to their rank.

INCOMBUSTIBLE, that which cannot be burnt or conſumed by fire. Metals melt, ſtones calcine, and are yet *incombuſtible*.

INCOMMENSURABLE, a term in geometry, uſed where two lines, when compared to each other, have no COMMON *meaſure*, how ſmall ſoever, that will exactly meaſure them both. In the general, two quantities are ſaid to be *incommenſurable*, when no third quantity can be found that is an aliquot part of both.

INCONTINENCE. Beſide the moral ſenſe of this word, it ſignifies in medicine an inability in any of the organs to retain what ſhould not be diſcharged without the concurrence of the will. But *incontinence* is moſt frequently uſed with regard to an involuntary diſcharge of urine.

INCONTINENCY, in a moral ſenſe, is of divers kinds: as in caſes of bigamy, rapes, ſodomy, &c. all which are puniſhed by ſtatute. See 25 Hen. VIII. cap. 6. 18 Eliz. cap. 7. 1 Jac. I. cap. 11. *Incontinency* of prieſts is puniſhable by the ordinary, by impriſonment, &c. 1 Hen. VII. cap. 4.

INCORPOREAL, *ſpiritual*; a thing, or ſubſtance, which has no body. Thus the ſoul of man is *incorporeal*, and may ſubſiſt independent of the body.

INCORRUPTIBLE, that which cannot be corrupted. Thus ſpiritual ſubſtances, as angels, human ſouls, &c. and thus alſo glaſs, gold, mercury, &c. may be called *incorruptible*.

INCRASSATING, the act of condenſing, or rendering fluids thicker, by the mixture of other leſs fluid particles; or by expelling the fine particles, and compinging and bringing the groſſer nearer together. *Incraſſating* medicines are ſuch as reduce the too fluid blood and juices to a proper conſiſtence.

INCUBATION, the action of a hen, or other fowl, brooding on her eggs.

INCUBUS, *Night-mare*, a diſeaſe conſiſting in the ſpaſmodic contraction of the muſcles of the breaſt ſo very violent, that the patient cannot ſpeak or even breathe. The word is derived from the Latin *incubare, to lie down on any thing*, and *preſs it*. The Greeks call it εφιαλτης, q. d. *ſaltator, leaper*, or ſomething that ruſheth on a perſon. In this diſeaſe the ſenſes are not quite loſt, but they are drowned and aſtoniſhed, as are alſo the underſtanding and imagination: ſo that the patient ſeems to think ſome huge weight thrown on him, and ready to ſtrangle him. Children are very liable to this diſtemper; ſo are fat people, and men of much ſtudy and application of mind, becauſe the ſtomach, in all theſe, finds ſome difficulty in digeſtion.

INCUMBENT, in eccleſiaſtical law, a clerk reſident on his benefice, with cure. He is called *incumbent* of ſuch church, becauſe he ought to bend his whole ſtudy to diſcharge his cure.

INDECIMABLE, *Indecimabilis*, in law, is applied to things not tythable, or which by law ought not to pay TITHE.

INDEFINITE, *indeterminate*, that which has no certain bounds, or to which the human mind cannot affix any. Des Cartes uſes the word, in his philoſophy, inſtead of *infinite*, both in numbers and quantities, to ſignify an *inconceiveable* number, or number ſo great, that an unit cannot be added to it; and a quantity ſo great, as not to be capable of any addition. Thus, he ſays, the ſtars, viſible and inviſible, are in number *indefinite*; and not, as the ancients held, infinite; and that quantity may be divided into an *indefinite* number of parts, not an infinite number.

INDENTED, INDENTEE, in heraldry, is when the outline of a bordure, ordinary, &c. is notched, in form of the teeth of a ſaw. See PLATE II.

INDENTURE, in law, a writing which compriſes ſome contract between two, at leaſt; being indented at top anſwerable to another part, which has the ſame contents. See DEED.

INDEPENDENTS, a ſect of Proteſtants in Britain and Holland, ſo called from their independency on other churches, and their maintaining, that each church or congregation has ſufficient power to act and perform every thing relating to religious government within itſelf, and is no way ſubject or accountable to other churches or their deputies. They therefore diſallow parochial and provincial ſubordination, and form all their congregations upon a ſcheme of co-ordinancy. But though they do not think it neceſſary to aſſemble ſynods, yet if any be held, they look upon their reſolutions as prudential counſels, but not as deciſions to which they are obliged to conform. The preſent Independents differ from the Preſbyterians only in their church-government; in being generally more attached to the doctrines diſtinguiſhed by the term *orthodoxy*, ſuch as original ſin, election, reprobation, &c.; and in adminiſtring the Lord's Supper at the cloſe of the afternoon's ſervice. See PRESBYTERIANS. The ſeveral ſects of Baptiſts are all Independents with reſpect to church-government: and, like them, adminiſter the Lord's Supper in the evening; whereas the Preſbyterians adminiſter it after the forenoon's ſervice.

INDEX, in arithmetic, is the ſame with what is otherwiſe called the characteriſtic, or exponent of a logarithm. See LOGARITHM.

INDEX *of a Book*, is that part annexed to a book, referring to the particular matters or paſſages therein contained. INDEX *of a Globe*, is a little ſtyle fitted on to the north pole, and turning round with it, pointing to certain diviſions in the hour circle. It is ſometimes alſo called *gnomon*. See Treatiſe on the GLOBES.

INDICATIVE, in grammar, the firſt mood or manner of conjugating verbs, ſhewing either the time preſent, paſt, or future, and aſſerting what we think certain. See Syſtem of GRAMMAR, Part I. Chap. II. Sect. I. Art. I.

INDICTMENT, in law, a bill or declaration, of complaint, drawn up in form of law, for the benefit of the commonwealth: exhibited as an accuſation of one for ſome offence, criminal or penal, and preferred to a grand jury, and by their verdict found to be true, and preſented before a judge or officer, who has power to puniſh or certify the ſame offence.

INDICTMENT, in common law, ſignifies as much as *accuſatio* among the civilians; though in ſome points it differs. See ACCUSATION.

INDIGENOUS, of *indigena*, denotes a native of a country; or that which was originally born or produced in the country where it is found. In this ſenſe, particular ſpecies of animals and plants are ſaid to *indigenous* in the country where they are native, in oppoſition to Exotic.

INDIGESTION, a crudity, or want of due coction, either in a food, a humour of the body, or an excrement. See DIGESTION.

INDIGO, a dye prepared from the leaves and ſmall branches of the *Indigofera Tinctoria*. See INDIGOFERA.

INDIGOFERA, the *Indigo Plant*; a genus of the decandria order, belonging to the diadelphia claſs of plants. There are five ſpecies; the moſt remarkable of which is the *tinctoria*, a native of the warm parts of Aſia, Africa, and America, and from which the Indigo dye is made.

Indigo is diſtinguiſhed into two kinds, the *true* and the *baſtard*. Though the firſt is ſold at a higher price on account of its ſuperiority, it is uſually advantageous to cultivate the other, becauſe it is heavier. The firſt will grow in many different ſoils; the ſecond ſucceeds beſt in thoſe which are moſt expoſed to the rain. Both are liable to great accidents. Sometimes the plant becomes dry, and is deſtroyed by an inſect frequently found on it; at other times, the leaves, which are the valuable part of the plant, are devoured in the ſpace of 24 hours by caterpillars. This laſt misfortune, which is but too common, has given occaſion to the ſaying, "that the planters of indigo go to bed rich, and riſe in the morning totally ruined."

Indigo is uſed, in waſhing, to give a blueiſh colour to linen: painters alſo employ it in their water-colours; and dyers cannot make fine blue without indigo. The ancients procured it from the Eaſt-Indies; in modern times, it has been tranſplanted into America. The cultivation of it, ſucceſſively attempted at different places, appears to be fixed at Carolina, St. Domingo, and Mexico. That which is known under the name of *Guatimala* indigo, from whence it comes, is the moſt perfect of all.

INDIVIDUAL, INDIVIDUUM, in logic, a particular being of any ſpecies; or that which cannot be divided into two or more beings, equal or alive. The uſual diviſion in logic is made into genera or genuſes, thoſe genera into ſpecies, and thoſe ſpecies into *individuals*. See GENUS, SPECIES, and DIVISION.

INDIVISIBLE, among metaphyſicians. A thing is ſaid to be abſolutely *indiviſible*, that is a ſimple being, and conſiſts of no parts into which it may be divided. Thus, God is *indiviſible* in all reſpects; as is alſo the human mind; not having extenſion, or other properties of body.

INDORSEMENT, in law, any thing written on the back of a deed; as a receipt for money received. There is likewiſe an *indorſement*, by way of aſſignment, on bills of exchange and notes of hand; which is done by writing a perſon's name on the back thereof.

INDUCTION, in eccleſiaſtical law, is putting a clerk or clergy-man in poſſeſſion of a benefice or living to which he is collated or preſented.

INDUCTION, in logic and oratory, a conſequence drawn from ſeveral propoſitions, or principles, firſt laid down. See LOGIC and ORATORY.

INDULGENCES, in the Romiſh church, are a remiſſion of the puniſhment due to ſins, granted by the church, and ſuppoſed to ſave the ſinner from purgatory. According to the doctrine of the Romiſh church, all the good works of the ſaints over and above thoſe which were neceſſary towards their own juſtification, are depoſited, together with the infinite merits of Jeſus Chriſt, in one inexhauſtible treaſury. The keys of this were committed to St. Peter, and to his ſucceſſors the popes, who may open it at pleaſure, and by transferring a portion of this ſuperabundant merit to any particular perſon, for a ſum of money, may convey to him either the pardon of his own ſins, or a releaſe for any one in whom he is intereſted, from the pains of purgatory. Such indulgences were firſt invented in the 11th century, by Urban II. as a recompenſe for thoſe who went in perſon upon the glorious enterprize of conquering the Holy Land. They were afterwards granted to thoſe who hired a ſoldier for that purpoſe; and in proceſs of time were beſtowed on ſuch as gave money for accompliſhing any pious work enjoined by the Pope.

The power of granting indulgences has been greatly abuſed in the church of Rome. Pope Leo X. in order to carry on the magnificent ſtructure of St. Peter's at Rome, publiſhed indulgences, and a plenary remiſſion to all ſuch as ſhould contribute money towards it. Finding the project take, he granted to Albert elector of Mentz, and archbiſhop of Magdeburg, the benefit of the indulgences of Saxony and the neighbouring parts, and farmed out thoſe of other countries to the higheſt bidders; who, to make the beſt of their bargain, procured the ableſt preachers to cry up the value of the ware. The form of theſe indulgences was as follows. May our Lord Jeſus Chriſt have mercy upon thee, and abſolve thee by the merits of his moſt holy paſſion. And I, by his authority, that of his bleſſed apoſtles Peter and Paul, and of the moſt holy Pope, granted and committed to me in theſe parts, do abſolve thee, firſt, from all eccleſiaſtical cenſures, in whatever manner they have been incurred; then from all thy ſins, tranſgreſſions, and exceſſes, how enormous ſoever they may be, even from ſuch as are reſerved for the cognizance of the holy ſee, and as far as the keys of the holy church extend: I remit to you all puniſhment which you deſerve in Purgatory on their account; and I reſtore you to the holy ſacraments of the church, to the unity of the faithful, and to that innocence and purity which you poſſeſſed at baptiſm; ſo that when you die, the gates of puniſhment ſhall be ſhut, and the gates of the paradiſe of delight ſhall be opened: and if you ſhall not die at preſent, this grace ſhall remain in full force when you are at the point of death. In the name of the Father, and of the Son, and of the Holy Ghoſt."

The terms in which the retailers of indulgences, deſcribed their benefits and the neceſſity of purchaſing them, are ſo extravagant, that they appear almoſt incredible. If any man (ſaid they) purchaſes letters of indulgence, his ſoul may reſt ſecure with reſpect to its ſalvation. The ſouls confined in purgatory, for whoſe redemption indulgences are purchaſed, as ſoon as the money tinkles in the cheſt, inſtantly eſcape from that place of torment, and aſcend into heaven. That the efficacy of indulgences was ſo great, that the moſt heinous ſins, even if one ſhould violate (which was impoſſible) the mother of God, would be remitted and expiated by them, and the perſon be freed both from puniſhment and guilt. That this was the unſpeakable gift of God, in order to reconcile men to himſelf. That the croſs erected by the preachers of indulgences was equally efficacious with the croſs of Chriſt itſelf. "Lo! the heavens are open; if you enter not now, when will you enter? For twelve pence you may redeem the ſoul of your father out of purgatory; and are you ſo ungrateful, that you will not reſcue your parent from torment? If you had but one coat, you ought to ſtrip yourſelf inſtantly, and ſell it, in order to purchaſe ſuch benefits," &c.

It was this great abuſe of indulgences that contributed not a little to the firſt reformation of religion in Germany, where Martin Luther began firſt to declaim againſt the preachers of indulgences, and afterwards againſt indulgences themſelves: but ſince that time the popes have been more ſparing in the exerciſe of this power: however, they ſtill carry on a great trade with them to the Indies, where they are purchaſed at two rials a-piece, and ſometimes more. The pope likewiſe grants indulgences to perſons at the point of death; that is, he grants them, by a brief power, to chooſe what confeſſor they pleaſe, who is authorized thereby to abſolve them from all their ſins in general.

INDURATING, a term applied to ſuch things as give a harder or firmer conſiſtence to others, either by the greater ſolidity of their particles, or by diſſipating the thinner parts of any matter, ſo as to leave the remainder harder.

INESCUTCHEON, in heraldry, a ſmall *eſcutcheon* borne in a larger one, as part of ſome other coat; ſee the SYSTEM, Sect. VI. Art. II. and Plate V.

INFALLIBLE, that which cannot deceive, or be deceived. Upon this term ſtands one of the principal heads of controverſy between the Reformed and the Catholics; the latter of whom maintain, that the church, aſſembled in general council, is *infallible:* which the former deny.

INFANCY, the firſt part of life. Fred. Hoffman ſays, that the human ſpecies are *infants* until they begin to talk, and *children* to the age of puberty. Anatomy diſcovers to us, that during infancy there is much imperfection in the human frame; e. g. its parts are diſproportioned, and its organs incapable of thoſe functions which in future life they are deſigned to perform. The head is larger in proportion to the bulk of the body than that of an adult. The liver and pancreas are much larger in proportion than in advanced life: their ſecretions are more in quantity alſo. The bile is very inert; the heart is ſtronger and larger than in future life; the quantity of blood ſent through the heart of an infant, in a given time, is alſo more in proportion than in adults. Though theſe circumſtances have their important uſefulneſs, yet the imperfection attending them ſubjects this age to many injuries and dangers from which a more perfect ſtate is exempted. Dr. Percival obſerves, in his *Eſſays Med. and Exp.* that of all the children who are born alive, two thirds do not live to be two years old.

Infants have a larger proportion of brain than adults, hence are more ſubject to nervous diſorders; and hence the diagnoſtics of diſeaſes are in many reſpects obſcure or uncertain, as particularly thoſe taken from the pulſe, which, from the irritability of the tender bodies of infants, is ſuddenly affected by a variety of accidents too numerous, and ſeemingly too trivial to gain our attention. However, no very great embarraſſment ariſes to the practitioner from hence; for the diſorders in this ſtate are generally acute, leſs complicated than thoſe in adults, and are more eaſily diſcovered than is generally apprehended.

INFANTE, and INFANTA, are titles of honour given to the children of ſome princes; particularly thoſe of the houſes of Spain and Portugal.

INFANTRY, the body of foot-ſoldiers, in an army, or other corps. The *infantry* ſtand contradiſtinguiſhed from the *cavalry*, or horſe. See Treatiſe on MILITARY AFFAIRS.

INFECTION, the catching a diſeaſe, by ſome effluvia, or fine particles, which fly off from diſtempered bodies, and, mixing with the juices of others, occaſion the ſame diſorders as were in the bodies they came from.

INFIDEL, a term applied to ſuch perſons as do not believe the truths of the Chriſtian religion. See DEIST.

INFINITE, that which has neither beginning, nor end; in which ſenſe God alone is *infinite*. *Infinite* is alſo uſed to ſignify that which has had a beginning, but will have no end: as angels, and human ſouls.

INFINITE, in mathematics, is applied to quantities which are either greater, or ſmaller, than any aſſignable ones. In which ſenſe it differs not much from what we otherwiſe call *indefinite*, or *indeterminate*.

INFINITIVE, in grammar, the name of one of the MOODS, which ſerve for the conjugating of verbs. The *infinitive* does not denote any preciſe time, nor does it determine the number, or perſons, but expreſſes things in a looſe indefinite manner; as, *to teach*, &c. See the SYSTEM, Part II. Chap. III. Art. V.

INFINITY, the quality which denominates a thing *infinite*. The idea ſignified by the name *infinity* is beſt examined by conſidering to what things *infinity* is by the mind attributed, and how the idea itſelf is framed: finite and infinite are looked upon as the modes of quantity, and are attributed primarily to things that have parts, and are capable of increaſe or diminution, by the addition or ſubtraction of any the leaſt part. Such are the ideas of ſpace, duration, and number. When we apply this idea to the Supreme Being, we do it primarily in reſpect of his duration and ubiquity: and more figuratively, when to his wiſdom, power, goodneſs, and other attributes, which are properly inexhauſtible and incomprehenſible: for when we call them *infinite*, we have no other idea of this *infinity* but what carries with it ſome reflection on the number, or the extent, of the acts or objects of God's power and wiſdom, which can never be ſuppoſed ſo great, or ſo many, that theſe attributes will not always ſurmount and exceed, though we multiply them in our thoughts with the *infinity* of endleſs number. We do not pretend to ſay, how theſe attributes are in God, who is infinitely beyond the reach of our narrow capacities: but this is our way of conceiving them, and theſe are our ideas of their *infinity*.

INFLAMMABILITY, is that property of bodies which diſpoſes them to kindle, or catch fire. See FLAME, HEAT, and PHLOGISTON.

INFLAMMABILITY *of Oils with Acids*. Among the many ſurpriſing phenomena which the world owes to the late improvements in chymiſtry, there is none which has more attracted the admiration of the generality of mankind than that remarkable one of producing actual flame by mixing two liquors, both cold, to the touch; the acid ſpirits of minerals, and the chymical oil of vegetables.

INFLAMMATION, from *in*, and *flamma*, *flame*, in ſurgery and phyſic, a tumor attended with a preternatural heat, and redneſs, and a continual pulſation and pricking: frequently ariſing from ſome obſtruction or ſtagnation in the ſmall arterial blood-veſſels or lymphatics: by means whereof the blood flowing into ſome part faſter than it can run off again, ſwells up, and cauſes a tenſion, with an unuſual ſoreneſs, redneſs, and heat.

INFLATION, formed from *in*, and *flatus*; of *flo*, *I blow*; *blowing up*, act of ſtretching or filling any flaccid, or diſtenſible body, with a flatulent or windy ſubſtance.

INFLECTION, called alſo *diffraction*, and *deflection*, in optics, is a property of light, by reaſon of which, when it comes within a certain diſtance of any body, it will either be bent from it, or towards it: which is a kind of imperfect reflection, or refraction; ſee the SYSTEM.

INFLECTION, *or Point of Inflection*, of a curve, in geometry, is a POINT or place where the curve begins to bend, or turn a contrary way.

INFLUENCE, a quality ſuppoſed to flow from the bodies of the ſtars, either with their heat, or light, to which aſtrologers vainly attribute all the events which happen on the earth.

INFLUENT, a term uſed where a liquor or juice, by the contrivance of nature, and the laws of circulation, falls into any current or receptacle. Thus with reſpect to the common receptacle, the chyle is its *influent* juice; and ſo is the bile to the gall-bladder; the venal blood to the heart in its diaſtole; and the like.

IN FORMA PAUPERIS, in law. See FORMA *Pauperis*.

INFORMATION, in law, for the king, is much the ſame with what is called DECLARATION for a common perſon.

INFRACTION, formed from *in*, and the ſupine of *frango*, *I break*, a rupture, or violation of a treaty, law, ordinance, or the like.

INFUSION, in chymiſtry, taken in its moſt general ſenſe, conſiſts in placing compound bodies in a liquor intended to be impregnated with ſome of their principles, either without heat, or with a heat leſs than that of the boiling liquor. From this definition we may ſee that *infuſion* is one of the principal operations of the analyſis by menſtruums, in the ſame manner in which decoction is, of which *infuſion* may be conſidered as the firſt degree. *Infuſion* may be made in watery, ſpirituous, oily, acid, or alkaline liquors, according to the nature of the matters to be infuſed, and of the principles intended to be extracted. It is nevertheleſs practiſed upon vegetable matters only; and almoſt always for the preparation of remedies, which are alſo called *infuſions*. Aromatic plants, and other odoriferous vegetable matters, are generally infuſed, when their odoriferous principle is to be preſerved, in which their virtue conſiſts, and which is at the ſame time ſo volatile as to be diſſipated and loſt by the heat of ebullition. To preſerve ſtill better theſe volatile principles, the ſmalleſt heat requiſite for the extraction ought to be employed; and theſe *infuſions* ought to be made in matraſſes, or other veſſels, which may be exactly cloſed. The principles extracted by *infuſion* are different according to the menſtruum employed. Pure water may be impregnated with the odoriferous principle, or *ſpiritus rector*, with ſaline, ſaponaceous, mucilaginous, extractive principles. Spirit of wine diſſolves the *ſpiritus rector*, the eſſential oils, thoſe reſinous matters the baſe of which is an oil of the nature of eſſential oils, and the greateſt part of the ſaponaceous extractive matter. Thoſe *infuſions* made by ſpirit of wine are particularly called *tinctures*, eſpecially in pharmacy. Oils diſſolve the *ſpiritus rector*, and any oily matter. Acids and alkalis diſſolve the earthy ſubſtances of vegetables, and almoſt all their other principles: but they diſguiſe them, alter them, and change conſiderably their virtues by the combination. They are therefore not much uſed for theſe kinds of extractions.

INGOT, a maſs, or lump of *gold* or *ſilver*, from the mines, melted down, and caſt into a ſort of mould, but not coined or wrought. *Ingot* is alſo a name given to the moulds or cavities, wherein they caſt melted metals, or regulus of ſemi-metals.

INGRESS, in aſtronomy, the ſun's entering the firſt ſcruple of one of the four cardinal ſigns, eſpecially Aries.

INGRESS, EGRESS, and REGRESS, in law, are words in leaſes of land, ſignifying a free entrance into, a going out of, and returning from ſome part of the premiſes leaſed to another; as to get in a crop of corn, &c. after the term expired.

INGROSSER, or ENGROSSER, in common law, is one who buys up corn growing, or any proviſions by wholeſale, before the market, to ſell again. See FORESTALLING. It alſo ſignifies a clerk, who writes records, or inſtruments of law, on ſkins of parchment. See ENGROSSING.

INHERITANCE, *Hæreditas*, a property in lands and tenements to a man and his heirs. See DESCENT.

INHIBITION, a writ to inhibit or forbid a judge from farther proceeding in a cauſe depending before him. Sometimes *prohibition* and *inhibition* are put together, as of the ſame import; but *inhibition* is moſt commonly a writ iſſuing out of a higher court to a lower; and *prohibition* out of the king's court to an inferior court.

INJECTION, in pharmacy, any liquid medicine made to be injected or thrown into the body, or any of its parts, by a ſyringe, clyſter-pipe, or other inſtrument.

Anatomical INJECTION, is uſed for the operation of filling the veſſels with coloured wax, or any other proper matter, to ſhew their figures and ramifications. Theſe are coloured, in order to make the parts more conſpicuous. Mr. Monro uſes red and green chiefly. For the red, vermillion finely levigated muſt be got. For the green, diſtilled verdigris is beſt; becauſe its colour is brighter than that of the common ſort, and it never runs into knots, and alſo diſſolves in oily liquors.

INITIATED, a term properly uſed in ſpeaking of the religion of the ancient heathens; where it ſignifies being admitted to the participation of the ſacred myſteries. The ancients never diſcovered the deeper myſteries of their religion, nor even permitted ſome of their temples to be open to any but thoſe who had been *initiated.* See MYSTERY.

INJUNCTION, in law, a writ generally grounded upon an interlocutory order or decree out of the court of chancery or exchequer, ſometimes to give poſſeſſion to the plaintiff, for want of the defendant's appearance; ſometimes to the king's ordinary court, and ſometimes to the court-chriſtian, to ſtop proceedings in a cauſe, upon ſuggeſtion made, that the rigour of the law, if it take place, is againſt equity and conſcience in that caſe, that the complainant is not able to make his defence in theſe courts for want of witneſſes, &c. or that they act erroneouſly, denying him ſome juſt advantage. The writ of *injunction* is directed not only to the party himſelf, but to all and ſingular his counſellors, attornies, and ſolicitors; and if any attorney, after having been ſerved with an *injunction*, proceeds afterward contrary to it, the court of chancery will commit the attorney to the Fleet for contempt. But if an *injunction* be granted by the court of chancery in a criminal matter, the court of king's bench may break it, and protect any that proceed in contempt of it.

INK, a black liquor uſed in writing, generally made of an infuſion of galls, copperas, and gum-arabic.

Indian INK, a valuable black for water colours, brought from China and other parts of the Eaſt Indies, ſometimes in large rolls, but more commonly in ſmall quadrangular cakes, and generally marked with Chineſe characters. Dr. Lewis, from experiments made on this ſubſtance, hath ſhewn that it is compoſed of fine lamp-black and animal glue: and accordingly for the preparation of it, he deſires us to mix the lamp-black with as much melted glue as is ſufficient to give it a tenacity proper for being made into cakes; and theſe when dry, he tells us, anſwered as well as thoſe imported from the Eaſt Indies, both with regard to the colour, and the freedom of working. Ivory-black, and other charcoal-blacks, levigated to a great degree of fineneſs, anſwered as well as the lamp-black; but in the ſtate in which ivory-black is commonly ſold, it proved much too gritty, and ſeparated too haſtily, from the water.

Printing INK, is totally different from Indian ink, or that made uſe of in writing,. It is an oily compoſition, of the conſiſtence of an ointment: the method of preparing it was long kept a ſecret by thoſe whoſe employment it was to make it, and who were intereſted in concealing it; and even yet is but imperfectly known. The properties of good printing-ink are, to work clean and eaſily, without daubing the types, or tearing the paper; to have a fine black colour; to waſh eaſily off the types; to dry ſoon; and to preſerve its colour, without turning brown. This laſt, which is a moſt neceſſary property, is effectually obtained by ſetting fire to the oil with which printing ink is made for a few moments, and then extinguiſhing it by covering the veſſel.

INK *for the Rolling Preſs*, is made of linſeed oil, burnt in the ſame manner as that for common printing, and then mixed with Francfort-black, and finely ground. There are no certain proportions which can be determined in this kind of ink; every workman adding oil or black to his ink, as he thinks proper, in order to make it ſuit his own taſte. Some, however, mix a portion of common boiled oil, which has never been burnt: but this muſt neceſſarily be a bad practice, if ſuch oil is apt to go through the paper; a fault very common in prints, eſpecially if the paper is not very thick. No ſoap is added; becauſe the ink is not cleared off from the copper-plates with alkaline ley as in common printing, but with a bruſh dipped in oil.

INLAND implies any thing ſituate in the main land, or heart of a country, far from the ſea-coaſts. Hence *inland* bills, in traffic, are ſuch bills as are payable in the ſame land wherein they are drawn.

INLAYING. See VENEERING, MOSAIC, and MARQUETRY.

INNS *of Court*, juſtly famed for the production of men of learning in the law, are governed by maſters, principals, benchers, ſtewards, and other officers; and have public halls for exerciſes, readings, &c. which the ſtudents are obliged to attend, and perform for a certain number of years, before they can be admitted to plead at the bar. Theſe ſocieties have not, however, any judicial authority over their members; but inſtead of this they have certain orders among themſelves, which have by conſent the force of laws. For lighter offences perſons are only excommoned, or put out of commons; for greater, they loſe their chambers, and are expelled the college; and when once expelled out of one ſociety, they are never received by any of the others. The gentlemen in theſe ſocieties may be divided into benchers, outer-barriſters, inner-barriſters, and ſtudents. The four principal *inns* of court, are the Inner Temple and Middle Temple, heretofore the dwelling of the Knights Templars, purchaſed by ſome profeſſors of the common law about three hundred years ago; Lincoln's *Inn*, and Gray's *Inn*, anciently belonging to the earls of Lincoln and Gray. The other *inns* are the two Serjeants *Inns*.

INNS *of Chancery* were probably ſo called, becauſe anciently inhabited by ſuch clerks as chiefly ſtudied the forming of writs, which regularly belonged to the curſitors, who are officers of *chancery*. The firſt of theſe is Thavies *Inn*, begun in the reign of Edward III. and ſince purchaſed by the ſociety of Lincoln's *Inn*. Beſide this we have New *Inn*, Symond's *Inn*, Clement's *Inn*; Clifford's *Inn*, anciently the houſe of the lord Clifford; Staple's *Inn*, belonging to the merchants of the ſtaple; Lion's *Inn*, anciently a common *inn* with the ſign of the lion; Furnival's *Inn*, and Bernard's *Inn*. Theſe were heretofore preparatory colleges for younger ſtudents; and many were entered here, before they were admitted into the *inns* of court. Now they are moſtly taken up by attornies, ſolicitors, &c. They all belong to ſome of the *inns* of court, who formerly uſed to ſend yearly ſome of their barriſters to read to them.

INNATE *Ideas*, or *Principles*, are certain primary notes or characters, by many ſuppoſed to be ſtamped on the mind of man when it firſt receives its being, and which it brings into the world with it. But the doctrine of *innate ideas* is abundantly confuted by Mr. Locke.

INNOCENTS *Day*, the name of a feaſt celebrated on the twenty-eighth day of December, in commemoration of the infants murdered by Herod.

INNOMINATUM OS, one of the bones of the pelvis. For deſcription, ſee the Syſtem of ANATOMY, Part II. Sect. II. For repreſentation, ſee Plate I. *fig.* 1, letters *f*, *g*, *h*.

INOCULATION, BUDDING, in gardening, a kind of grafting, or an artificial operation, by which the bud of one fruit tree is ſet into the ſtock or branch of another, ſo as ſometimes to make different ſorts of fruit grow on the ſame trees. See the Syſtem, Part II. *Fruit Garden*, month of July.

INOCULATION, in a phyſical ſenſe, is uſed for the tranſplantation of diſtempers from one ſubject to another, particularly for the engraftment of the ſmall-pox; which is a new practice among us, but of ancient uſe in the eaſtern countries.

INPROMPTU, or IMPROMPTU, a Latin word frequently uſed among the French, and ſometimes in Engliſh, to ſignify a piece made off-hand, or extempore, without any previous meditation, by the mere force and vivacity of imagination.

INQUISITION, in the church of Rome, a tribunal in ſeveral Roman Catholic countries, erected by the popes for the examination and puniſhment of heretics. This court was founded in the twelfth century by father Dominic and his followers, who were ſent by pope Innocent III. with orders to excite the Catholic princes and people to extirpate heretics, to ſearch into their number and quality, and to tranſmit a faithful account thereof to Rome. Hence they were called *inquiſitors*; and this gave birth to the formidable tribunal of the inquiſition, which was received in all Italy, and the dominions of Spain, except the kingdom of Naples and the Low Countries.

This diabolical tribunal takes cognizance of hereſy, Judaiſm, Mahometaniſm, Sodomy, and polygamy; and the people ſtand in ſo much fear of it, that parents deliver up their children, huſbands their wives, and maſters their ſervants, to its officers, without daring in the leaſt to murmur. The priſoners are kept for a long time, till they themſelves turn their own accuſers, and declare the cauſe of their impriſonment; for they are neither told their crime, nor confronted with witneſſes. As ſoon as they are impriſoned, their friends go into mourning, and ſpeak of them as dead, not daring to ſolicit their pardon, leſt they ſhould be brought in as accomplices. When there is no ſhadow of proof againſt the pretended criminal, he is diſcharged, after ſuffering the moſt cruel tortures, a tedious and dreadful impriſonment, and the loſs of the greateſt part of his effects. The ſentence againſt the priſoners is pronounced publicly, and with extraordinary ſolemnity. In Portugal, they erect a theatre capable of holding 3000 perſons; in which they place a rich altar, and raiſe ſeats on each ſide in the form of an amphitheatre. There the priſoners are placed; and over againſt them is a high chair, whither they are called, one by one, to hear their doom, from one of the inquiſitors.

Theſe unhappy people know what they are to ſuffer, by the cloaths they wear that day. Thoſe who appear in their own cloaths, are diſcharged upon payment of a fine: thoſe who have a ſanto benito, or ſtrait yellow coat without ſleeves, charged with St. Andrew's croſs, have their lives, but forfeit all their effects: thoſe who have the reſemblance of flames, made of red ſerge, ſewed upon their ſanto benito, without any croſs, are pardoned, but threatened to be burnt if ever they relapſe: but thoſe who, beſides theſe flames, have on their ſanto benito their own picture, ſurrounded with figures of devils, are condemned to expire in the flames. The inquiſitors, who are eccleſiaſtics, do not pronounce the ſentence of death; but form and read an act, in which they ſay, that the criminal being convicted of ſuch a crime, by his own confeſſion, is with much reluctance delivered to the ſecular power to be puniſhed according to his demerits: and this writing they give to the ſeven judges who attend at the right ſide of the altar, who immediately paſs ſentence.

The Auto da Fe may be called the laſt act of the inquiſitorial tragedy; it is a kind of goal delivery, appointed as oft as a competent number of priſoners in the inquiſition are convicted of hereſy, either by their own voluntary or extorted confeſſion, or on the evidence of certain witneſſes. The proceſs is thus: in the morning, they are brought into a great hall, where they have certain habits put on, which they are to wear in the proceſſion. The proceſſion is led up by Dominican Friars; after which come the penitents, ſome with ſan-benitoes, and ſome without, according to the nature of their crimes; being all in black coats without ſleeves, and bare footed, with a wax candle in their hands. Theſe are followed by the penitents who have narrowly eſcaped being burnt, and who over their black coats have flames painted with their points turned downwards, *Fuego revolto*. Next come the negative and relapſed, who are to be burnt, having flames on their habits pointed upwards. After theſe come ſuch as profeſs doctrines contrary to the faith of Rome, who, beſides flames pointed upwards, have their pictures painted on their breaſts, with dogs, ſerpents, and devils, all open mouthed, about it. Each priſoner is attended with a familiar of the inquiſition; and thoſe to be burnt, have alſo a *Prieſt* on each hand, who are continually preaching to them to abjure. After the priſoners, comes a troop of familiars on horſe-back; and after them the inquiſitors, and other officers of the court, on mules; laſt of all, the inquiſitor-general on a white horſe, led by two men with black hats, and green hat-bands. A ſcaffold is erected in the *Terriero de Paio*, big enough for two, or three thouſand people; at one end of which are the priſoners, at the other the inquiſitors. After a ſermon made up of encomiums on the inquiſition, and invectives againſt heretics, a prieſt aſcends the deſk near the middle of the ſcaffold, and having taken the abjuration of the penitents, recites the final ſentence of thoſe who are to be put to death; and delivers them to the ſecular arm, earneſtly beſeeching at the ſame time the ſecular power not to touch their blood, or put their lives in danger. The priſoners being thus in the hands of the civil magiſtrate, are preſently loaded with chains, and carried firſt to the ſecular goal, and from thence in an hour, or two, are brought before the civil judge, who, after aſking in what religion they intend to die, pronounces ſentence, on ſuch as declare they die in the communion of the church of Rome, that they ſhall be firſt ſtrangled, and then burnt to aſhes; on ſuch as die in any other faith, that they be burnt alive. Both are immediately carried to the Ribera, the place of execution; where there are as many ſtakes ſet up as there are priſoners to be burnt, with a quantity of dry furz about them. The ſtakes of the profeſſed, that is, ſuch as perſiſt in their hereſy, are about four yards high, having a ſmall board towards the top for the priſoner to be ſeated on. The negative and relapſed being firſt ſtrangled, and then burnt, the profeſſed mount their ſtakes by a ladder, and the *Prieſts*, after ſeveral repeated exhortations to be reconciled to the church, part with them, telling them they leave them to the devil, who is ſtanding at their elbow ready to receive their ſouls, and carry them with him to the flames of hell. On this a great ſhout is raiſed; and the cry is, "let the dogs *beards be made*;" which is done by thruſting flaming furzes faſtened to long poles againſt their faces, till their faces are burnt to aſhes, which is accompanied with the loudeſt acclamations of joy. At laſt, fire is ſet to the furzes at the bottom of the ſtake, over which the profeſſed are chained ſo high, that the top of the flame ſeldom reaches higher than the ſeat they ſit on, ſo that they rather ſeem roaſted than burnt. There cannot be a more lamentable ſpectacle; the ſufferers continually cry out, while they are able, *Miſericordia per amor de Dios:* yet it is beheld by all ſexes and ages, with tranſports of joy and ſatisfaction. For a more particular account of this and other horrid cruelties exerciſed under the papal authority; ſee Southwell's Edition of Fox's Book of Martyrs.

INROLLMENT, in law, the regiſtering, recording, or entering of any lawful act, or inſtrument, in the records of chancery; as a recognizance acknowledged, or a ſtatute, or a fine levied. *Inrollments* are alſo made in the rolls of the exchequer, king's bench, common pleas; in the huſtings at Guildhall, London; and by the clerk of the peace in any county.

INSCRIPTION, a title or writing carved, engraved, or affixed to any thing, to give a more diſtinct knowledge of it, or to tranſmit ſome important truth to poſterity. The inſcriptions mentioned by Herodotus and Diodorus Siculus, ſufficiently ſhew that this was the firſt method of conveying inſtruction to mankind, and tranſmitting the knowledge of hiſtory and the ſciences to poſterity; thus the ancients engraved upon pillars both the principles of ſciences, and the hiſtory of the world. Piſiſtratus carved precepts of huſbandry on pillars of ſtone; and the treaties of confederacy between the Romans and Jews, were engraved on plates of braſs. Hence, antiquarians have been very curious in examining the inſcriptions on ancient ruins, coins, medals, &c.

INSCRUTABLE, *Unſearchable*, in theology, is uſually underſtood of the ſecrets of Providence, and the judgments of God, which cannot be found out, or into which human reaſon cannot penetrate.

INSECTS, Insecta, (the word is originally Latin, formed of *in*, and *ſeco*, *I cut*; the reaſon of which is, that in ſome of this tribe, as ants, the body ſeems to be cut, or divided into two, or becauſe the bodies of many, as worms, caterpillars, &c. are compoſed of divers circles, or rings, which form a ſort of inciſure), in *Natural Hiſtory*; a ſmaller ſort of animals, commonly ſuppoſed to be exſanguineous; and diſtinguiſhed by certain inciſures, cuttings, or indentings, in their bodies. For a copious ſcientific deſcription, and accurate claſſification of this part of animal nature, ſee the Syſtem of Entomology.

INSERTION, a term frequently uſed in anatomy, to ſignify the implication of one part within another. Thus we ſay, the *inſertion* of a muſcle. The *inſertion* of the bones, muſcles, and nerves in the members of an animal is very curious.

INSIPID, *taſteleſs*, that which has nothing in it pungent enough to affect the palate, tongue, &c. and to occaſion that ſenſation we call *taſting*.

INSOLATION, in pharmacy, a method of preparing certain fruits, drugs, &c. by expoſing them to the heat of the ſun's rays; either to dry, to maturate, or to ſharpen them; as is done in vinegar, figs, &c.

INSPIRATION, among *Divines*, &c. implies the conveying of certain extraordinary and ſupernatural notices, or motions, into the ſoul: or, it denotes any ſupernatural influence of God upon the mind of a rational creature, whereby he is formed to any degree of intellectual improvements, to which he could not, or would not in fact have attained in his preſent circumſtances in a natural way. Thus the prophets are ſaid to have ſpoken by divine *inſpiration*. Some authors reduce the *inſpiration* of the ſacred writers to a particular care of Providence, which prevented any thing they had ſaid from failing, or coming to nought; maintaining, that they never were really *inſpired*, either with knowledge, or expreſſion. The ancient Poets laid claim to inſpiration, and to this end they always invoked Apollo, and the Muſes, at the beginning of any great work.

Inspiration, in phyſic, is underſtood of that action of the breaſt, by which the air is admitted into the lungs. In which ſenſe, *inſpiration* is a branch of reſpiration; and ſtands oppoſed to *expiration*. This admiſſion of the air depends immediately on its ſpring, or elaſticity, at the time when the cavity of the breaſt is enlarged by the elevation of the thorax and abdomen, and particularly by the motion of the diaphragm downwards: ſo that the air does not enter the lungs, becauſe they are dilated; but thoſe dilate, becauſe the air enters within them. Nor is it the dilatation of the breaſt, which draws in the air, as is commonly thought; though this is a condition abſolutely neceſſary to *inſpiration*; but there is an actual intruſion of the air into the lungs.

INSTALLMENT, a ſettling or inſtating a perſon in a dignity. The word is derived from the Latin *in*, and *ſtallum*, a term uſed for a ſeat in church, in the choir, or a ſeat or bench in a court of juſtice. *Inſtallment* is chiefly uſed for the induction of a dean, prebendary, or other eccleſiaſtical dignitary, into the poſſeſſion of his ſtall, or proper ſeat, in the cathedral church to which he belongs. This is ſometimes alſo called *inſtallation*. *Inſtallment* is likewiſe uſed for the ceremony, whereby the knights of the Garter are placed in their rank, in the chapel of St. George at Windſor; and on many other like occaſions.

INSTAURATION, the re-eſtabliſhment, or reſtauration, of a religion, a church, or the like, to its former ſtate.

INSTINCT, a natural diſpoſition, or ſagacity, wherewith animals are endued; and by virtue whereof they are enabled to provide for themſelves, and know what is good for them, and are determined to preſerve and propagate their ſpecies. *Inſtinct* in brutes bears ſome analogy to reaſon in men. There have been many ſyſtems adopted to explain the principles which produce and direct the ſpontaneous actions of brute animals. Many of the ancient philoſophers aſcribed to brutes an underſtanding, differing only in degree from that of man, and attributed their inferiority to the want of proper and ſufficient bodily organs. This ſyſtem has been lately very ſtrenuouſly ſupported by M. Helvetius, de l'Eſprit, tom. i. p. 2, &c. Among the moderns, the learned Cudworth endeavoured to explain the *inſtinct* of animals, by means of a certain *plaſtic nature*.

INSTITUTION, in a general ſenſe, the act of ordaining, founding, or eſtabliſhing any thing. Thus we ſay Moſes *inſtituted* the ceremonies of the old law; Jeſus Chriſt *inſtituted* the ſacraments of the new. *Inſtitution*, in the canon and common law, is the act of the biſhop, or of one commiſſioned by him, whereby a clerk is inveſted with the ſpiritualities of a rectory, or vicarage.

INSULATED, in electricity, is a term applied to bodies that are ſupported by electrics, or non-conductors; ſo that their communication with the earth, by conducting ſubſtances, is interrupted. See the Syſtem, Part I. Sect. I.

INSURANCE, in law and commerce, a contract, whereby one party engages to pay the loſſes which the other may ſuſtain, for a ſtipulated premium or conſideration. The moſt common ſorts are, Inſurance againſt the dangers of the ſeas, inſurance againſt fire, inſurance of debts, and inſurance of lives.

Insurance *againſt Loſs at Sea*, a moſt beneficial inſtitution, for promoting the ſecurity of trade, and preventing the ruin of individuals; is now conducted by a regular ſyſtem of rules, eſtabliſhed by the interpoſition of the legiſlature, the deciſion of the courts of juſtice, and the practice of merchants. It is carried on to the beſt advantage by public companies, or by a conſiderable number of private perſons, each of whom only engages for a ſmall ſum, on the ſame veſſel. There are two public companies eſtabliſhed by authority of parliament, viz. the London and Royal Exchange Inſurance-Companies. For procuring ſubſcription by private perſons, brokers are generally employed, who extend the policy or contract of inſurance, procure ſubſcriptions, and aſſiſt at ſettling loſſes. They are entitled to an allowance for their trouble, generally 5 per cent. on premiums, and 2 per cent. on loſſes. The parties who engage to pay the damage are called the *inſurers*, or *under-writers*; the parties for whoſe ſecurity they engage are called the *inſured*. The premium is underſtood to be paid when the inſurance is made; but, if it be not paid, the inſurers have a preferable right on the ſubject inſured.

Insurance *againſt Fire.* There are ſeveral offices in Britain for this purpoſe, of which the ſun fire-office is the moſt conſiderable. Inſurances are divided into common, hazardous, and doubly hazardous, according to the nature of the ſubject inſured. When the ſum inſured is high, there is a higher premium *per cent.* demanded; and money, papers, jewels, pictures, and gun-powder, are not comprehended. If a ſubject be wrong deſcribed, in order that it may be inſured at a lower premium, the policy is void. The benefit of a policy is transferred, by indorſement, to the repreſentatives of the perſon in whoſe favour it was made; and it may be transferred to other houſes when the inſured changes his habitation. If inſurance be made on the ſame ſubject in different offices, it muſt be ſpecified, by indorſement, on the policy; and, in caſe of loſs, the offices pay proportionally. The inſurers pay all expences in attempting to extinguiſh fire, or ſave goods, though not ſucceſsful. If the value of a ſubject be inſured in part, and damage be ſuſtained, the inſurers pay the whole, if it does not exceed the ſum inſured.

Insurance *of Debts*. See Bottomry.

In virtue of **Insurances** *for Lives*, when the perſon dies, a ſum of money becomes payable to the perſon on whoſe behalf the policy of inſurance was granted. The principal inſurance office of this kind, is that of the amicable ſociety for a perpetual aſſurance, kept in Serjeant's inn, Fleet-ſtreet, London.

In this office, after paying the charges of the policy, and 10*s.* entrance-money, each perſon pays 5*l.* *per annum*, by quarterly payments; and from theſe payments, the dividends, which uſually amount 100*l.* and upwards, are to ariſe. All perſons admitted are to be between the ages of 12 and 45, and in a good ſtate of health. Any perſon is allowed to have two or three inſurances or numbers on the ſame life, whereby ſuch perſon will be intitled to a claim on each number ſo inſured; and every claimant is empowered to put in a new life in the room of one deceaſed, within 12 calendar months next after the end of the current year. By becoming members of this ſociety, clergymen, phyſicians, lawyers, tradeſmen, and all whoſe income ceaſes at the time of their death, may, in all probability, leave to their families a claim of not leſs than 100*l.* for every 5*l.* annually paid in. The value of inſurances upon lives, depends upon the probability of the continuance of any propoſed life or lives, during any propoſed term. Any queſtions of this kind may be determined from Dr. Halley's table, and from the principles of the doctrine of chances. But, as far as we can learn of the practice on ſuch occaſions, the premiums paid to inſurers are generally higher than any computation founded on obſervations concerning the probabilities of human life will warrant. Thus it is not unuſual to make a perſon pay 5 *per cent.* for the inſurance of his life for a twelve month; that is, in caſe the perſon dies within the year, the inſurer is to pay 100*l.* for every 5*l.* received. Now it appears from Dr. Halley's table, which eſtimates the probability of life low enough, that 5 *per cent.* is an adequate value only for a life of an advanced age, ſuch as 64. For an eſtimate of lives; tables ſhewing the expectation of life at every age; and problems to find the value of annuities granted on lives of different ages and on various conditions, ſee the Syſtem of Annuities.

INTEGERS, in arithmetic, denote whole numbers; in contradiſtinction to fractions. *Integers* may be defined to be, numbers which refer to unity as a whole to a part.

INTEGRAL, or **Integrant**, is applied to thoſe parts which are neceſſary to the integrity of a whole. In which ſenſe they ſtand contradiſtinguiſhed from *eſſential* parts. Thus the arms, legs, &c. are *integral* parts; body and ſoul, eſſential parts of a man.

INTEGRANT *Parts*, in philoſophy, the ſimilar parts of a body, or parts of the ſame nature with the whole; as filings of iron are the *integrant* parts of iron, and have the ſame nature and properties with the bar they were filed off from. The chymiſts diſtinguiſh, in their reſolutions of bodies, between the dividing and reſolving them into *integrant* parts like theſe, and what they call conſtituent parts; that is, diſſimilar parts, or the principles of the bodies they work upon.

INTEGUMENTS, formed of *in*, and *tegumentum*, of *tego*, *I cover*, in anatomy, denote the common coverings which inveſt the body; as the cuticula, cutis, and even the paniculus carnoſus, and tunica reticularis.

INTELLECT, a term uſed among philoſophers, to ſignify that faculty of the ſoul uſually called the Understanding.

INTELLIGIBLE, any thing capable of being underſtood, or conceived by the mind. Philoſophers have invented certain beings which are purely *intelligible*, and only ſubſiſt in the underſtanding: ſuch are the *entia rationis*, univerſal ideas, and other chimæras.

INTERCOLUMNIATION, or **Intercolumnation**, in architecture, ſignifies the ſpace between two columns. See the Syſtem, on the Orders of Architecture in general.

INTERCOSTAL, in anatomy, an appellation given to ſuch muſcles, nerves, arteries, and veins, as lie between the ribs.

INTERDICT, a cenſure inflicted by a pope, or biſhop, ſuſpending the prieſts from their functions, and depriving the people of the uſe of ſacraments, divine ſervice, and Chriſtian burial.

INTEREST, a ſum of money, reckoned for the loan and forbearance of ſome other ſum, lent for, or due at, a certain time, according to ſome certain rate. In reſpect hereof, the ſum lent, or forborn, is called the *principal*, becauſe it is the ſum that procreates the *intereſt*, or from which the *intereſt* is reckoned. For the particular Definitions, Rules, and Examples, ſee Syſtem of Arithmetic, Art. 17.

INTERJECTION, in grammar, an expreſſion uſed to denote ſome ſudden motion or paſſion of the mind: as *oh! eh! alas!* &c. See the Syſtem, Part I. Chap. II. Sect. II.

INTERLUDE, an entertainment exhibited on the theatre between the acts of a play; to amuſe the ſpectators while the actors change their dreſs; or to give time for changing the ſcenes and decorations.

INTERMITTING, a thing which ceaſes its action for ſome time; which time is called the *interval*. Thus Fevers which go off, and ſoon return again, are called *intermittents*, in oppoſition to thoſe which are always continued.

INTERPOSITION, the ſituation of a body between two others, ſo as to hide them, or prevent their action. The eclipſe of the ſun is occaſioned by an *interpoſition* of the moon between the ſun and us; and that of the moon by the *interpoſition* of the earth between the ſun and moon. See Eclipse.

INTERPRETER, a perſon who explains the thoughts, words, or writings, of ſome other, which before were unintelligible. There have been great debates about *interpreting* Scripture. The Romaniſts contend, that it belongs abſolutely to the church; adding, that where ſhe is ſilent, reaſon may be conſulted; but, where ſhe ſpeaks, reaſon is to be diſregarded. The Proteſtants generally allow reaſon to be the ſovereign judge, or *interpreter*, though ſome among them have a ſtrong regard to ſynods, and others to the authority of the primitive fathers. Laſtly, others have recourſe to the ſpirit within every perſon to *interpret* for them; which is what Bochart calls *αποδειξις τȣ ϖνευματος*.

INTERREGNUM, the time during which the throne is vacant in elective kingdoms; for in ſuch as are hereditary, like ours, there is no ſuch thing as an interregnum.

INTERROGATION, or *point of Interrogation*, a character in grammar, which ſerves to diſtinguiſh ſuch parts of a diſcourſe, where the author ſpeaks as if he were aſking queſtions. See the Syſtem, Part II. Chap. IV. under the Article Punctuation.

INTERSECTION, in mathematics, the cutting of one line, or plane, by another; or the point or line wherein two lines, or two planes, cut each other.

INTERVAL, the diſtance or ſpace between two extremes, either in time or place.

Interval, in muſic, the difference between two ſounds, in reſpect of acute and grave: or that imaginary ſpace terminated with two ſounds differing in acuteneſs or gravity. When two or more ſounds are compared in this relation, they are either equal or unequal in the degree of tune: ſuch as are equal are called *uniſons*, with regard to each other, as having one tune; the other, being at a diſtance from each other, conſtitute what we call an *interval* in muſic; which is properly the diſtance in tune between two ſounds. *Intervals* are diſtinguiſhed into *ſimple* and *compound*.

Simple **Interval**, is that without parts, or diviſion; ſuch are the octave, and all that are within it; as the ſecond, third, fourth, fifth, ſixth, and ſeventh, with their varieties.

Compound **Interval** conſiſts of ſeveral leſſer *intervals*: ſuch are all thoſe greater than the octave; as the ninth, tenth, eleventh, twelfth, &c. with their varieties.

INTESTATE, a perſon who dies without making a will. An heir *ab inteſtato*, is a perſon who inherits an eſtate by ſome other right than that of will or teſtament.

INTESTINES, **Intestina**, in anatomy, the *guts* or *bowels*; thoſe hollow membranous, cylindrical parts, extended from the right orifice of the ſtomach to the anus; by which the chyle is conveyed to the lacteals, and the excrements are voided; for a particular deſcription, ſee the System, Part V. Sect. VI. For a general repreſentation, ſee Plate III. *Fig.* 3.

INTESTINES *of Fiſh*. See *Comparative* ANATOMY, Sect. III.

INTRANSITIVE *Verbs*, in grammar, ſuch whoſe action does not (*tranſire*) paſs on an object, or ſubject. See VERB *Neuter*, in the Syſtem, Part I. Chap. II. Sect. I. Art. I.

INTRENCHMENT, in the art of war, all ſorts of works made to fortify a poſt againſt an enemy. See Treatiſe on MILITARY *Affairs*.

INTRIGUE, an aſſemblage of events, or circumſtances occurring in an affair, and perplexing the perſons concerned in it. In this ſenſe it is uſed to ſignify the plot of a play, or romance: or that point wherein the principal characters are the moſt embarraſſed, through the artifice and oppoſition of certain perſons, or the unfortunate falling out of certain accidents and circumſtances.

INTRIGUE, in common language, is uſed to denote a plot; a private tranſaction in which ſeveral parties are engaged, and uſually an affair of love. Johnſon.

INTRODUCTION, in rhetoric, is the firſt part of an oration, or diſcourſe, deſigned to prepare the minds of the hearers for a ſuitable reception of the ſucceeding parts; and for this purpoſe it is neceſſary that the orator gain the good opinion of his hearers, ſecure their attention, and give them ſome general notion of his ſubject. In order to gain the good opinion of his hearers, the orator, when he introduces the diſcourſe with his own perſon, will be careful to do it with modeſty, and ſeem rather to extenuate his virtues and abilities than to magnify them; when he ſets out with the perſons of thoſe to whom the diſcourſe is addreſſed, it is not unuſual to commend them for their virtues, and thoſe eſpecially which have a more immediate relation to the preſent ſubject. The other topics which are to be inſiſted upon for gaining eſteem, are principally taken from the ſubject, as its juſtice, importance, advantage, or pleaſure. In ſpeaking of gaining the attention of hearers, Cicero ſays, we ſhall be heard attentively by one of theſe three things; if we propoſe what is great, neceſſary, or for the intereſt of thoſe to whom the diſcourſe is addreſſed. Some account of the ſubject ſhould always make a part of the *introduction*. As to the compoſition of this part of a diſcourſe, it ſhould appear eaſy and natural, and connected with the reſt of the diſcourſe; it ſhould be ſuited to its length; the language of it ſhould be juſt, eaſy, and pleaſant; it ought neither to be wholly without paſſions, nor too violent and impetuous. It ought not to be too general. The *introduction*, however, is not an eſſential part of a diſcourſe, and is ſometimes omitted by the beſt orators. Ward's Or. vol. i. lect. 12.

INTUITION, among Logicians, the act whereby the mind perceives the agreement or diſagreement of two ideas, immediately by themſelves, without the intervention of any other; in which caſe the mind perceives the truth, as the eye doth the light, only by being directed toward it. Thus the mind perceives that white is not black, that three are more than two, and equal to one and two. This part of knowledge, ſays Mr. Locke, is irreſiſtible, and like the ſun-ſhine forces itſelf immediately to be perceived, as ſoon as the mind turns its view that way. It is on this *intuition* that all the certainty and evidence of our other knowledge depends; this certainty every one finds to be ſo great, that he cannot imagine, and therefore cannot require, a greater. See JUDGMENT, KNOWLEDGE, DEMONSTRATION, &c.

INVALID, a perſon wounded, maimed, or diſabled for action by age. At Chelſea and Greenwich are magnificent *hoſpitals* or rather colleges, built for the reception and accommodation of *invalids*, or ſoldiers and ſeamen worn out in the ſervice.

INVECTED, in heraldry, denotes a thing fluted, or furrowed. *Invected* is juſt the reverſe of *engrailed*, in which the points are turned outward to the field: whereas in *invected* they are turned inward to the ordinary. See the Syſtem, Plate II.

INVENTION, denotes the act of finding any thing new; or even the thing thus found. Thus we ſay, the *invention* of gunpowder, printing, &c.

INVENTION is alſo uſed for ſubtilty of mind, or ſomewhat peculiar to a man's genius, which leads him to a diſcovery of things new. In which ſenſe we ſay a man of *invention*.

INVERSE, is applied to a manner of working the rule of three, or proportion, which ſeems to go backward, or contrarily to the order of the common and direct rule. See Syſtem of ARITHMETIC, Art. *Double Rule of Three*.

INVOCATION, in theology, an act whereby we adore God, and call on him for his aſſiſtance. The Romaniſts alſo practiſe *invocation* of ſaints, begging them to intercede with God in their behalf. This is one of the grand articles of diſpute between the Romaniſts and the Reformed. *Invocation*, in poetry, an addreſs at the beginning of a poem, wherein the poet calls for the aſſiſtance of ſome god, particularly of his Muſe, or the deity of poetry. See MUSES.

INVOICE, or INVOYCE, a liſt, or account, of commodities, with their value, cuſtoms, proviſion, charges, &c. ſent by a merchant to his factor, or correſpondent, in another country.

INVOLUTION, in algebra, the raiſing of any quantity from its root to any height, or *power*, aſſigned. See the Syſtem, Sect. 6.

JOB, or *the Book of* JOB, a canonical book, of the Old Teſtament, containing the narrative of a ſeries of misfortunes, which happened to a man whoſe name was *Job*, as a trial of his virtue and patience; together with the conferences he had with his cruel friends on the ſubject of his misfortunes: and the manner in which he was reſtored to eaſe and happineſs. This book is filled with thoſe noble, bold, and figurative expreſſions, which conſtitute the very ſoul of poetry. Many of the Jewiſh rabbins pretend, that this relation is altogether a fiction; others think it a ſimple narrative of a matter of fact, juſt as it happened; while a third ſort of critics own the ground-work of the ſtory to be true, but that it is wrote in a poetical ſtrain, and decorated with peculiar circumſtances, to render the narration more profitable and entertaining. The time is not ſet down in which Job lived. Some have thought that he was much ancienter than Moſes, becauſe the law is never cited by Job or his friends, and becauſe it is related that Job himſelf offered ſacrifices. Some imagine that this book was wrote by himſelf; others ſay, that Job wrote it originally in Syriac or Arabic, and that Moſes tranſlated it into Hebrew: but the rabbins generally pronounce Moſes to be the author of it, and many Chriſtian writers are of the ſame opinion.

JOEL, or *the propheſy of* JOEL, a canonical book of the Old Teſtament. *Joel* was the ſon of Pethuel, and the ſecond of the twelve leſſer prophets. The ſtyle of this prophet is figurative, ſtrong, and expreſſive. He upbraids the Iſraelites for their idolatry, and foretels the calamities they ſhould ſuffer as the puniſhment of that ſin: but he endeavours to ſupport them with the comfort that their miſeries ſhould have an end upon their reformation and repentance. Some writers, inferring the order of time in which the minor prophets lived from the order in which they are placed in the Hebrew copies, conclude that *Joel* propheſied before Amos, who was contemporary with Uzziah, king of Judah. Archbiſhop Uſher makes this inference from *Joel's* foretelling that drought, chap. i. which Amos mentions as having happened, chap. iv. 7, 8, 9. If we conſider the main deſign of *Joel's* prophecy, we ſhall be apt to conclude, that it was uttered after the captivity of the ten tribes; for he directs his diſcourſe only to Judah, and ſpeaks diſtinctly of the ſacrifices and oblations that were daily made in the temple. Lowth.

JOHN, or *the Goſpel of St.* JOHN; a canonical book of the New Teſtament, containing a recital of the life, doctrine and death, of our Saviour, Jeſus Chriſt, written by *St.* JOHN, the apoſtle and evangeliſt. *St. John*, according to Mill, Fabricus, and Le Clerc, wrote his Goſpel at Epheſus, after his return from the iſle of Patmos, A. D. 97, at the deſire of the Chriſtians of Aſia. Wetſtein thought that this Goſpel might be writ about the year 32, after our Lord's aſcenſion: Baſnage and Lampe ſuppoſe that it was writ before the deſtruction of Jeruſalem: Dr. Lardner adopts this opinion, and aſſigns the date of it to the year of Chriſt 68. This period brings it nearer to that of the three other goſpels, which was about the year 64 or 65, and the Goſpel itſelf, the leading deſign of which was to ſhew how inexcuſable the Jews were in not receiving Jeſus as the Chriſt, and to vindicate the providence of God in the calamities already befallen, or now coming upon them, was ſuitable to the circumſtances of the Jews at this period. The ancients aſſign two reaſons for this undertaking; the firſt is, becauſe in the other three Goſpels, there was wanting the hiſtory of the beginning of Jeſus Chriſt's preaching, until the impriſonment of John the Baptiſt, which therefore he applied himſelf particularly to relate: the ſecond reaſon was, in order to remove the errors of the Cerinthians, Ebionites, and other ſects. But Mr. Lampe and Dr. Lardner have urged ſeveral reaſons to ſhew that St. *John* did not write againſt Cerinthus or any other heretics in his Goſpel. Lamp. Prolegom. in Johan. lib. ii. cap. 3. Lardner's Credibility, vol. xv. ch. 9.

JOINT, the juncture, articulation, or aſſemblage, of two or more things. The joints of the human body are called by anatomiſts, *Articulation*. See Syſtem of ANATOMY, Part I. Sect. XII.

The ſuppleneſs which the *joints* may be brought to by long practice from the time of infancy, is ſurpriſing. Every common poſture-maſter at a country fair ſhews us a great deal of this; but the moſt wonderful inſtance we have ever had of it, was in the perſon famous in London, ſeveral years ago, whoſe name was Clark, and commonly called Clark the poſture-maſter. This man had found the way, by long practice, to diſtort many of the bones, which nobody before had ever thought it practicable to alter the poſition of; and had ſuch an abſolute command of the muſcles and *joints*, that he could almoſt disjoint his whole body; ſo that he once impoſed on the famous Mullens by his diſtortions, ſo far that he refuſed to undertake his cure, as ſuppoſing him beyond relief. But, to his amazement, he had no ſooner given him over, than the man reſtored himſelf to the figure and condition of a proper man, with no diſtortion about him. See Phil. Tranſ. N° 242. p. 262.

JOINT-*Cartilage*, or ARTICULATING-*Cartilage*, in anatomy. See the Syſtem, Part I. Sect. XIII.

Univerſal-JOINT, in mechanics, an excellent invention of Dr. Hook, adapted to all kinds of motions and flexures; of which he has given a large account in his Cutlerian Lectures, printed in 1678. This ſeems to have given occaſion to the *gimbols* uſed in ſuſpending the ſea compaſs, the mechaniſm of which is the ſame with that of Deſaguliers's rolling lamp.

JOINTURE, in law, a covenant whereby the huſband or ſome friend in his behalf, makes over to his wife on condition of marriage, certain lands and tenements for term of her life, or otherwiſe in lieu of *dower*. Others define *jointure* a bargain and contract of livelihood, adjoined to the contract of marriage; being a competent proviſion of freehold lands or tenements, &c. for the wife, to take effect after the death of the huſband, if ſhe herſelf is not the cauſe of the extermination or forfeiture of it.

JONAH, or *the Prophecy of* Jonah, a canonical book of the Old Teſtament, in which is related, that Jonah was ordered to go and propheſy the deſtruction of the Ninevites; but that diſobediently attempting a voyage another way, he was diſcovered by the riſing of a ſudden tempeſt, and caſt into the ſea, where he was ſwallowed up by a whale. Having lodged three days and three nights in the whale's belly, he was diſgorged upon the ſhore: whereupon, being ſenſible of his paſt danger, and ſurpriſing deliverance, he betook himſelf to the journey and embaſſy to which he was appointed. Arriving at Nineveh, the metropolis of Aſſyria, he, according to his commiſſion, boldly laid open to the inhabitants their ſins and miſcarriages, and proclaimed their ſudden overthrow; upon which the whole city, by prayer and faſting, and a ſpeedy repentance, happily averted the divine vengeance, and eſcaped the threatened ruin. *Jonah* was the moſt ancient of all the prophets whoſe writings are preſerved in the Scripture canon. Some have ſuppoſed that he propheſied in the latter end of Jehu's or the beginning of Jehoahaz's reign, at which time the kingdom of Iſrael was brought very low by the oppreſſions of Hazael king of Syria. 2 Kings xiii. 22.

IONIC, in architecture, the name of one of the five orders of columns. For deſcription, ſee the Syſtem on the orders of Architecture, in general. For the repreſentation, ſee Plate VI.

JOSHUA, a canonical book of the Old Teſtament, containing a hiſtory of the wars and tranſactions of the perſon whoſe name it bears. This book may be divided into three parts; the firſt of which is a hiſtory of the conqueſt of the land of Canaan; the ſecond, which begins at the twelfth chapter, is a deſcription of that country, and the diviſion of it among the tribes; and the third, compriſed in the two laſt chapters, contains the renewal of the covenant he cauſes the Iſraelites to make, and the death of their victorious leader and governor. The whole comprehends a term of ſeventeen, or, according to others, of twenty ſeven years.

JOURNAL, a day book, regiſter, or account of what paſſes daily.

Journal, in merchants accounts, is a book into which every particular article is poſted out of the waſte book, and made debtor. This is to be very clearly worded, and fairly engroſſed. See the Syſtem of Book-*Keeping*, Sect. III.

Journal, in navigation, a ſort of diary, or daily regiſter of the ſhip's courſe, winds, and weather; together with a general account of whatever is material to be remarked in the period of a ſea-voyage. In all ſea-journals, the day, or what is called the 24 *hours*, terminates at noon, becauſe the errors of the dead-reckoning are at that period generally corrected by a ſolar obſervation. The daily compact uſually contains the ſtate of the weather; the variation, increaſe, or diminution of the wind; and the ſuitable ſhifting, reducing, or enlarging the quantity of ſail extended; as alſo the moſt material incidents of the voyage, and the condition of the ſhip and her crew; together with the diſcovery of other ſhips or fleets, land, ſhoals, breakers, ſoundings, &c.

JOY, in ethics, is that paſſion which is produced by love, regarding its object as preſent, either immediately, or in proſpect; in reality, or imagination. This paſſion has been found to increaſe the perſpiration and urine of human bodies. For the repreſentation, ſee Treatiſe on Drawing, Plate I.

IPECACUANHA, or Ipecacoanha, in pharmacy, a little wrinkled root, about the thickneſs of a moderate quill, brought hither from ſeveral parts of the Weſt-Indies; much uſed as an emetic, and againſt diarrhœas and dyſenteries.

IRON, in natural hiſtory, a hard, fuſible, and malleable metal, of a greyiſh colour, of great uſe in the affairs of life. Like other metals it is ſaid to conſiſt of earth, phlogiſton, and a metallic or mercurial principle. This metal has, next to *gold*, the greateſt tenacity of parts: an *iron*-wire, the diameter of which is 1-10th of an inch, being capable of ſuſtaining 450 lb. without being broken. It is the lighteſt of all metals, except tin, being between ſeven and eight times ſpecifically heavier than water. It is alſo the hardeſt, moſt elaſtic, and, except *platina*, and *manganeſe*, the moſt difficult to melt, of all metallic ſubſtances. *Iron* expands the leaſt of the metals by heat: and in the act of fuſion, inſtead of continuing to expand, like the other metals, it ſhrinks; and in its return to a conſiſtent ſtate, inſtead of ſhrinking, like the other metals, it expands or dilates into a large volume; and one of the marks of this dilation is, the convexity of its ſurface, in circumſtances wherein that of other metals is depreſſed. *Iron* appears to be a combuſtible ſubſtance, from the great loſs or waſte of quantity obſervable in it, when expoſed to a red, and eſpecially to a white heat: and this *combuſtion* is excited and maintained like that of other combuſtible ſubſtances, by contact of air. The ſparks produced by the colliſion of ſteel with *flint*, appear to be globular particles of *iron*, which have been fuſed, and imperfectly ſcorified or vitrified. The ignition, light, and fuſion of the ſparks, are occaſioned by the heat excited by the combuſtion of their own inflammable matter, and continued in theſe particles during their paſſage through the air, and not merely by the heat communicated by the colliſion; for by an experiment of Mr. Hawkſbee, it appears, that theſe ſparks ſtruck by colliſion, are not viſible, that is, they are not ignited, and do not deflagrate in an exhauſted receiver; the air being neceſſary to maintain and excite their deflagration and combuſtion. *Iron*, like other calcinable metals, acquires an increaſe of weight by *calcination*; and, by complete calcination, it is ſaid to receive an augmentation of one third of its weight. *Iron* may be ſoftened by heating it often in the fire, hammering it, and letting it cool of itſelf; and it is hardened by extinguiſhing it in water.

Many methods have been uſed to preſerve *iron* utenſils from ruſt; as animal fats, oils, boiled oil mixed with melted lead, &c. Homberg's ſalve for this purpoſe, conſiſts of two pounds of hog's lard, an ounce of camphor, and as much black lead as will render the mixture of an *iron* colour: when this is uſed, the *iron* muſt be previouſly heated. M. Reaumur has diſcovered a better compoſition for this purpoſe; it is oil, inſpiſſated by being expoſed to the air in flat ſhallow veſſels, ſo as juſt to cover the bottom, mixed with a ſolution of copal in ſpirit of wine; this forms an elegant hard varniſh, which, rubbed on poliſhed *iron*, made a little hotter than the hand can bear, will cover it with a ſolid, thin, tranſparent coat, without any injury to its colour or appearance. *Iron* has a greater affinity than any other metal with ſulphur; and, therefore, may be employed to ſeparate moſt metals from ſulphur by fuſion; and ſulphur, thus united with *iron*, conſiderably augments its fuſibility. If a bar of *iron* be heated till it becomes white, and a roll of ſulphur be applied to one of its extremities thus heated, the ſulphur uniting with the *iron* makes it fuſe ſo as to run down in red-hot drops. See *Artificial* Earthquakes.

Iron has a great conformity with copper; and the two are not eaſily ſeparated, when ſoldered together; whence ariſes that uncommon friendſhip which the poets feign between Mars and Venus. Gold is alſo particularly diſpoſed to unite with *iron*, of which, if the *iron* be pure, it diſſolves twice or thrice its own weight in a degree of heat far leſs than that in which *iron* melts. In virtue of this property, gold proves an excellent ſolder for the finer kinds of *iron* and ſteel inſtruments; a ſmall thin plate of gold being wrapped round the parts to be joined, the gold is ſoon made to melt, by a blow-pipe, and ſtrongly unites the pieces together. *Iron* and ſteel, in very ſmall proportion, render gold hard and eager; ſome of theſe mixtures are of ſuch a degree of hardneſs and cloſeneſs, as adapts them for receiving a fine edge; and it is ſaid they have been formed into razors. For the method of gilding *iron*, ſee Gilding.

Iron is diſſolved by all the metals made fluid by ſufficient heat, except lead, on which it floats diſtinct, as oil upon water. Among the ſemi-metallic bodies, it is averſe to any union with mercury; no method has been hitherto diſcovered of amalgamating *iron*; though quick-ſilver, in certain circumſtances, ſeems in ſome ſmall degree to act upon it; a plate of tough *iron* kept immerſed in mercury for ſome days, becomes brittle; and mercury has been obſerved to adhere to, and coat the heads of *iron* peſtles uſed in triturating certain amalgams with ſaline liquors. *Iron* filings may be amalgamated with mercury when the ſolution of green vitriol is added. See Amalgamation.

Iron is capable of being combined either by fuſion, or by cementation, with a more abundant quantity of phlogiſton; and of being thus converted into a more perfect *iron*, called *Steel*, which is capable of acquiring, by ſudden cooling or tempering, a very great hardneſs, that renders it uſeful for many neceſſary purpoſes. It would ſcarce have been believed, till experiments confirmed it, that *iron* makes a part of almoſt all ſorts of ſubſtances. So that it is truly an univerſal metal, being found in all the mineral earths and ſtones that have been examined, in the ores of all other metals, and even in the aſhes of all vegetables and animals. When we conſider the power of the heat of the ſun, and of the ſuction of the roots of plants, which are in a manner ſo many ſyphons acting together upon the juices of an earth, among which there are particles of *iron* thus diſſolved; we are not to wonder that *iron* is conveyed into the veſſels of the plant, or found afterwards in its aſhes. The wonder would be that there ſhould be any vegetable aſhes which did not afford *iron*. The qualities of *iron*, with regard to hardneſs, brittleneſs, malleability, &c. are different according to the nature of the ore from which it is obtained, and the operation it has undergone. The *iron* run from ſome of the German ores, when forged only to a certain point, is found to be a good ſteel; whilſt that of many others, taken in the ſame intermediate ſtate, betwixt caſt and completely forged *iron*, cannot be worked either as ſteel or *iron*. The Swediſh, and ſome of our own ores, yield an excellent tough *iron*; whilſt others give a brittle metal, that cannot by any forging be made perfectly malleable, and hence employed only for ſome kinds of nails and heavy works. The inferior ores are ſaid to be meliorated by mixing two or three different ſorts together.

The Swediſh *iron* has generally been preferred on many accounts, and particularly for making of ſteel; but the Engliſh *iron*, properly manufactured, has been found not inferior to it. The German *iron*, commonly called among us, *Dort-ſquare*, becauſe it is brought hither from Dort, and wrought into bars of three quarters of an inch ſquare, is a coarſe *iron*, and only fit for ordinary uſes.

That ſort which is uſed for the making of *wire*, is the ſofteſt and tougheſt of all, and acquires theſe qualities from being refined to a higher degree than is neceſſary for ordinary purpoſes. Generally ſpeaking, the beſt *iron* is that which is ſofteſt and tougheſt, and which, when it breaks, is of an even greyiſh colour, without any glittering ſpecks, or any flaws or diviſions like thoſe ſeen in broken antimony.

Iron, in medicine, is ſaid to have greater virtues than any of the other metals, which is not to be wondered at, as being the only one that is in a manner ſoluble in the human body. All the other metals, whether hard or ſoft, poiſonous or ſalutary, nay even fluid mercury itſelf, ſwallowed in their crude ſtate, paſs out of the body again unaltered; but this is not the caſe with *iron*, its crude filings are often taken as a medicine, and are always ſo much acted upon by their juices, as to produce conſiderable effects. It is ſo eaſily wrought upon out of the body alſo by fire, and by different menſtruums, that it becomes an aperient or aſtringent, as it is differently treated; and is, under proper management, grearly ſuperior to all other medicines in chronic caſes.

The great medicinal virtue of *iron* is cauſed by its tonic and ſtrengthening qualities. It produces a ſlight and gentle irritation of the fibres, the effect of which is to conſtringe the ſenſible organic parts upon which it acts, and to increaſe their force and elaſticity. *Iron* particularly acts upon the fibres, and the veſſels of the ſtomach and inteſtines; hence it produces excellent effects in all diſeaſes which proceed from laxity and inactivity of the digeſtive organs. Such are crudities, bad digeſtion, accompanied with diarrhœa, flatulencies, flatulent colics, &c. &c.

Iron *Ore*. It has been ſuppoſed that no *iron* is found in its metallic ſtate; though a malleable native *iron* is mentioned by Wallerius, Linnæus, and Cartheuſer: and it is now known that native *iron* exiſts in many places; the moſt remarkable maſs of this ſort is that diſcovered in Siberia; which weighs 1600 pounds.

In the *iron* works in Staffordſhire, after the ore is dug, before it be fit for the furnace, they burn or calcine it on the open ground with ſmall charcoal, wood, or ſea-coal, to make it break into ſmall pieces, which will be done in three days. This they call annealing or fitting it for the furnace.

The fuel uſed in moſt parts of Europe for the ſmelting of ores of *iron* is charcoal, which produces an *iron* capable of being rendered malleable by forging, better than any other. However, lately in ſeveral works in England and Scotland, *iron*-ore has been ſmelted by means of pit-coal, previouſly reduced to cinders or coaks, by a kind of calcination ſimilar to the operation of converting wood into charcoal, by which the aqueous and ſulphureous parts of the coal are expelled, while only the more fixed bituminous parts are left behind. In France uncalcined pit-coal has been tried, but without ſucceſs. The uſe of *peat*, mixed with charcoal, and likewiſe by itſelf, has been introduced in ſome parts of England. Mr. Maſon informs us, that at Colebrook Dale, in Shropſhire, Mr. Ford makes *iron* brittle or tough as he pleaſes, from *iron*-ore and coal, both got in the ſame dale; there being cannon thus caſt, ſo ſoft as to bear turning like wrought *iron*. Phil. Tranſ. N° 482. ſect. VI.

IRONY, in rhetoric, is when a perſon ſpeaks contrary to his thoughts, in order to add force to his diſcourſe; whence Quintilian calls it *diverſiloquium*. Thus, when a notorious villain is ſcornfully complimented with the titles of a very honeſt and excellent perſon; the character of the perſon commended, the air of contempt that appears in the ſpeaker, and the exorbitancy of the commendations, ſufficiently diſcover the diſſimulation of irony. Ironical exhortation is a very agreeable kind of trope; which, after having ſet the inconveniences of a thing in the cleareſt light, concludes with a feigned encouragement to purſue it. Such is that of Horace, when, having beautifully deſcribed the noiſe and tumults of Rome, he adds ironically,

"Go now and ſtudy tuneful verſe at Rome!"

IRRADIATION, ſignifies an emanation, or ſhooting out of rays, or ſubtile effluvia, from any body. See Emanation.

IRRITABILITY, a term firſt invented by Gliſſon, and adopted by Dr. Haller, to denote an eſſential property of all animal bodies; and which, he ſays, exiſts independently of and in contradiſtinction to *ſenſibility*. This ingenious author calls that part of the human body *irritable*, which becomes ſhorter upon being touched; *very irritable*, if it contracts upon a ſlight touch; and the contrary, if by a violent touch it contracts but little.

ISAIAH, or *the Prophecy of* Isaiah, a canonical book of the Old Teſtament. *Iſaiah* is the firſt of the four greater prophets; the other three being Jeremiah, Ezekiel, and Daniel. This prophet was of royal blood, his father Amos being brother to Azariah, king of Judah. The five firſt chapters of his prophecy relate to the reign of Uzziah; the viſion in the ſixth chapter happened in the time of Jotham: the next chapters, to the fifteenth, include his prophecies under the reign of Ahaz; and thoſe that were made under the reigns of Hezekiah and Manaſſeh, are related in the next chapters to the end. *Iſaiah* foretold the deliverance of the Jews from their captivity in Babylon by Cyrus, one hundred years before it came to paſs. But the moſt remarkable of his predictions are thoſe concerning the Meſſiah, which deſcribe not only his deſcent, but all the remarkable circumſtances of his life and death. The ſtyle of this prophet is noble, nervous, ſublime, and florid, which he acquired by converſe with men of the greateſt abilities and elocution: Grotius calls him the Demoſthenes of the Hebrews. However the profoundneſs of his thoughts, the loftineſs of his expreſſions, and the extent of his prophecy, render him one of the moſt difficult of all the prophets; and the commentaries that have been hitherto written on his prophecy fall ſhort of a full explication of it. Biſhop Lowth's new tranſlation, &c. publiſhed in 1778, throws conſiderable light on the compoſition and meaning of *Iſaiah*.

ISATIS, *Woad*; a genus of the ſiliquoſa order, belonging to the tetradynamia claſs of plants. There are four ſpecies; but the only one worthy of notice is the tinctoria, or common woad, which is cultivated in ſeveral parts of Britain for the purpoſes of dyeing; being uſed as a foundation for many of the dark colours. For its cultivation, ſee Syſtem of Agriculture, Sect. XVIII.

ISCHIUM, or Ischion, derived from ισχυς, *robur*, *ſtrength*, in anatomy, the name of one of the bones of the hip; called alſo *coxa* and *coxendix*. See the Syſtem, Part II. Sect. II. and Plate I. *fig*. 1. letter *i*.

ISINGLASS. See Ichthyocolla.

ISLAND, or Isle, a tract of dry land encompaſſed with water; either with the ſea, a river or lake. In which ſenſe *Iſland* ſtands contradiſtinguiſhed from *continent*, or terra firma. Some conclude that iſlands are as ancient as the world, and, it is by no means probable, that the large *iſlands*, far remote from the continent, are new, or that they either aroſe out of the ſea, or were torn from the main land. Nor is it leſs certain, that there have been new *iſlands* formed by the caſting up of vaſt heaps of clay, mud, ſand, &c. as that, for inſtance, of Tſongming, in the province of Nanquin in China: or by the violence of the ſea, which has torn off large promontories from the continent, as the ancients imagined Sicily, and even Great Britain to have been formed. It is alſo certain, that ſome have emerged above the waves, as Santorini formerly, and three other *iſles* near it lately; the laſt in 1707, which roſe from the bottom of the ſea after an earthquake, that was ſuppoſed to have looſened it from its hold. Several naturaliſts are of opinion, that iſlands were formed at the deluge: others think they have been rent and ſeparated from the continent by violent ſtorms, inundations, and earthquakes. Theſe laſt have obſerved that the Eaſt Indies, which abound in *iſlands* more than any other part of the world, are likewiſe more annoyed with earthquakes, tempeſts, lightnings, volcanos, &c. than any other part. Varenius thinks moſt of theſe opinions true in ſome inſtances, and believes that there have been *iſlands* produced each of theſe ways. St. Helena, Aſcenſion, and other ſteep rocky *iſlands*, he ſuppoſes to have become ſo, by the ſeas overflowing the neighbouring champaigns. By the heaping up huge quantities of ſand, and other terreſtrial matters, he thinks the *iſlands* of Zealand, Japan, &c. were formed: Sumatra and Ceylon, and moſt of the Eaſt Indian *iſlands*, he rather thinks were rent off from the main land; and concludes, that the *iſlands* of the Archipelago were formed in the ſame way; imagining it probable, that Deucalion's flood might contribute towards it.

The ancients had a notion, that Delos and ſome few other *iſlands* roſe from the bottom of the ſea; which, how fabulous ſoever it might appear, agrees very well with ſome later obſervations. Seneca takes notice, that the *iſland* of Theraſia roſe out of the Ægean ſea in his time, of which the mariners were eye witneſſes. Iſlands from their ſituation enjoy many great advantages, the principal of which are theſe. In the firſt place, many benefits are derived to the inhabitants of an *iſland* from its unity. The very largeſt country on a continent is ſtill but a part, which implies dependence, and is neceſſarily attended with a train of imperfections; from all of which, by the unerring and unalterable laws of nature, the people who live in an *iſland* are or may be entirely free. All countries on the continent are expoſed to continual dangers, againſt which their inhabitants muſt be perpetually upon their guard. This renders a large military force requiſite. It involves them in continual negotiations, leagues, and alliances; all of which, however, cannot exempt them from frequent wars, or the miſeries that attend them, and which have commonly bad effects on their internal policy. In the next place, the climate is generally mild and ſalubrious from the vapours of the ſurrounding ſea, which according to the latitude abates the violence of heat, and moderates the rigour of cold, both which are ſenſibly and conſtantly leſs than on continents under the ſame elevation of the pole. We have a remarkable inſtance of this, in the iſlands called anciently *Stœchades*, in the modern Latin *Inſulæ Arearum*, by us the iſlands of *Hieres*. They are three in number, lying in 43° north latitude, before the port of Toulon. In them, the fruits of France and Italy arrive at the higheſt perfection, and all the medical herbs of Italy, Greece, and Egypt, grow wild. Yet the climate is wonderfully temperate and pleaſant in all ſeaſons. There is alſo commonly a greater variety, and always a greater fertility, in the ſoil, occaſioned chiefly by the warmth of the circumambient air, frequent ſhowers, and, in conſequence of both, being continually impregnated with vegetable ſalts. Another conſiderable advantage ariſes from its acceſſibility on every ſide, by which it is open to receive ſupplies from other countries, and has the conveniency of exporting its commodities and manufactures to all markets, and in compariſon of the continent, at all ſeaſons. The oppoſite ſides of an iſland may in regard to commerce be conſidered as two countries; each has its ports, its proper commodities, its proper correſpondencies; in conſequence of which, it promotes the cultivation, and procures vent for the manufactures, of a large diſtrict behind it; while the intermediate midland ſpace finds a profit in that inland trade, which theſe two diſtricts ſupply. The winds contrary on one ſide are favourable on the other; and the ſea, the common road to both coaſts, is continually ploughed by veſſels outward and homeward bound, which keeps up that active and enterprizing ſpirit which characterizes iſlanders. An *iſland* has at once the moſt extenſive and the moſt effectual frontier, and this on all ſides, ſubſiſting for ever, without repairs, and without expence: and, which is ſtill more, derives from this very frontier a great part of the ſubſiſtence of its inhabitants, and a valuable article in its commerce, from its fiſheries. It is commonly ſaid the ſea is a mine, but in truth it is better; its treaſures are more laſting and more certain, procured by labour ſolely, and fit for uſe or for ſale as ſoon as procured, quickly conſumed, and thereby the ſource of continual employment to a ſtout, hardy, laborious race of men, who likewiſe find employment for numbers, and are in various reſpects otherwiſe beneficial members of the community. The defence of this natural barrier, which as we have ſaid, coſts nothing; but on the contrary yields much, is not only permanent, but in every reſpect more to be relied on than any that could be raiſed by the ſkill and induſtry of men at the greateſt expence. All theſe bleſſings and benefits are inſured by the leſſon that Nature dictates, ſome would ſay the law which ſhe preſcribes, to the inhabitants of every *iſland*, to place all their hopes in the aſſiduous cultivation of their own country, to bend all their endeavonrs to raiſing and extending their commerce, and to put their truſt in Providence, and in the ſafeguard which ſhe directs; men accuſtomed to robuſt and hardy exerciſes, and in what neceſſarily ariſes from their way of life, a naval force. The firſt inhabitants come in veſſels, are for a time dependent on the country from whence they came, arrive at independence by enlarging their correſpondence: and thus commerce is natural and eſſential to the people of an *iſland*; which is the reaſon that they thrive ſo long as they poſſeſs it, and gradually decline in the ſame proportion in which that decays.

ISSUES, in phyſic, and ſurgery, ſmall artificial apertures in a fleſhy part of the body, to drain off ſuperfluous moiſture, or give vent to any noxious humour. They are uſually made in the arms, legs, or back, either by cauſtics or inciſion.

ISTHMUS, Ισθμος, in geography, a narrow neck, or ſlip of ground, which joins two continents; or joins a peninſula to the terra firma, and ſeparates two ſeas. The moſt celebrated *iſthmuſes* are that of Panama or Darien, which joins North and South America; that of Suez, which connects Aſia and Africa; that of Corinth, or Peloponneſus, in the Morea; that of Crim-Tartary, otherwiſe called Taurica Cherſoneſus; that of the Peninſula Romania and Eriſſo, or the *iſthmus* of the Thracian Cherſoneſus, twelve furlongs broad; being that which Xerxes undertook to cut through. The ancients had ſeveral deſigns of cutting the *iſthmus* of Corinth, which is a rocky hillock, about ten miles over; but they were all vain, the invention of ſluices being not then known. There have been attempts, too, for cutting the *iſthmus* of Suez, to make a communication between the Red-ſea and the Mediterranean. See *Bankes's Geography*.

ITALIAN, the language ſpoken in Italy. This tongue is derived principally from the Latin, and of all the languages formed from the Latin, there is none which carries with it more viſible marks of its original than the *Italian*. It is accounted one of the moſt perfect among the modern tongues. It is complained, indeed, that it has too many diminutives and ſuperlatives, or rather augmentatives; but without any great reaſon: for if thoſe words convey nothing farther to the mind than the juſt ideas of things, they are no more faulty than our pleonaſms and hyperboles. The language correſponds to the genius of the people; they are ſlow and thoughtful; and accordingly, their language runs heavily, though ſmoothly; and many of their words are lengthened out to a great degree. They have a great taſte for muſic; and, to gratify their paſſion this way, have altered abundance of their primitive words; leaving out conſonants, taking in vowels, ſoftening and lengthening out their terminations, for the ſake of the cadence. Hence the language is rendered extremely muſical, and ſucceeds better than any other in operas, and ſome parts of poetry: but it fails in ſtrength and nervouſneſs: hence alſo a great part of its words, borrowed from the Latin, become ſo far diſguiſed that they are not eaſily known again.

The multitude of ſovereign ſtates into which Italy is divided, has given riſe to a great number of different dialects in that language; which, however, are all good in the place where they are uſed. The Tuſcan is uſually preferred to the other dialects, and the Roman pronunciation to that of the other cities; whence the *Italian* proverb, *Lingua Toſcana in bocca Romana*. The *Italian* is generally pretty well underſtood throughout Europe, and is frequently ſpoken in Germany, Poland, and Hungary. At Conſtantinople, in Greece, and in the ports of the Levant, the *Italian* is uſed as commonly as the language of the country; indeed in thoſe places it is not ſpoken ſo pure as in Tuſcany, but is corrupted, with many of the proper words and idioms of the place: whence it takes a new name, and is called *Frank Italian*.

ITALIC *Character*, in printing. See LETTER.

ITCH, a diſeaſe of the ſkin, wherein it is corrupted by the ouzing out of certain ſharp ſaline humours, which gather into puſtules, and occaſion a pruritus, or itching. The pſora or *itch* is deſcribed by Celſus as a reddiſh hardneſs and roughneſs of the ſkin, from an eruption of puſtules thereon: ſome drier, other moiſter; and ouzing out a ſanious matter, which occaſions a continual *pruritus*, or itching. Theſe eruptions are moſt frequent about the junctures of the limbs, and between the fingers: in ſome they ſpread over the whole body; in others they ſoon ceaſe; and in ſome they return at certain ſeaſons of the year. In youth, this diſeaſe frequently prevents others, or cures them. But it ſometimes degenerates into a leproſy. There are two kinds of *itch*, a *humid* and a *dry* kind.

ITCH *Animal*, a creature found in the puſtules of the *itch*: it is a ſpecies of Acarus. See Syſtem of ENTOMOLOGY, on the *Deſtructive Properties of Inſects*. For the repreſentation of this animal magnified, ſee Plate II. of Microſcopical *Objects*.

ITINERARY, the deſcription a traveller gives of the courſe of his journey, and of the curioſities, &c. he obſerved therein.

JUBILEE, a time of public and ſolemn feſtivity among the ancient Hebrews. This was kept every 50th year: it began about the autumnal equinox, and was proclaimed by ſound of trumpet throughout all the country. At this time all ſlaves were releaſed, all debts annihilated, and all lands, houſes, wives and children, however alienated, were reſtored to their firſt owners. During this whole year all kind of agriculture was forbidden; and the poor had the benefit of the harveſt, vintage, and the other productions of the earth, in the ſame manner as in the ſabbatical or ſeventh year. As this was deſigned to put the Iſraelites in mind of their Egyptian ſervitude, and to prevent their impoſing the like upon their brethren, it was not obſerved by the Gentile proſelytes. The Chriſtians in imitation of the Jews, have likewiſe eſtabliſhed *jubilees*, which began in the time of pope Boniface VIII. in the year 1300, and are now practiſed every 25 years: but theſe relate only to the pretended forgiveneſs of ſins, and the indulgences granted by the church of Rome; together with the privilege of performing a thouſand frolics in maſquerade. The ceremony of the *jubilee* obſerved at Rome, begins in the following manner: the pope goes to St. Peter's church, to open the holy gate, which is walled up, and opened only on this occaſion; and, holding a golden hammer in his hand, he knocks at the gate three times, repeating theſe words, *Aperite mihi portas juſtitiæ, &c.* "Open to me the gates of righteouſneſs; I will go into them, and I will praiſe the Lord, (Pſal. cxviii. 19.)" Upon which the maſons fall to work, and break down the wall that ſtops up the gate: which done, the pope kneels down before it, and the penitentiaries ſprinkle him with holy water. Then, taking up the croſs, he begins to ſing *Te Deum*; and enters the church, followed by the clergy. In the mean time, three cardinal legates are ſent to open the three other holy gates which are in the churches of St. John of Lateran, St. Paul, and St. Mary the Greater. When the holy year is expired, the holy gates are ſhut in this manner: The pope, after he has bleſſed the ſtones and mortar, lays the firſt ſtone, and leaves there 12 boxes of gold and ſilver medals; after which the holy gates are walled up as before, and cohtinue ſo till the next *jubilee*. *Jubilees* are now become more frequent, and the pope grants them as often as the church, or himſelf, have occaſion for them. There is uſually one at the inauguration of a new pope.

To be entitled to the privileges of the *jubilee*, the bull enjoins faſtings, alms, and prayers. It gives the prieſts a full power to abſolve, in all caſes, even thoſe otherwiſe reſerved to the pope; to make commutations of vows, &c. in which it differs from a *plenary indulgence*. During the time of *jubilee*, all other indulgences are ſuſpended. One of our kings, viz. Edward III. cauſed his birth day to be obſerved in manner of a *jubilee*, when he became fifty years of age, in 1362, but never before or after. This he did, by releaſing priſoners, pardoning all offences except treaſon, making good laws, and granting many privileges to the people.

JUDAISM, the religious doctrines and rites of the *Jews*. *Judaiſm* was but a temporary diſpenſation, and was to give way, at leaſt the ceremonial part of it, at the coming of the Meſſias. For a complete ſyſtem of *Judaiſm*, ſee the books of Moſes. *Judaiſm* was anciently divided into ſeveral ſects; the principal whereof were the Phariſees, Sadducees, and Eſſenians. At preſent there are two ſects among the Jews, viz. the Caraites, who admit of no rule of religion but the law written by Moſes; and the Rabbiniſts, who add to the law the traditions of the Talmud. It has been obſerved, that *Judaiſm*, of all religions, is that which is the moſt rarely abjured. In the 18th of Edward I. the parliament granted the king a fifteenth for the expulſion of *Judaiſm*. In England, formerly, the Jews and all their goods belonged to the chief lord where they lived, and he had ſuch abſolute property in them, that he might ſell them; for they had not liberty to remove to another lord without leave. Mat. Paris tells us, that Henry III. ſold the Jews to earl Richard, his brother, for a term of years. They were diſtinguiſhed from the Chriſtians, both living and dying; for they had proper judges and courts wherein their cauſes were tried, and they wore a badge on their breaſt over their cloaths in ſhape of a table; and they were fined, if they ſtirred abroad without ſuch badges. They were never buried in the country, but always brought up to London, and interred without the walls.

JUDE, or *the Epiſtle of* Jude, a canonical book of the New Teſtament, written againſt the heretics, who by their impious doctrines and diſorderly lives, corrupted the faith and good morals of the Chriſtians. In the early ages of Chriſtianity, ſeveral rejected this Epiſtle, becauſe the apocryphal books of Enoch, and the aſcenſion of Moſes, are quoted in it. Nevertheleſs it is to be found in all the ancient catalogues of the ſacred writings; and Clement of Alexandria, Tertullian, and Origen, quote it as written by Jude, and reckon it among the books of ſacred Scripture.

JUDGE, an officer appointed by the ſovereign powers of any country, to diſtribute that juſtice to their ſubjects which they cannot adminiſter in perſon. The character of *judge* is part of the regal authority, whereof the king diveſts himſelf. The chief function of *judges* is for the trial of cauſes both civil and criminal; ſee the Article Court.

The *judges* are bound by oath to determine according to the known laws and ancient cuſtoms of the realm. Their rule herein muſt be the judicial deciſions, and reſolutions upon the various cauſes that have occurred, and not their own arbitrary will and pleaſure, or that of their prince. *Judges* are free from all proſecutions for any thing done by them in court, which appears to have been an error of their judgment. But for wilful corruption, they have been complained of to the ſtar-chamber formerly, and may now be called to an account in parliament.

JUDGMENT, a faculty of the ſoul, by which it perceives the relation between two, or more, ideas. Thus, when we *judge*, that the ſun is greater than the moon, the underſtanding firſt compares the two ideas of the ſun and the moon; and, finding the idea of the ſun greater than that of the moon, the will perfectly acquieſces in that perception, nor puts the mind upon any farther enquiry. It is not the underſtanding then that *judges*, as is ordinarily thought; *judgments* and reaſonings on the part of the underſtanding, are but mere perceptions; it is the will alone that *judges*, by acquieſcing in what is repreſented to it by the underſtanding. The only difference then between *perception, judgment*, and *reaſoning*, ſo far as the underſtanding is concerned in them, is this; that it perceives a thing ſimply, without any relation to any other thing, in a ſimple perception: that it perceives the relations between two or more things in *judgments*; and, laſtly, that it perceives the relations that are between the relations of things in reaſonings; ſo that all the operations of the underſtanding are in effect no more that pure perceptions.

Judgment, in law, is the ſentence pronounced by the court upon the matter contained in the record. *Judgments* are of four ſorts. Firſt, where the facts are confeſſed by the parties, and the law determined by the court; as in caſe of judgment upon *demurrer*: ſecondly, where the law is admitted by the parties, and the facts diſputed; as in a caſe of judgment on *verdict*: thirdly, where both the fact and the law ariſing thereon are admitted by the defendant; which is the caſe of judgments by *confeſſion*, or *default*: or, laſtly, where the plaintiff is convinced that either fact, law, or both, are inſufficient to ſupport his action, and therefore abandons or withdraws his proſecution; which is the caſe in judgments upon a *nonſuit* or *retraxit*.

JUDICIUM *Parium*, denotes a trial by a man's equals, i. e. of peers by peers, and of commoners by commoners. In *magna charta* it is more than once inſiſted on as the principal bulwark of our liberties, but eſpecially by chap. 29. that no freeman ſhall be hurt in either his perſon or property, *niſi per legale* judicium *parium ſuorum vel per legem terræ*. And this was ever eſteemed, in all countries, a privilege of the higheſt and moſt beneficial nature.

JUGULAR, among anatomiſts, is applied to certain veins of the neck, which terminate in the ſubclavians. See Syſtem of Anatomy, Part IV. Sect. II.

JUGULARES, the name of an order or diviſion of fiſh, the general character of which is, that they have ventral fins before the pectoral fins. This order comprehends five genera, viz. *callionymus, uranoſcopus, trachinus, gadus*, and *blennius*, and thirty-five ſubordinate ſpecies; ſee Syſtem of Ichthyology, Order III.

JUICE, a liquid ſubſtance, which makes part of the compoſition of plants; being diffuſed among all the ſolid parts, and ſerving for their nutriment and growth. The *juice*, or ſap, is that to *plants* which blood is to animals. There are *juices* of divers kinds, *aqueous, vinous, oleaginous, gummous, reſinous*, and *bituminous*; and of all taſtes and colours. *Juice* is alſo applied to ſeveral, and even to all fluids, or humours, in an animal body.

JULY, in chronology, the ſeventh month of the year, during which the ſun enters the ſign Leo. The word is derived from the Latin *Julius*, the ſurname of C. Cæſar the dictator, who was born in it. Mark Antony firſt gave this month the name *July*, which was before called *Quintilis*, as being the fifth month of the year, in the old Roman calendar eſtabliſhed by Romulus, which began in the month of March. For the ſame reaſon, Auguſt was called *Sextilis*; and September, October, November, and December, ſtill retain the name of their firſt rank.

Quæ ſequitur, numero turba notata ſuo.

On the third day of this month the dog days are commonly ſuppoſed to begin, and to end on the eleventh day of Auguſt.

JUNE, the ſixth month of the year, during which the ſun enters the ſign of Cancer. The word comes from the Latin *Junius*, which ſome derive *a Junone*. Ovid, in the ſixth of his *Faſti*, makes the goddeſs ſay,

Junius a noſtro nomine nomen habet.

In this month is the ſummer ſolſtice.

JUNIPERUS, the Juniper tree; a genus of the monadelphia order, belonging to the dioecia claſs of plants. The *communis*, or common juniper, grows naturally in many parts of Britain, upon dry barren commons, where it ſeldom riſes above the height of a low ſhrub. Mr. Evelyn aſſures us, that "the juniper, though naturally of the growth of England, is very little known in many parts of the country; for it grows naturally only in dry, chalky, or ſandy land; and, where the ſoil is oppoſite to this, the plant is rarely found. Thoſe who have been uſed to ſee it in its wild ſtate, on ſandy barren commons, &c. will have little inducement to plant it; as there they will ſee it procumbent, ſeldom ſhewing a tendency to aſpire; but when planted in a good ſoil, it will riſe to the height of 15 or 16 feet, and produce numerous branches from the bottom to the top, forming a well-looking buſhy plant. The flowers are ſmall, and of a yellowiſh colour. They are ſucceeded by the berries, which are of a blueiſh colour when ripe." Of this genus there are eight ſpecies.

Juniper-berries have a ſtrong, not diſagreeable ſmell; and a warm, pungent, ſweet taſte; which, if they are long chewed, or previouſly well bruiſed, is followed by a bitteriſh one. The pungency ſeems to reſide in the bark; the ſweet in the juice; the aromatic flavour in oily veſicles ſpread through the ſubſtance of the pulp, and diſtinguiſhable even by the eye; and the bitter in the ſeeds. The freſh berries yield on expreſſion, a rich, ſweet, honey-like aromatic juice; if previouſly pounded ſo as to break the ſeeds, the juice proves tart and bitter. Theſe berries are uſeful carminatives and ſtomachics: for theſe purpoſes a ſpirituous water and eſſential oil are prepared from them, and they are alſo ingredients in various medicines. The liquor remaining after the diſtillation of the oil paſſed through a ſtrainer, and gently exhaled to the conſiſtence of a rob, proves likewiſe a medicine of great utility, and in many caſes is perhaps preferable to the oil or the berry itſelf. Hoffman is expreſsly of this opinion, and recommends the rob of juniper in debility of the ſtomach and inteſtines, and ſays it is particularly ſerviceable to old people who are ſubject to theſe diſorders, or labour under a difficulty with regard to the urinary ſecretion. This rob is of a dark browniſh-yellow colour, a balſamic ſweet taſte, with a little of the bitter, more or leſs, according as the ſeeds in the berry have been more or leſs bruiſed. The Swedes prepare an extract from the berries, probably of the nature of the rob above mentioned, which ſome people eat for breakfaſt. In Germany the berries are bruiſed and put into the ſauce made uſe of for a wild-boar; and are frequently alſo eaten with other pork, to give it a wild-boar flavour. In Carniola and ſome other diſtricts, the inhabitants make a kind of wine of them ſteeped in water: but it is difficult to prevent this liquor from growing ſour. Thruſhes and grous feed on the berries, and diſſeminate the ſeed in their dung. It is remarkable that the berries of the juniper are two years in ripening. They ſometimes appear in an uncommon form; the leaves of the cup grow double the uſual ſize, approaching, but not cloſing; and the three petals fit exactly cloſe, ſo as to keep the air from the *tipulæ juniperi* which inhabit them. The whole plant has a ſtrong aromatic ſmell. The wood when burnt emits a fragrant odour like incenſe. It is of a reddiſh colour, very hard and durable; and, when large enough, is uſed in marquetry and vaneering, and in making cups, cabinets, &c. From the clefts of the bark, in warm climates, there ſometimes exſudes a reſinous gum called by the Arabs, *Sandaracha*. This reſin, or as it is improperly called *gum*, is brought to us from Africa, where the trees grow very large, and in great numbers. Graſs will not grow beneath juniper, but this tree itſelf is ſaid to be deſtroyed by the meadow-oat. The oil of juniper mixed with that of nuts, makes an excellent varniſh for pictures, wood-work, and preſerving iron from ruſting. The reſin powdered and rubbed into paper, prevents the ink from ſinking through it, for which it is frequently uſed under the name of *pounce*. The charcoal made from this wood endures longer than any other, inſomuch that live embers are ſaid to have been found in the aſhes, after being a year covered. The fruit or berries of the ſhurb *juniperus*, which is common on heaths in different parts in Europe, is much uſed in medicine.

JUNO, in the heathen mythology, a goddeſs; the daughter of Saturn and Ops, the ſiſter and wife of Jupiter; ſhe is otherwiſe called Lucina. Juno, as well as Jupiter, had a great variety of characters among the ancients; but the favourite one of them all, among the Romans, was that of the *Juno Matrona*, dreſſed like the Roman matrons in a long robe; which covered her from head to foot. The figures of the Roman empreſſes were often formed under this character of Juno.

IVORY, the tooth, or tuſk, of an elephant, growing on each ſide of his trunk, ſomewhat in form of a horn. *Ivory*, is much eſteemed for its colour, its poliſh, and the fineneſs of its grain when wrought. Dioſcorides ſays, that by boiling it the ſpace of ſix hours with the root of mandragoras, it becomes ſo ſoft and tractable that any one may manage it as he pleaſes. In the hiſtory of the French Academy, for the years 1742, and 1743, there is an account that M. Geoffroy produced before the academy, a ſmall *ivory* ſpoon, which, by lying long in muſtard, was become flexible and tranſparent like horn; that M. Fouchy ſaw an *ivory* ſpoon, which, by lying for a conſiderable time in milk, was become ſupple like leather; and that M. Hunauld produced bones which had been ſoftened by ſteeping in vinegar, afterwards hardened to their natural ſtate by ſteeping in water, and ſoftened a ſecond time by vinegar.

Dr. Lewis has obſerved, that the nitrous and marine acids diluted, and the acetous acid, make bones flexible and tough, like leather; but that the diluted vitriolic acid, though it ſoftens them to a conſiderable degree, makes them, at the ſame time brittle; nor has he found, that the ſoftened bones, whatever acid they were ſoftened by, recovered their hardneſs by ſteeping in water. Slips of ſoftened *ivory*, after lying above a month in water, continued nearly as ſoft as when they were taken out of the acid liquor. *Ivory* may be ſoftened and whitened by boiling red ſage-leaves in thrice-diſtilled white-wine vinegar, with a little quick-lime, and putting in the *ivory* while the liquor is boiling hot; *ivory* may be alſo whitened and cleaned from ſpots, by laying it in quick-lime, and pouring a little water on it; the quantity of water ſhould be ſmall, leſt the heat be too great, and the *ivory* ſcale, and become brittle. The *ivory* of the iſle of Ceylon, and that of the iſland of Achem, have this peculiarity, that they never become yellow, as thoſe of the Terra Firma, and Eaſt Indies do; on which account the former are much dearer.

Ivory may be prepared as a ground for miniature painting, by cleanſing the *ivory* leaves or tables, and rubbing them over with the juice of garlic. This is ſaid to be more eſſential for taking off the greaſineſs, which prevents the colours from fixing on the ground, than ſoap or gall. *Ivory* has the ſame medical virtues with hartſhorn; its ſhavings too, like thoſe of hartſhorn, boil into a jelly with water, and has the ſame reſtorative quality.

Foſſile Ivory. The abundance of elephants teeth found buried in different parts of the world, and many of thoſe parts ſuch as no elephant is ever known to have lived in, have given amazement to naturaliſts. The long tuſks, which are what we call *ivory*, are the only teeth the vulgar are acquainted with in this creature, yet even theſe, in their foſſile ſtate, have often been miſtaken for horns, or other animal parts. The grinders of this animal are ſo enormouſly large, and of ſo ſingular a ſhape, that it requires ſome knowledge in natural hiſtory to diſcover them at ſight, and many have miſtaken them when imperfect, for parts of a petrified ſhell-fiſh of the nautilus kind, their root being hallowed all along, and armed with an indented ridge on each ſide, in the manner of the back parts of ſome ſhells of that and of the cornu Ammonis kind. We are not to wonder that the teeth of elephants are found more frequently than any other bones of the animal, ſince their uſe in the creature, required that they ſhould be harder than any other bone, and that hardneſs has preſerved them in places where the other bones have periſhed. The different ſtate in which theſe teeth are found, is wholly owing to the different juices abounding in the earth in the places where they were depoſited, ſome of thoſe juices being of power to preſerve, others to deſtroy them; ſome eating them inſenſibly away, ſome as it were calcining them by ſlow degrees, and others rendering them greatly more hard and durable than before. Mem. Acad. Par. 1727.

Count Marſigli, and ſome other writers, have thought it an eaſy ſolution of the queſtion of the teeth and bones of elephants being found in countries where elephants are not naturally found, that we owe them to the Romans, who bringing them over for their uſe in war, buried them wherever they happened to die. But Sir Hans Sloane expreſſes himſelf very juſtly againſt this opinion: he obſerves, that of the remains of elephants found in Europe, nothing is ſo common as the *ivory* tuſks. Now, as he well obſerves, the Romans held *ivory* in the higheſt eſteem, and it ſold among them at a great price; wherefore had they been the buriers of theſe elephants, they would certainly have taken away the *ivory* tuſks firſt. It is certain, therefore, that accident, and not deſign, hath buried theſe bones, and that accident can have been no other than ſome prodigious inundation. Woodward is deſirous of making the univerſal deluge to have done all this, but that ſeems not neceſſary to be ſuppoſed in every caſe. Sir Hans Sloane gives an enumeration of the moſt curious of theſe pieces of foſſile *ivory*, which his own cabinet contained, and of ſome others of the moſt remarkable, mentioned by authors; from which we may form a very diſtinct idea both of the nature of the bodies themſelves, and of the places where they are uſually met with. See Philoſ. Tranſ. Nº 403. p. 458.

The power of ſubterranean calcinations to render things of this kind brittle, is remarked by the ſame author from Moreton's Hiſtory of Northamptonſhire, in the inſtance of a foſſile tuſk of an elephant which was in the whole at leaſt ſix feet long, and had preſerved its natural whiteneſs, though rendered ſo brittle as to fall into ſeveral pieces in the digging. This was dug up near Little Bowden, in Northamptonſhire; and the ſtrata of the place where it lay, were as follows: 1. Vegetable mould fourteen inches. 2. Loam a foot and half. 3. Large pebbles, with a ſmall mixture of earth among them, two foot and a half. 4. Blue clay; in the upper part of this laſt ſtratum, the tooth was found.

JUPITER, or Jove, in the heathen mythology, the ſovereign god of the heathens; the ſon of Saturn and Ops; born in the iſland of Crete, at the ſame birth with Juno: he married Juno, expelled his father out of his kingdom, and divided the kingdom of the world with his brethren. Under ſeveral ſhapes he is ſaid to have played many wanton pranks; ſo that, according to poetic fiction, he filled heaven with his natural children. As mankind are directed by an internal ſpirit or mind, the univerſe alſo is governed by an over-ruling intelligence; which as the cauſe and preſerver of all animal beings, was called Ζευς ὰ Ζοος. See God. The heathens in general believed that there was but one ſupreme God; but when they conſidered this one great being as influencing the affairs of the world, they gave him as many different names; and hence proceeded their variety of nominal gods. When he thundered or lightned, they called him Jupiter; when he calmed the ſea, Neptune; when he guided their councils, Minerva; and when he gave them ſtrength in battle, Mars. In proceſs of time they uſed different repreſentations of this Jupiter, &c. and conſidered them, vulgarly at leaſt, as ſo many different perſons. They afterward regarded each of them in different views: e. g. The Jupiter that ſhowered down bleſſings, was called the Kind Jupiter; and when puniſhing, the Terrible Jupiter. There was alſo one Jupiter for Europe, and another for Africa; and in Europe, there was one great Jupiter who was the particular friend of the Athenians, and another who was the ſpecial protector of the Romans: nay, there was ſcarce a town or hamlet perhaps, in Italy, that had not a Jupiter of its own; and the Jupiter of Terracina or Jupiter Anxur, repreſented in medals as young and beardleſs, with rays round his head, more reſembled Apollo than the great Jupiter at the Capitol. In this way Jupiter at length had temples and different characters almoſt every where: at Carthage, he was called Ammon; in Egypt, Serapis; at Athens, the great Jupiter was the Olympian Jupiter; and at Rome, the greateſt Jupiter, was the Capitoline Jupiter, who was the guardian and benefactor of the Romans, and whom they called the beſt and greateſt Jupiter, Jupiter *optimus maximus*. The figure of this Jupiter was repreſented in his chief temple on the Capitoline hill, as ſitting on a curule chair, with the fulmen or thunder, or rather lightning in one hand, a ſceptre in the other, and an eagle at his feet. This fulmen in the figures of the old artiſts was always adapted to the character under which they were to repreſent Jupiter. If his appearance was to be mild and calm, they gave him the conic fulmen or bundle of flames wreathed cloſe together, held down in his hand: when puniſhing, he holds up the ſame figure, with two tranſverſe darts of lightning, ſometimes with wings added to each ſide of it, to denote its ſwiftneſs: this was called by the poets, the three-forked bolt of Jove: and when he was going to do ſome exemplary execution, they put in his hand a handful of flames, all let looſe in their utmoſt fury; and ſometimes filled both his hands with flames. The ſuperiority of Jupiter was principally manifeſted, in that air of majeſty which the ancient artiſts endeavoured to expreſs in his countenance: particular attention was paid to the head of air, the eye-brows and the beard. There are ſeveral heads of the mild Jupiter on ancient ſeals; where his face has a mixture of dignity and eaſe in it, admirably deſcribed by Virgil, Æn. i. v. 256.

Jupiter, ♃, in aſtronomy, one of the ſuperior planets, remarkable for its bigneſs; and which, by its proper motion, ſeems to revolve round the earth in about twelve years. See the System, Sect. VIII.

JURISDICTION, a power, or authority, which a man has to do juſtice in caſes of complaint made before him. There are two kinds of *juriſdiction*; the one *eccleſiaſtical*, the other *ſecular*.

Secular Jurisdiction, belongs to the king, and his juſtices, or delegates.

Eccleſiaſtical Jurisdiction belongs to biſhops and their deputies. See Bishop.

JURISPRUDENCE, the ſcience of what is juſt and unjuſt, or of the laws, rights, cuſtoms, ſtatutes, &c. neceſſary for their doing of juſtice.

JUROR, Jurator, in a legal ſenſe, is one of thoſe twenty-four, or twelve men, who are ſworn to deliver truth upon ſuch evidence as ſhall be given them touching any matter in queſtion. The puniſhment of petty jurors attainted of giving a verdict contrary to evidence, willingly, is very ſevere. See Attaint.

JURY, a certain number of men ſworn to inquire into and try a matter of fact, and to declare the truth upon ſuch evidence as ſhall appear before them. Juries are, in theſe kingdoms, the ſupreme judges in all courts and in all cauſes in which either the life, property, or reputation, of any man is concerned; this is the diſtinguiſhing privilege of every Briton, and one of the moſt glorious advantages of our conſtitution; for as every one is tried by his peers, the meaneſt ſubject is as ſafe and as free as the greateſt. See the article Trial.

JUST, a ſportive kind of combat on horſeback; man againſt man with lances. Anciently, *juſts* and tournaments made a part of the entertainment at all ſolemn feaſts and rejoicings. The

Spaniards borrowed theſe exerciſes from the Moors, and called them *jugeo de cannas, reed*, or *cane-play*. Some take them to be the ſame with *ludus Trojanus*, anciently practiſed by the youth of Rome. The Turks uſe them ſtill, and call them *lancing the gerid*. The difference between *juſts* and tournaments conſiſts in this, that the latter is the genus, of which the former is only a ſpecies: tournaments included all kinds of military ſports and engagements, which were made out of gallantry and diverſions. *Juſts* were thoſe particular combats where the parties were near each other, and engaged with lance and ſword; add, that the tournament was frequently performed by a number of cavaliers, who fought in a body; the *juſt* was a ſingle combat of one man againſt another. Though the *juſts* were uſually made in tournaments, after a general rencounter of all the cavaliers, yet they were ſometimes ſingly, and independent of any tournament. He who appeared for the firſt time at a juſt, forfeited his helm, or caſque, unleſs he had forfeited before at a tournament.

JUSTICE, in a moral ſenſe, is one of the four cardinal virtues, which gives every perſon his due.

JUSTICE, in a legal ſenſe, a perſon deputed by the king to adminiſter juſtice to his ſubjects, whoſe authority ariſes from his deputation, and not by right of magiſtracy.

Fountain of JUSTICE, one of the characters or attributes of the king. See PREROGATIVE.

By the fountain of juſtice the law does not mean the *author* or *original*, but only the *diſtributor*. Juſtice is not derived from the king, as from his *free gift*; but he is the ſteward of the public, to diſpenſe it to whom it is *due*. He is not the ſpring, but the reſervoir, from whence right and equity are conducted, by a thouſand channels, to every individual. The original power of judicature, by the fundamental principles of ſociety, is lodged in the ſociety at large: but as it would be impracticable to render complete juſtice to every individual, by the people in their collective capacity; therefore every nation has committed that power to certain ſelect magiſtrates, who with more eaſe and expedition can hear and determine complaints; and in England this authority has immemorially been exerciſed by the king or his ſubſtitutes. He therefore has alone the right of erecting courts of judicature: for, though the conſtitution of the kingdom hath entruſted him with the whole executive power of the laws, it is impoſſible, as well as improper, that he ſhould perſonally carry into execution this great and extenſive truſt: it is conſequently neceſſary, that courts ſhould be erected, to aſſiſt him in executing this power; and equally neceſſary, that, if erected, they ſhould be erected by his authority. And hence it is, that all juriſdictions of courts are either mediately or immediately derived from the crown, their proceedings run generally in the king's name, they paſs under his ſeal, and are executed by his officers.

It is probable, and almoſt certain, that in very early times, before our conſtitution arrived at its full perfection, our kings in perſon often heard and determined cauſes between party and party. But at preſent, by the long and uniform uſage of many ages, our kings have delegated their whole judicial power to the judges of their ſeveral courts; which are the grand depoſitary of the fundamental laws of the kingdom, and have gained a known and ſtated juriſdiction, regulated by certain and eſtabliſhed rules, which the crown itſelf cannot now alter but by act of parliament. And, in order to maintain both the dignity and independence of the judges in the ſuperior courts, it is enacted by the ſtatute 13 W. III. c. 2. that their commiſſions ſhall be made (not, as formerly, *durante bene placito*, but) *quam diu bene ſe geſſerint*, and their ſalaries aſcertained and eſtabliſhed; but that it may be lawful to remove them on the addreſs of both houſes of parliament. And now, by the noble improvements of that law in the ſtatute of 1 Geo. III. c. 23. enacted at the earneſt recommendation of the king himſelf from the throne, the judges are continued in their offices during their good behaviour, notwithſtanding any demiſe of the crown (which was formerly held immediately to vacate their ſeats), and their full ſalaries are abſolutely ſecured to them during the continuance of their commiſſions; his majeſty having been pleaſed to declare, that "he looked upon the independence and uprightneſs of the judges, as eſſential to the impartial adminiſtration of juſtice; as one of the beſt ſecurities of the rights and liberties of his ſubjects; and as moſt conducive to the honour of the crown."

In criminal proceedings, or proſecutions for offences, it would ſtill be a higher abſurdity, if the king perſonally ſat in judgment; becauſe in regard to theſe he appears in another capacity, that of *proſecutor*.

All offences are either againſt the king's peace, or his crown and dignity; and are ſo laid in every indictment. For though in their conſequences they generally ſeem (except in the caſe of treaſon and a very few others) to be rather offences againſt the kingdom than the king; yet, as the public, which is an inviſible body, has delegated all its power and rights, with regard to the execution of the laws, to one viſible magiſtrate, all affronts to that power, and breaches of thoſe rights, are immediately offences againſt him, to whom they are ſo delegated by the public. He is therefore the proper perſon to proſecute for all public offences and breaches of the peace, being the perſon injured in the eye of the law. And this notion was carried ſo far in the old Gothic conſtitution, (wherein the king was bound by his coronation oath to conſerve the peace), that in caſe of any forcible injury offered to the perſon of a fellow ſubject, the offender was accuſed of a kind of perjury, in having violated the king's coronation oath; *dicebatur fregiſſe juramentum regis juratum*. And hence alſo ariſes another branch of the prerogative, that of *pardoning* offences; for it is reaſonable, that he only who is injured ſhould have the power of forgiving. See PARDON.

In this diſtinct and ſeparate exiſtence of the judicial power, in a peculiar body of men, nominated indeed, but not removeable at pleaſure, by the crown, conſiſts one main preſervative of the public liberty; which cannot ſubſiſt long in any ſtate, unleſs the adminiſtration of common juſtice be in ſome degree ſeparated both from the legiſlative and alſo from the executive power. Were it joined with the legiſlative, the life, liberty, and property of the ſubject would be in the hands of arbitrary judges, whoſe deciſions would be then regulated only by their own opinions, and not by any fundamental principles of law; which, though legiſlators may depart from, yet judges are bound to obſerve. Were it joined with the executive, this union might ſoon be an overbalance for the legiſlative. For which reaſon, by the ſtatute of 16 Car. I. c. 10. which aboliſhed the court of ſtar-chamber, effectual care is taken to remove all judicial power out of the hands of the king's privy-council; who, as then was evident from recent inſtances, might ſoon be inclined to pronounce that for law, which was moſt agreeable to the prince or his officers. Nothing therefore is more to be avoided in a free conſtitution, than uniting the provinces of a judge and a miniſter of ſtate. And indeed, that the abſolute power, lately claimed and exerciſed in France, was more tolerable than that of the eaſtern empires, was in a great meaſure owing to their having veſted the judicial power in their parliaments, a body ſeparate and diſtinct from both the legiſlative and executive: and that nation's recovery, of its former liberty, is owing to the efforts of thoſe aſſemblies. The happy period is at length arrived, when in that nation the man will no longer be diſtinguiſhed by his talents, but by his virtues. Parchments and baubles; ſolicitations by unworthy means; and acquiſitions by intrigue, will no more eſtabliſh an injurious difference. He who poſſeſſes titles without merit, will be diſrobed of them, and claſſed with the meaneſt citizens. How lamentable is it for a ſenſible mind to witneſs, that this effort of reaſon, this triumph of philoſophy, could not be effected without violent meaſures! But will he, who has only exiſted by abuſes, voluntarily give up that power which he has uſurped? In Turky, where every thing is centered in the ſultan or his miniſters, deſpotic power is in its meridian, and wears a moſt dreadful aſpect.

A conſequence of this prerogative is the legal ubiquity of the king. His majeſty, in the eye of the law, is always preſent in all his courts, though he cannot perſonally diſtribute juſtice. His judges are the mirror by which the king's image is reflected. It is the regal office, and not the royal perſon, that is always preſent in court, always ready to undertake proſecutions, or pronounce judgment, for the benefit and protection of the ſubject. And from this ubiquity it follows, that the king can never be nonſuit; for a nonſuit is the deſertion of the ſuit or action by the non-appearance of the plaintiff in court. For the ſame reaſon alſo, in the forms of legal proceedings, the king is not ſaid to appear by his attorney, as other men do; for he always appears, in contemplation of law, in his own proper perſon.

From the ſame original, of the king's being the fountain of juſtice, we may alſo deduce the prerogative of iſſuing proclamations, which is veſted in the king alone. See PROCLAMATION, GOVERNMENT, &c.

JUSTICE, *Juſtitiarius*, is likewiſe an officer appointed by the king or commonwealth, to do right by way of judgment. He is called *juſtice*, not *judge*; anciently *juſtitio* not *juſtitiarius*, becauſe he has his authority by deputation, as delegate to the king, and not *jure magiſtratus*; ſo that he cannot depute any other in his ſtead, the *juſtice* of the foreſt only excepted. Of theſe *juſtices* we have various kinds in England. See the Article COURT.

JUSTICES *of the Peace* are perſons of intereſt and credit, appointed by the king's commiſſion to keep the peace of the county where they live. Of theſe, ſome, for ſpecial reſpect, are made of the *quorum*, ſo as no buſineſs of importance may be diſpatched without the preſence, or aſſent, of them, or one of them. However, every *juſtice* of peace hath a ſeparate power, and his office is to call before him, examine, iſſue warrants for apprehending, and commit to priſon, all thieves, murderers, wandering rogues; thoſe that hold conſpiracies, riots, and almoſt all delinquents which may occaſion the breach of the peace, and quiet of the ſubject; to commit to priſon ſuch as cannot find bail, and to ſee them brought forth in due time to trial; and bind over the proſecutors to the aſſiſes. And if they neglect to certify examinations and informations to the next gaol-delivery, or do not bind over proſecutors, they ſhall be fined.

A *juſtice* is to exerciſe his authority only within the county where he is appointed by his commiſſion, not in any city which is a county of itſelf, or town corporate, having their proper *juſtices*, &c. but in other towns and liberties he may. For a farther account of the duty of *juſtices*, ſee QUARTER *Seſſions*.

K

K, The tenth letter, and ſeventh conſonant, of our alphabet; being formed by the voice, by a guttural expreſſion of the breath through the mouth, together with a depreſſion of the lower jaw and opening of the teeth. Its ſound is much the ſame with that of the hard *c*, or *qu:* and it is uſed, for the moſt part, only before *e*, *i*, and *n*, in the beginning of words; as *ken*, *kill*, *know*, &c. It uſed formerly to be always joined with *e* at the end of words, but is at preſent very properly omitted, at leaſt in words derived from the Latin: thus, for *publick*, *muſick*, &c. we ſay, *public*, *muſic*, &c. However, in monoſyllables, it is ſtill retained, as *jack*, *block*, *mock*, &c. Though it is ſeldom uſed in words derived from the French, as being altogether wanting in that language, yet we meet with *riſk*, *burleſk*, &c. in very good authors inſtead of *riſque*, *burleſque*; and indeed the former orthography is certainly moſt agreeable to the genius of the Engliſh language.

KALENDAR, a diſtribution of time, accommodated to the uſes of life; or a table, or almanac, containing the order of days, weeks, months, feaſts, &c. happening throughout the year. See TIME, MONTH, YEAR, &c.

It is called *kalendar*, from the word *kalendæ*, anciently wrote in large characters at the head of each month. See KALENDS.

There are divers kalendars, according to the different forms of the year, and diſtributions of time, eſtabliſhed in different countries. Hence the Roman, the Jewiſh, the Perſian, the Julian, the Gregorian, &c. kalendars.

The Roman KALENDAR owed its origin to Romulus; but it has undergone various reformations ſince his time. This kalendar, called alſo *Julian kalendar*, from its reformer Julius, is diſpoſed into quadriennial periods; whereof the firſt three years, which he called *communes*, conſiſt of 365 days; and the fourth *biſſextile*, of 366; by reaſon of the ſix hours, which in four years make a day, or ſomewhat leſs, for in 134 years an intercalary day is to be retrenched. On this account it was, that pope Gregory XIII. with the advice of Clavius and Ciaconius, appointed, that the hundredth year of each century ſhould have no biſſextile, excepting in each fourth century: that is, a ſubtraction is made of three biſſextile days in the ſpace of four centuries; by reaſon of the 11 minutes wanting in the ſix hours whereof the biſſextile conſiſts. The reformation of the kalendar, or the *new ſtyle*, as we call it, commenced on the fourth of October 1582, when ten days were thrown out at once; ſo many having being introduced into the computation ſince the time of the council of Nice, in 325, by the defect of 11 minutes.

Julian Chriſtian KALENDAR, is that wherein the days of the week are determined by the letters A, B, C, D, E, F, G, by means of the ſolar cycle; and the new and full moons, eſpecially the paſchal full moon, with the feaſt of Eaſter, and the other moveable feaſts depending thereon, by means of golden numbers, rightly diſpoſed through the Julian year. See CYCLE. In this kalendar, the vernal equinox is ſuppoſed to be fixed to the 21ſt day of March; and the cycle of 19 years, or the golden numbers, conſtantly to indicate the places of the new and full moons, yet both are erroneous. And hence aroſe a very great irregularity in the time of Eaſter. To ſhew this error the more apparently, let us apply it to the year 1715. In this year, then, the vernal equinox falls on the tenth of March; and therefore comes too early by 11 days. The paſchal full-moon falls on the 7th of April; and therefore too late, with regard to the cycle, by three days. Eaſter, therefore, which ſhould have been on the 10th of April, was that year on the 17th. The error here lies only in the metemptoſis, or poſtpoſition of the moon, through the defect of the lunar cycle. If the full moon had fell on the 11th of March, Eaſter would have fallen on the 13th of March; and therefore the error ariſing from the anticipation of the equinox, would have exceedingly augmented that ariſing from the poſtpoſition. Theſe errors, in courſe of time, were ſo multiplied, that the kalendar no longer exhibited any regular Eaſter. Pope Gregory XIII. therefore, by the advice of Aloyſius Lilius, in 1582, threw 10 days out of the month of October, to reſtore the equinox to its place, viz. the 21ſt of March; and thus introduced the form of the Gregorian year, with ſuch a proviſion, as that the equinox ſhould be conſtantly kept to the 21ſt of March. The new moons and full moons, by advice of the ſame Lilius, were not to be indicated by golden numbers, but by epacts. The kalendar, however, was ſtill retained in Britain, without this correction: whence there was a difference of 11 days between our time and that of our neighbours. But by 24 Geo. II. c. 23. the Gregorian computation is eſtabliſhed here, and accordingly took place in 1752.

Gregorian KALENDAR is that which, by means of epacts, rightly diſpoſed through the ſeveral months, determines the new and full moons, and the time of Eaſter with the moveable feaſts depending thereon, in the Gregorian year. The Gregorian kalendar, therefore, differs from the Julian, both in the form of the year, and in that epacts are ſubſtituted in lieu of golden numbers: for the uſe and diſpoſition whereof, ſee EPACT.

Conſtruction of a KALENDAR, or *Almanac*. 1. Compute the the ſun's and moon's place for each day of the year; or take them from ephemerides. 2. Find the dominical letter, and, by means thereof, diſtribute the kalendar into weeks. 3. Compute the time of Eaſter, and thence fix the other moveable feaſts. 4. Add the immoveable feaſts, with the names of the martyrs. 5. To every day add the ſun's and moon's place, with the riſing and ſetting of each luminary; the length of day and night; the crepuſcula, and the aſpects of the planets. 6. Add, in the proper places, the chief phaſes of the moon, and the ſun's entrance into the cardinal points; i. e. the ſolſtices and equinoxes; together with the riſing and the ſetting, eſpecially heliacal, of the planets and chief fixed ſtars. The duration of the crepuſcula, or the end of the evening and beginning of the morning twilight, together with the ſun's riſing and ſetting, and the length of days, may be transferred from the kalendars of one year, into thoſe of another; the differences in the ſeveral years being too ſmall to be of any conſideration in civil life. Hence it appears, that the conſtruction of a kalendar has nothing in it of myſtery, or difficulty, if tables of the heavenly motions be at hand. Some divide kalendars or almanacs into public and private, perfect and imperfect; others into heathen and Chriſtian.

Almanacs are of ſomewhat different compoſition, ſome containing more points, others fewer. The eſſential part is the kalendar of months and days, with the riſings and ſettings of the ſun, age of the moon, &c. To theſe are added various parerga, aſtronomical, aſtrological, meteorological, chronological, and even political, rural, medical, &c. as calculations, and accounts of eclipſes, ſolar ingreſſes, aſpects, and configurations of the heavenly bodies, lunations, heliocentrical and geocentrical motions of the planets, prognoſtics of the weather, and predictions of other events, tables of the planetary motions, the tides, terms, intereſt, twilight, equation, kings, &c.

KALENDAR *Months*, the ſolar months, as they ſtand in the kalendar, viz. January 31 days, &c.

KALENDS, or CALENDS, in the Roman chronology, the firſt day of every month. The kalends were reckoned backwards, or in a retrograde order. Thus, v. g. the firſt of May being the kalends of May; the laſt, or 30th of April, was the *pridie Kalendarum*, or ſecond of the kalends of May; the 29th of April, the third of the kalends, or before the kalends: and ſo back to the 13th, where the ides commence; which are, likewiſe, numbered invertedly to the fifth, where the nones begin; which are numbered after the ſame manner to the fifth day of the month, which is the kalends of April. See IDES, and NONES.

KANGUROO, in zoology, an animal on the coaſt of New Holland, which, when full grown, is as big as a ſheep. The head, neck, ſhoulder, and feet, are very ſmall in proportion to the other parts of the body; the tail is nearly as long as the body, thick near the rump, and tapering towards the end; the fore-legs of one of them meaſured only eight inches in length, and the hind-legs twenty-two; the progreſs is by ſucceſſive leaps or hops of great length, in an erect poſture; the fore-legs are kept bent cloſe to the breaſt, and ſeemed to be of uſe only for digging; the ſkin is covered with a ſhort fur, of a dark mouſe or grey colour, excepting the head and ears, which bear a ſlight reſemblance to thoſe of a hare; for a particular deſcription of this animal, ſee *Bankes's Geography*, page 6.

KAOLIN, the name of an earth which is uſed as one of the two ingredients in oriental porcelain. Some of this earth was brought from China, and examined by Mr. Reaumur. He found that it was perfectly unfuſible by fire, and believed that it was a talky earth; but M. Macquer obſerves, that it is more probably of an argillaceous nature, from its forming a tenacious paſte with the other ingredient called *petuntſe*, which has no tenacity. Mr. Bomare ſays, that by analyſing ſome Chineſe kaolin, he found it was a compound earth conſiſting of clay, to which it owed its tenacity; of calcareous earth, which gave it a meally appearance; of ſparkling cryſtals of mica; and of ſmall gravel, or particles of quartz cryſtals. He ſays, that he has found a ſimilar earth upon a ſtratum of granite, and conjectures that it may be a decompoſed granite. This conjecture is the more probable, as kaolins are frequently found in the neighbourhood of granites. See PORCELAIN.

KEEL, the loweſt piece of timber in a ſhip, placed in the bottom of her hull; one end thereof being let into the ſtern-poſt, and the other into the ſtern.

KEEL-*Hauling*, a puniſhment inflicted for various offences in the Dutch navy. It is performed by plunging the delinquent repeatedly under the ſhip's bottom on one ſide, and hoiſting him up on the other, after having paſſed under the keel. The blocks, or pullies, by which he is ſuſpended, are faſtened to the oppoſite extremities of the main-yard, and a weight of lead or iron is hung upon his legs, to ſink him to a competent depth. By this apparatus he is draw cloſe up to the yard-arm, and thence let fall ſuddenly into the ſea, where, paſſing under the ſhip's bottom, he is hoiſted up on the oppoſite ſide of the veſſel. As this extraordinary ſentence is executed with a ſerenity of temper peculiar to the Dutch, the culprit is allowed ſufficient intervals to recover the ſenſe of pain, of which indeed he is frequently deprived during the operation. In truth, a temporary inſenſibility to his ſufferings ought by no means to be conſtrued into a diſreſpect of his judges, when we conſider that this puniſhment is ſuppoſed to have peculiar propriety in the depth of winter, whilſt the flakes of ice are floating on the ſtream; and that it is continued till the culprit is almoſt ſuffocated for want of air, benumbed with the cold of the water, or ſtunned with the blows his head receives by ſtriking the ſhip's bottom.

KEEPER *of the Great-Seal*, is a lord by his office, and is ſtyled *lord keeper of the great-ſeal.* He is one of the king's privy-council, through whoſe hands paſs all charters, commiſſions and grants of the king under the great-ſeal; without which ſeal, all ſuch inſtruments, by law, are of no force; for the king is, in the interpretation of the law, a corporation, and paſſes nothing firmly but under the ſaid ſeal; which is, as the public faith of the kingdom, in the higheſt eſteem and reputation. The lord *keeper* has the ſame place, authority, pre-eminence, juriſdiction, execution of laws, and all other cuſtoms, commodities, and advantages, as the lord chancellor of England has for the time being. Both theſe officers cannot properly ſubſiſt at the ſame time, ſince the ſtatute of 5 Eliz. The lord CHANCELLOR, or lord *keeper*, is ſuperior in point of precedency to every temporal lord.

KEEPER *of the Privy-Seal*, is a lord by his office; through whoſe hands paſs all charters ſigned by the king, before they come to the great-ſeal, and ſome things which do not paſs the great-ſeal at all. He is of the king's privy-council, and was anciently called *clerk of the privy-ſeal*; yet reckoned in the number of the great officers of the realm. 12 Ric. II. c. 11. 27 Hen. VIII. c. 11.

KEEPING, in painting, denotes the repreſentation of objects in the ſame manner that they appear to the eye, at different diſtances from it, for which the painter ſhould have recourſe to the rules of perſpective.

KELP, in the glaſs-trade, a term uſed for a ſort of pot-aſhes uſed in many of their works; particularly for the cryſtalline metal. It is the calcined aſhes of a plant, called by the ſame name, and in ſome places ſea-thongs, or laces, a ſort of thick-leaved fucus or ſea-wrack; the *alga anguſtifolia vitrariorum* of John Bauhine. This plant, if kept moiſt a little after gathering, will ſhew afterwards, though long kept, its white ſalt upon the ſurface of its leaves. This plant is thrown on the rocks and ſhores in great abundance, and in the ſummer months is raked together, and dried as hay in the ſun and wind, and afterwards burnt to the aſhes called *kelp*, which are uſed not only in the glaſs, but in the alum works. This contains an alkali of the ſame kind with the plant kali, but more impure.

KERMES, in entomology, the name of an inſect produced in the excreſcenes of a ſpecies of the oak. The kermes appears at firſt wrapped up in a membranaceous bladder, of the ſize of a pea, ſmooth and ſhining, of a browniſh red colour, and covered with a very fine aſh-coloured powder. This bag teems with a number of reddiſh eggs or inſects, which, being rubbed with the fingers, pour out a crimſon liquor. It is only met with in warm countries in the months of May and June. In the month of April this inſect becomes of the ſize and ſhape of a pea; and its eggs ſome time after burſt from the womb, and, ſoon turning into worms, run about the branches and leaves of the tree.

KETCH, a kind of veſſel, equipped with two maſts, viz. the main-maſt, and mizen-maſt, and uſually from one hundred to two hundred and fifty tons burthen: they are uſed either as yachts, for conveying princes of the blood, ambaſſadors, or other great perſonages, from one place to another, or as BOMB-*veſſels*: theſe are built remarkably ſtrong, and fitted with a great number of RIDERS than any other veſſels. See NAVAL *Architecture*, Plate II. *Fig.* 1.

KEY, or KEY-STONE, of an *Arch*, or *Vault*, is the laſt ſtone placed atop thereof; which being wider and fuller at the top than bottom, wedges as it were, and binds in all the reſt. See Syſtem of Architecture on the Orders of Architecture in general, Article ARCHES.

KEY, in muſic, is a certain fundamental note, or tone, to which the whole piece, be it concerto, ſonata, cantata, &c. is accommodated; and with which it uſually begins, but always ends.

KEYS alſo denote thoſe little pieces in the fore-part of an organ, ſpinett, or harpſichord; by means whereof the jacks are played, ſo as to ſtrike the ſtrings of the inſtrument; and wind is given to the pipes, by raiſing and ſinking the ſucker of the ſound-board. In large organs there are ſeveral ſets of theſe *keys*; ſome to play the ſmall ſecond organ, ſome for the main organ, ſome for the trumpet, and ſome for the echoing trumpet. In ſome there are but a part that play, the reſt being for ornament. There are twenty ſlits in large *keys*, which make the half notes.

KHAZINE, the grand ſeignior's treaſury. Here are kept regiſters of receipts, accounts of provinces, in drawers, marked with the years, and the places names: here is alſo kept part of the emperor's wardrobe. There are apartments for the money, where the officers are never allowed to enter with any cloaths that have pockets in them.

KIDNAPPING, in law, is the offence of ſtealing and conveying away a man, woman, or child, and at common law is puniſhable by fine, pillory, &c. Alſo if a maſter of a ſhip ſhall, during his being abroad, force any man aſhore, and wilfully leave him behind, he ſhall ſuffer three months impriſonment. 11 & 12 W. III. c. 7.

KIDNEYS, in anatomy. For a particular deſcription, ſee the Syſtem, Part V. Sect. II. For repreſentation, ſee Plate VII. letters QQ.

KIDNEYS *of Fiſh*. Fiſh of all kinds have *kidneys*, but they differ extremely in the ſeveral genera. See *Comparative* ANATOMY, Sect. III.

KILDERKIN, a kind of liquid meaſure, which contains two firkins, or eighteen gallons, beer-meaſure, and ſixteen ale-meaſure. Two *kilderkins* make a barrel, and four a hogſhead.

KILN, a ſtove uſed in the manufacture of various articles. A fabric formed for admitting heat, in order to dry or burn materials placed in it to undergo ſuch operations.

KINDRED, in law, are a certain body of perſons of kin, or related to each other; ſee CONSANGUITY, and DESCENT.

KING, in the general acceptation of the word, is a perſon who has a ſupreme authority, with the power of levying taxes, making laws, and enforcing an obedience to them. Among the Greeks the *king* of Perſia had anciently the appellation of the *great king*; the *king* of France now has that of the *moſt Chriſtian king*; and the *king* of Spain has that of *Catholic king*. The *king* of the Romans is a prince choſen by the emperor, as a coadjutor in the government of the empire. The *kings* of England, by the Lateran council, under pope Julius II. had the title of *Chriſtianiſſimus* conferred on them; and that of DEFENDER *of the faith* was added by pope Leo X. though it had been uſed by them ſome time before.

A deſpotic king can never be conſidered ſo happy and ſo permanent on his throne, as one who is ſubject to the reſtrictions of a limited power, an inſtance of this evidently appears in the revolution in France; and it is ſomewhat ſingular that a neat century ſhould have meaſured the interval between the glorious revolution of the Britiſh Empire and that of France.—But which was the more wonderful of the two? is a queſtion that naturally ariſes to the ſpeculatiſt—to the politician—to the hiſtorian. In our idea that of France—moſt certainly! It was marked by the almoſt miraculous ſpirit of a people whom we, at leaſt, if not the reſt of Europe, conſidered as dead to the ſpirit of Liberty—as broken down to the humbleſt, the moſt paſſive reſignation to the dictates of deſpotiſm. The attempts made againſt the freedom of the Conſtitution by the unfortunate James II. were by the laſt dying ſpaſms of the infatuated Stuart family on the freedom of that Empire where their intuitive principles ſo long, and ſo glaringly marked their conduct. Theſe were attempts againſt the rights of a People uſed to conſtitutional Liberty—they were innovations of the long eſtabliſhed freedom of the Empire. The ſpirit of the people, wild to deſpotiſm, unbroken to tyranny, reſiſted in the whole force of nature and of reaſon. The thunder of the popular-arm, directed by our glorious Deliverer, overturned the ſchemes of deſpotiſm and reſtored the Conſtitution to its balance.

But let us look at France—bent for ages to the yoke, humbled not only to the moſt abject ſufferance of deſpotiſm, but almoſt to an enthuſiaſtic adoration of its ſource!—kiſſing the very ſcourge that whipped them, and licking the hand that applied it!

To behold this people, rouzing from lethargic ſlavery into a reviviſcence of freedom; to behold them not only ſpurning the ſceptre of deſpotiſm, burſting the ſhackles of oppreſſion, and aſſerting the rights of men, by culling flowers from the Britiſh conſtitution, from philoſophy and ſound policy: at a period when we are celebrating the commemoration of the firſt age of our liberties—and age, alas! tottering under the natural infirmities of all human conſtitutions—we are taught to lament, that a ſpirit ſo glorious ſhould have remained dormant ſo long, and that the ſpirit of mankind ſhould have ſo long looked with aſtoniſhment at the ſolitary example of Great Britain, without daring, as France has done, to follow her example. The ſeeds of freedom, imbibed by the French nation in her aid to the revolution of America, formed in fact, the yeaſt which has fermented the ſpirit of freedom againſt her own people. But we ſee with aſtoniſhment every purpoſe of conſtitutional liberty anſwered, comparatively ſpeaking, without an hundredth part of that tumult and bloodſhed which marked the firſt ſteps of Freedom in theſe realms.

In Great Britain, which is a limited monarchy, the power of the king is greatly reſtrained: which is ſo far from diminiſhing his honour, that it adds a glory to his crown; for while other kings are abſolute monarchs over innumerable multitudes of ſlaves, the king of Great Britain has the diſtinguiſhed glory of governing a free people, the leaſt of whom is protected by the laws; he has great prerogatives, and a boundleſs power in doing good; and is at the ſame time only reſtrained from acting inconſiſtently with his own happineſs, and that of his people. To underſtand the royal rights and authority, we muſt conſider the king under ſix diſtinct views. 1. With regard to his title. 2. His royal family. 3. His councils. 4. His duties. 5. His prerogative. 6. His revenue.

I. His title. For this, ſee HEREDITARY *Right*, and SUCCESSION.

II. His royal family. See ROYAL *Family*.

III. His councils. See COUNCIL.

IV. His duties. By our conſtitution, there are certain duties incumbent on the king; in conſideration of which, his dignity and prerogative are eſtabliſhed by the laws of the land; it being a maxim in the law, that protection and ſubjection are reciprocal. And theſe reciprocal duties are what Sir William Blackſtone apprehends were meant by the convention in 1688, when they declared that king James had broken the original contract between king and people. But however, as the terms of that original contract were in ſome meaſure diſputed, being alleged to exiſt principally in theory, and to be only deducible by reaſon and the rules of natural law, in which deduction different underſtandings might very conſiderably differ; it was, after the revolution, judged proper to declare theſe duties expreſsly, and to reduce that contract to a plain certainty. So that, whatever doubts might be formerly raiſed by weak and ſcrupulous minds about the exiſtence of ſuch an original contract, they muſt now entirely ceaſe; eſpecially with regard to every prince who hath reigned ſince the year 1688. The principal duty of the king is, To govern his people according to law. *Nec regibus infinita aut libera proteſtas*, was the conſtitution of our German anceſtors on the continent. And this is not only conſonant to the principles of nature, of liberty, of reaſon, and of ſociety; but has always been eſteemed an expreſs part of the common law of England, even when prerogative was at the higheſt. "The king," ſaith Bracton, who wrote under Henry III. "ought not to be ſubject to man; but to God, and to the law: for the law maketh the king. Let the king therefore render to the law, what the law has inveſted in him with regard to others; dominion, and power; for he is not truly king, where will and pleaſure rules, and not the law." And again: The king hath a ſuperior, namely God; and alſo the law, by which he was made a king." Thus Bracton; and Forteſcue alſo, having firſt well diſtinguiſhed between a monarchy abſolutely and deſpotically regal, which is introduced by conqueſt and violence, and a political or civil monarchy, which ariſes from mutual conſent, (of which laſt ſpecies he aſſerts the government of England to be), immediately lays it down as a principle, that "the king of England muſt rule his people according to the decrees of the laws thereof; inſomuch that he is bound by an oath at his coronation to the obſervance and keeping of his own laws." But to obviate all doubts and difficulties concerning this matter, it is expreſsly declared by ſtatute 12 & 13 W. III. c. 2. "that the laws of England are the birthright of the people thereof; and all the kings and queens who ſhall aſcend the throne of this realm ought to adminiſter the government of the ſame according to the ſaid laws, and all their officers and miniſters ought to ſerve them reſpectively according to the ſame; and therefore all the other laws and ſtatutes of this realm, for ſecuring the eſtabliſhed religion, and the rights and liberties of the people thereof, and all other laws and ſtatutes of the ſame now in force, are by his majeſty, by and with the advice and conſent of the lords ſpiritual and temporal, and commons, and by authority of the ſame, ratified and confirmed accordingly." And, as to the terms of the original contract between king and people, theſe, it is apprehended, are now couched in the coronation-oath, which by the ſtatute 1 W. & M. ſt. 1. c. 6. is to be adminiſtered to every king and queen who ſhall ſucceed to the imperial crown of theſe realms, by one of the archbiſhops or biſhops of the realm, in the preſence of all the people; who on their parts do reciprocally take the oath of allegiance to the crown. This coronation oath is conceived in the following terms:

"*The archbiſhop or biſhop ſhall ſay*, Will you ſolemnly promiſe and ſwear to govern the people of this kingdom of Britain, and the dominions thereto belonging, according to the ſtatutes in parliament agreed, and the laws and cuſtoms of the ſame? *The king or queen ſhall ſay*, I ſolemnly promiſe ſo to do.

"*Archbiſhop or biſhop.* Will you to your power cauſe law and juſtice, in mercy, to be executed in all your judgments? *King or queen.* I will.

"*Archbiſhop or biſhop.* Will you to the utmoſt of your power maintain the laws of God, the true profeſſion of the goſpel, and the proteſtant reformed religion eſtabliſhed by the law? and will you preſerve unto the biſhops and clergy of this realm, and to the churches committed to their charge, all ſuch rights and privileges as by law do or ſhall appertain unto them, or any of them? *King or queen.* All this I promiſe to do.

"*After this the king or queen, laying his or her hand upon the holy goſpel, ſhall ſay*, The things which I have here before promiſed, I will perform and keep: ſo help me God. *And then ſhall kiſs the book.*"

This is the form of the coronation-oath, as it is now preſcribed by our laws; the principal articles of which appear to be at leaſt as ancient as the mirror of juſtices, and even as the time of Bracton: but the wording of it was changed at the revolution, becauſe (as the ſtatute alleges) the oath itſelf had been framed in doubtful words and expreſſions, with relation to ancient laws and conſtitutions at this time unknown. However, in what form ſoever it be conceived, this is moſt indiſputably a fundamental and original expreſs contract; though, doubtleſs, the duty of protection is impliedly as much incumbent on the ſovereign before coronation as after: in the ſame manner as allegiance to the king becomes the duty of the ſubject immediately on the deſcent of the crown, before he has taken the oath of allegiance, or whether he ever takes it at all. This reciprocal duty of the ſubject will be conſidered in its proper place. At preſent we are only to obſerve, that in the king's part of this original contract are expreſſed all the duties which a monarch can owe to his people, viz. to govern according to law; to execute judgment in mercy; and to maintain the eſtabliſhed religion. And, with reſpect to the latter of theſe three branches, we may farther remark, that by the act of union, 5 Ann. c. 8. two preceding ſtatutes are recited and confirmed; the one of the parliament of Scotland, the other of the parliament of England: which enact; the former, that every king at his acceſſion ſhall take and ſubſcribe an oath, to preſerve the Proteſtant religion, and preſbyterian church-government in Scotland; the latter, that at his coronation he ſhall take and ſubſcribe a ſimilar oath, to preſerve the ſettlement of the church of England, within England, Ireland, Wales, and Berwick, and the territories thereunto belonging.

V. His prerogative. See Prerogative.

VI. His revenue. See Revenue.

Having in the preceding articles chalked out all the principal outlines of this vaſt title of the law, the ſupreme executive magiſtrate, or the king's majeſty, conſidered in his ſeveral capacities and points of view; it may not be improper to take a ſhort comparative review of the power of the executive magiſtrate, or prerogative of the crown, as it ſtood in former days, and as it ſtands at preſent. And we cannot but obſerve, that moſt of the laws for aſcertaining, limiting, and reſtraining this prerogative, have been made within the compaſs of little more than a century paſt; from the petition of right in 3 Car. I. to the preſent time. So that the powers of the crown are now to all appearance greatly curtailed and diminiſhed ſince the reign of king James I. particularly by the abolition of the ſtar-chamber and high commiſſion courts in the reign of Charles I. and by the diſclaiming of martial law, and the power of levying taxes on the ſubject, by the ſame prince: by the diſuſe of foreſt laws for a century paſt: and by the many excellent proviſions enacted under Charles II. eſpecially the abolition of military tenures, purveyance, and pre-emption; the *habeas corpus* act; and the act to prevent the diſcontinuance of parliaments for above three years: and, ſince the revolution, by the ſtrong and emphatical words in which our liberties are aſſerted in the bill of rights and act of ſettlement; by the act for triennial, ſince turned into ſeptennial, elections; by the excluſion of certain officers from the houſe of commons; by rendering the ſeats of the judges permanent, and their ſalaries independent; and by reſtraining the king's pardon from obſtructing parliamentary impeachments. Beſides all this, if we conſider how the crown is impoveriſhed and ſtripped of all its ancient revenues, ſo that it greatly depends on the liberality of parliament for its neceſſary ſupport and maintenance, we may perhaps be led to think, that the balance is inclined pretty ſtrongly to the popular ſcale; and that the executive magiſtrate has neither independence nor power enough left, to form that check upon the lords and commons which the founders of our conſtitution intended.

But, on the other hand, it is to be conſidered, that every prince, in the firſt parliament after his acceſſion, has by long uſage a truly royal addition to his hereditary revenue ſettled upon him for his life; and has never any occaſion to apply to parliament for ſupplies, but upon ſome public neceſſity of the whole realm. This reſtores to him that conſtitutional independence, which at his firſt acceſſion ſeems, it muſt be owned, to be wanting. And then, with regard to power, we may find perhaps that the hands of government are at leaſt ſufficiently ſtrengthened; and that a Britiſh monarch is now in no danger of being overborne by either the nobility or the people. The inſtruments of power are not perhaps ſo open and avowed as they formerly were, and therefore are the leſs liable to jealous and invidious reflections; but they are not the weaker upon that account. In ſhort, our national debt and taxes (beſides the inconveniences before mentioned), have alſo in their natural conſequences thrown ſuch a weight of power into the executive ſcale of government, as we cannot think was intended by our patriot anceſtors; who glorioufly ſtuggled for the abolition of the then formidable parts of the prerogative, and by an unaccountable want of foreſight eſtabliſhed this ſyſtem in their ſtead. The entire collection and management of ſo vaſt a revenue, being placed in the hands of the crown, have given riſe to ſuch a number of new officers, created by and removed at the royal pleaſure, that they have extended the influence of government to every corner of the nation. Witneſs the commiſſioners, and the multitude of dependents on the cuſtoms, in every port of the kingdom; the commiſſioners of exciſe, and their numerous ſubalterns, in every inland diſtrict; the poſt-maſters, and their ſervants, planted in every town, and upon every public road; the commiſſioners of the ſtamps, and their diſtributors, which are full as ſcattered and full as numerous; the officers of the ſalt duty, which, though a ſpecies of exciſe, and conducted the ſame manner, are yet made a diſtinct corps from the ordinary managers of that revenue; the ſurveyors of houſes and windows; the receivers of the land tax; the managers of lotteries; and the commiſſioners of hackney-coaches: all which are either mediately or immediately appointed by the crown, and removeable at pleaſure without any reaſon aſſigned: theſe, it requires but little penetration to ſee, muſt give that power, on which they depend for ſubſiſtence, an influence moſt amazingly extenſive. To this may be added the frequent opportunities of conferring particular obligations, by preference in loans, ſubſcriptions, tickets, remittances, and other money tranſactions, which will greatly increaſe this influence; and that over thoſe perſons whoſe attachment, on account of their wealth, is frequently the moſt deſirable. All this is the natural, though perhaps the unforeſeen, conſequence of erecting our funds of credit, and, to ſupport them, eſtabliſhing our perpetual taxes: the whole of which is entirely new ſince the reſtoration in 1660; and by far the greateſt part ſince the revolution in 1688. And the ſame may be ſaid with regard to the officers in our numerous army, and the places which the army has created. All which put together give the executive power ſo perſuaſive an energy with reſpect to the perſons themſelves, and ſo prevailing an intereſt with their friends and families, as will amply make amends for the loſs of external prerogative.

But though this profuſion of offices ſhould have no effect on individuals, there is ſtill another newly acquired branch of power; and that is, not the influence only, but the force, of a diſciplined army: paid indeed ultimately by the people, but immediately by the crown: raiſed by the crown, officered by the crown, commanded by the crown. They are kept on foot, it is true, only from year to year, and that by the power of parliament: but during that year, they muſt by the nature of our conſtitution, if raiſed at all, be at the abſolute diſpoſal of the crown. And there need but few words to demonſtrate how great a truſt is thereby repoſed in the prince by his people: A truſt, that is more than equivalent to a thouſand little troubleſome prerogatives.

Add to all this, that, beſides the civil liſt, the immenſe revenue of almoſt ten millions ſterling, which is annually paid to the creditors of the public, or carried to the ſinking fund, is firſt depoſited in the royal exchequer, and thence iſſued out to the reſpective offices of payment. This revenue the people can never refuſe to raiſe, becauſe it is made perpetual by act of parliament: which alſo, when well conſidered, will appear to be a truſt of great delicacy and high importance.

Upon the whole, therefore, it ſeems clear, that whatever may have become of the *nominal*, the real power of the crown has not been too far weakened by any tranſactions in the laſt century. Much is indeed given up; but much is alſo acquired. The ſtern commands of prerogative have yielded to the milder voice of influence: the ſlaviſh and exploded doctrine of non-reſiſtance has given way to a military eſtabliſhment by law; and to the diſuſe of parliaments has ſucceeded a parliamentary truſt of an immenſe perpetual revenue.

When, indeed, by the free operation of the ſinking fund, our national debts ſhall be leſſoned; when the poſture of foreign affairs, and the univerſal introduction of a well-planned and national militia, will ſuffer our formidable army to be thinned and regulated; and when (in conſequence of all) our taxes ſhall be gradually reduced; this adventitious power of the crown will ſlowly and imperceptibly diminiſh, as it ſlowly and imperceptibly roſe. But, till that ſhall happen, it will be our eſpecial duty, as good ſubjects and good Engliſhmen, to reverence the crown, and yet guard againſt corrupt and ſervile influences from thoſe who are intruſted with its authority; to be loyal, yet free; obedient and yet independent; and above every thing, to hope that we may long, very long, continue to be governed by a ſovereign, who, in all thoſe public acts that have perſonally proceeded from himſelf, hath manifeſted the higheſt veneration for the free conſtitution of Britain; hath already in more than one inſtance remarkably ſtrengthened its outworks; and will therefore never harbour a thought, or adopt a perſuaſion, in any the remoteſt degree detrimental to public liberty. See GOVERNMENT.

KING *at Arms* or *of Arms*, is an officer of great antiquity, and anciently he was of great authority; his buſineſs is to direct the heralds, preſide at their chapters, and have the juriſdiction of armory. In England we have three *kings* of arms; viz. Garter, Clarencieux, and Norroy; ſee GARTER, CLARENCIEUX *and* NORROY.

KING-*fiſher*, the Engliſh name of the genus Alcedo, according to Linnæus it is the 22d genus, and of the order of *Picæ*. But Latham in his improved arrangement makes it the 23d genus, but of the ſame order. For the generic character ſee ALCEDO. For repreſentation, ſee Syſtem of Ornithology, Plate II.

KINGDOM, the territories or extent of country ſubject to a king.

KINGDOMS, in natural hiſtory. Moſt naturaliſts and chymiſts divide all natural bodies into three great claſſes, which they call *kingdoms*. Theſe are the *mineral*, the *vegetable*, and the *animal* kingdoms. This great and firſt diviſion is founded on this conſideration, that any plant or vegetable which is produced, which grows, which is organized, which contains a ſeed, and which produces its like, ſeems to be a being very diſtinct and different from a ſtone or a metal, in which we at moſt obſerve only a regular arrangement of parts, but not a true organization, and which contains no ſeed by which it is capable of reproduction; and another foundation of this diviſion is, that an animal differs no leſs from a ſimple plant, by ſenſation, by the uſe of its ſenſes, and by the power of voluntary motion which it poſſeſſes, while theſe qualities do not belong to any thing which is merely vegetable. But notwithſtanding theſe ſo diſtinctive marks, philoſophers pretend, that this diviſion of natural bodies into claſſes is only ideal. They affirm, that, by obſerving nature attentively, we may perceive, that all her productions are connected together by an uninterrupted chain; and that by ſurveying the ſeveral beings, we muſt be convinced, that any one being differs very little from ſome other two between which it ſeems to be placed; ſo that we may deſcend from the moſt perfect animal to the rudeſt mineral by inſenſible degrees, and without finding any interval from which a diviſion might be made. The opinions of naturaliſts are therefore divided upon this ſubject; and each opinion ſeems to be founded upon obſervations, analogies, and reaſonings, more or leſs concluſive. If we avoid inveſtigating extremes, however, the diſtinctive marks muſt be acknowledged ſufficiently obvious to juſtify the triple diviſion abovementioned, and to diſcriminate the individuals of each. For a general view of the operations or conduct of nature in theſe her three kingdoms, ſee the article NATURE. For a particular conſideration of them, (in the animal-kingdom), ſee MAMMALIA, ORNITHOLOGY, ICHTHYOLOGY, ENTOMOLOGY, and the different animals under their reſpective names; (in the vegetable kingdom), BOTANY, PLANT, AGRICULTURE, VEGETATION, DEFOLIATION, FRONDESCENTIA, GEMMATIO, FRUIT, LEAF, GERMINATION, &c. and the different plants under their reſpective names; (in the mineral kingdom), MINERALOGY, METALLURGY, and the different ſtones and metals under their reſpective names.

Books of KINGS, two canonical books of the Old Teſtament, ſo called, becauſe they contain the hiſtory of the *kings* of Iſrael and Judah, from the beginning of the reign of Solomon, down to the Babyloniſh captivity, for the ſpace of near ſix hundred years. The firſt book of *Kings* contain the latter part of the life of David, and his death; the flouriſhing ſtate of the Iſraelites under Solomon, his building and dedicating the temple of Jeruſalem, his ſhameful defection from the true religion, and the ſudden decay of the Jewiſh nation after his death, when it was divided into two kingdoms; the reſt of the book was taken up in relating the acts of four *kings* of Judah and eight of Iſrael. The ſecond book, which is a continuation of the ſame hiſtory, is a relation of the memorable acts of ſixteen *kings* of Judah, and twelve of Iſrael, and the end of both kingdoms, by the carrying off the ten tribes captive into Aſſyria by Salmanaſſar, and the other two into Babylon by Nebuchadnezzar. It is probable that theſe books were compoſed by Ezra, who extracted them out of the public records, which were kept of what paſſed in that nation.

KITCHEN, in the king's houſhold, is under the direction and management of a clerk-comptroller, who has a ſalary of 500l. a year, ſubordinate clerk at 250l. a year, firſt clerk at 150l. a year, junior clerks, two maſter-cooks, the ſalary of the firſt being 237l. 10s. a year; and of the ſecond 217l. 10s. a year, yeomen, grooms, &c.

KITCHEN-*Garden*. For ample directions, for the management and cultivation of the kitchen garden, ſee the Syſtem, Part II. under that article for every month throughout the year.

KITE, the Engliſh name of a ſpecies of the falco. See FALCO.

KNEE, *genu*, in anatomy, the articulation of the thigh and legbones. See FEMUR and TIBIA.

KNIGHT, *Eques*, among the Romans, was the ſecond degree of the nobility; following immediately that of the ſenators.

KNIGHT, in a more modern ſenſe, properly ſignifies a perſon, who for his virtue and marſhal proweſs, is, by the king, raiſed above the rank of gentleman, into a higher claſs of dignity and honour.

KNIGHT is alſo underſtood of a perſon admitted into any order, either purely military, or military and religious, inſtituted by ſome king or prince, with certain marks and tokens of honour and diſtinction. Such are the *knights of the Garter*, *of the Bath*, *of the Thiſtle*, *of the order of St. Patrick*, &c.

KNIGHTHOOD, a military order, or honour; or a mark or degree of ancient nobility, or reward of perſonal virtue and merit; there are four kinds of *knighthood*; *military*, *regular*, *ſocial*, and *honorary*.

Military KNIGHTHOOD, is that of the ancient knights, who acquired it by high feats of arms.

Regular KNIGHTHOOD, is applied to all military orders, which profeſs to wear ſome particular habit, to bear arms againſt the infidels, to ſuccour and aſſiſt pilgrims in their paſſage to the Holy Land, and to ſerve in hoſpitals where they ſhould be received; ſuch were the knights Templars, and ſuch ſtill are the knights of Malta, &c.

Social KNIGHTHOOD, is that which is not fixed, nor confirmed by any formal inſtitution, nor regulated by any laſting ſtatutes; of which kinds there have many orders been erected on occaſion of factions, of tilts and tournaments, maſquerades, and the like.

Honorary KNIGHTHOOD, is that which princes confer on other princes, and even on their own great miniſters and favourites; ſuch are knights of the ſeveral orders of which the particular deſcriptions follow.

KNIGHTS *of the Garter*. This order conſiſts of twenty-ſix knights, or companions, generally peers or princes; whereof the king of England is the ſovereign, or chief. They wear a garter, ſet with pearls and precious ſtones, on their left leg, between the knee and calf, with this motto: *honi ſoit qui mal y penſe*, q. d. *ſhame to him that thinks evil hereof:* and they bear this motto ſurrounding their arms, as repreſented in plate VI. of Heraldry. The meaning of which motto is ſaid to be, that king Edward having laid claim to the kingdom of France, retorted ſhame and defiance upon him that ſhould dare to think amiſs of the juſt enterpriſe he had undertaken for recovering his lawful right to that crown; and that the bravery of thoſe knights whom he had elected into this order was ſuch as would enable him to maintain the quarrel againſt thoſe who thought ill of it. They are a college or corporation, having a great and little ſeal: their officers are, a prelate, chancellor, regiſter, king at arms, and uſher. Beſides which, they have a dean, and twelve canons, with petty canons, vergers, and twenty-ſix penſioners, or poor knights. The prelate is the head; and the office is veſted in the biſhop of Wincheſter; next to him is the chancellor, which office is veſted in the biſhop of Saliſbury, who keeps the ſeals. All theſe officers, except the prelate, have fees and penſions.

The order is under the patronage or protection of St. George of Cappadocia, the tutelar ſaint of this kingdom. Their college is held at the caſtle of Windſor, within the chapel of St. George, and the chapter houſe, erected by the founder for that purpoſe. Their robes, &c. are the *garter*, decked with gold and gems, and a buckle of gold, to be worn at feaſts and ſolemnities, a ſur-coat mantle, high velvet cap, collar of SS's, compoſed of roſes enamelled, &c. The mantle is the chief of thoſe veſtments made uſe of on ſolemn occaſions. Its colour by the ſtatutes appointed to be blue. The length of the train of the mantle only diſtinguiſhes the ſovereign from the knights-companions: to the collar of the mantle is fixed a pair of long ſtrings, anciently wove with blue ſilk only, but now twiſted round, and made of Venice gold and ſilk, of the colour of the robe, with knobs or buttons, and taſſels at the end. The left ſhoulder of the mantle has from the inſtitution been adorned with a large *garter*, with the device *honi ſoit*, &c. within this is the croſs of the order, which was ordained to be wore at all times by king Charles I. At length the ſtar was introduced, which is a ſort of croſs irradiated with beams of ſilver. The collar is appointed to be compoſed of pieces of gold in faſhion of *garters*, with the ground enamelled blue, and the motto gold. When they wear not their robes, they are to have a ſilver ſtar on the left ſide; and they commonly bear the picture of St. George, enamelled on gold, and beſet with diamonds, at the end of a blue ribbon, croſſing the body from the left ſhoulder.

The order of the *garter* appears the moſt ancient and noble lay-order in the world. It is prior to the French order of St. Michael, by 50 years; to that of the Golden Fleece, by 80 years: to that of St. Andrew, by 190; and to that of the Elephant, by 290 years. Since the inſtitution of this order, there have been eight emperors and twenty eight kings, beſides numerous ſovereign princes, enrolled as companions thereof. Its origin is ſomewhat differently related. The common account is, that the counteſs of Saliſbury at a ball happening to drop her garter, the king took it up and preſented it to her with theſe words, "*Honi ſoit qui mal y penſe*;" i. e. Evil to him that evil thinks. This accident, it is ſaid, gave riſe to the order and the motto; it being the ſpirit of the times to mix love and war together: but as in the original ſtatutes of this order there is not the leaſt conjecture to countenance ſuch a feminine inſtitution, credit cannot be given to this tradition: the true motive is therefore attributed by very reſpectable hiſtorians, to a nobler origin; which is, that king Edward III. having iſſued forth his own garter for the ſignal of a battle, it ended ſo fortunately, that he thence took occaſion to inſtitute that order, not only as an incentive to honour and martial virtue, but alſo as a ſymbol of unity and ſociety.

Knights *of the Bath*, are a military order in England inſtituted by Richard II. who ordained that there ſhould be no more than four; however, his ſucceſſor, Henry IV. increaſed them to forty-ſix. Their motto was *Tria juncta in uno*, ſignifying the three theological virtues.

It was the cuſtom to bathe before they received the golden ſpurs: but this was only obſerved at firſt, being afterwards gradually dropped: however, it was this occaſioned the denomination of Knights of the Bath.

The order of Knight of the Bath is ſcarce ever conferred but at the coronation of kings, or the inauguration of a prince of Wales, or duke of York. They wear a red ribband belt-wiſe; to which is affixed the badge of the order, viz. a ſceptre, roſe, thiſtle, and three imperial crowns joined within a circle; upon which circle is the motto in pure gold. Each knight wears a ſilver ſtar of eight points upon the left breaſt of his upper garment. See Plate VI. Heraldry.

The order of the Bath, after remaining many years extinct, was revived uuder king George I. by a ſolemn creation of a great number of knights.

Knights *of the Thiſtle*, or *of St. Andrew*, a military order of knighthood in Scotland, the riſe and inſtitution whereof is variouſly related by different authors. The chief and principal enſign is a gold collar compoſed of thiſtles and ſprings of rue interlinked with amulets of gold, having pendent thereuuto the image of St. Andrew with his croſs, and the motto, Nemo me impune lacesset. The ordinary or common enſign worn by the knights, is a ſtar of four ſilver points, and over them a green circle, bordered and lettered with gold, containing the ſaid motto, and in the centre is a thiſtle proper; all which is embroidered on their left breaſt, and worn with the collar, with a green ribband over the left ſhoulder, and brought under the right arm; pendent thereto is the image of St. Andrew, with his croſs, in a purple robe, within an oval of gold enamelled vert, with the former motto: but ſometimes they wear, encircled in the ſame manner, a thiſtle crowned. About the time of the Reformation, this order was dropped, till James II. of England reſumed it, by creating eight knights: however, the Revolution unſettled it again; and it lay neglected, till queen Anne, in 1703, reſtored it to the primitive deſign, of twelve knights of St. Andrew.

Knights *of the Order of St. Patrick*. This order was inſtituted in 1783, and the inveſtiture took place at Dublin Caſtle on the 11th of March of the ſame year. By virtue of his Majeſty's letter, ſignifying his pleaſure to his Excellency the Lord Lieutenant, the Archbiſhop of Dublin was inveſted, by his Excellency, with the proper badge as Chancellor; the Dean of St. Patrick was inveſted in the like manner as Regiſter; as was Lord Delvin as Secretary of that moſt illuſtrious order. The order is compoſed of twelve knights, who are inveſted by the Grand Maſter with the ribband and badge. The ceremony of the inſtallation was performed in the cathedral church of St. Patrick, where the knights reſpectively deſcending into the middle of the choir, were inveſted with the ſword, the mantle, and the collar, by the chancellor and regiſter, after reading the admonitions preſcribed, viz.

Upon putting on the ſword; "Take this ſword to the increaſe of your honour; and in token and ſign of the moſt illuſtrious order, which you have received, wherewith you being defended, may be bold, ſtrongly to fight in defence of thoſe rights and ordinances to which you be engaged, and to the juſt and neceſſary defence of thoſe who be oppreſſed and needy."

Upon putting on the mantle; "Receive this robe and livery of this moſt illuſtrious order, in augmentation of thine honour, and wear it with firm and ſteady reſolution, that by your character, conduct, and demeanour, you may approve yourſelf a true ſervant of the Almighty God; and a worthy brother and knight companion of this moſt illuſtrious order."

Upon putting on the collar; "Sir, the loving company of the order of St. Patrick hath received you their brother, lover, and fellow; and in token and knowledge of this, they give you and preſent you this badge, the which God will that you receive and wear from henceforth, to his praiſe and pleaſure, and to the exaltation and honour of the ſaid illuſtrious order, and yourſelf." For a repreſentation of the Inſignia and Regalia of the reſpective Orders, ſee the Syſtem of Heraldry, Plate VII.

Knights-*Errant*, a pretended order of chivalry, whereof ample mention is made in the old romances. They were a kind of heroes, who travelled the world in ſearch of adventures, redreſſing wrongs, reſcuing damſels, and taking all occaſions of ſignalizing their proweſs. This romantic bravery of the old *knights* was heretofore the chimera of the Spaniards; among whom there was no cavalier but had his miſtreſs, whoſe eſteem he was to gain by ſome heroic action. The duke of Alva, notwithſtanding his age and gravity, is ſaid to have vowed the conqueſt of Portugal to a young lady.

Knights *of the Shire*, or Knights *of Parliament*, are two gentlemen of worth, choſen on the king's writ in pleno comitatu, by ſuch of the freeholders of every county as have the value of 40s. per ann. within the county, clear of all taxes and deductions except parliamentary and parochial taxes, to repreſent ſuch county in parliament

KNOUT is the name of a puniſhment inflicted in Ruſſia, with a kind of whip called *knout*, and made of a long ſtrap of leather prepared for this purpoſe. With this whip the executioners dextrouſly carry off a ſlip of ſkin from the neck to the bottom of the back laid bare to the waſte, and repeating their blows, in a little while rend away all the ſkin off the back in parallel ſtripes. In the common *knout*, the criminal receives the laſhes ſuſpended on the back of one of the executioners: but in the great *knout*, which is generally uſed on the ſame occaſions as racking on the wheel in France, the criminal is raiſed into the air, by means of a pulley fixed to the gallows, and a cord faſtened to the two wriſts tied together; a piece of wood is placed between his two legs alſo tied together; and another of a crucial form under his breaſt. Sometimes his hands are tied behind over his back, and when he is pulled up in this poſition, his ſhoulders are diſlocated. The executioners can make this puniſhment more or leſs cruel; and, it is ſaid, are ſo dextrous, that when a criminal is condemned to die, they can make him expire at pleaſure, either by one, or ſeveral laſhes.

KNOWLEDGE, according to Mt. Locke, conſiſts in the perception of the connexion and agreement, or diſagreement and repugnancy, of our ideas. To *know that white is not black*, is only to perceive that theſe two ideas do not agree. So, in *knowing* that the three angles of a triangle are equal to two right ones; what do we more than perceive, that equality to two right ones neceſſarily agrees to, and is inſeparable from, the three angles of a triangle?

Different Kinds of Knowledge. For what relates to the agreement or diſagreement of ideas, we may reduce the whole doctrine, and conſequently the whole ſtock of our *knowledge*, to four heads, viz. *identity*, or *diverſity*, *relation*, *co-exiſtence*, and *real exiſtence*. As to the identity or diverſity of our ideas, we may obſerve, that it is the firſt act of the mind to perceive its own ideas: and, ſo far as it perceives them, to *know* what each is, and thereby to perceive their difference; that is, the one not to be the other; by this the mind clearly perceives each idea to agree with itſelf, and to be what it is; and all diſtinct ideas to diſagree. This it does without any pains, or deduction, by its natural power of perception, and diſtinction: and, for doing this, men of art have eſtabliſhed certain general rules or principles; as that, what is, is; and that it is impoſſible for the ſame to be, and not to be. But no maxim can make a man *know* it clearer, that round is not ſquare, than the bare perception of the two ideas, which the mind, at firſt ſight, perceives to diſagree.

The next kind of agreement, or diſagreement, the mind perceives, in any of its ideas, may be called *relative*, and is nothing but the perception of the relation between any two ideas, of what kind ſoever; that is, their agreement or diſagreement, one with another, in the ſeveral ways, or reſpects, the mind takes of comparing them. The third ſort of agreement, or diſagreement, to be found in our ideas, is co-exiſtence, or non-exiſtence, in the ſame ſubject; and this belongs particularly to ſubſtances. Thus when we pronounce concerning gold, that it is fixed, it amounts to no more but this, that fixedneſs, or a power to remain in the fire unconſumed, is an idea which always accompanies that particular ſort of yellowneſs, weight, fuſibility, &c. which make our complex idea ſignified by the word *gold*. The fourth ſort is that of actual and real exiſtence, agreeing to any idea. Within theſe four ſorts of agreement, or diſagreement, ſeems contained all the *knowledge* we have, indeed all we are capable of; for all that we *know*, or can affirm, concerning any idea, is, that it is, or is not, the ſame with ſome other; as, that blue is not yellow; that it does, or does not, co-exiſt with another in the ſame ſubject; as, that iron is ſuſceptible of magnetical impreſſions: that it hath that or this relation to ſome other ideas; as, that two triangles upon equal baſes, between the ſame parallels, are equal: or that it has a real exiſtence without the mind; as, that God is.

Knowledge alſo may be properly diſtinguiſhed into three kinds: hiſtorical, philoſophical, and mathematical.

Hiſtorical Knowledge, is merely the knowledge of facts, or of what is or happens in the material world, or within our own minds. Thus, that the ſun riſes and ſets, that trees bud in the ſpring, that we remember, will, &c. are inſtances of *hiſtorical knowledge*.

Philoſophical Knowledge, is the *knowledge* of the reaſons of things, or of what is or happens. Thus he has a *philoſophical knowledge* of the motion of rivers, who can explain how it ariſes from the declivity of the bottom, and from the preſſure which the lower part of the water ſuſtains from the upper. So likewiſe the ſhewing how, and by what reaſon, deſire or appetite ariſes from the perception or imagination of its object, would be *philoſophical knowledge*.

Mathematical Knowledge, is the *knowledge* of the quantity of things, that is, of their proportions or ratios to ſome given meaſure. Thus he who knows the proportion of the meridian heat of the ſun at the ſummer ſolſtice to its meridian heat at the winter ſolſtice, might ſo far be ſaid to have a *mathematical knowledge* of the ſun's heat. So likewiſe he has a *mathematical knowledge* of the motion of a planet in its orbit, who can diſtinctly ſhew how, from the quantity of the impreſſed and centripetal force, the velocity of the planet is produced; and how, from the action of this double force, the elliptical figure of the orbit ariſes. Theſe three kinds of *knowledge* differ evidently, it being one thing to know that a thing is; another, the reaſon why it is; and a third, to know its quantity or meaſure. It is evident, that hiſtorical *knowledge*, though extenſively uſeful, and the foundation of the reſt, is the loweſt degree of human *knowledge*. Thoſe who aim at the greateſt certainty ought to join *mathematical* with *philoſophical knowledge*. Nothing can more evidently ſhew that an effect ariſes from a certain cauſe, than the *knowledge* that the quantity of the effect is proportional to the force of the cauſe. Beſides, there are many things in nature, the reaſons of which depending on certain figures or quantities, are not aſſignable but from mathematical principles.

Method of improving or enlarging Knowledge. It being the received opinion amongſt men of letters, that maxims are the foundation of all *knowledge*, and that ſciences are each of them built upon certain præcognita, from whence the underſtanding is to take its riſe, and by which it is to conduct itſelf in its enquiries in the matters belonging to that ſcience: the beaten road of the ſchools has been to lay down, in the beginning, one or more general propoſitions, called *principles*, as foundations whereon to build the *knowledge* that was to be had of that ſubject. The way to improve in *knowledge* is, not to ſwallow principles with an implicit faith, and without examination, which would be apt to miſlead men, inſtead of guiding them into truth; but to get and fix in our minds clear and complete ideas, as far as they are to be had, and to annex to them proper and conſtant names: and thus, barely by conſidering our ideas, and comparing them together, obſerving their agreement or diſagreement, their habitudes and relations, we ſhall get more true and clear *knowledge* by the conduct of this one rule, than by taking up principles, and thereby putting our minds into the diſpoſal of others. Men, who have ſenſes, cannot chooſe but receive ſome ideas by them; and, if they have memory, they cannot but retain ſome of them; and if they have any diſtinguiſhing faculty, cannot but perceive the agreement or diſagreement, of ſome of them one with another. As he that has eyes, if he will open them by day, cannot but ſee ſome objects, and perceive a difference in them; yet he may chooſe whether he will turn his eyes towards an object, curiouſly ſurvey it, and obſerve accurately all that is viſible in it. But what he doth ſee he cannot ſee otherwiſe than he doth; it depends not on his will to ſee that black which appears yellow. Juſt thus it is with our underſtanding: all that is voluntary in our *knowledge*, is the employing or with-holding any of our faculties from this or that ſort of objects, and a more or leſs accurate ſurvey of them; but, they being employed, our will hath no power to determine the knowledge of the mind one way or other; that is done only by the objects themſelves, as far as they are clearly diſcovered. Thus, he that has got the ideas of numbers, and has taken the pains to compare one, two, or three, to ſix, cannot chooſe but *know* they are equal. He alſo, that hath the idea of an intelligent, but weak and frail being, made by, and depending on another, who is eternal, omnipotent, and perfectly wiſe and good, will as certainly know, that man is to honour, fear, and obey God, as that the ſun ſhines when he ſees it. But yet, be theſe truths ever ſo certain, ever ſo clear, he may be ignorant of either or both of them, who will not take the pains to employ his faculties as he ſhould, to inform himſelf about them.

KOKOB, the name of a ſpecies of ſerpent, found in the Weſt Indies, and very fatal by its bite. It is ſmaller than our viper, and of a brown colour, variegated with green and red ſpots.

L

L, A ſemi-vowel, or liquid, making the eleventh letter of the alphabet. It was derived from the old Hebrew Lamed, or Greek Lambda λ. It is ſounded by intercepting the breath between the top of the tongue and fore-part of the palate, with the mouth open; and makes a ſweet ſound, with ſomething of an aſpiration; and therefore the Britons and Spaniards uſually doubled it, or added an *h* to it in the beginning of words, as in *llan*, or *lhan*, a temple ſounding nearly like *fl*, &c. In Engliſh words of one ſyllable it is doubled at the end, as *tell*, *bell*, *knell*, &c. but in words of more ſyllables than one it is ſingle at the end, as *evil*, *general*, *conſtitutional*, &c. It is placed after moſt of the conſonants in the beginning of words and ſyllables, as *black*, *glare*, *ab-le*, *ea-gle*, &c. but before none. Its ſound is clear in *Abel*, but obſcure in *able*, &c. As a numeral letter, L denotes 50; and with a daſh over it, thus, $\bar{L}$, 5000. Uſed as an abbreviature, L ſtands for Lucius; and L. L. S. for a ſeſterce. See Sesterce.

LABEL, in heraldry, a kind of addition to the arms of the heir or firſt ſon, to diſtinguiſh him from the others. See the Syſtem, Sect. V. Plate II.

LABIAL *Letters*, are thoſe whoſe pronunciation is chiefly effected by the motion of the lips. By which they ſtand contradiſtinguiſhed from palatal, dental, guttural, &c. letters.

LABORATORY, or Elaboratory, the chymiſts workhouſe, or place where they perform their operations, where the furnaces are built, their veſſels kept, &c. and in general, the term *laboratory*, is applied to any place where phyſical experiments in pharmacy, chymiſtry, pyrotechny, &c. are performed. As laboratories muſt be of very different kinds, according to the nature of the operations to be performed in them, it is impoſſible that any directions can be given which will anſwer for every one. Where the purpoſes are merely experimental, a ſingle furnace or two of the portable kind will be ſufficient. It is ſcarce needful to add, that ſhelves are neceſſary for holding veſſels with the products of the different operations; and that it is abſolutely neceſſary to avoid confuſion and diſorder, as by theſe means the products of the operations might be loſt or miſtaken for one another. Mortars, filters, levigating ſtones, &c. muſt alſo be procured: but from a knowledge of the methods of performing the different chymical operations will eaſily be derived the knowledge of a proper place to perform them in; for which, ſee the articles Chymistry, Metallurgy, and Furnace.

LABOUR, is uſed to denote the pain which women endure in giving birth to their offspring; and is uſually divided into natural, difficult, and preternatural. See Midwifry.

LABYRINTH, Λαϐυρινθος, among the ancients, was a large and intricate edifice cut out in various iſles and meanders, running into each other, ſo as to render it difficult to get out of it. There is mention made of four celebrated *labyrinths* among the ancients, ranked by Pliny in the number of the wonders of the world; viz. the Cretan, Egyptian, Lemnian, and Italian. That of Crete is the moſt famed; it was built by Dædalus, for king Minos, on the model of that of Egypt; and it was hence that Theſeus made his eſcape by means of Ariadne's clue. That of Egypt, according to Pliny, was the oldeſt of all, and was ſubſiſting in his time, after having ſtood 3600 years. He ſays it was built by king Peteſucus, or Tithoes: but Herodotus makes it the work of ſeveral kings; it ſtood on the banks of the lake Mœris, and conſiſted of twelve palaces, in which the twelve kings of Egypt aſſembled to tranſact affairs of ſtate and religion, containing three thouſand apartments, See a plan and deſcription of this *labyrinth*, in the preſent ſtate of it, in Pocock's Hiſt. of the Eaſt, vol. i. p. 61, &c. See alſo Perry's View of the Levant, p. 381, &c. That of Lemnos was ſupported by columns of wonderful beauty; there were ſome remains of it at the time when Pliny wrote. That of Italy was built by Porſenna, king of Hetruria, for his tomb.

LABYRINTH, in anatomy, denotes the ſecond cavity of the internal EAR, which is formed or excavated out of the os petroſum; and is thus called, as having ſeveral windings in it. For deſcription, ſee Syſtem of ANATOMY, Part VI. Sect. X. and Plate II. *Fig.* VII.

Labyrinth, in gardening, is a part of the ground ſo planted and diſpoſed, as to render it difficult, when any one is in it, to find the way out; and in the attempting to get out, there are to be as many ſtops and diſappointments laid in the way as poſſible: the centre alſo is to be made difficult to be found. *Labyrinths* are only proper for large gardens; and the fineſt in the world is ſaid to be that of Verſailles. That at Hampton-court, is well known.

LACE, in commerce, a work compoſed of many threads of gold, ſilver, or ſilk, interwoven the one with the other, and worked upon a pillow with ſpindles according to the pattern deſigned. The open work is formed with pins, which are placed and diſplaced as the ſpindles are moved. The importation of gold and ſilver lace is prohibited.

*Method of Cleaning Gold-*LACE *and Embroidery when tarniſhed.* For this purpoſe alkaline liquors are by no means to be uſed; for while they clean the gold, they corrode the ſilk, and change or diſcharge its colour. Soap alſo alters the ſhade, and even the ſpecies of certain colours. But ſpirit of wine may be uſed without any danger of its injuring either the colour or quality of the ſubject; and in many caſes proves as effectual, for reſtoring the luſtre of the gold, as the corroſive detergents. A rich brocade, flowered with a variety of colours, after being diſagreeably tarniſhed, had the luſtre of the gold perfectly reſtored by waſhing it with a ſoft bruſh dipt in warm ſpirit of wine; and ſome of the colours of the ſilk, which were likewiſe ſoiled, became at the ſame time remarkably bright and lively. Spirit of wine ſeems to be the only material adapted to this intention, and probably the boaſted ſecret of certain artiſts is no other than this ſpirit diſguiſed. Among liquids, Dr. Lewis ſays, he does not know of any other that is of ſufficient activity to diſcharge the foul matter, without being hurtful to the ſilk: as to powders, however fine, and however cautiouſly uſed, they ſcratch and wear the gold, which here is only ſuperficial and of extreme tenuity.

But though ſpirit of wine is the moſt innocent material that can be employed for this purpoſe, it is not in all caſes proper. The golden covering may be in ſome parts worn off; or the baſe metal, with which it had been iniquitouſly alloyed, may be corroded by the air, ſo as to leave the particles of the gold diſunited; while the ſilver underneath, tarniſhed to a yellow hue, may continue a tolerable colour to the whole: in which caſes it is apparent, that the removal of the tarniſh would be prejudicial to the colour, and make the lace or embroidery leſs like gold than it was before. A piece of old tarniſhed gold lace, cleaned by ſpirit of wine, was deprived, with its tarniſh, of the greateſt part of its golden hue, and looked now almoſt like ſilver-lace.

Lace, *bone*, a lace made of fine linen thread or ſilk, much in the ſame manner as that of gold and ſilver. The pattern of the lace is fixed upon a large round pillow, and pins being ſtuck into the holes or opening in the pattern, the threads are interwoven by means of a number of bobbins made of bone or ivory, each of which contains a ſmall quantity of fine thread, in ſuch a manner as to make the lace exactly reſemble the pattern. There are ſeveral towns in England, and particularly in Buckinghamſhire, that carry on this manufacture; but vaſt quantities of the fineſt laces have been imported from Flanders.

LACERTA, lizard, in aſtronomy, a conſtellation of the northern hemiſphere. See the Syſtem, Sect. VIII.

Lacerta, the *lizard*, in zoology, a genus of amphibious animals, belonging to the order of reptilia, the characters of which are theſe: The body is naked, with four feet, and a tail. There are 49 ſpecies, the moſt remarkable are,

The *crocodilus*, or crocodile, has a compreſſed jagged tail, five toes on the fore-feet, and four on the hind-feet. This is the largeſt animal of the lizard kind. One that was diſſected at Siam, an account of which was ſent to the Royal Academy at Paris, was 18 feet and a half long, of which the tail was no leſs than five feet and a half, and the head and neck above two and a half. He was four feet and nine inches in circumference where thickeſt. The ſkull, between the two creſts, was proof againſt a muſket-ball, for it only rendered the part a little white that it ſtruck againſt.

The ſkin was defended with a ſort of armour, which, however, was not proof againſt a muſket ball, contrary to what has been commonly ſaid. However, it muſt be acknowledged, that the attitude in which it was placed might contribute not a little thereto; for probably, if the ball had ſtruck obliquely againſt the ſhell, it would have flown off. Thoſe parts of the girdles underneath the belly were of a whitiſh colour, and were made up of ſcales of divers ſhapes. They were about one-ſixth of an inch in thickneſs, and were not ſo hard as thoſe on the back.

This creature lays eggs, which ſhe covers over with ſand, and leaves to be hatched by the heat of the ſun. They are to be met with in the rivers Nile, Niger, and Ganges, beſides moſt other large rivers in the ſouthern parts of Aſia, Africa, and America.

Mr. Haſſelqueſt informs us, that the crocodile ſwallows ſtones to aſſiſt digeſtion, after the manner of ſeed-eating birds, which commit to the ſtomach the work of maſtication as well as concoction, being deſtitute of the inſtruments adapted to that purpoſe. The Egyptians ſay, that his excrements do not paſs by the anus: this ſeems to be confirmed by the ſtructure of the gut, which is near the pylorus; for it cannot eaſily be conceived, that excrements ſhould paſs through ſuch a narrow paſſage, ſeemingly deſtined for the conveyance of the chyle only; but the ſtructure of the parts, and the gut being ſo near the pylorus, ſeem to indicate that the excrements paſs through it into the ventricle, and are vomited up. The inhabitants about Cairo ſay they ſee this daily; and obſerve, that the crocodile is obliged to come on ſhore as often as he has occaſion to eaſe himſelf. There is a folliculus, of the bigneſs of a hazel nut, under the ſhoulders of the old crocodiles, which contains a thick matter, ſmelling like muſk. The Egyptians are very anxious to get this when they kill a crocodile, it being a perfume much eſteemed by the grandees. When the male copulates with the female, he turns her with his ſnout on her back. The Egyptians uſe the fat againſt the rheumatiſm and ſtiffneſs of the tendons, eſteeming it a powerful remedy outwardly applied. They ſay the gall is good for the eyes; they make uſe of it as a certain remedy for barrenneſs in women, taking about ſix grains internally, and outwardly they apply a peſſus made of cotton and the gall of a crocodile. The eyes of the crocodile are the beſt aphrodiſiacs of any known by the Arabs; who prefer them to all confections, deaſatyrii, hyacinthi, &c. and even to ambergreaſe.

The crocodile is a very dangerous and terrible animal in ſome countries. It does a great deal of miſchief among the common people of Upper Egypt, often killing and devouring women who come to the river to fetch water, and children playing on the ſhore or ſwimming in the river. In the ſtomach of one diſſected before Mr. Barton the Engliſh conſul, they found the bones of the legs and arms of a woman, with the rings which they wear in Egypt as ornaments. Theſe animals are ſeen in ſome places lying for whole hours, and even days, ſtretched in the ſun and motionleſs; ſo that one not uſed to them might miſtake them for trunks of trees covered with a rough and dry bark: but the miſtake would ſoon be fatal; for the ſeemingly torpid animal, at the near approach of any living creature, inſtantly darts upon it, and carries it to the bottom. In the times of an inundation they ſometimes enter the cottages of the natives, where they ſeize the firſt animal they meet with. There have been ſeveral examples of their taking a man out of a canoe in the ſight of his companions, without their being able to lend him any aſſiſtance. The crocodile, however, except when preſſed with hunger, or with a view of depoſiting its eggs, ſeldom leaves the water. Its uſual method is to float along upon the ſurface, and ſeize whatever animals come within its reach; but when this method fails, it then goes cloſer to the bank. There it waits in patient expectation of ſome land animal that comes to drink; the dog, the bull, the tiger, or man himſelf. Nothing is to be ſeen as the animal approaches, nor is its retreat diſcovered till it is too late for ſafety. It ſeizes the victim with a ſpring, and goes at a bound much faſter than ſuch an unwieldy animal could be ſuppoſed to do; then having ſecured the creature both with teeth and claws, it drags it into the water, inſtantly ſinks with it to the bottom, and in this manner quickly drowns it. Sometimes it happens, that the creature wounded by the crocodile makes its eſcape; in which caſe, the latter purſues with great celerity, and often takes it a ſecond time. In theſe depredations, however, this terrible animal often ſeizes on another as formidable as itſelf, and meets with a deſperate reſiſtance. We are told of frequent combats between the crocodile and the tiger. All creatures of the tiger kind are continually oppreſſed by a parching thirſt, that keeps them in the vicinity of great rivers, whither they deſcend to drink very frequently. On theſe occaſions they are ſeized by the crocodile; upon whom they inſtantly turn with the greateſt agility, and force their claws into his eyes, while he plunges, with his fierce antagoniſt, into the river. There they continue to ſtruggle for ſome time, till at laſt the tiger is drowned. Notwithſtanding all this, however, we are aſſured by Labat, that a negro, with no other weapon than a knife in his right hand, and his left arm wrapped round with a cow-hide, ventures boldly to attack this animal in its own element. As ſoon as he approaches the crocodile, he preſents his left arm, which the animal ſwallows moſt greedily: but as it ſticks in his throat, the negro has time to give it ſeveral ſtabs below the chin, where it is eaſily vulnerable; and the water alſo getting in at the mouth, which is held involuntarily open, the creature is ſoon bloated up as big as a tun, and expires.

The natives of Siam ſeem particularly fond of the capture of all the great animals with which their country abounds. The crocodiles are taken by throwing three or four ſtrong nets acroſs a river at proper diſtances from each other; ſo that if the animal breaks through the firſt, it may be caught by one of the reſt. When it is firſt taken, it employs the tail, which is the grand inſtrument of ſtrength, with great force; but after many unſucceſsful ſtruggles, the animal's ſtrength is at laſt exhauſted. Then the natives approach their priſoner in boats, and pierce him in the moſt tender parts till he is weakened by loſs of blood. When he has done ſtirring, they begin by tying up his mouth, and with the ſame cord tie his head to his tail, which laſt they bend back like a bow. However they are not yet perfectly ſecure from his fury; but for their greater ſafety they tie his forefeet, as well as thoſe behind, to the top of his back. Theſe precautions are not uſeleſs, for if they were to omit them, the crocodile would ſoon recover ſtrength enough to do a great deal of miſchief. When thus brought into ſubjection, or when taken young and tamed, this formidable animal is uſed to divert and entertain the great men of the eaſt. It is often managed like a horſe; a curb is put into its mouth, and the rider directs it as he thinks proper. Though aukwardly formed, it does not fail to proceed with ſome degree of ſwiftneſs; and is thought to move as faſt as ſome of the moſt unwieldy of our own animals, the hog or the cow. Some indeed aſſert, that no animal could eſcape it but for its ſlowneſs in turning; which, however, ſeems very improbable, as its back bone is full of articulations, and ſeemingly as flexible as that of other large animals.

All crocodiles breed near freſh waters; and though they are ſometimes found in the ſea, yet that may be conſidered rather as a place of excurſion than abode. The preſence of a man, a beaſt, or even a bird, is ſufficient to deter the female of depoſiting her eggs at the time; and if ſhe perceives any creature looking on, ſhe infallibly returns. If, however, nothing appears, ſhe then goes to work, ſcratching up the ſand with her fore paws, and making a hole pretty deep in the ſhore. There ſhe depoſits from 80 to 100 eggs, of the ſize of a tennis ball, and of the ſame figure, covered with a tough white ſkin like parchment. She takes above an hour to perform this taſk; and then, covering up the place ſo artfully that it can ſcarcely be perceived, ſhe goes back to return again the next day. Upon her return, with the ſame precaution as before, ſhe lays about the ſame number of eggs; and the day following alſo a like number. Thus having depoſited her whole quantity, and having covered them cloſe up in the ſand, they are ſoon vivified by the heat of the ſun; and at the end of 30 days, the young ones begin to open the ſhell. At this time the female is inſtinctively taught that her young ones want relief; and ſhe goes upon land to ſcratch away the ſand and ſet them free. Her brood quickly avail themſelves of their liberty; a part run unguided to the water; another part aſcend the back of the female, and are carried thither in greater ſafety. But the moment they arrive at the water, all natural connexion is at an end; when the female has introduced her young to their natural element, not only ſhe, but the male, become amongſt the number of their moſt formidable enemies, and devour as many of them as they can. The whole brood ſcatters into different parts at the bottom; by far the greateſt number are deſtroyed, and the reſt find ſafety in their agility or minuteneſs.

But it is not the parent alone that is thus found to thin their numbers; the eggs of this animal are not only a delicious feaſt to the ſavage, but are eagerly ſought after by every beaſt and bird of prey. The ichneumon was erected into a deity among the ancients for its ſucceſs in deſtroying the eggs of theſe monſters: at preſent, that ſpecies of the vulture called the *gallinazo* is their moſt prevailing enemy. All along the banks of great rivers, for thouſands of miles, the crocodile is ſeen to propagate in numbers that would ſoon over-run the earth, but for the vulture, that ſeems appointed by Providence to abridge its ſecundity. Theſe birds are ever found in great numbers where the crocodile is moſt numerous; and hiding themſelves within the thick branches of the trees that ſhade the banks of the river, they watch the female in ſilence, and permit her to lay all her eggs without interruption. Then when ſhe has retired, they encourage each other with cries to the ſpoil; and flocking all together upon the hidden treaſure, tear up the eggs, and devour them in a much quicker time than they were depoſited. Nor are they leſs diligent in attending the female while ſhe is carrying her young to the water; for if any one of them happens to drop by the way, it is ſure to receive no mercy.

Such is the extraordinary account given us by late travellers of the propagation of this animal; an account adopted by Linnæus and the moſt learned naturaliſts of the age. Yet, if one might argue from the general analogy of nature, the crocodile's devouring her own young when ſhe gets to the water ſeems doubtful. This may be a ſtory raiſed from the general idea of this animal's rapacious cruelty; when, in fact, the crocodile only ſeems more cruel than other animals becauſe it has more power to do miſchief. It is probable, that it is not more diveſted of parental tenderneſs than other creatures; and we are the more led to think ſo from the peculiar formation of one of the crocodile kind. This is called the *open-bellied crocodile*, and is furniſhed with a falſe belly like the opoſſum, where the young creep out and in as their dangers or neceſſities require. The crocodile, thus furniſhed at leaſt, cannot be ſaid to be an enemy to her own young, ſince ſhe thus gives them more than parental protection. It is probable alſo, that this open-bellied crocodile is vivaporous, and foſters her young that are prematurely excluded in this ſecond womb, until they come to proper maturity.

How long the crocodile lives, we are not certainly informed: if we may believe Ariſtotle, it lives the age of a man; but the ancients ſo much amuſed themſelves in inventing fables concerning this animal, that even truth from them is ſuſpicious. What we know for certain from the ancients is, that among the various animals that were produced to fight in the amphitheatre at Rome, the combat of the crocodile was not wanting. Marcus Scaurus produced them living in his unrivalled exhibitions; and the Romans conſidered him as the beſt citizen, becauſe he furniſhed them with the moſt expenſive entertainments.

The laſt mentioned kind of crocodile, is a ſpecies not deſcribed by Linnæus. Mr. Edwards tells us, that three of theſe creatures were ſent from Bengal, about the year 1747, to the late Dr. Mead, phyſician in ordinary to the king. Two of theſe the Doctor preſerved in his collection, and preſented the third to the late curious Mrs. Kennon; and ſince the deceaſe of theſe worthy perſons, they became the property of Mr. James Lemon of London, who obliged us with one of them to produce to the royal ſociety. The narrowneſs of the beak is the moſt extraordinary circumſtance in this crocodile, which appears like the bill of the bird called *gooſeander*. It has ſmall ſharp teeth. Another peculiarity is a paunch or open purſe in the middle of the under ſide of the belly, which ſeems to be naturally formed with round hips, and hollow within, to receive its young in time of danger, as it appears in the American animal called *opoſſum*. Dr. Parſons gave it as his opinion, that the opening in the belly was really natural, it having no appearance of being cut or torn open. In other reſpects it hath all the marks common to alligators or crocodiles. The beak was finely creaſed tranſverſely. The animal appeared, in the ſpirits, all over of a yellowiſh oval colour, the under ſide lighter than the upper, the latter having ſome duſky marks and ſpots. This ſpecies inhabits the banks of the Ganges; and it is very ſtrange that they ſhould never have been deſcribed before, as our India company have been ſo long ſettled there, and the animal is, at full growth, nearly, if not altogether, as large as the common crocodile.

The chamæleon has a crooked cylindrical tail. The head of a large chamæleon is almoſt two inches long, and from thence to the beginning of the tail it is four inches and a half. The tail is five inches long, and the feet two and a half. The thickneſs of the body is different at different ſeaſons; for ſometimes from the back to the belly it is two inches, and ſometimes but one; for he can blow himſelf up and contract himſelf at pleaſure. This ſwelling and contraction is not only of the back and belly, but of the legs and tail. Theſe different motions, are not like thoſe of other animals, which proceed from a dilatation of the breaſt in breathing, and which riſes and falls ſucceſſively; but they are very irregular, as in tortoiſes and frogs. The chamæleon has continued as it were blown up for two hours together, and then he would grow leſs and leſs inſenſibly; for the dilatation was always more quick and viſible than the contraction. In this laſt ſtate he appeared extremely lean, and the ſpine of the back was ſharp, and all his ribs might be told; likewiſe the tendons of the arms and legs might be ſeen very diſtinctly.

The jaws are furniſhed with teeth, or rather with a bone in the form of teeth, which he makes little or no uſe of, becauſe he lives upon ſwallowing flies and other inſects, without chewing them; and hence aroſe the vulgar notion of his living upon air, becauſe he was never ſeen to eat. But the moſt extraordinary thing relating to the eyes is, that this animal often moves one when the other is entirely at reſt; nay, ſometimes one eye will ſeem to look directly forward and the other backward, and one will look up to the ſky when the other regards the earth. His walk is ſlower than that of a tortoiſe, and he ſeems to move along with an affectation of gravity. His tail is like that of a viper, when it is puffed up and round; for otherwiſe the bones may be ſeen in the ſame manner as on the back. He always wraps his tail round the branches of trees, and it ſerves him as it were inſtead of a fifth hand. He is a native of Africa and Aſia. Mr. Haſſelquiſt is of opinion, that the change of colour in the chamæleon is owing to its being exceedingly ſubject to the jaundice, which particularly happens either when it is expoſed to the ſun, or when it is made angry. The mixture of the bile with its blood is then very perceptible, and, as the ſkin is tranſparent, makes it ſpotted with green and yellow. He never ſaw it coloured with red, blue, or purple; and does not believe that ever it aſſumes theſe colours.

The gecko has a cylindrical tail, concave ears, and a warty body. It is the Indian ſalamander of Bontius. "This animal is very frequent in Cairo, (ſays Haſſelquiſt), both in the houſes and without them. The poiſon in this animal is very ſingular, as it exhales from the lobuli of the toes. The animal ſeeks all places and things impregnated with ſea-ſalt, and, paſſing over them ſeveral times, leaves this very noxious poiſon behind it. In July 1750, Mr. Haſſelquiſt ſaw two women and a girl in Cairo at the point of death, from eating cheeſe new ſalted, bought in the market, and on which this animal had dropt its poiſon. The ſalamandra, or ſalamander, has a ſhort cylindrical tail, four toes on the fore-feet, and a naked porous body. This animal has been ſaid, even in the Philoſophical Tranſactions, to live in the fire; but this is found to be a miſtake. Its properties are very little known. It is found in the ſouthern countries of Europe.

LACHRYMAL, or **Lachrymal** *Gland*, in anatomy, a ſmall oblong gland, ſituate above the eye, near the little canthus, whence proceed two or three ſmall ducts, which, opening on the inward ſurface of the eye-lid, filtrate a ſeroſity ſerving to moiſten the ball of the eye, and facilitate its motion. For a particular deſcription, ſee Syſtem Part V. Sect. XI. For repreſentation, ſee Plate XI. *Fig.* 19, letter *b*.

LACQUER, or LACKER, is a varniſh applied upon tin, braſs, and other metals, to preſerve them from tarniſhing, and to improve their colour. The baſis of *lacquers* is a ſolution of the reſinous ſubſtance called ſeed-lac, in ſpirit of wine. The ſpirit ought to be very much dephlegmated in order to diſſolve much of the lac. For this purpoſe, ſome authors direct dry pot-aſh to be thrown into the ſpirit. This alkali attracts the water, with which it forms a liquid that ſubſides diſtinctly from the ſpirit, at the bottom of the veſſel. From this liquid the ſpirit may be ſeparated by decantation. By this method the ſpirit is much dephlegmated: but at the ſame time it becomes impregnated with part of the alkali, which depraves its colour, and communicates a property to the *lacquer* of imbibing moiſture from the air. Theſe inconveniences may be prevented by diſtilling the ſpirit; or, if the artiſt has not an opportunity of performing that proceſs, he may cleanſe the ſpirit in a great meaſure from the alkali, by adding to it ſome calcined alum, the acid of which uniting with the alkali remaining in the ſpirit, forms with it a vitriolated tartar, which, not being ſoluble in ſpirit of wine, falls to the bottom, together with the earth of the decompoſed alum. To a pint of the dephlegmated and purified ſpirit about three ounces of powdered ſhell-lac are to be added; and the mixture to be digeſted during ſome days with a moderate heat. The liquor ought then to be poured off, ſtrained, and cleared by ſettling. This clear liquor is now fit to receive the required colour, from certain reſinous colouring ſubſtances, the principal of which are gamboge, and anotto, the former of which gives a yellow, and the latter an orange colour. In order to give a golden colour, two parts of gamboge are added to one of anotto; but theſe colouring ſubſtances may be ſeparately diſſolved in the tincture of lac, and the colour required may be adjuſted by mixing the two ſolutions in different proportions. When ſilver-leaf, or tin, are to be lacquered, a larger quantity of the colouring materials is requiſite than when *lacquer* is intended to be laid on braſs.

LACTEALS, or LACTEAL *Veins* or *Veſſels*, a kind of long ſlender tubes, for the conveyance of the chyle from the inteſtines, to the common reſervatory. They are called veins, becauſe their valves are diſpoſed as thoſe of the ordinary blood-veins, and becauſe the fluid which they contain runs from ſmaller into larger tubes. See Syſtem of ANATOMY, Part I. Sect. V.

Fevers LACTEAL, a term uſed by medical writers, to expreſs what the women call *milk-fevers*, that is, ſuch fevers as attend the difficult ingreſs of milk to the breaſts of lying-in women.

LACTEUS *Lapis*, in natural hiſtory, a name given by ſome authors to the *Galactites*.

LACTIFER *Tubuli*. See TUBULI.

LACTIFEROUS, an epithet applied to ſuch plants as abound with a milk-like juice, ſuch as the tithymal, ſow-thiſtle, and many others.

LACUNÆ, among anatomiſts, certain excretory canals in the *genital* parts of women. Between the fleſhy fibres of the ureters, and the membrane of the vagina, is found a whitiſh glandulous body, about a finger thick, running round the neck of the bladder, having a great number of excretory ducts, which de Graef calls *lacunæ*, and which terminate in the lower part of the orifice of the womb; conveying thither a ſlimy matter, that mixes with the ſeed of the male.

LAITY comprehends ſuch of the people as are not included under the denomination of *clergy*; and may be divided into three diſtinct ſtates, viz. the *civil*, the *military*, and the *maritime*.

LAKE, a collection of waters contained in ſome cavity in an inland place, of a large extent, ſurrounded with land, and having no communication with the ocean. Lakes may be divided into four kinds. 1. Such as neither receive nor ſend forth rivers. 2. Such as emit rivers, without receiving any. 3. Such as receive rivers, without emitting any. And, 4. Such as both receive and ſend forth rivers. Of the firſt kind, ſome are temporary and others perennial. Moſt of thoſe that are temporary owe their origin to the rain, and the cavity or depreſſion of the place in which they are lodged; thus in India there are ſeveral ſuch lakes made by the induſtry of the natives, of which ſome are a mile, and ſome two in circuit; theſe are ſurrounded with a ſtone wall, and being filled in the rainy months, ſupply the inhabitants in dry ſeaſons, who live at a great diſtance from ſprings or rivers. There are alſo ſeveral of this kind formed by the inundations of the Nile and the Niger; and in Muſcovy, Finland, and Lapland, there are many lakes formed, partly by the rains, and partly by the melting of the ice and ſnow: but moſt of the perennial lakes, which neither receive nor emit rivers, probably owe their riſe to ſprings at the bottom, by which they are conſtantly ſupplied. The ſecond kind of lakes, which emit without receiving rivers, is very numerous. Many rivers flow from theſe as out of ciſterns; where their ſprings being ſituated low within a hollow place, firſt fill the cavity and make it a lake, which not being capacious enough to hold all the water, it overflows and forms a river; of this kind is the Wolga, at the head of the river Wolga; the lake Odium, at the head of the Tanais; the Adac, from whence one branch of the river Tigris flows; the Ozero, or White lake, in Muſcovy, is the ſource of the river Shakſna. The great lake Chaamay, which emits four very large rivers, which water the countries of Siam, Pegu, &c. viz. the Menan, the Aſa, the Caipoumo, and the Laquia, &c. The third ſpecies of lakes, which receive rivers but emit none, apparently owe their origin to thoſe rivers which, in their progreſs from their ſource, falling into ſome extenſive cavity, are collected together, and form a lake of ſuch dimenſions as may loſe as much by exhalation as it continually receives from theſe ſources; of this kind is that great lake improperly called the *Caſpian Sea*; the lake Aſphaltites, alſo called the *Dead Sea*; the lake of Geneva, and ſeveral others. Of the fourth ſpecies, which both receive and emit rivers, we reckon three kinds, as the quantity they emit is greater, equal, or leſs than they receive. If it be greater, it is plain that they muſt be ſupplied by ſprings at the bottom; if leſs, the ſurplus of the water is probably ſpent in exhalations; and if it be equal, their ſprings juſt ſupply what is evaporated by the ſun. Lakes are alſo divided into thoſe of freſh water, and thoſe of ſalt. Dr. Halley is of opinion, that all great perennial lakes are ſaline, either in a greater or leſs degree; and that this ſaltneſs encreaſes with time: and on this foundation he propoſes a method for determining the age of the world. Large lakes anſwer the moſt valuable purpoſes in the northern regions, the warm vapours that ariſe from them moderating the pinching cold of thoſe climates; and what is ſtill a greater advantage, when they are placed in warmer climates at a great diſtance from the ſea, the exhalations raiſed from them by the ſun cauſe the countries that border upon them to be refreſhed with frequent ſhowers, and conſequently prevent their being barren deſarts.

LAMA, the ſovereign pontiff, or rather god, of the Aſiatic Tartars, inhabiting the country of Barantola. The lama is not only adored by the inhabitants of the country, but alſo by the kings of Tartary, who ſend him rich preſents, and go in pilgrimage to pay him adoration, calling him *lama congiu*, i. e. god, the everlaſting father of heaven. He is never to be ſeen but in a ſecret place of his palace, amidſt a great number of lamps, ſitting croſs legged upon a cuſhion, and adorned all over with gold and precious ſtones; where, at a diſtance, they proſtrate themſelves before him, it not being lawful for any to kiſs even his feet. He is called the *great lama*, or *lama of lamas*, that is, *prieſt of prieſts*. And to perſuade the people that he is immortal, the inferior prieſts, when he dies, ſubſtitute another in his ſtead, and ſo continue the cheat from generation to generation. Theſe prieſts perſuade the people, that the lama was raiſed from death many hundred years ago, that he has lived ever ſince, and will continue to live for ever.

LAMB, in zoology, the young of the ſheep-kind. See OVIS.

A male lamb of the firſt year is called a *wedder-hog*, and the female a *ewe-hog*; the ſecond year it is called a *wedder*, and the female a *ſheave*. If a lamb be ſick, mare's milk with water may be given it; and by blowing into the mouth, many have been recovered, after appearing dead. The beſt ſeaſon for weaning them is when they are 16 or 18 weeks old, and about Michaelmas. The males ſhould be ſeparated from the females, and ſuch males as are not deſigned for rams, gelded. "Lamb, (ſays Dr. Cullen), appears a more fibrous kind of meat, and upon that account is leſs eaſily ſoluble than veal. In Scotland, houſe-lamb is never reared to advantage."

LAMENESS, *claudicatio*, in ſurgery. We want a chirurgical treatiſe on *lameneſs*: no perſon has yet enquired into the various cauſes, and the proper remedies adapted to them, in caſes of *lameneſs*; and in ſome inſtances remedies may be efficaciouſly applied. *Lameneſs* ariſes from a variety of cauſes. From native deformity, or from the thigh being put out of joint in the birth; from the bad conformation of the cotyloid cavity of the oſſa innominata; from the weakneſs of the hips; from external accidents; and from diſeaſes. See LUXATION.

LAMENTATIONS, a canonical book of the Old Teſtament, written by the prophet Jeremiah, according to archbiſhop Uſher and ſome other learned men who follow the opinion of Joſephus and St. Jerom, on occaſion of Joſiah's death. But this opinion does not ſeem to agree with the ſubject of the book, the lamentation compoſed by Jeremiah on that occaſion being probably loſt. The fifty ſecond chapter of the book of Jeremiah was probably added by Ezra, as a preface or introduction to the *lamentations*: the two firſt chapters are employed in deſcribing the calamities of the ſiege of Jeruſalem: in the third the author deplores the perſecutions he himſelf had ſuffered: the fourth treats of the deſolation of the city and temple, and the misfortune of Zedekiah: the fifth chapter is a prayer for the Jews in their diſperſion and captivity: and at the cloſe of all he ſpeaks of the cruelty of the Edomites, who had inſulted Jeruſalem in her miſery. All the chapters of this book, except the laſt, are in metre, and digeſted in the order of the alphabet, with this difference, that in the firſt, ſecond, and fourth chapter, the firſt letter of every verſe follows the order of the alphabet; but in the third the ſame initial letter is continued for three verſes together. This order was probably adopted, that the book might be more eaſily learnt and retained. The ſubject of this book is of the moſt moving kind; and the ſtyle throughout lively, pathetic, and affecting. In this kind of writing the prophet Jeremiah was a great maſter, according to the character which Grotius gives him: *Mirus in affectibus concitandis.*

LAMMAS-DAY, the firſt of Auguſt; ſo called, as ſome will have it, becauſe lambs then grow out of ſeaſon, as being too big. Others derive it from a Saxon word, ſignifying *loaf maſs*, becauſe on that day our forefathers made an offering of bread prepared with new wheat. On this day, the tenants who formerly held lands of the cathedral church of York, were bound by their tenure to bring a lamb alive into the church at high maſs. It is celebrated by the Romiſh church in memory of St. Peter's impriſonment.

LAMP, Λαμπας, a ſort of luminary, conſiſting of oil diſpoſed with a wick in a proper veſſel for burning.

LAMP, *rolling*, in mechanics, is a *lamp* A B (Tab. IV. *Mechanics, fig.* 48.) that has within it the two moveable circles DE and FG, whoſe common centre of motion is at K, where their axes of motion croſs one another, in which point alſo is their common centre of gravity. If to the inward circle you join withinſide to the lamp KC, made pretty heavy, and moveable about its axis HI, whoſe centre of gravity is at C, the common centre of gravity of the whole machine will fall between K and C, and by reaſon of the pivots A, B, D, E, H, I, will be always at liberty to deſcend; and therefore let the whole *lamp* be rolled along the ground, or moved in any manner, the flame will always be uppermoſt, and the oil cannot be ſpilt. In this manner the compaſs is hung at ſea; and thus ſhould all the moon-lanthorns be made that are carried upon a pole before coaches or carriages which travel in the night. See the Plate of *Miſcellaneous Subjects.*

LAMPREY, the Engliſh name of the genus *Petromizon*, in ichthyology. For a deſcription, ſee PETROMIZON. For claſſification, ſee the Syſtem, Sect. V.

LAND, in a general ſenſe. See Syſtem of AGRICULTURE, Sect. I. Dr. Davenant, from a ſcheme of Mr. King, ſtates the quantity of *land* in England and Wales to be thirty nine millions of acres; which, reckoning the number of inhabitants, as he does, to be 5,500,000, will at an average be $7\frac{1}{4}$ acres per head. Davenant's Works, vol. vi. § 3.

Draining of LAND. The draining of *land* is alſo another great improvement to it; for though meadows and paſtures, which are capable of being overflowed, produce a greater quantity of herbage than dry land, yet where the wet lies too long upon the ground, the graſs will be four and extremely coarſe; and when there is not care taken in time to drain this *land*, it will produce ittle graſs, and ſoon be over-run with ruſhes and flags, ſo as to be of ſmall value. For the beſt method of draining lands, ſee Syſtem of AGRICULTURE, Sect. XIX.

Flooding or *overflowing of* LAND. See the Syſtem of AGRICULTURE, Sect. XIX.

LAND-*Tax*, one of the annual taxes raiſed upon the ſubject. See TAX.

The land-tax, in its modern ſhape, has ſuperſeded all the former methods of rating either property, or perſons in reſpect of their property, whether by tenths or fifteenths, ſubſidies on land, hydages, ſcutages, or talliages; a ſhort explication of which will, however, greatly aſſiſt us in underſtanding our ancient laws and hiſtory. Tenths, and fifteenths, were temporary aids iſſuing out of perſonal property, and granted to the king by parliament. They were formerly the real tenth or fifteenth part of all the moveables belonging to the ſubject; when ſuch moveables, or perſonal eſtates, were a very different and a much leſs conſiderable thing than what they uſually are at this day. Tenths are ſaid to have been firſt granted under Henry II. who took advantage of the faſhionable zeal for croiſades to introduce this new taxation, in order to defray the expence of a pious expedition to Paleſtine, which he really or ſeemingly had projected againſt Saladine emperor of the Saracens, whence it was originally denominated the *Saladine tenth*. But afterwards fifteenths were more uſually granted than tenths. Originally the amount of theſe taxes was uncertain, being levied by aſſeſſments new-made at every freſh grant of the commons, a commiſſion for which is preſerved by Matthew Paris: but it was at length reduced to a certainty in the eighth year of Edward III. when, by virtue of the king's commiſſion, new taxations were made of every townſhip, borough, and city in the kingdom, and recorded in the exchequer; which rate was, at the time, the fifteenth part of the value of every townſhip, the whole amounting to about 29000*l*. and therefore it ſtill kept up the name of a *fifteenth*, when, by the alteration of the value of money and the increaſe of perſonal property, things came to be in a very different ſituation. So that when, of later years, the commons granted the king a fifteenth, every pariſh in England immediately knew their proportion of it; that is, the ſame identical ſum that was aſſeſſed by the ſame aid in the eighth of Edward III.; and then raiſed it by a rate among themſelves, and returned it into the royal exchequer.

The other ancient levies were in the nature of a modern land-tax: for we may trace up the original of that charge as high as to the introduction of our military tenures; when every tenant of a knight's fee was bound, if called upon, to attend the king in his army for 40 days in every year. But this perſonal attendance growing troubleſome in many reſpects, the tenants found means of compounding for it, by ſending others in their ſtead, and in proceſs of time by making a pecuniary ſatisfaction to the crown in lieu of it. This pecuniary ſatisfaction at laſt came to be levied by aſſeſſments, at ſo much for every knight's fee, under the name of ſcutages; which appear to have been levied for the firſt time in the fifth year of Henry II. on account of his expedition to Toulouſe, and were then (Sir Wm. Blackſtone apprehends) mere arbitrary compoſitions, as the king and the ſubject could agree. But this precedent being afterwards abuſed into a means of oppreſſion, (by levying ſcutages on the landholders by the king's authority only, whenever our kings went to war, in order to hire mercenary troops and pay their contingent expences) it became thereupon a matter of national complaint; and king John was obliged to promiſe in his *magna charta*, that no ſcutage ſhould be impoſed without the conſent of the common council of the realm. Of the ſame nature with ſcutages upon knights fees were the aſſeſſments of hydage upon all other lands, and of talliage upon cities and burghs. But they all gradually fell into diſuſe, upon the introduction of ſubſidies, about the time of King Richard II. and king Henry IV. Theſe were a tax, not immediately impoſed upon property, but upon perſons in reſpect of their reputed eſtates, after the nominal rate of 4*s*. in the pound for lands, and 2*s*. and 6*d*. for goods; and for thoſe of aliens in a double proportion. But this aſſeſſment was alſo made according to an ancient valuation: wherein the computation was ſo very moderate, and the rental of the kingdom was ſuppoſed to be ſo exceeding low, that one ſubſidy of this ſort did not, according to Sir Edward Coke, amount to more than 70,000*l*. whereas a modern land-tax at the ſame rate produces two millions. It was anciently the rule never to grant more than one ſubſidy and two fifteenths at a time: but this rule was broke through for the firſt time on a very preſſing occaſion, the Spaniſh invaſion in 1588; when the parliament gave queen Elizabeth two ſubſidies and four fifteenths. Afterwards, as money ſunk in value, more ſubſidies were given; and we have an inſtance, in the firſt parliament of 1640, of the king's deſiring 12 ſubſidies of the commons, to be levied in three years; which was looked upon as a ſtartling propoſal: though Lord Clarendon tells us, that the ſpeaker, ſerjeant Glanvile, made it manifeſt to the houſe, how very conſiderable a ſum 12 ſubſidies amounted to, by telling them he had computed what he was to pay for them; and when he named the ſum, he being known to be poſſeſſed of a great eſtate, it ſeemed not worth any farther deliberation. And, indeed, upon calculation, we ſhall find, that the total amount of theſe 12 ſubſidies, to be raiſed in three years, is leſs than what is now raiſed in one year by a land tax of 2*s*. in the pound. The method of raiſing this tax is by charging a particular ſum upon each county, according to the valuation given in A. D. 1692; and this ſum is aſſeſſed and raiſed upon individuals by commiſſioners appointed in the act, being the principal land-holders in the county, and their officers.

LANDED *Intereſt*, a term oppoſed to moneyed intereſt, in political conſiderations; though there is a near connexion between them: for, the *landed intereſt* is affected by foreign trade. The foreign trade of every country muſt decline, that, 1, Lays unequal taxes in general on its people. 2. That cramps its commerce, the fountain of riches, by high duties, and impolitic prohibitions. 3. That ſuffers many monopolies. 4. That oppreſſes its people by prohibiting the importation of victuals under the pretence of raiſing the value of its lands. 5. That encourages idleneſs, by bad laws relating to its poor. 6. That tempts foreigners to carry away its coin for leſs than its intrinſic value. 7. That makes the obtaining juſtice chargeable. 8. That ſuffers a heavy national debt, contracted in time of war, to continue unpaid in time of peace. The reaſon why the decline of foreign trade ſinks the value of land is, 1. becauſe it ſinks the markets at home. For, the produce of land being rendered exceſſively dear from the cauſes above enumerated, foreigners will not take its ſuperfluities; and labour being by the ſame cauſes rendered exceſſively dear, we cannot manufacture or improve that produce, becauſe nations which can afford cheaper ſupply the markets abroad; ſo that the produce of the lands, not being carried off as uſual, muſt become a dead ſtock on the farmer's hands, and cauſe great quantities to be crowded into markets, where, being encouragement but for few buyers, the price naturally falls; as, for inſtance, the declining demand of our woolen goods abroad falls the price of wool at home. 2. Becauſe it increaſes the number of poor, to burden the *land*. 3. Becauſe it diminiſhes the number of people: for as employment leſſens, the moſt induſtrious, rather than ſtarve here, will fly to other countries, where trade can maintain them. So the conſumption of theſe being taken away, the demand at market muſt grow leſs, and of courſe rents muſt fall, yet the farmer's charges muſt grow greater; for the fewer the hands, the higher wages are; this muſt break him in the end, and produce all the conſequences following that misfortune; beſide men who trade, bring in money; therefore the fewer they are, the leſs money will be brought; and the leſs money, the leſs rent can be given for *land*. 4. Becauſe the decline of trade diminiſhes *our riches*. This is a conſequence of the above remarks; for having fewer goods capable of being exported by reaſon of their dear price, and our manufactures declining, muſt in time be loſt: therefore the importation of foreign goods, muſt naturally increaſe, and more money go out to pay for them.

Nations that have no mines of gold and ſilver, have no means to get them but by foreign trade; and according to the quantity of theſe metals they poſſeſs, the price of their commodities, and therewith the value of their lands, riſe and fall in proportion, which ſhall now be proved. According to Dr. Davenant, the whole rental of England, in 1600, did not exceed ſix millions per annum, and the price of *land* was twelve years purchaſe: in 1688 the rental was fourteen millions; and the price of *land* was eighteen years purchaſe; ſo that, within this period, the *landed* intereſt roſe from ſeventy-two to two hundred and fifty-two millions: and this advance was owing to an increaſe of trade.

The Britannia Languens, page 12, ſays, if there were but five hundred pounds in England, an ox could hardly be worth a penny: therefore the rent muſt bear its proportion to the riches. This appears by the Hiſtory of London; for he ſays that, in the year 961, *land* ſold at one ſhilling per acre. The reaſon that *land* then bore ſo low a price, was the low price the produce ſold at; for he ſays, that, in the year 1000, an ox ſold for 2*s*. 6*d*. a cow for 2*s*. a ſheep, for 1*s*. and a ſwine for 8*d*. In 1445, wheat was at 4*s*. 6*d*. per quarter. See the citations in the Supplement to Price's Obſ. on Reverſionary Payments, &c. p. 385, &c. This could be only owing to the little foreign trade the nation had at theſe reſpective periods, and, conſequently, to the little quantity of gold and ſilver which trade had then brought in.

But if it ſhould be aſked, what is the reaſon that, at preſent, all things are naturally ſo much advanced in price, to what they were in thoſe days? the anſwer is, that the quantities of gold and ſilver brought to Europe ſince the progreſs made by the Spaniards and Portugueſe in America, have made thoſe metals more common, and of leſs value than formerly, ſo that 20*s*. will hardly purchaſe what 1*s*. would before the diſcovery of the Weſt Indies. To which may be added the great increaſe of our national debt and taxes, together with the circulation of the intereſt of the principal money of the public funds, and likewiſe that great circulation of paper credit in trade, occaſioned by notes and bills, which, by promoting an artificial circulation of property, raiſe the price of commodities, and give the appearance of wealth to the nation; though they are really the characteriſtics of a declining ſtate. Poſt. Dict. Com. The dearneſs of commodities and the cheapneſs of money are the ſame things.

LANGUAGE, in the moſt general meaning of the word, ſignifies any ſound uttered by an animal, by which it expreſſes any of its paſſions, ſenſations, or affections; but it is more particularly underſtood to denote thoſe various modifications of the human voice, by which the ſeveral ſenſations and ideas of one man are communicated to another.

Thus man is endowed with two different ſpecies of language: one conſiſting of tones and geſtures; which, as it is natural to man, conſidered as a diſtinct ſpecies of animals, and neceſſary for the preſervation and well-being of the whole, is univerſally underſtood by all mankind: thus laughter and mirth univerſally expreſs cheerfulneſs of mind; while tears, in every part of the globe, diſcover a heart overflowing with tender ſenſations; and the humble tone of ſupplication, or the acute accent of pain, are equally underſtood by the Hurons of America, and by the more refined inhabitants of Europe. The other ſpecies of language, as it is entirely artificial, and derives its power from particular compact, for before any thing can be recognized as the ſymbol of an idea, ſeveral perſons muſt firſt agree that ſuch an idea ſhall be always denoted by this ſymbol, muſt be different in different parts of the globe; and every diſtinct form which it may aſſume, from the different genius of every ſociety who originally formed a particular language for themſelves, will be altogether unintelligible to every other body of men, but thoſe belonging to the ſame ſociety where that language was originally invented, or thoſe who have been at pains to acquire a knowledge of it by means of ſtudy.

As the words IDIOM and GENIUS of a language are often confounded, it will be neceſſary to inform the reader, that by IDIOM we would here be underſtood to mean *that general mode of arranging words into ſentences which prevails in any particular language*; and by the GENIUS of a language we mean to expreſs *the particular ſet of ideas which the words of any language, either from their formation or multiplicity, are moſt naturally apt to excite in the mind of any one who hears it properly uttered.* Thus although the *Engliſh*, *French*, *Italian*, and *Spaniſh* languages, nearly agree in the ſame general IDIOM; yet the particular GENIUS of each is remarkably different; the *Engliſh* is naturally bold, nervous, and ſtrongly articulated; the *French* is weaker, and more flowing; the *Italian* more ſoothing and harmonious; and the *Spaniſh* more grave, ſonorous, and ſtately. Now, when we examine the ſeveral languages which have been moſt eſteemed in Europe, we find that there are only two diſtinct IDIOMS among them which are eſſentially diſtinguiſhed from one another; and all thoſe languages are divided between theſe two idioms, following ſometimes the one, and ſometimes the other, either wholly or in part. The languages which may be ſaid to adhere to the firſt idiom, are thoſe which in their conſtruction follow the order of nature; that is, expreſs their ideas in the natural order in which they occur to the mind; the ſubject which occaſions the action appearing firſt; then the action, accompanied with its ſeveral modifications; and, laſt of all, the object to which it has reference. Theſe may properly be called ANALOGOUS languages; and of this kind are the Engliſh, French, and moſt of the modern languages in Europe. The languages which may be referred to the other idiom, are thoſe which follow no other order in their conſtruction than what the taſte or fancy of the compoſer may ſuggeſt; ſometimes making the object, ſometimes the action, and ſometimes the modification of the action, to precede or follow the other parts. The confuſion which this might occaſion is avoided by the particular manner of *inflecting* their words, by which they are made to refer to the others with which they ought to be connected, in whatever part of the ſentence they occur, the mind being left at liberty to connect the ſeveral parts with one another after the whole ſentence is concluded. And as the words may be here tranſpoſed at pleaſure, thoſe languages may be called TRANSPOSITIVE languages. To this claſs we muſt, in an eſpecial manner, refer the *Latin* and *Greek* languages. As each of theſe idioms has ſeveral advantages and defects peculiar to itſelf, we ſhall endeavour to point out the moſt conſiderable of them, in order to aſcertain with greater preciſion the particular character and excellence of ſome of thoſe languages now principally ſpoken or ſtudied in Europe.

The partiality which our foreſathers, at the revival of letters in Europe, naturally entertained for the Greek and Roman languages, made them look upon every diſtinguiſhing peculiarity belonging to them, as *one* of the *many* cauſes of the amazing ſuperiority which thoſe languages evidently enjoyed above every other at that time ſpoken in Europe. This blind difference ſtill continues to be paid to them, as our minds are early prepoſſeſſed with theſe ideas, and as we are taught in our earlieſt infancy to believe, that to entertain the leaſt idea of our own language being equal to the Greek or Latin in any particular whatever, would be a certain mark of ignorance or want of taſte. Their rights, therefore, like thoſe of the church in former ages, remain ſtill to be examined; and we, without exerting our reaſon to diſcover truth from falſehood, tamely ſit down ſatisfied with the idea of their undoubted pre-eminence in every reſpect. But if we look around us for a moment, and obſerve the many excellent productions which are to be met with in almoſt every language of Europe, we muſt be ſatisfied, that *even theſe* are now poſſeſſed of *ſome* powers which might afford at leaſt a preſumption, that, if they were cultivated with a proper degree of attention, they might, in *ſome reſpects*, be made to rival, if not to excel, thoſe beautiful and juſtly admired remains of antiquity.

The learned reader well knows, that the ſeveral changes which take place in the arrangement of the words in every *tranſpoſitive* language could not be admitted without occaſioning great confuſion, unleſs certain claſſes of words were endowed with particular variations, by means of which they might be made to refer to the other words with which they ought naturally to be connected. From this cauſe proceeds the neceſſity of ſeveral variations of *verbs*, *nouns*, and *adjectives*; which are not in the leaſt eſſential or neceſſary in the analogous languages, as we have pretty fully explained under the article *Grammar*, to which we refer for ſatisfaction on this head.

Having thus conſidered *language* in general, and pointed out the genius and tendency of the two moſt diſtinguiſhed *idioms* which have prevailed; we ſhall cloſe theſe remarks with a few obſervations upon the particular nature and genius of thoſe languages which are now chiefly ſpoken or ſtudied in Europe.

Of all the nations whoſe memory hiſtory has tranſmitted to us, none have been ſo eminently diſtinguiſhed for their literary accompliſhments, as well as acquaintance with the polite arts, as the Greeks; nor are we as yet acquainted with a language poſſeſſed of ſo many advantages, with ſo few defects, as that which they uſed, and which continues ſtill to be known by their name. The neceſſary connection between the progreſs of knowledge and the improvement of language has been already explained; ſo that it will not be ſurpriſing to find their progreſs in the one keep pace with that of the other: but it will be of utility to point out ſome advantages which that diſtinguiſhed people poſſeſſed, which other nations, perhaps not leſs diſtinguiſhed for talents or taſte, have not enjoyed, which have contributed to render their language the moſt univerſally admired in ancient as well as in modern times.

As it is probable, that many different ſocieties of men, in the early ages of antiquity, may have found themſelves in ſuch circumſtances as to be obliged to invent a language to themſelves; each would naturally adopt thoſe ſounds into their language which chance might ſuggeſt, or were moſt agreeable to their perception of harmony, or moſt conſonant to the diſpoſition of mind of the original inventors; in the ſame manner as we ſee that each compoſer of muſic has a particular ſpecies of ſounds of which he is fonder than any other, which will predominate through all his compoſitions, and give them a certain characteriſtic tone by which they may be diſtinguiſhed from that of other compoſers: ſo the language of each particular ſet of people would have originally a certain characteriſtic tone of harmony, which would diſtinguiſh it from all others; and which would neceſſarily be more or leſs perfect, according to the greater or leſs degree of that delicate ſenſe of harmony, diſtinguiſhed by the name of *taſte*. Happy therefore, in this reſpect, muſt we deem thoſe nations, whoſe earlieſt anceſtors have been ſo fortunate as to adopt no unharmonious ſounds into their language, whereby they are freed from one bar to the cultivating thoſe refined pleaſures which proceed from the uſe of a delicate taſte, which others may perhaps never be able to ſurmount: and in this reſpect no nation was ever ſo eminently diſtinguiſhed as the Greeks; which no doubt contributed its ſhare to promote that general elegance and harmony of proportion which prevailed in all their arts. The original ſounds and fundamental tones of that language are the moſt harmonious, and the moſt agreeable to the ear, of any that have hitherto been invented; inſomuch, that from this principle alone, the ſound of their language is agreeable to every nation who has heard it, even when the meaning of the words are not underſtood: whereas almoſt all other languages, till they are underſtood, appear, to an ear which has not been accuſtomed to them, jarring and diſcordant. This is the fundamental excellence of that juſtly admired language; nor have the people failed to improve this to the utmoſt of their power, by many aids of their own invention. The Greek language is of the *tranſpoſitive* kind: but a people ſo lively, ſo acute, and ſo loquacious, could ill bear the ceremonious reſtraint to which that mode of language naturally ſubjected them; and have therefore, by various methods, freed it in a great meaſure from the ſtiffneſs which that produced.

Hence it happened that while the vivacity of the people rendered it eaſy, the great men ſtudiouſly improved every excellence that it could reap from its powers as a *tranſpoſitive* language; ſo that, when brought to its utmoſt perfection by the amazing genius of the great Demoſthenes, it attained a power altogether unknown to any other language. Thus happily circumſtanced, the Greek language arrived at that envied pre-eminence which it ſtill juſtly retains. From the progreſs of arts and ſciences; from the gaiety and inventive genius of the people; from the number of free ſtates into which Greece was divided, each of which invented words of its own, all of which contributed to the general ſtock; and from the natural communication which took place between theſe ſtates, which excited in the ſtrongeſt degree the talents of the people; it acquired a copiouſneſs unknown to any ancient language, and excelled by few of the moderns. In point of harmony of numbers, it is altogether unrivalled; and on account of the eaſe as well as dignity of which it admitted from the cauſes above aſſigned, it admits of perfection in a greater number of particular kinds of compoſition than any other language known. The irreſiſtible force and overwhelming impetuoſity of Demoſthenes ſeems not more natural to the genius of the language than the more flowery charms of Plato's calm and harmonious cadences, or the unadorned ſimplicity of Xenophon; nor does the majeſtic pomp of Homer ſeem to be more agreeable to the genius of the language in which he wrote, than the more humble ſtrains of Theocritus, or the laughing feſtivity of Anacreon. Equally adapted to all purpoſes, when we peruſe any of theſe authors, we would imagine the language was moſt happily adapted for his particular ſtyle alone. The ſame powers it likewiſe, in a great meaſure, poſſeſſed for converſation; and the dialogues ſeems not more natural for the dignity of Sophocles or Euripides, than for the more eaſy tenderneſs of Menander, or buffoonery of Ariſtophanes. With all theſe advantages, however, it muſt be acknowledged, that it did not poſſeſs that unexceptionable clearneſs of meaning which ſome analogous languages enjoy, or that characteriſtic force which the accent has power to give it, were not theſe defects counterbalanced by other cauſes. The Romans, a people of fierce and warlike diſpoſitions, for many ages during the infancy of their republic, more intent on purſuing conqueſts and military glory than in making improvements in literature or the fine arts, beſtowed little attention to their language. Of a diſpoſition leſs ſocial or more phlegmatic than the Greeks, they gave themſelves no trouble about rendering their language fit for converſation; and it remained ſtrong and nervous, but, like their ideas, was limited and confined. More diſpoſed to command reſpect by the power of their arms than by the force of perſuaſion, they deſpiſed the more effeminate powers of ſpeech: ſo that, before the Punic wars, their language was perhaps more reſerved and uncourtly than any other at that time known. But after their rival Carthage was deſtroyed, and they had no longer that powerful curb upon their ambition; when riches flowed in upon them by the multiplicity of their conqueſts, luxury began to prevail, the ſtern auſterity of their manners to relax, and ſelfiſh ambition to take place of that diſintereſted love for their country ſo eminently conſpicuous among all orders of men before that period. Popularity began then to be courted: ambitious men, finding themſelves not poſſeſſed of that merit which inſured them ſucceſs with the virtuous ſenate, amuſed the mob with artful and ſeditious harangues; and by making them believe that they were poſſeſſed of all power, and had their ſacred rights encroached upon by the ſenate, led them about at their pleaſure, and got themſelves exalted to honours and riches by theſe inſidious arts. It was then the Romans firſt began to perceive the uſe to which a command of language could be put. Ambitious men then ſtudied it with care, to be able to accompliſh their ends; while the more virtuous were obliged to acquire a ſkill in this, that they might be able to repel the attacks of their adverſaries. Thus it happened, that in a ſhort time that people, from having entirely neglected, began to ſtudy their language with the greateſt aſſiduity; and as Greece happened to be ſubjected to the Roman yoke about that time, and a friendly intercourſe was eſtabliſhed between theſe two countries, this greatly conſpired to nouriſh in the minds of the Romans, a taſte for that art of which they had lately become ſo much enamoured. Greece had, long before this period, been corrupted by luxury; their taſte for the fine arts had degenerated into unneceſſary refinement; and all their patriotiſm conſiſted in popular harangues and unmeaning declamation. Oratory was then ſtudied as a refined art; and all the ſubtleties of it were taught by rule, with as great care as the gladiators were afterwards trained up in Rome.

From the view which we have already given of the Latin language, it appears evident, that its idiom was more ſtrictly tranſpoſitive than that of any other language yet known, and was attended with all the defects to which that idiom is naturally ſubjected: nor could it boaſt of ſuch favourable alleviating circumſtances as the Greek, the prevailing ſounds of the Latin being far leſs harmonious to the ear: and although the formation of the words are ſuch as to admit of full and diſtinct ſounds, and ſo modulated as to lay no reſtraint upon the voice of the ſpeaker; yet, to a perſon unacquainted with the language, they do not convey that enchanting harmony ſo remarkable in the Greek language. The Latin is ſtately and ſolemn; it does not excite diſguſt; but at the ſame time it does not charm the ear, ſo as to make it liſten with delighted attention.

Of the compoſitions in that language which have been preſerved to us, the *orations* of Cicero are beſt adapted to the genius of the language, and we there ſee it in its utmoſt perfection. In the *philoſophical works* of that great author we perceive ſome of its defects; and it requires all the powers of that great man to render his *epiſtles* agreeable, as theſe have the genius of the language to ſtruggle with. Next to oratory, hiſtory agrees with the genius of this language; and Cæſar, in his commentaries, has exhibited the language in its pureſt elegance, without the aid of pomp or foreign ornament. Among the poets, Virgil has beſt adapted his words to his language. The flowing harmony and pomp of it is well adapted for the epic ſtrain, and the correct delicacy of his taſte rendered him perfectly equal to the taſk. But Horace is the only poet whoſe force of genius was able to overcome the bars which the language threw in his way, and ſucceed in lyric poetry. Were it not for the brilliancy of the thoughts, and acuteneſs of the remarks, which ſo eminently diſtinguiſh this author's compoſitions, his odes would long ere now have ſunk into utter oblivion. But ſo conſcious have all the Roman poets been of the unfitneſs of their language for eaſy dialogue, that almoſt none of them, after Plautus and Terence, have attempted any dramatic compoſitions in that language.

The modern *Italian* language, from an inattention too common in literary ſubjects, has been uſually called a *child of the Latin language*, and is commonly believed to be the ancient Latin a little debaſed by the mixture of the barbarous language of thoſe people who conquered Italy. The truth is, the caſe is directly the reverſe: for this language, in its general idiom and fundamental principles, is evidently of the analogous kind, firſt introduced by thoſe fierce invaders, although it has borrowed many of its words, and ſome of its modes of phraſeology, from the Latin, with which they were ſo intimately blended that this could ſcarcely be avoided; and it has been from remarking this ſlight connection ſo obvious at firſt ſight, that ſuperficial obſervers have been led to draw this general concluſion, ſo contrary to fact.

When Italy was over-run with the Lombards, and the empire deſtroyed by theſe northern invaders, they, as conquerors, continued to ſpeak their own native language. Fierce and illiterate, they would not ſtoop to the ſervility of ſtudying a language ſo clogged with rules, and difficult of attainment, as the Latin would naturally be to a people altogether unacquainted with nice grammatical diſtinctions: while the Romans of neceſſity were obliged to ſtudy the language of their conquerors, as well to obtain ſome relief of their grievances by prayers and ſupplications, as to deſtroy that odious diſtinction which ſubſiſted between the conquerors and conquered, while they continued as diſtinct people.

Thus a language in time was formed, ſomewhat reſembling the Latin, both in the general tenor of the ſounds, and in the meaning of many words: and as the barbarians gave themſelves little trouble about language, and in ſome caſes perhaps hardly knew the general analogy of their own language, it is not ſurpriſing if their new ſubjects ſhould find themſelves ſometimes at a loſs on that account, or if, in theſe ſituations, they followed, on ſome occaſions, the analogy ſuggeſted to them by their own: which accounts for the ſtrange degree of mixture of heterogeneous grammatical analogy we meet with in the Italian as well as Spaniſh and French languages.

Theſe obſervations are equally applicable to the French and Spaniſh, as to the Italian language. With regard to this laſt in particular, we may obſerve, that as the natural inhabitants of Italy, before the laſt invaſion of the barbarians, were ſunk and enervated by luxury, and that by depreſſion of mind and genius which anarchy always produces, they had become fond of feaſting and entertainments, and the enjoyment of ſenſual pleaſures conſtituted their higheſt delight; and their language partook of the ſame debility as their body. The barbarians too, unaccuſtomed to the ſeductions of pleaſure, ſoon fell from their original boldneſs and intrepidity, and, like Hannabal's troops of old, were enervated by the ſenſual gratifications in which a nation of conquerors unaccuſtomed to the reſtraint of government freely indulged. The ſoftneſs of the air, the fertility of the climate, the unaccuſtomed flow of riches which they at once acquired; together with the voluptuous manner of their conquered ſubjects; all conſpired to enervate their minds, and render them ſoft and effeminate. No wonder then, if a language new moulded at this juncture ſhould partake of the genius of the people who formed it; and inſtead of participating of the martial boldneſs and ferocity of either of their anceſtors, ſhould be ſoftened and enfeebled by every device which an effeminate people could invent. The ſtrong conſonants which terminated the words, and gave them life and boldneſs, being thought too harſh for the delicate ears of theſe ſons of ſloth, were baniſhed their language; while ſonorous vowels, which could be protracted to any length in muſic, were ſubſtituted in their ſtead. Thus the Italian language is formed flowing and harmonious, but deſtitute of thoſe nerves which conſtitute the ſtrength and vigour of a language: at the ſame time, the ſounds are neither enough diverſified, nor in themſelves of ſuch an agreeable tone, as to afford great pleaſure without the aid of muſical notes: and the ſmall pleaſure which this affords is ſtill leſſened by the little variety of meaſure which the great ſimilarity of the terminations of the words occaſions. Hence it happens, that this language is fitted for excelling in fewer branches of literature than almoſt any other: and although we have excellent hiſtorians, and more than ordinary poets, in Italian, yet they labour under great inconveniences, from the language wanting nerves and ſtatelineſs for the former, and ſufficient variety of modulation for the latter.

The only ſpecies of poetry in which the Italian language can claim a ſuperior excellence, is the tender tone of elegy: and here it remains unrivalled and alone; the plaintive melody of the ſounds, and ſmooth flow of the language, being perfectly adapted to expreſs that ſoothing melancholy which this ſpecies of poetry requires. On this account the plaintive ſcenes of the *Paſtor Fido* of *Guarini* have juſtly gained to that poem an univerſal applauſe; although, unleſs on this account alone, it is perhaps inferior to almoſt every other poem of the kind which ever appeared.

The Engliſh is perhaps poſſeſſed of a greater degree of excellence, blended with a greater number of defects, than any of the languages we have hitherto mentioned. As the people of Great Britain are a bold, daring, and impetuous race of men; ſubject to ſtrong paſſions, and, from the abſolute freedom and independence which reigns among all ranks of people throughout this happy iſle, little ſolicitous about controlling theſe paſſions; our language takes its ſtrongeſt characteriſtical diſtinction from the genius of the people; and, being bold, daring, and abrupt, is admirably well adapted to expreſs thoſe great emotions which ſpring up in an intrepid mind at the proſpect of intereſting events. Peculiarly happy too in the full and open ſound of the vowels, which forms the characteriſtic *tone* of the language, and in the ſtrong uſe of the aſpirate H in almoſt all thoſe words which are uſed as exclamations, or marks of ſtrong emotions, upon intereſting occaſions, that particular claſs of words called interjections have, in our language, more of that fullneſs and unreſtrained freedom of tones, in which their chief power conſiſts, and are puſhed forth from the inmoſt receſſes of the ſoul in a more forcible and unreſtrained manner, than any other language whatever. Hence it is more peculiarly adapted for the great and intereſting ſcenes of the *drama* than any language that has yet appeared in the globe. Nor has any other nation ever arrived at that perfection which the Engliſh may juſtly claim in that reſpect; for however faulty our dramatic compoſitions may be in ſome of the critical niceties which relate to this art, in nervous force of diction, and in the natural expreſſion of thoſe great emotions which conſtitute its ſoul and energy, we claim, without diſpute, an unrivalled ſuperiority. Our language too, from the great intercourſe that we have had with almoſt all nations of the globe by means of our extenſive commerce, and from the eminent degree of perfection which we have attained in all the arts and ſciences, has acquired a copiouſneſs beyond what any other modern nation can lay claim to; and even the moſt partial favourers of the Greek language are forced to acknowledge, that in this reſpect it muſt give place to the Engliſh.

We could produce ſuch numerous works of proſe in our language, which excel in almoſt every different ſtyle of compoſition as would be tireſome to enumerate; every reader of taſte and diſcernment will be able to recollect a ſufficient number of writings which excel in point of ſtyle, between the graceful and becoming gravity ſo conſpicuous in all the works of the author of the *Whole Duty of Man*, and the animated and nervous diction of Robertſon in his hiſtory of Charles the Fifth,—the more flowery ſtyle of Shafteſbury, or the Attic ſimplicity and elegance of Addiſon. But although we can equal, if not ſurpaſs, every modern language in works of proſe, it is in its poetical powers that our language ſhines forth with the greateſt luſtre. The brevity to which we muſt here neceſſarily confine ourſelves, prevents us from entering into a minute examination of the poetical powers of our own, compared with other languages; otherwiſe it would be eaſy to ſhew, that every other modern language labours under great reſtraints in this reſpect which ours is freed from; that our language admits of a greater variety of poetic movements, and diverſity of cadence, than any of the admired languages of antiquity.

Though, in mere pleaſantneſs of ſounds, or harmonious flow of ſyllables, our language may be inferior to the Greek, the Latin, Italian, and Spaniſh; yet in point of manly dignity, graceful variety, intuitive diſtinctneſs, nervous energy of expreſſion, unconſtrained freedom and harmony of poetic numbers, it will yield the palm to none. Our immortal Milton, ſlowly riſing, in graceful majeſty ſtands up as equal, if not ſuperior, in theſe reſpects to any poet, in any other language, that ever yet exiſted; while Thomſon, with more humble aim, in melody more ſmooth and flowing, ſoftens the ſoul to harmony and peace; the plaintive moan of Hammond calls forth the tender tear and ſympathetic ſigh; while Gray's more ſoothing melancholy fixes the ſober mind to ſilent contemplation; more tender ſtill than theſe, the amiable Shenſton comes; and from his Doric reed, ſtill free from courtly affectation, flows a ſtrain ſo pure, ſo ſimple, and of ſuch tender harmony, as even Arcadian ſhepherds would be proud to own. But far before the reſt, the daring Shakeſpeare ſteps forth conſpicuous, clothed in native dignity; and, preſſing forward with unremitting ardour, boldly lays claim to both dramatic crowns held out to him by Thalia and Melpomene; his rivals, far behind, look up, and envy him for theſe unfading glories; and the aſtoniſhed nations round, with diſtant awe, behold and tremble at his daring flight. Thus the language, equally obedient to all, bends with eaſe under their hands, whatever form they would have it aſſume; and, like the yielding wax, readily receives, and faithfully tranſmits to poſterity, thoſe impreſſions which they have ſtamped upon it. Such are the principal outlines of the language of Great Britain, ſuch are its beauties, and ſuch its moſt capital defects; a language more peculiarly circumſtanced than any that has ever yet appeared. It is the language of a great and powerful nation, whoſe fleets ſurround the globe, and who ſee merchants are in every port; a people admired or revered by all the world: and yet it is leſs known in every foreign country, than any other language in Europe. In it are written more perfect treatiſes on every art and ſcience, than are to be found in any other language.

The pretenſions of the Chineſe in particular to priority, have been ſupported not only from the great antiquity of that nation, their early acquaintance, with arts and ſciences, and their having preſerved themſelves ſo many ages from any conſiderable mixture or intercourſe with other nations; but alſo from the ſingularity of the tongue itſelf, which conſiſts of few words, all monoſyllables, and is moſt ſimple in its conſtruction, having no variety of declenſions, conjugations, or grammatical rules. Beſides, it is urged, that the Chineſe are the poſterity of Noah, and that Fohi, the firſt king of China was Noah. Mr. Webb, an ingenious writer in the reign of Charles II. ſtrenuouſly maintains, that this is the only original *language*, and that they now talk in China, the *language* of Paradiſe. Others maintain, that the *language* ſpoken by Adam is loſt; and that the Hebrew, Chaldee, and Arabic, are only dialects of the original tongue. So far are they from giving the priority to the Hebrew, that they maintain Abraham ſpoke Chaldee before he paſſed the Euphrates; and that he firſt learned the Hebrew in the land of Canaan; ſo that this was not a ſpecial *language* conſecrated to the people of God, but was originally the *language* of the Canaanites. Mr. Le Clerc is of opinion, the Hebrew is far ſuperior to the Greek both in copiouſneſs, elegance and perſpicuity; it is dry, and deſtitute of ornaments, inſomuch that, wanting expreſſions to vary the phraſe, the ſame periods are perpetually returning. The Arabic is held the moſt copious of all *languages*. See the Preliminary Diſcourſe to Sale's Koran.

LANGUAGES are in general divided into *original* or *mother-tongues*; as the HEBREW and ARABIC, in the Eaſt; the TEUTONIC and SCLAVONIC, in the Weſt.

LANGUOR, in medicine, ſignifies a *faintneſs*, or relaxation of the members, ariſing either from a want or decay of ſpirits, through indigeſtion, or too much exerciſe; or from an additional weight of fluids, cauſed by a diminution of the excretion by the common diſcharges.

LAOCOON, in the hiſtory of the arts, is a celebrated monument of Greek ſculpture, executed in marble by Polydorus, Athenodorus, and Ageſander, the three famous artiſts of Rhodes. This remain of antiquity was found at Rome in the ruins of the palace of Titus, in the beginning of the ſixteenth century, under the pontificate of Julius II. and ſince depoſited in the Farneſe palace. *Laocoon*, the prieſt of Apollo and Neptune, is here repreſented with his two ſons, with two hideous ſerpents clinging round his body, gnawing it, and injecting their poiſon: Virgil has given us the following deſcription of the fact.

Serpens amplexus uterque
Implicat & miſeros morſu depaſcitur artus:
Corripiunt, ſpiriſque ligant ingentibus, & jam
Bis medium amplexit, bis collo ſquamea circum
Terga dati, ſuperant capite, & cervicibus altis.

The ſtatue exhibits the moſt aſtoniſhing dignity and tranquility of mind in the midſt of the moſt excruciating torments: Pliny ſays of it, that it is *opus omnibus, picturæ & ſtatuariæ artis, preferendum.* Lib. xxxvi. c. 5. See Treatiſe on the Art of DRAWING, Plate III.

LAPIDARY, *Lapidarius*, an artificer, who cuts precious ſtones. The art of cutting precious ſtones is very ancient; but like other arts, its original was very imperfect. The French have ſucceeded in it the beſt; and the *lapidaries* of Paris, who have been a corporation ſince the year 1290, have carried it, eſpecially in cutting of diamonds called *brilliants*, to a very great perfection, but not ſuperior to that of the Engliſh. There are various machines uſed in the cutting of precious ſtones, according to the quality of the matter to be cut: the diamond, which is extremely hard, is cut and formed on a wheel of ſoft ſteel, turned by a kind of mill, with diamond duſt tempered in oil of olives; and this ſerves to poliſh them as well as to cut them. Oriental rubies, ſapphires, and topazes, are cut and formed on a copper wheel, with oil of olives, and diamond duſt: they are afterwards poliſhed on another copper wheel with tripoli and water. Emeralds, hyacinths, amethyſts, garnets, agates, and other ſtones leſs hard, are cut on a leaden wheel, with ſmalt and water, and poliſhed on a tin wheel with tripoli.

LAPIS *Bononienſis*, the *Bolonian ſtone*, a peculiar ſpecies of ſtone found in Bolonia. The whole art of preparing this ſtone, ſo as to make it ſhine in the dark, is deſcribed at large in Hook's Philoſophical Collections, by Sir Marc Antonio Cellio, and in a book of the ſame author, publiſhed at Rome in 1680, expreſsly on that ſubject. The *ſtone* is found moſt eaſily after rain; when the earth being waſhed away, the ſeveral maſſes of it appear as bright as burniſhed ſilver, or with the glittering of talc, reſembling the gloſs of a looking-glaſs. Il Foſforo de Marc Anton. Cellio. When this *ſtone* is prepared, it affords an efflореſcence, in which lies its principal virtue of receiving light; which it does either from the ſun, the moon, the common day-light, or a flame, but in different degrees. When carried into the dark, it appears exactly like a burning coal, and the light it gives is ſufficient to read by, if the letters be placed near the *ſtone*. It does not retain its light long, but requires often renewing; and when well prepared, its virtues will laſt five or ſix years, but ſeldom longer. The way of ſeeing it to the greateſt advantage, is after the eye has been kept for ſome time in a dark room, and the ſtone is brought in there immediately from being held in the ſun.

LAPSE, a ſlip or omiſſion of a patron to preſent a clerk to a benefice within ſix months of its being void; in which caſe, the benefice is ſaid to be in *lapſe*, or lapſed, and the right of preſentation devolved to the ordinary. And if the ordinary neglect to preſent during the ſame time, the right of preſentation accrues to the metropolitan, and to the king by neglect of the metropolitan.

LAPWING, in ornithology, the Engliſh name of a ſpecies of the genus Tringa. See TRINGA.

LARCENY, in law, is a theft of perſonal goods or chattels, in the owner's abſence. *Larceny* is diſtinguiſhed by the law into two ſorts; the one called *ſimple larceny*, or plain theft unaccompanied with any other atrocious circumſtance; and *mixt* or *compound larceny*, which includes in it the aggravation of taking from one's houſe or perſon. In reſpect of the things ſtolen, ſimple *larceny* is either *great* or *ſmall*. *Great larceny*, is when the things ſtolen, though ſeverally, exceed the value of 12*d*. *Petty larceny*, is when the goods ſtolen exceed not the value of 12*d*.

LARES, among the ancients, a kind of domeſtic genii, or divinities, worſhipped in houſes, and eſteemed the guardians and protectors of families; ſuppoſed to reſide more immediately in the chimney corner. The *Lares* were diſtinguiſhed from the PENATES, as the former were ſuppoſed to preſide over houſe-keeping, the ſervants in families, and domeſtic affairs, and the latter were the protectors of the maſters of families, their wives and children; accordingly the *Lares* were dreſſed in ſhort ſuccinct habits, to ſhew their readineſs to ſerve, and they held a ſort of cornucopia in their hands, as a ſignal of hoſpitality and good houſe-keeping. According to Ovid there were generally two of them, who were ſometimes repreſented with a dog at their feet. Faſt. 5. v. 146. Plutarch diſtinguiſhes good and evil *Lares*, as he had before done good and evil Genii.

LARK, the Engliſh name of the genus *alauda*, in ornithology. For the generic and ſpecific characters, ſee ALAUDA. For the claſſification, ſee the Syſtem, for the repreſentation, ſee Plate III.

LARUS, the GULL, in ornithology, a genus belonging to the order of Anſeres, the characters of which are theſe: the bill is ſtrait, cultrated, a little crooked at the point, and without teeth; the inferior mandible is gibbous below the apex; the noſtrils are linear, a little broader before, and ſituated in the middle of the back. There are 11 ſpecies, principally diſtinguiſhed by their colour. The moſt remarkable ſpecies are, the cataractes, or ſkua gull. The length of this ſingular gull is two feet; the extent four feet and a half; the weight three pounds; the bill two inches one-fourth long, very much hooked at the end, and very ſharp; the upper mandible covered more than half-way with a black cere or ſkin, as in the hawk-kind; the noſtrils placed near the bend, and are pervious. The feathers on the head, neck, back, ſcapulars, and coverts of the wings, are of a deep brown, marked with ruſt-colour (brighteſt in the male). The breaſt, belly, and vent, are ferruginous, tinged with aſh-colour. The tail when ſpread is circular, of a deep brown, white at the root, and with ſhafts of the ſame colour. The legs are covered with great black ſcales; the talons black, ſtrong, and crooked; the interior remarkably ſo. This bird inhabits Norway, the Ferroe iſles, Shetland, and the noted rock Foula, a little weſt of them. It is alſo a native of the South Sea. It is the moſt formidable gull; its prey being not only fiſh, but, what is wonderful in a web-footed bird, all the leſſer ſort of water-fowl, ſuch as teal, &c. Mr. Schroter, a ſurgeon in the Ferroe iſles, relates that it likewiſe preys on ducks, poultry, and even young lambs. It has all the fierceneſs of the eagle in defending its young; when the inhabitants of thoſe iſlands viſit the neſt; it attacks them with great force, ſo that they hold a knife erect over their heads, on which the ſkua will transfix itſelf in its fall on the invaders. The Rev. Mr. Low, miniſter of Birſa in Orkney, confirmed part of the above account: on approaching the quarters of theſe birds, they attacked him and his company with moſt violent blows; and intimidated a bold dog of Mr. Low's in ſuch a manner, as to drive him for protection to his maſter. The natives are often very rudely treated by them, while they are attending their ſheep on the hills; and are obliged to guard their heads by holding up their ſticks, on which the birds often kill themſelves. In Foula it is a privileged bird, becauſe it defends the flocks from the eagle, which it beats and purſues with great fury; ſo that even that rapacious bird ſeldom ventures near its quarters. The natives of Foula on this account lay a fine on any perſon who deſtroys one; they deny that it ever injures their flocks or poultry; but imagine it preys on the dung of the arctic and other larger gulls, which it proſecutes till they moot for fear.

The fuſcus, or herring-gull, weighs upwards of 30 ounces; the length 23 inches, its breadth 52; the bill yellow, and the lower mandible marked with an orange-coloured ſpot; the back, and coverts of the wings aſh-coloured: the upper-part of the five firſt quill-feathers are black, marked with a white ſpot near their end; the legs of a pale fleſh-colour. Theſe birds breed on the ledges of rocks that hang over the ſea; they make a large neſt of dead graſs, and lay three eggs of a dirty white, ſpotted with black. The young are aſh-coloured, ſpotted with brown. They do not come to their proper colour the firſt year; this is common to other gulls; which has greatly multiplied the ſpecies among authors, who are inattentive to theſe particulars. This gull is a great devourer of fiſh, eſpecially of that from which it takes its name; it is a conſtant attendant on the nets, and ſo bold as to ſeize its prey before the fiſhermens faces.

The ridibundus, pewit, or black-head gull. Theſe birds breed in vaſt numbers in the iſlands of certain pools in the county of Stafford; and, as Dr. Fuller tells us, in another on the Eſſex ſhores; alſo in the fens of Lincolnſhire. They are birds of paſſage; reſort there in the ſpring, and after the breeding ſeaſon diſperſe to the ſea-coaſts; they make their neſt on the ground, with ruſhes, dead graſs, and the like; and lay three eggs of a dirty olive-colour, marked with black. The young were formerly highly eſteemed, and numbers were annually taken and fattened for the table. Whitelock, in his annals, mentions a piece of ground near Portſmouth, which produced to the owner 40l. a-year by the ſale of pewits, or this ſpecies of gull. Theſe are the *ſea gulls* that in old times were admitted to the noblemens tables. The notes of theſe gulls diſtinguiſh them from any others, being like a hoarſe laugh. Their weight is about 10 ounces; their length 15 inches, their breadth 37; their irides are of a bright hazel; the edges of the eye-lids of a fine ſcarlet; and on each, above and below, is a ſpot of white feathers; for repreſentation, ſee Plate V.

LARYNX, *Λαϱυγξ*, in anatomy, the upper part or head of the trachea, lying below the root of the tongue, and before the pharynx. The *larynx* is one of the organs of reſpiration, and the principal inſtrument of voice. See the Syſtem, Part III. Sect. X.

LASSITUDE, among phyſicians, expreſſes that wearineſs, or heavineſs, of members, that proceeds from a diſtempered ſtate of body, and not from exerciſe; either from an increaſe of bulk, a diminution of proper evacuation, or too great a conſumption of that fluid which is neceſſary to maintain the force and ſpring of the ſolids; as in fevers, and convulſions; or from a vitiated ſecretion of that juice, whereby the fibres are not ſupplied either in due quantity or quality. The remedy, in the firſt caſe, is a vacuation; in the latter, a proper diet, or ſuch alterative medicines as influence ſuch a ſecretion.

LATIN, a dead language, firſt ſpoken in Latin, and afterwards at Rome; and ſtill uſed in the Romiſt church, and among many of the learned. This language is principally derived from the Greek, and particularly from the Eolic dialect of that tongue, though it has a great number of words which it borrowed from the languages of the Etruſci, Oſci, and other ancient people of Italy; and foreign commerce and wars, in courſe of time, added a great many more. The Latin is a ſtrong nervous language, perfectly ſuitable to the character of the people who ſpoke it; we have ſtill works of every kind admirably well written in the Latin, though there are vaſt numbers loſt. For its peculiarities and beauties, ſee LANGUAGE.

LATISSIMUS *Dorſi*, in anatomy, a muſcle, ſo called from its ſhape, covering almoſt the whole back. For its origin, inſertion, and uſe; ſee the Syſtem, Part III. Sect. XII. for repreſentation, ſee Plate III, *Fig.* 1, letter *c*.

LATITUDE, in geography, the diſtance of a place from the equator; or an arch of the meridian, intercepted between the zenith of the place, and the equator. Hence *latitude* is either *northern* or *ſouthern*, according as the place, whoſe *latitude* is ſpoken of, is on this or that ſide of the equator. See Treatiſe on the GLOBES.

LATITUDINARIAN, among *Divines*, denotes a perſon of moderation, with regard to religious opinions, who believes there is a latitude in the road to heaven, which may admit people of different perſuaſions. This name was given by way of diſtinction to thoſe excellent perſons in England, who, about the middle and towards the cloſe of the laſt century, endeavoured to allay the conteſts that prevailed between the more violent epiſcopalians on the one hand, and the more rigid preſbyterians and independents on the other, with reſpect to the forms of church government and public worſhip, and alſo between the Arminians and Calviniſts, with reſpect to certain religious tenets. Many of them were zealouſly attached to the forms of eccleſiaſtical government and worſhip that were eſtabliſhed in the church of England, and they recommended epiſcopacy with all their eloquence; but they did not conſider it as of divine inſtitution, and abſolutely neceſſary to the conſtitution of a Chriſtian church; and therefore they maintained that thoſe who followed other forms of government and worſhip, were not, on that account, to be excluded from their communion, or to forfeit the title of brethren. Others had no great liking for the liturgy or ceremonies, or, indeed, the government of this church, but yet for the ſake of peace and order conformed. As to the doctrinal part of religion, they took the ſyſtem of the famous Epiſcopius for their model, and, like him, reduced the fundamental doctrines of Chriſtianity, i. e. thoſe doctrines, the belief of which is neceſſary to ſalvation, to a few points. By this manner of proceeding they ſhewed that neither of the epiſcopalians, who, generally ſpeaking, embraced the ſentiments of the Arminians, nor the preſbyterians and independents, who as generally adopted the doctrine of Calvin, had any reaſon to oppoſe each other with ſuch bitterneſs and animoſity, ſince the ſubjects of their debate were matters of indifference, with reſpect to ſalvation, and might be variouſly explained and underſtood, without any prejudice to their eternal intereſts. The chief leaders of theſe *Latitudinarians* were Hales and Chillingworth: to them may be added the reſpectable names of More, Cudworth, Gale, Whitchcot, Wilkins, and Tillotſon. The firſt fruits of their charitable zeal were the odious appellations of atheiſts, deiſts, and Socinians, liberally beſtowed upon them by the Roman catholics, and the more rigid of the proteſtant contending parties. However, they were afterwards raiſed to the firſt dignities of the church, and deſervedly held in general eſteem. And at this time the church of England is chiefly governed by *Latitudinarians* of this kind; and the ſpirit of moderation and mutual charity has generally prevailed, with that of liberal enquiry, among the various ſects and denominations of Chriſtians. Moſheim's Eccl. Hiſt. vol. iv. p. 535, &c. 8vo. and Birch's Life of Tillotſon, p. 407.

LAVA, is a name given by the Italians to the liquid and vitrified matter diſcharged by Veſuvius, Ætna, and other volcanos, at the time of their *Eruption*. This *lava* is a mixture of ſtones, ſand, earth, metallic ſubſtances, ſalts, &c. calcined, rendered fuſible, and vitrified by the fire of the volcanos: but as the maſs of which it originally conſiſts is very heterogeneous, the *lava*, when cold, appears under various forms and colours. The pureſt *lava*, is a hard black, homogeneous, compact glaſs: of this kind is the ſtone found in many parts of Peru, and called by the Spaniards *pedra di Gallinaço*. There is another ſpecies of *lava*, which is hard, heavy, and compact, like marble, and which is ſuſceptible of a very fine poliſh. This is converted at Naples to a variety of domeſtic uſes. There is another kind which is a groſſer ſtone, and commonly aſh-coloured, uſed for building and paving the ſtreets. That which is found on the ſurface is ſtill more groſs and ſpongy, and reſembles the ſcoria of metals. According to Mr. Wiegleb's Analyſis, 100 parts of it contain 65 of ſilex, 16 of argill, 5 of iron; and the remaining 14 gr. were diſſipated. Kirwan's Elm. of Miner. p. 97.

LAVENDULA, LAVENDER, a genus of the gymnoſpermia order, belonging to the didynamia claſs of plants.

Species. The ſpica, or lavender ſpike, hath a ſhort ſhrubby ſtalk, riſing two or three feet high; ſmall ſpear-ſhaped entire leaves; and from the ends of the branches, numerous, long, erect, naked ſpikes of ſmall ringent flowers, of different colours in the varieties. The varieties of this are common narrow-leaved lavender, with blue flowers, and with white flowers: broad-leaved lavender: dwarf lavender: all of them flowering in July. This ſpecies is the common lavender; but the narrow-leaved variety, with blue flowers, is the ſort commonly cultivated for its flowers for medicine; for the culture, ſee Syſtem of GARDENING, Part II. Kitchen Garden, the month of March.

Uſes. The two firſt ſpecies are proper both for the kitchen-garden, for medicinal and other family-uſes; and to plant in the pleaſure-ground to adorn the front of ſmall ſhrubbery compartments, where they will increaſe the variety very agreeably; and are finely-ſcented aromatics, both when growing, and their flowers when gathered, eſpecially thoſe of the firſt ſpecies, which are in great eſteem for putting among cloaths, and for diſtilling and other œconomical uſes. The flowers of the firſt ſort are gathered for uſe in July; which being the time of their perfection, cut off the ſpikes cloſe in a dry day, and tie them in ſmall bunches for uſe. Theſe and the ſummits are in a very eminent degree cephalic and nervine. They are given in palſies, vertigos, lethargies, tremors, and ſuppreſſion of the menſtrual evacuation. The compound ſpirit diſtilled from them is famous in theſe and many other like caſes. The diſtilled oil is particularly celebrated for deſtroying the *pediculi inguinales*, and other cutaneous inſects. If ſoft ſpongy paper, dipt in this oil, either alone, or mixed with oil of almonds, be applied at night to the parts infected, the inſects will certainly, ſays Geoffroy, be all found dead in the morning.

LAUGHTER, an action or paſſion peculiar to man. Authors attribute *laughter* to the fifth pair of nerves, which ſending branches to the eye, ear, lips, tongue, palate, and muſcles of the cheek, parts of the mouth, præcordia, &c. there hence ariſes a ſympathy, or conſent, between all theſe parts; ſo that when one of them is acted upon, the others are proportionably affected. Hence a ſavoury thing ſeen or ſmelt, affects the glands and parts of the mouths, a thing ſeen or heard, that is ſhameful, affects the cheek with bluſhes; on the contrary, if it pleaſe and tickle the fancy, it affects the præcordia and muſcles of the mouth and face, with *laughter*; if it cauſes ſadneſs and melancholy, it likewiſe affects the præcordia, and demonſtrates itſelf by cauſing the glands of the eyes to emit tears. Dr. Willis accounts for the pleaſure of kiſſing from the ſame cauſe; the branches of this fifth pair being ſpread to the lips, the præcordia, and the genital parts; whence ariſes a ſympathy between thoſe parts. For repreſentation of this paſſion, ſee Treatiſe on DRAWING, Plate I.

LAURUS, the *Bay tree*; a genus of the monogynia order, belonging to the decandria claſs of plants. The moſt valuable ſpecies is the laurus cinnamomum, or cannamon-tree, a native of Ceylon. It hath a large root, and divides into ſeveral branches, covered with a bark, which on the outer ſide is of a greyiſh brown, and on the inſide has a reddiſh caſt. The wood of the root is hard, white, and has no ſmell. The body of the tree, which grows to the height of 40 or 50 feet, is covered, as well as its numerous branches, with a bark which at firſt is green and and afterwards red. The leaf is longer and narrower than the common bay-tree. The flowers are ſmall and white, and grow in large bunches at the extremity of the branches: they have an agreeable ſmell, ſomething like that of the lily of the valley. The fruit is ſhaped like an acorn, but is not ſo large.

Uſes. The leaves and berries of the common bay-tree have a moderately ſtrong aromatic ſmell, and a warm, bitteriſh, pungent taſte: the berries are ſtronger in both reſpects than the leaves, and afford in diſtillation a larger quantity of eſſential aromatic oil. The root of the ſaſſafras has a fragrant ſmell, and a ſweetiſh, aromatic, ſubacrid taſte; the bark taſtes much ſtronger than any other part; and the ſmall twigs ſtronger than the large pieces. It is a warm aperient and corroborant, and frequently employed with good ſucceſs for purifying and ſweetening the blood and juices. For theſe purpoſes, infuſions made from the raſped root or bark may be drank as tea.

The cinnamon is the under bark of the *laurus cinnamomum* above deſcribed. The beſt ſeaſon for ſeparating it from the outer-bark, which is grey and rugged, is the ſpring, when the ſap flows in the greateſt abundance. It is cut into thin ſlices, and expoſed to the ſun, and curls up in drying. The old trees produce a coarſe kind of cinnamon; the ſpice is in perfection only when the trees are not older than three or four years. When the trunk has been ſtripped of its bark, it receives no further nouriſhment; but the root is ſtill alive, and continues to throw out freſh ſhoots. The fruit of the tree is ſhaped like an acorn, but is not ſo large. It contains a ſeed from whence the tree may be raiſed, and is commonly ripe in September. When boiled in water, it yields an oil which ſwims at top, and takes fire. If left to cool, it hardens into a white ſubſtance, of which candles are made, which have an agreeable ſmell, and are reſerved for the uſe of the king of Ceylon. Cinnamon is a very elegant and uſeful aromatic, more grateful both to the palate and ſtomach than moſt other ſubſtances of this claſs. By its aſtringent quality it likewiſe corroborates the viſcera, and proves of great ſervice in ſeveral kinds of alvine fluxes, and immoderate diſcharges from the uterus.

THE NATURE OF LAWS IN GENERAL.

LAW, in its moſt general and comprehenſive ſenſe, ſignifies a rule of action; and is applied indiſcriminately to all kinds of action, whether animate or inanimate, rational or irrational. Thus we ſay, the laws of motion, of gravitation, of optics, or mechanics, as well as the laws of nature and of nations. And it is that rule of action, which is preſcribed by ſome ſuperior, and which the inferior is bound to obey.

Thus when the Supreme Being formed the univerſe, and created matter out of nothing, he impreſſed certain principles upon that matter, from which it can never depart, and without which it would ceaſe to be. When he put that matter into motion, he eſtabliſhed certain laws of motion, to which all moveable bodies muſt conform. And, to deſcend from the greateſt operations to the ſmalleſt, when a workman forms a clock, or other piece of mechaniſm, he eſtabliſhes at his own pleaſure certain arbitrary laws for its direction; as, that the hand ſhall deſcribe a given ſpace in a given time; to which law as long as the work conforms, ſo long it continues in perfection, and anſwers the end of its formation.

If we farther advance, from mere inactive matters to vegetable and animal life, we ſhall find them ſtill governed by laws; more numerous indeed, but equally fixed and invariable. The whole progreſs of plants, from the ſeed to the root, and from thence to the ſeed again; the method of animal nutrition, digeſtion, ſecretion, and all other branches of vital œconomy; are not left to chance, or the will of the creature itſelf, but are performed in a wondrous involuntary manner, and guided by unerring rules laid down by the great Creator. And conſequently, as man depends abſolutely upon his Maker for every thing, it is neceſſary that he ſhould in all points conform to his Maker's will.

Law of Nature. This will of his Maker is called the *law of nature.* For as God, when he created matter, and endued it with a principle of mobility, eſtabliſhed certain rules for the perpetual direction of that motion; ſo, when he created man, and endued him with free will to conduct himſelf in all parts of life, he laid down certain immutable laws of human nature, whereby that free will is in ſome degree regulated and reſtrained, and gave him alſo the faculty of reaſon to diſcover the purport of thoſe laws.

Conſidering the Creator only as a being of infinite power, he was able unqueſtionably to have preſcribed whatever laws he pleaſed to his creature, man, however unjuſt or ſevere. But as he is alſo a Being of infinite wiſdom, he has laid down only ſuch laws as were founded in thoſe relations of juſtice that exiſted in the nature of things antecedent to any poſitive precept. Theſe are the eternal, immutable laws of good and evil, to which the Creator himſelf in all his diſpenſations conforms; and which he has enabled human reaſon to diſcover, ſo far as they are neceſſary for the conduct of human actions. Such, among others, are theſe principles: that we ſhould live honeſtly, ſhould hurt nobody, and ſhould render to every one his due; to which three general precepts Juſtinian has reduced the whole doctrine of law.

But if the diſcovery of theſe firſt principles of the law of nature depended only upon the due exertion of right reaſon, and could not otherwiſe be obtained than by a chain of metaphyſical diſquiſitions, mankind would have wanted ſome inducement to have quickened their inquiries, and the greater part of the world would have reſted content in mental indolence, and ignorance its inſeparable companion. As therefore the Creator is a being, not only of infinite power and wiſdom, but alſo of infinite goodneſs, he has been pleaſed ſo to contrive the conſtitution and frame of humanity, that we ſhould want no other prompter to inquire after and purſue the rule of right, but only our own ſelf-love, that univerſal principle of action. For he has ſo intimately connected, ſo inſeparably interwoven, the laws of eternal juſtice with the happineſs of each individual, that the latter cannot be attained but by obſerving the former; and, if the former be punctually obeyed, it cannot but induce the latter. In conſequence of which mutual connection of juſtice and human felicity, he has not perplexed the law of nature with a multitude of abſtracted rules and precepts, referring merely to the fitneſs or unfitneſs of things, as ſome have vainly ſurmiſed; but has graciouſly reduced the rule of obedience to this one paternal precept, "that man ſhould purſue his own happineſs." This is the foundation of what we call *ethics*, or *natural law.*

The law of nature, being coeval with mankind, and dictated by God himſelf, is of courſe ſuperior in obligation to any other. It is binding over all the globe, in all countries, and at all times: no human laws are of any validity, if contrary to this; and ſuch of them as are valid derive all their force, and all their authority, mediately or immediately, from this original.

But in order to apply this to the particular exigencies of each individual, it is ſtill neceſſary to have recourſe to reaſon; whoſe office it is to diſcover, as was before obſerved, what the law of nature directs in every circumſtance of life; by conſidering, what method will tend the moſt effectually to our own ſubſtantial happineſs. And if our reaſon were always, as in our firſt anceſtor before his tranſgreſſion, clear and perfect, unruffled by paſſions, unclouded by prejudice, unimpaired by diſeaſe or intemperance, the taſk would be pleaſant and eaſy; we ſhould need no other guide but this. But every man now finds the contrary in his own experience; that his reaſon is corrupt, and his underſtanding full of ignorance and error.

This has given manifold occaſion for the benign interpoſition of Divine Providence; which, in compaſſion to the frailty, the imperfection, and the blindneſs of human reaſon, hath been pleaſed, at ſundry times and in divers manners, to diſcover and enforce its laws by an immediate and direct revelation.

Law of Revelation. The doctrines thus delivered, we call the *revealed* or *divine law*, and they are to be found only in the Holy Scriptures. Theſe precepts, when revealed, are found upon compariſon to be really a part of the original law of nature, as they tend in all their conſequences to man's felicity. But we are not from thence to conclude, that the knowledge of theſe truths was attainable by reaſon, in its preſent corrupted ſtate; ſince we find, that, until they were revealed, they were hid from the wiſdom of ages. As then the moral precepts of this law are indeed of the ſame original with thoſe of the law of nature, ſo their intrinſic obligation is of equal ſtrength and perpetuity. Yet undoubtedly the revealed law is of infinitely more authenticity than that moral ſyſtem which is framed by ethical writers, and denominated the *natural law:* becauſe one is the law of nature, expreſsly declared ſo to be by God himſelf; the other is only what, by the aſſiſtance of human reaſon, we imagine to be that law. If we could be as certain of the latter as we are of the former, both would have an equal authority: but, till then, they can never be put in any competition together.

Upon theſe two foundations, the law of nature and the law of revelation, depend all human laws; that is to ſay, no human laws ſhould be ſuffered to contradict theſe. There are, it is true, a great number of indifferent points, in which both the divine law and the natural, leave a man at his own liberty; but which are found neceſſary, for the benefit of ſociety, to be reſtrained within certain limits. And herein it is that human laws have their greateſt force and efficacy: for, with regard to ſuch points as are not indifferent, human laws are only declaratory of, and act in ſubordination to, the former. To inſtance in the caſe of murder: this is expreſsly forbidden by the divine, and demonſtrably by the natural law; and from theſe prohibitions ariſes the true unlawfulneſs of this crime. Thoſe human laws, that annex a puniſhment to it, do not at all increaſe its moral guilt, or ſuperadd any freſh obligation in *foro conſcientiæ* to abſtain from its perpetration. Nay, if any human law ſhould allow or enjoin us to commit it, we are bound to tranſgreſs that human law, or elſe we muſt offend both the natural and the divine. But with regard to matters that are in themſelves indifferent, and are not commanded or forbidden by thoſe ſuperior laws; ſuch, for inſtance, as exporting of wool into foreign countries; here the inferior legiſlature has ſcope and opportunity to interpoſe, and to make that action unlawful which before was not ſo.

If man were to live in a ſtate of nature, unconnected with other dividuals, there would be no occaſion for any other laws than the law of nature and the law of God. Neither could any other law poſſibly exiſt: for a law always ſuppoſes ſome ſuperior who is to make it; and in a ſtate of nature we are all equal, without any other ſuperior but him who is the Author of our being. But man was formed for ſociety; and, as is demonſtrated by the writers on this ſubject, is neither capable of living alone, nor indeed has the courage to do it. However, as it is impoſſible for the whole race of mankind to be united in one great ſociety, they muſt neceſſarily divide into many; and form ſeparate ſtates, commonwealths, and nations, entirely independent of each other, and yet liable to a mutual intercourſe.

Law of Nations. Hence ariſes a third kind of law to regulate this mutual intercourſe, called *the law of nations:* which, as none of theſe ſtates will acknowledge a ſuperiority in the other, cannot be dictated by either; but depends entirely upon the rules of natural law, or upon mutual compacts, treaties, leagues, and agreements, between theſe ſeveral communities: in the conſtruction alſo of which compacts we have no other rule to reſort to, but the law of nature; being the only one to which both communities are equally ſubject: and therefore the civil law very juſtly obſerves that *quod naturalis ratio inter omnes homines conſtituit, vocatur jus gentium.*

Municipal or Civil Law. To the conſideration, then of the law of nature, the revealed law, and the law of nations, ſucceeds that of the municipal or civil law; that is, the rule by which particular diſtricts, communities, or nations are governed; being thus defined by Juſtinian, "*jus civile eſt quod quiſque ſibi populus conſtituit.*" We call it *municipal* law, in compliance with common ſpeech; for though, ſtrictly, that expreſſion denotes the particular cuſtoms of one ſingle *municipium* or free town, yet it may with ſufficient propriety be applied to any one ſtate or nation which is governed by the ſame laws and cuſtoms.

Municipal law is "a rule of civil conduct preſcribed *by the Supreme Power in a ſtate.*" For legiſlature, as was before obſerved, is the greateſt act of ſuperiority that can be exerciſed by one being over another. Wherefore it is requiſite to the very eſſence of a law, that it be made by the ſupreme power. Sovereignty and legiſlature are indeed convertible terms; one cannot ſubſiſt without the other. This will naturally lead us into a ſhort inquiry concerning the nature of ſociety and civil government; and the natural inherent right that belongs to the ſovereignty of a ſtate, wherever that ſovereignty be lodged, of making and enforcing laws.

Civil Society. The only true and natural foundations of ſociety are the wants and fears of individuals. Not that we can believe, with ſome theoretical writers, that there ever was a time when there was no ſuch thing as ſociety; and that, from the impulſe of reaſon, and through a ſenſe of their wants and weakneſſes, individuals met together in a large plain, entered into an original contract, and choſe the talleſt man preſent to be their governor. This notion, of an actually exiſting unconnected ſtate of nature, is too wild to be ſeriouſly admitted: and beſides, it is plainly contradictory to the revealed accounts of the primitive origin of mankind, and their preſervation 2000 years afterwards; both which were effected by the means of ſingle families. Theſe formed the firſt ſociety, among themſelves; which every day extended its limits; and when it grew too large to ſubſiſt with convenience in that paſtoral ſtate wherein the patriarchs appear to have lived, it neceſſarily ſubdivided itſelf by various migrations into more. Afterwards, as agriculture increaſed, which employs and can maintain a much greater number of hands, migrations became leſs frequent: and various tribes, which had formerly ſeparated, reunited again; ſometimes by compulſion and conqueſt, ſometimes by accident, and ſometimes perhaps by compact. But though ſociety had not its formal beginning from any convention of individuals, actuated by their wants and their fears; yet it is the ſenſe of their weakneſs and imperfection that keeps mankind together; that demonſtrates the neceſſity of this union; and that therefore is the ſolid and natural foundation, as well as the cement, of ſociety. And this is what we mean by the original contract of ſociety; which, though perhaps in no inſtance it has ever been formerly expreſſed at the firſt inſtitution of a ſtate, yet in nature and reaſon muſt always be underſtood and implied in the very act of aſſociating together: namely, that the whole ſhould protect all its parts, and that every part ſhould pay obedience to the will of the whole; or, in other words, that the community ſhould guard the rights of each individual member, and that (in return for this protection) each individual ſhould ſubmit to the laws of the community; without which ſubmiſſion of all, it was impoſſible that protection could be certainly extended to any.

Government. For when ſociety is once formed, government reſults of courſe, as neceſſary to preſerve and to keep that ſociety in order. Unleſs ſome ſuperior be conſtituted, whoſe commands and deciſions all the members are bound to obey, they would ſtill remain as in a ſtate of nature, without any judge upon earth to define their ſeveral rights, and redreſs their ſeveral wrongs. But, as all the members of ſociety are naturally equal, it may be aſked, In whoſe hands are the reins of government to be entruſted? To this the general anſwer is eaſy; but the application of it to particular caſes has occaſioned one half of thoſe miſchiefs which are apt to proceed from miſguided political zeal. In general, all mankind will agree, that government ſhould be repoſed in ſuch perſons, in whom thoſe qualities are moſt likely to be found, the perfection of which is among the attributes of him who is emphatically ſtyled the *Supreme Being*; the three grand requiſites, namely, of wiſdom, of goodneſs, and of power: wiſdom, to diſcern the real intereſt of the community; goodneſs, to endeavour always to purſue that real intereſt; and ſtrength, or power, to carry this knowledge and intention into action. Theſe are the natural foundations of ſovereignty, and theſe are the requiſites that ought to be found in every well conſtituted frame of government.

Different Forms thereof. The political writers of antiquity will not allow more than three regular forms of government: the firſt, when the ſovereign power is lodged in an aggregate aſſembly conſiſting of all the members of a community, which is called a *democracy*; the ſecond, when it is lodged in a council compoſed of ſelect members; and then it is ſtyled an *ariſtocracy*; the laſt, when it is entruſted in the hands of a ſingle perſon, and then it takes the name of a *monarchy*. All other ſpecies of government, they ſay, are either corruptions of, or reducible to, theſe three.

By the ſovereign power, as was before obſerved, is meant the making of laws; for wherever that power reſides, all others muſt conform to and be directed by it, whatever appearance the outward form and adminiſtration of the government may put on. For it is at any time in the option of the legiſlature to alter that form and adminiſtration by a new edict or rule, and to put the execution of the laws into whatever hands it pleaſes: and all the other powers of the ſtate muſt obey the legiſlative power in the execution of their ſeveral functions, or elſe the conſtitution is at an end.

In a democracy, where the right of making laws reſides in the people at large, public virtue, or goodneſs of intention, is more likely to be found, than either of the other qualities of government. Popular aſſemblies are frequently fooliſh in their contrivance, and weak in their execution; but generally mean to do the thing that is right and juſt, and have always a degree of patriotiſm or public ſpirit.

In ariſtocracies there is more wiſdom to be found than in the other forms of government; being compoſed, or intended to be compoſed, of the moſt experienced citizens: but there is leſs honeſty than in a republic, and leſs ſtrength than in a monarchy. A monarchy is indeed the moſt powerful of any, all the ſinews of government being knit and united together in the hand of the prince; but then there is imminent danger of his employing that ſtrength to improvident or oppreſſive purpoſes.

Thus theſe three ſpecies of government have, all of them, their ſeveral perfections and imperfections. Democracies are uſually the beſt calculated to direct the end of a law; ariſtocracies, to invent the means by which that end ſhall be obtained; and monarchies, to carry thoſe means into execution. And the ancients, as was obſerved, had in general no idea of any other permanent form of government but theſe three: for though Cicero declares himſelf of opinion, "*eſſe optime conſtitutam rempublicam, quæ ex tribus generibus illis, regali, optimo, et populari, ſit modice confuſa*;" yet Tacitus treats this notion of a mixed government, formed out of them all, and partaking of the advantages of each, as a viſionary whim, and one that, if effected, could never be laſting or ſecure.

Britiſh Conſtitution. But, happily for us of this iſland, the Britiſh conſtitution has long remained, and we truſt will long continue, a ſtanding exception to the truth of this obſervation. For, as with us the executive power of the laws is lodged in a ſingle perſon, they have all the advantages of ſtrength and diſpatch that are to be found in the moſt abſolute monarchy: and, as the legiſlature of the kingdom is entruſted to three diſtinct powers, entirely independent of each other; firſt, the king; ſecondly, the lords ſpiritual and temporal, which is an ariſtocratical aſſembly of perſons ſelected for their piety, their birth, their wiſdom, their valour, or their property; and thirdly, the houſe of commons, freely choſen by the people from among themſelves, which makes it a kind of democracy; as this aggregate body, actuated by different ſprings and attentive to different intereſts, compoſes the Britiſh parliament, and has the ſupreme diſpoſal of every thing, there can no inconvenience be attempted by either of the three branches, but will be withſtood by one of the other two, each branch being armed with a negative power ſufficient to repel any innovation which it ſhall think expedient or dangerous. Here, then, is lodged the ſovereignty of the Britiſh conſtitution; and lodged as beneficially as is poſſible for ſociety. For in no other ſhape could we be ſo certain of finding the three great qualities of government ſo well and ſo happily united.

If the ſupreme power were lodged in any of the three branches ſeparately, we muſt be expoſed to the inconveniences of either abſolute monarchy, ariſtocracy, or democracy; and ſo want two of the three principal ingredients of good polity, either virtue, wiſdom, or power. If it were lodged in any two of the branches; for inſtance, in the king and houſe of lords; our laws might be providently made and well executed, but they might not always have the good of the people in view: if lodged in the king and commons, we ſhould want that circumſpection and mediatory caution, which the wiſdom of the peers is to afford: if the ſupreme rights of legiſlature were lodged in the two houſes only, and the king had no negative upon their proceedings, they might be tempted to encroach upon the royal prerogative, or perhaps to aboliſh the kingly office, and thereby weaken (if not totally deſtroy) the ſtrength of the executive power. But the conſtitutional government of this iſland is ſo admirably tempered and compounded, that nothing can endanger or hurt it, but deſtroying the equilibrium of power between one branch of the legiſlature and the reſt. For if ever it ſhould happen, that the independence of any one of the three ſhould be loſt, or that it ſhould become ſubſervient to the views of either of the other two, there would ſoon be an end of our conſtitution. The legiſlature would be changed from that which was originally ſet up by the general conſent and fundamental act of the ſociety; and ſuch a change, however effected, is, according to Mr. Locke, (who perhaps carries his theory too far), at once an entire diſſolution of the bands of government; and the people are thereby reduced to a ſtate of anarchy, with liberty to conſtitute to themſelves a new legiſlative power.

Having thus curſorily conſidered the three uſual ſpecies of government, and our own ſingular conſtitution ſelected and compounded from them all; we proceed to obſerve, that, as the power of making laws conſtitutes the ſupreme authority, ſo wherever the ſupreme authority in any ſtate reſides, it is the right of that authority to make laws; that is, in the words of our definition, *to preſcribe the rule of civil action*. And this may be diſcovered from the very end and inſtitution of civil ſtates. For a ſtate is a collective body, compoſed of a multitude of individuals, united for their ſafety and convenience, and intending to act together as one man. If it therefore is to act as one man, it ought to act by one uniform will. But, inaſmuch as political communities are made up of many natural perſons, each of whom has his particular will and inclination, theſe ſeveral wills cannot by any natural union be joined together, or tempered and diſpoſed into a laſting harmony, ſo as to conſtitute and produce that one uniform will of the whole. It can therefore be no otherwiſe produced than by a political union; by the conſent of all perſons to ſubmit their own private wills to the will of one man, or of one or more aſſemblies of men, to whom the ſupreme authority is entruſted; and this will of that one man, or aſſemblage of men, is in different ſtates, according to their different conſtitutions, underſtood to be law.

Second Branch of the Definition, illuſtrated. From what has been advanced, the truth of the former branch of our definition is (we truſt) ſufficiently evident; that "municipal law is a rule of civil conduct, preſcribed *by the ſupreme power in a ſtate*." We proceed now to the latter branch of it; that it is a rule ſo preſcribed, "commanding what is right, and prohibiting what is wrong." Now, in order to do this completely, it is firſt of all neceſſary that the boundaries of right and wrong be eſtabliſhed and aſcertained by law. And when this is once done, it will follow of courſe, that it is likewiſe the buſineſs of the law, conſidered as a rule of civil conduct, to enforce theſe rights, and to reſtrain or redreſs theſe wrongs. It remains therefore only to conſider, in what manner the law is ſaid to aſcertain the boundaries of right and wrong; and the methods which it takes to command the one and prohibit the other. For this purpoſe, every law may be ſaid to conſiſt of ſeveral parts; one, declaratory; whereby the rights to be obſerved, and the wrongs to be eſchewed, are clearly defined and laid down; another, directory; whereby the ſubject is inſtructed and enjoined to obſerve thoſe rights, and to abſtain from the commiſſion of thoſe wrongs; a third, remedial; whereby a method is pointed out to recover a man's private rights, or redreſs his private wrongs; to which may be added a fourth, uſually termed the *ſanction*, or *vindicatory* branch, of the law; whereby it is ſignified what evil or penalty ſhall be incurred by ſuch as commit any public wrongs, and tranſgreſs or neglect their duty.

Of the Interpretation of Laws. When any doubt aroſe upon the conſtruction of the Roman laws, the uſage was to ſtate the caſe to the emperor in writing, and take his opinion upon it. This was certainly a bad method of interpretation. To interrogate the legiſlature to decide particular diſputes, is not only endleſs, but affords great room for partiality and oppreſſion. The anſwers of the emperor were called his reſcripts, and theſe had in ſucceeding caſes the force of perpetual laws; though they ought to be carefully diſtinguiſhed, by every rational civilian. In like manner the canon laws, or decretal epiſtles of the popes, are all of them reſcripts in the ſtricteſt ſenſe. Contrary to all true forms of reaſoning, they argue from particulars to generals. The faireſt and moſt rational method to interpret the will of the legiſlator, is by exploring his intentions at the time when the law was made, by ſigns the moſt natural and probable. And theſe ſigns are either the words, the context, the ſubject-matter, the effects and conſequence, or the ſpirit and reaſon of the law.

Equity. From this method of interpreting laws by the reaſon of them, ariſes what we call *equity:* which is thus defined by Grotius, "the correction of that, wherein the law (by reaſon of its univerſality) is deficient." For ſince in laws all caſes cannot be foreſeen or expreſſed, it is neceſſary, that, when the general decrees of the law come to be applied to particular caſes, there ſhould be ſomewhere a power veſted of defining thoſe circumſtances, which (had they been foreſeen) the legiſlator himſelf would have expreſſed. And theſe are the caſes which according to Grotius, "*lex non exacte definit, ſed arbitrio boni viri permittit.*"

Equity thus depending, eſſentially, upon the particular circumſtances of each individual caſe, there can be no eſtabliſhed rules and fixed precepts of equity laid down, without deſtroying its very eſſence, and reducing it to a poſitive law. And, on the other hand, the liberty of conſidering all caſes is an equitable light, muſt not be indulged too far; leſt thereby we deſtroy all law, and leave the deciſion of every queſtion entirely in the breaſt of the judge. And law, without equity, though hard and diſagreeable, is much more deſirable for the public good, than equity without law; which would make every judge a legiſlator, and introduce moſt infinite confuſion; as there would then be almoſt as many different rules of action laid down in our courts, as there are differences of capacity and ſentiment in the human mind. But this large diviſion of laws may be reduced to the common diviſion; and all is founded on the law of nature or reaſon and the revealed law of God, as all other laws ought to be.

THE LAW OF ENGLAND.

The municipal law of England, or the rule of civil conduct preſcribed to the inhabitants of that kingdom, may with ſufficient propriety be divided into two kinds: the *lex non ſcripta*, the unwritten or common law; and the *lex ſcripta*, the written or ſtatute law.

Common Law. The *lex non ſcripta*, or unwritten law, includes not only general cuſtoms, or the common law properly ſo called; but alſo the particular cuſtoms of certain parts of the kingdom, and likewiſe thoſe particular laws that are by cuſtom obſerved only in certain courts and juriſdictions. In calling theſe parts of the law *leges non ſcriptæ*, we would not be underſtood as if all thoſe laws were at preſent merely oral, or communicated from the former ages to the preſent ſolely by word of mouth. It is true indeed, that, in the profound ignorance of letters which formerly overſpread the whole weſtern world, all laws were entirely traditional; for this plain reaſon, that the nations among which they prevailed had but little idea of writing. Thus the Britiſh as well as the Gallic druids committed all their laws as well as learning to memory; and it is ſaid of the primitive Saxons here, as well as their brethren on the continent, that *leges ſola memoria et uſu retinebant*. But, with us at preſent, the monuments and evidences of our legal cuſtoms are contained in the records of the ſeveral courts of juſtice, in books of reports and judicial deciſions, and in the treatiſes of learned ſages of the profeſſion, preſerved and handed down to us from the times of higheſt antiquity. However, we therefore ſtyle theſe parts of our law *leges non ſcriptæ*, becauſe their original inſtitution and authority are not ſet down in writing, as acts of parliament are; but they receive their binding power, and force of laws, by long and immemorial uſage, and by their univerſal reception throughout the kingdom: in like manner as Aulus Gellius defines the *jus non ſcriptum* to be that, which is *tacito et illiterato hominum conſenſu et moribus expreſſum*. Our ancient lawyers, and particularly Forteſcue, inſiſt with abundance of warmth, that theſe cuſtoms are as old as the primitive Britons, and continued down through the ſeveral mutations of government and inhabitants, to the preſent time, unchanged and unadulterated. This may be the caſe as to ſome. But in general, as Mr. Selden in his notes obſerves, this aſſertion muſt be underſtood with many grains of allowance; and ought only to ſignify, as the truth ſeems to be, that there never was any formal exchange of one ſyſtem of laws for another; though doubtleſs, by the intermixture of adventitious nations, the Romans, the Picts, the Saxons, the Danes, and the Normans, they muſt have inſenſibly introduced and incorporated many of their own cuſtoms with thoſe that were before eſtabliſhed; thereby, in all probability, improving the texture and wiſdom of the whole, by the accumulated wiſdom of divers particular countries. Our laws, ſaith lord Bacon, are mixed as our language; and as our language is ſo much the richer, the laws are the more complete.

And indeed our antiquarians and firſt hiſtorians do all poſitively aſſure us, that our body of laws is of this compounded nature. For they tell us, that in the time of Alfred the local cuſtoms of the ſeveral provinces of the kingdom were grown ſo various, that he found it expedient to compile his dome-book, or *liber judicialis*, for the general uſe of the whole kingdom. This book is ſaid to have been extant ſo late as the reign of Edward the fourth, but is now unfortunately loſt. It contained, we may probably ſuppoſe, the principal maxims of the common law, the penalties for miſdemeanours, and the forms of judicial proceedings. Thus much may at leaſt be collected from that injunction to obſerve it, which we find in the laws of king Edward the elder, the ſon of Alfred. *Omnibus qui republicæ præſunt etiam atque etiam mando, ut omnibus æquos ſe præbeant judices, perinde ac in judiciali libro ſcriptum habetur: nec quiquam formident quin jus commune audacter libereque dicant.*

But the irruption and eſtabliſhment of the Danes in England, which followed ſoon after, introduced new cuſtoms, and cauſed this code of Alfred in many provinces to fall into diſuſe, or at leaſt to be mixed and debaſed with other laws of a coarſer alloy. So that, about the beginning of the 11th century, there were three principal ſyſtems of laws prevailing in different diſtricts. 1. The ***Mercen-Lage***, or Mercian laws, which were obſerved in many of the inland counties, and thoſe bordering on the principality of Wales, the retreat of the ancient Britons; and therefore very probably intermixed with the Britiſh or Druidical cuſtoms. 2. The ***Weſt Saxon-Lage***, or laws of the Weſt Saxons, which obtained in the counties to the ſouth and weſt of the iſland, from Kent to Devonſhire. Theſe were probably much the ſame with the laws of Alfred above-mentioned, being the municipal law of the far moſt conſiderable part of his dominions, and particularly including Berkſhire, the ſeat of his peculiar reſidence. 3. The ***Dane-Lage***, or Daniſh law, the very name of which ſpeaks its original and compoſition. This was principally maintained in the reſt of the midland counties, and alſo on the eaſtern coaſt, the part moſt expoſed to the viſits of that piratical people. As for the very northern provinces, they were at that time under a diſtinct government. Out of theſe three laws, Roger Hoveden and Ranulphus Ceſtrenſis informs us, king Edward the confeſſor extracted one uniform law, or digeſt of laws, to be obſerved throughout the whole kingdom; though Hoveden and the author of an old manuſcript chronicle aſſure us likewiſe, that this work was projected and begun by his grandfather king Edgar.

Both theſe undertakings, of king Edgar and Edward the confeſſor, ſeem to have been no more than a new edition, or freſh promulgation, of Alfred's code or dome-book, with ſuch additions and improvements as the experience of a century and a half had ſuggeſted. For Alfred is generally ſtyled by the ſame hiſtorians the *legum Anglicanarum conditor*, as Edward the confeſſor is the *reſtitutor*. Theſe, however, are the laws which our hiſtories ſo often mention under the name of the *laws of Edward the Confeſſor*; which our anceſtors ſtruggled ſo hardly to maintain, under the firſt princes of the Norman line; and which ſubſequent princes ſo frequently promiſed to keep and to reſtore, as the moſt popular act they could do, when preſſed by foreign emergencies or domeſtic diſcontents. Theſe, in ſhort, are the laws which gave riſe and original to that collection of maxims and cuſtoms which is now known by the name of the *common law*. A name either given to it, in contradiſtinction to other laws, as the ſtatute law, the civil law, the law merchant, and the like; or, more probably, as a law common to all the realm, the *jus commune* or *folcright* mentioned by king Edward the elder, after the abolition of the ſeveral provincial cuſtoms and particular laws before-mentioned. This unwritten, or common law, is properly diſtinguiſhable into three kinds: 1. General cuſtoms; which are the univerſal rule of the whole kingdom, and form the common law in its ſtricter and more uſual ſignification. 2. Particular cuſtoms; which for the moſt part affect only the inhabitants of particular diſtricts. 3. Certain particular laws; which by cuſtom are adopted and uſed by ſome particular courts, of pretty general and extenſive juriſdiction.

Firſt Branch of the unwritten Law: General Cuſtoms. 1. As to general cuſtoms, or the common law properly ſo called; this is that law, by which proceedings and determinations in the king's ordinary courts of juſtice are guided and directed. This, for the moſt part, ſettles the courſe in which lands deſcend by inheritance; the manner and form of acquiring and transferring property; the ſolemnities and obligation of contracts; the rules of expounding wills, deeds, and acts of parliament; the reſpective remedies of civil injuries; the ſeveral ſpecies of temporal offences, with the manner and degree of puniſhment; and an infinite number of minuter particulars, which diffuſe themſelves as extenſively as the ordinary diſtribution of common juſtice requires.

Second Branch of the unwritten Laws: Particular Cuſtoms. The ſecond branch of the unwritten laws of England are particular cuſtoms, or laws which affect only the inhabitants of particular diſtricts. Theſe particular cuſtoms, or ſome of them, are without doubt the remains of that multitude of local cuſtoms before-mentioned, out of which the common law, as it now ſtands, was collected at firſt by king Alfred, and afterwards by king Edgar and Edward the confeſſor: each diſtrict mutually ſacrificing ſome of its own ſpecial uſages, in order that the whole kingdom might enjoy the benefit of one uniform and univerſal ſyſtem of laws. But, for reaſons that have been now long forgotten, particular counties, cities, towns, manors, and lordſhips, were very early indulged with the privilege of abiding by their own cuſtoms, in contradiſtinction to the reſt of the nation at large; which privilege is confirmed to them by ſeveral acts of parliament.

Third Branch of the unwritten Laws. The third branch of them are thoſe peculiar laws which by cuſtom are adopted and uſed only in certain peculiar courts and juriſdictions. And by theſe are underſtood the civil and canon laws.

Civil Law. By the civil law, abſolutely taken, is generally underſtood the civil or municipal law of the Roman empire, as compriſed in the inſtitutes, the code, and the digeſt of the emperor Juſtinian, and the novel conſtitutions of himſelf and ſome of his ſucceſſors. Juſtinian commanded only the eaſtern remains of the empire; and it was under his auſpices, that the preſent body of civil law was compiled and finiſhed by Tribonian and other lawyers, about the year 533. This conſiſts of, 1. The inſtitutes; which contain the elements or firſt principles of the Roman law, in four books. 2. The digeſts or pandects, in 50 books; containing the opinions and writings of eminent lawyers, digeſted in a ſyſtematical method. 3. A new code, or collection of imperial conſtitutions; the lapſe of a whole century having rendered the former code of Theodoſius imperfect. 4. The novels, or new conſtitutions, poſterior in time to the other books, and amounting to a ſupplement to the code; containing new decrees of ſucceſſive emperors, as new queſtions happened to ariſe. Theſe form the body of Roman law, or *corpus juris civilis*, as publiſhed about the time of Juſtinian: which, however, fell ſoon into neglect and oblivion, till about the year 1130, when a copy of the digeſts was found at Amalfi in Italy: which accident, concurring with the policy of the Roman eccleſiaſtics, ſuddenly gave new vogue and authority to the civil law, introduced it into ſeveral nations, and occaſioned that mighty inundation of voluminous comments, with which this ſyſtem of law, more than any other, is now loaded.

Canon Law. The canon law is a body of Roman eccleſiaſtical law, relative to ſuch matters as that church either has, or pretends to have, the proper juriſdiction over. This is compiled from the opinions of the ancient Latin fathers, the decrees of general councils, the decretal epiſtles and bulls of the holy ſee. Beſides theſe pontifical collections, which during the times of popery were received as authentic in this iſland, as well as in other parts of Chriſtendom, there is alſo a kind of national canon law, compoſed of legatine and provincial conſtitutions, and adapted only to the exigencies of this church and kingdom. At the dawn of the reformation, in the reign of king Henry VIII. it was enacted in parliament, that a review ſhould be had of the canon law; and till ſuch review ſhould be made, all canons, conſtitutions, ordinances and ſynodals provincial, being then already made, and not repugnant to the law of the land or the king's prerogative, ſhould ſtill be uſed and executed. And, as no ſuch review has yet been perfected, upon this ſtatute now depends the authority of the canon law in England. As for the canons enacted by the clergy under James I. in the year 1603, and never confirmed in parliament, it has been ſolely adjudged upon the principles of law and the conſtitution, that where they are not merely declaratory of the ancient canon law, but are introductory of new regulations, they do not bind the laity, whatever regard the clergy may think proper to pay them.

There are four ſpecies of courts, in which the civil and canon laws are permitted under different reſtrictions to be uſed. 1. The courts of the archbiſhops, and their derivative officers; uſually called *courts Chriſtian, (curiæ Chriſtianitatis)*, or the *eccleſiaſtical courts*. 2. The military courts. 3. The courts of admiralty. 4. The courts of the two univerſities. In all, their reception in general, and the different degrees of that reception, are grounded entirely upon cuſtom; corroborated in the latter inſtance by act of parliament, ratifying thoſe charters which confirm the cuſtomary law of the univerſities. The more minute conſideration of them will fall under their proper articles.

Let us next proceed to the *leges ſcriptæ*, the written laws of the kingdom; which are ſtatutes, acts, or edicts, made by the king's majeſty, by and with the advice of the lords ſpiritual and temporal and commons in parliament aſſembled.

The written Laws. The oldeſt of theſe now extant, and printed in our ſtatute books, is the famous *magna charta*, as confirmed in parliament 9 Hen. III. though doubtleſs there were many acts before that time, the records of which are now loſt, and the determinations of them perhaps at preſent currently received for the maxims of the old common law. The manner of making theſe ſtatutes being explained under the articles BILL and PARLIAMENT, we ſhall here only take notice of the different kinds of ſtatutes; and of ſome general rules with regard to their conſtruction.

Kinds of Statutes. Firſt, as to their ſeveral kinds. Statutes are either *general* or *ſpecial*, public or private. A general or public act is an univerſal rule that regards the whole community: and of this the courts of law are bound to take notice judicially and *ex officio*, without the ſtatute being particularly pleaded, or formally ſet forth, by the party who claims an advantage under it. Special or private acts are rather exceptions than rules, being thoſe which only operate upon particular perſons and private concerns; ſuch as the Romans entitled *ſenatus-decreta*, in contradiſtinction to the *ſenatus conſulta*, which regarded the whole community; and of theſe the judges are not bound to take notice, unleſs they be formally ſhewn and pleaded. Thus, to ſhew the diſtinction, the ſtatute 13 Eliz. c. 10. to prevent ſpiritual perſons from making leaſes for longer terms than 21 years or three lives, is a public act; it being a rule preſcribed to the whole body of ſpiritual perſons in the nation: but an act to enable the biſhop of Cheſter to make a leaſe to A. B. for 60 years, is an exception to this rule; it concerns only the parties and the biſhop's ſucceſſors, and is therefore a private act.

Statutes alſo are either *declaratory* of the common law, or *remedial* of ſome defects therein. Declaratory, where the old cuſtom of the kindom is almoſt fallen into diſuſe, or become diſputable; in which caſe the parliament has thought proper, *in perpetuum rei teſtimonium*, and for avoiding all doubts and difficulties, to declare what the common law is and ever hath been. Thus the ſtatute of treaſons, 25 Edw. III. cap. 2. doth not make any new ſpecies of treaſons; but only, for the benefit of the ſubject, declares and enumerates thoſe ſeveral kinds of offence which before were treaſon at the common law. Remedial ſtatutes are thoſe which are made to ſupply ſuch defects, and abridge ſuch ſuperfluities, in the common law, as ariſe either from the general imperfection of all human laws, from change of time and circumſtances, from the miſtakes and unadviſed determinations of unlearned judges, or from any other cauſe whatſoever. And this being done, either by enlarging the common law where it was too narrow and circumſcribed, or by reſtraining it where it was too lax and luxuriant, hath occaſioned another ſubordinate diviſion of remedial acts of parliament into *enlarging* and *reſtraining* ſtatutes. To inſtance again in the caſe of treaſon. Clipping the current coin of the kingdom was an offence not ſufficiently guarded againſt by the common law: therefore it was thought expedient by ſtatute 5 Eliz. c. 11. to make it high treaſon, which it was not at the common law: ſo that this was an *enlarging* ſtatute. At common law, alſo, ſpiritual corporations might leaſe out their eſtates for any term of years, till prevented by the ſtatute 13 Eliz. before-mentioned: this was therefore a *reſtraining* ſtatute.

Theſe are the ſeveral grounds of the laws of England: over and above which, equity is alſo frequently called in to aſſiſt, to moderate, and to explain them. What equity is, and how impoſſible in its very eſſence to be reduced to ſtated rules, hath been ſhewn above. It may be ſufficient, therefore, to add in this place, that (beſides the liberality of ſentiment with which our common-law judges interpret acts of parliament, and ſuch rules of the unwritten law as are not of a poſitive kind) there are alſo courts of equity eſtabliſhed for the benefit of the ſubject, to detect latent frauds and concealments, which the proceſs of the courts of law is not adapted to reach; to enforce the execution of ſuch matters of truſt and confidence, as are binding in conſcience, though not cognizable in a court of law; to deliver from ſuch dangers as are owing to misfortune or overſight; and to give a more ſpecific relief, and more adapted to the circumſtances of the caſe, than can always be obtained by the generality of the rules of the poſitive or common law. This is the buſineſs of the courts of equity, which however are only converſant in matters of property. For the freedom of our conſtitution will not permit, that in criminal caſes a power ſhould be lodged in any judge to conſtrue the law otherwiſe than according to the letter. This caution, while it admirably protects the public liberty, can never bear hard upon individuals. A man cannot ſuffer *more* puniſhment than the law aſſigns, but he may ſuffer *leſs*. The laws cannot be ſtrained by partiality to inflict a penalty beyond what the letter will warrant; but, in caſes where the letter induces any apparent hardſhip, the crown has the power to pardon.

LAW, *Spiritual*, is the eccleſiaſtical or canon law, allowed and authorized in this realm, ſo far as it is not againſt the common *law*, nor againſt the ſtatutes and cuſtoms of the kingdom. And according to ſuch eccleſiaſtical *laws*, the ordinary and other eccleſiaſtical judges proceed in caſes within their cognizance.

Game LAWS. See GAME.

LAWN, a ſpacious plain in a park or adjoining to a noble ſeat. Theſe ſpacious plains make a noble figure before grand houſes, and the great rule in regard to their dimenſions, is to make thoſe in large parks as large as the ground will admit, never leſs, if poſſible, than thirty or forty acres: but in gardens a *lawn* of eight or ten acres is ſufficient. *Lawns* ought always to lie open to the front of the houſe, and to be open to the neighbouring country, not pent up with trees; and the moſt happy ſituation is, when the beſt rooms of the houſe front the eaſt, or rather the ſouth-eaſt, and the *lawn* lies immediately before them; becauſe the ſun, in an afternoon, in this caſe, ſhines on the proſpect, and at the ſame time not into the rooms. The beſt ſituation for a *lawn*, except this, is on the ſouth ſide of a houſe; for if on the weſt, it expoſes the houſe to too much wind, and if on the north too much open to the cold. It is beſt therefore to plant trees and wilderneſſes on the weſt and north ſides of houſes.

As to the figure of a *lawn*, ſome recommend an exact ſquare, others an oblong ſquare, ſome an oval, and others a circular figure: but neither of theſe ſhould be invariably regarded; becauſe it ought to be contrived ſo as to ſuit the figure of the ground: and as there ſhould be trees planted for ſhade on the boundaries of the *lawns*, the ſide may be broken by irregular plantations of trees, ſome breaking forwarder than others, and not too cloſely clouded together, which make a better appearance than any regular plantations can do. When there are no good proſpects beyond the *lawn*, it will be proper to have it bounded on every ſide by plantations, which may be brought round pretty near to each end of the houſe, ſo that perſons may ſoon get into ſhade. For this purpoſe thoſe trees ſhould be preferred, which grow large, ſtraight and handſome. Of the deciduous trees, the moſt proper are the elm, oak, beech, and cheſnut; and if there are ſome clumps of ever-green trees intermixed with the others, they will add to the beauty of the whole, eſpecially in the winter-ſeaſon; the beſt ſorts for this purpoſe are lord Weymouth's pine, and the ſilver and ſpruce firs. See Syſtem of GARDENING, Part I. Art. II.

LAWYER, (*legiſta, legiſperitus, juriſconſultus*) by the Saxons called *lahman*, is a counſellor, or one learned in the law: and *lawyers*, ſuch as counſellors, attornies, &c. are within the act 3 Jac. I. againſt extortion; but it has been held only to extend to officers. See COUNSELLOR, ATTORNEY, &c.

LAY-*Brother*, among the Romaniſts, a pious, but illiterate perſon, who devotes himſelf, in ſome convent, to the ſervice of the religious. The *lay-brother* wears a habit different from that of the religious, nor ever enters into the choir, or the chapter. He is not in any orders, nor does he make any vow, excepting of conſtancy and obedience. Theſe *lay-brothers* make the three vows of religion. In the nunneries are alſo *lay-ſiſters*, who never enter the choir, &c. and who are only retained for the ſervice of the convent.

LAYER, in gardening, a young tender ſhoot or twig of a plant, not far from the ground, which is bent down, and ſeveral joints or knots buried under ground, till, having ſtruck root below, it is cut and ſeparated from the parent ſtock, and commences a new plant. See the Syſtem, Part II. *Fruit Garden*, month of *March*.

LAYMAN, a perſon not engaged in any order of eccleſiaſtics: accordingly, in the diſtribution of the people, *laity* is oppoſed to the clergy, and may be divided into three diſtinct ſtates, viz. the *civil*, the *military*, and the *maritime*.

LEAD, called by the chymiſts *ſaturn*, a coarſe, heavy, impure metal, of a pale and livid white colour, the ſofteſt, and moſt flexible, the leaſt ductile and tenacious, leaſt elaſtic, and leaſt ſonorous of all metals. Next to gold, platina and mercury, it is the heavieſt metal, being upwards of eleven times heavier than an equal bulk of water. See *Specific* GRAVITY.

Lead is ſo ſoft and flexible, that it is eaſily cut with a knife, ſhaved with a plane, grooved for windows, by being drawn through the glazier's vice, and flatted, by paſſing betwixt wooden rollers, into large thin ſheets. When broke by repeated bendings, each piece appears drawn out ſmooth to an edge, like the fracture of well nealed gold and ſilver.

In the trying *lead* by the teſt of the burning glaſs, a piece of that metal laid on a charcoal very readily melts, and afterwards wholly diſſipates itſelf in fumes; if it be placed on a piece of ſtone it fumes very much, and becomes at length a thin fluid reſembling oil, or melted reſin; and this liquor, in cooling, fixes itſelf into a ſort of glaſs, which has this peculiar quality, that it is always compoſed of plates, or ſcales, in the manner of talc; it is of a greeniſh or yellowiſh colour, with ſome reddiſh ſpots, and is very ſoft to the touch. If it be kept longer in the focus of the glaſs it ſpreads abroad upon the ſtone, and by degrees penetrates its ſubſtance and promotes its fuſion. If the common calx of *lead*, red-*lead*, or litharge, be uſed inſtead of plain *lead* in this experiment, the event is the ſame: the whole becomes a thin fluid matter, which in cooling affords a flaky glaſs, like talc. Memb. Acad. Paris, 1709. If this talcky glaſs of *lead* be expoſed to the ſame focus, laid on a piece of charcoal, it preſently melts, and re-aſſumes the form of *lead*; and if then taken away, and ſuffered to cool is no way different from common *lead*. If the calx of *lead*, or red-*lead*, or litharge, be in the ſame manner melted in the focus of the burning glaſs on a piece of charcoal, they in the ſame manner immediately re-aſſume the form of *lead*.

It appears from the whole, that there is in *lead* an oily inflammable matter, which is eaſily driven off either by the ſolar or by a common fire; that the baſis of *lead*, which appears alone, when this is driven off, is a ſcaly or talcky earth; and that this oily matter of *lead* is no way different from the oils of vegetables, ſince the oil of charcoal is able perfectly well to ſupply its place, and to reſtore this talcky earth to the form of *lead* again. See PHLOGISTON. *Lead* is found in various countries, but it abounds particularly in England. It is found, too, in ſeveral kinds of ſoils, and ſtones, ſome whereof, beſides contain gold, ſome ſilver, others tin, &c. It is melted in a furnace provided for that purpoſe, with a ſtrong coal-fire upon it; as it melts, it runs through a canal on one ſide; leaving the earth, ſtone, and ſcoria, with the aſhes of the coals. It is purified by ſkimming it before it be cold, and throwing ſuet and other fat bodies into it. The ores of ſilver, copper, and other metals, except tin and iron, have often a *lead* ore intermixed.

Dr. Morris relates that native *lead* is found intermixed with the *lead* ore of the mine in Monmouthſhire. Phil. Tranſ. vol. lxiii. and Linnæus ſays, that he has ſeen what externally appeared to be ſuch. This metal as in common uſe, always contains ſome ſilver, which is not in quantity enough to be worth the charges of ſeparating. The moſt common proportion is not more than two drams to a centner. *Lead* and all its products turn into glaſs by a ſtrong fire; and this glaſs, or in the place of it litharge melted with ſtones, and other vitrifiable ſubſtances, makes them run into glaſs with a much leſs fire than they otherwiſe would do; and if a large quantity of this glaſs or litharge be added, they become ſo far attenuated as to run through the ſides of the veſſels. *Lead* is a metal of much uſe: it eaſily melts, and mixes with gold, ſilver, and copper; but not being able to endure the violence of the fire which they undergo, it riſes to the ſurface, and carries with it all that was heterogeneous in them; ſo that neither gold nor ſilver are refined without *lead*. *Lead* is much uſed in varniſhes and painting with oil, both as a colour and as a dryer. It is alſo uſed in the preparations of *enamels* and of *porcelain* as a flux, and makes the baſis of the *glazing* of almoſt all pottery wares; and by means of *lead* the moſt perfect metals are refined and aſſayed. See REFINING.

LEAD, in medicine. This metal is celebrated by ſome chymical writers for its great medical virtues; but after all, it ſeems to be a metal which ought to be given internally with the greateſt caution, and to be rather calculated for outward application. Its ore is ſo poiſonous, that the ſteam, ariſing from the furnaces where it is worked, infects the graſs of all the neighbouring places. Its beſt preparation is *ſaccharum ſaturni*; which, though capable of doing great good in hæmorrhages, and ſome other caſes, is apt, however, to bring on colics of ſo violent a kind, that the remedy often proves worſe than the diſeaſe.

The poiſonous quality of this ore is ſuch, that the people who live in the countries where it is dug, and near the places where it is waſhed, can keep neither dog nor cat, nor any kind of fowl, but all die in a ſhort time: and it has been known that a little houſe, in which *lead ore* had been kept for ſome time, though afterwards made very clean, and bedded with fern, infected calves which were put into it, ſo that all died in a very ſhort time; and it is a too melancholy obſervation, that children often die ſtrangely and ſuddenly about theſe places. Philoſophical Collections, N° 2. p. 6. The internal uſe of *lead* is dangerous on account of the colics and palſies that are occaſioned by it. Culinary veſſels, lined with a mixture of tin and lead, which is the uſual tinning, are apt to communicate to acid foods pernicious qualities, and require to be uſed with great precaution. The ſame thing has been alſo ſaid of liquors kept in glazed ware, and of cyder made in veſſels, where *lead* is uſed, and of wines adulterated with litharge, &c.

LEAD *Duſt* is a preparation uſed by the potters; made by throwing charcoal duſt into melted *lead*, and ſtirring them a long time together: to ſeparate the coal again, they only waſh it in water, and dry it afreſh. Its uſe is, to give a varniſh and gloſs to their works.

Extract of LEAD, or *Saturn*, is prepared by ſimmering together as many pounds of the *litharge* of gold as quarts of vinegar, for an hour and a quarter, and often ſtirring them; then taking it from the fire, and as ſoon as it is cool enough, pouring the clear liquor into bottles to be kept for uſe. If this liquor be made into the common conſiſtence of an extract, it muſt boil yet longer after its ſeparation from the maſs, and will acquire a reddiſh colour. This is Goulard's extract and the baſis of all his preparations of *lead*. Aikin's Obſ. on the external Uſe of Preparations of *Lead*, &c. p. 2.

Black LEAD, is a kind of mineral of a black or rather of a deep ſhining blue colour, but ſoft and unctuous, inſomuch that it has been uſed, inſtead of oil or ſoap, to prevent the friction of machines, found chiefly in England, and appearing to be nothing elſe but a peculiar talcky earth. It is much uſed for pencils, or crayons for deſigning. Theſe pencils, however, are of different quality, on account of different ſorts of the mineral being fraudulently joined together in one pencil, the fore part being commonly pretty good, and the reſt of an inferior kind. To avoid theſe inconveniences, ſome take the finer pieces of *black lead* itſelf, which they ſaw into ſlips, and fix for uſe in port-crayons. Lewis's

Commerce of Arts, p. 328. The name ſeems given to this ſubſtance with ſome impropriety, the common *lead* being the true *black lead*, ſo called by way of contradiſtinction from tin, otherwiſe called *white lead*. Plott, in Phil. Tranſ. N° 240. p. 183. *Black lead* is otherwiſe commonly denominated *wad* or *wadt*, and *kellow*; by naturaliſts *nigrica fabrilis*, from its uſe in ſcoring; by analogy to the *rubrica fabrilis*, or ruddle, which has the ſame uſe. Woodw. Meth. Foſſ. cl. 5. p. 43.

It is found in divers parts of Germany, &c. but the better ſort is the produce of England alone, and that reſtrained to the mines near Keſwick in Cumberland; beſides which, Dr. Woodward aſſures us, there is none found worth any thing in any other country. Woodw. Nat. Hiſt. Eng. Foſſ. tom. i. p. 5.

LEAF, *folium*, in botany, a part of a plant ordinarily very thin and flat, growing in the ſpring, and uſually falling off in autumn. For a copious deſcription of this branch of the ſcience, See the Syſtem, Sect. IV. The *leaf* of a plant or tree is diſtinguiſhed from that of flowers: the firſt is called *folium* and the other *petalum*: in this article the term is uſed in the former ſenſe.

LEAGUE, a meaſure of length, containing more or fewer geometrical paces, according to the different uſages and cuſtoms of countries. A league at ſea, where it is chiefly uſed by us, being a land meaſure moſtly peculiar to the French and Germans, contains 3000 geometrical paces, or three Engliſh miles. The French league ſometimes contains the ſame meaſure, and in ſome parts of France it conſiſts of 3500 paces: the mean or common league conſiſts of 2400 paces, and the little league of 2000. The Spaniſh leagues are larger than the French, 17 Spaniſh leagues making a degree, or 20 French leagues, or 69½ Engliſh ſtatute-miles. The Dutch and German leagues contain each four geographical miles. The Perſian leagues are pretty near of the ſame extent with the Spaniſh; that is, they are equal to four Italian miles: which is pretty near to what Herodotus calls the length of the Perſian paraſang, which contained 30 ſtadia, eight whereof, according to Strabo, make a mile.

League alſo denotes an alliance or confederacy between princes and ſtates for their mutual aid, either in attacking ſome common enemy, or in defending themſelves.

LEAP-YEAR, the ſame with *biſſextile*. See Bissextile.

LEASE and Release, a ſpecies of conveyance uſed in the Engliſh law, firſt invented by ſerjeant Moore, ſoon after the ſtatute of uſes, and now the moſt common of any, and therefore not to be ſhaken; though very great lawyers, (as particularly Mr. Noy,) have formerly doubted its validity. It is thus contrived. A leaſe, or rather bargain and ſale, upon ſome pecuniary conſideration, for one year, is made by the tenant of the freehold to the leſſee or bargainee. Now this, without any enrollment, makes the bargainor ſtand ſeized to the uſe of the bargainee, and veſts in the bargainee the *uſe* of the term for a year; and then the ſtatute immediately annexes the *poſſeſſion*. He therefore, being thus in poſſeſſion, is capable of receiving a releaſe of the freehold and reverſion, which muſt be made to a tenant in poſſeſſion: and accordingly, the next day, a releaſe is granted to him. This is held to ſupply the place of livery of ſeiſin; and ſo a conveyance by leaſe and releaſe is ſaid to amount to a feoffment.

LEASH, among ſportſmen, denotes three creatures of any kind; but chiefly greyhounds, foxes, bucks, and hares.

LEATHER, in commerce, the ſkins of ſeveral ſorts of beaſts dreſſed and prepared for the uſe of various manufacturers, whoſe buſineſs is to make them up, according to their different employments. The butcher diſpoſes of them raw or ſalted to the tanner and tawyer; they to the ſhamoy, morocco, and other kind of *leather*-dreſſers, who prepare them according to their reſpective arts, in order to vent them among the curriers and *leather*-cutters, glovers, harneſs-makers, coach-makers, ſaddlers, breeches-makers, gilt-*leather*-makers, chair-makers, ſhoe-makers, book-binders, and all in any way concerned in the article of *leather*. *Leather* has divers names according to the ſtate wherein it is, and according to the different kinds of ſkins whereof it is prepared, and its peculiar qualities when ſo prepared. 1. The ſkin is raw as it comes off the animal. 2. Some are ſalted with ſea-ſalt and alum, or with natron, which is a ſpecies of ſalt-petre, or white ſalt-wort, to prevent corruption in keeping, or ſending to diſtant tanneries during hot ſeaſons.

The art of dreſſing *leather* in oil conſiſts in firſt ſoaking the ſkins; then throwing them into the lime-pit; and when they are taken hence, pulling them and delivering them to the friezer: they are then ſtruck with the oil and ſent to the mill; when they are milled ſufficiently, they are thrown into the ditch to be ſcoured, and by ſome ſcudded, and afterwards hung upon the hooks to dry. When they have been weighed and marked by the proper officers, in order to fix the exciſe duty, they are fit for ſale. The ſorts of ſkins dreſſed in oil are thoſe of deer, ſheep, and lambs, and ſome few of goat, and the oil uſed for this purpoſe is Newfoundland or cod's liver oil. The alum *leather*-dreſſers art conſiſts in properly ſoaking, liming, wringing, (an operation ſometimes omitted), and ſtriking them in a liquor compoſed of water, ſalt, and alum, and then drying them properly. The ſorts of ſkins dreſſed in alum are thoſe of ſheep and lambs, and a large quantity of kid. Poſtleth. Dict. Com. art. *Leather*. For the methods of currying and tanning leather, ſee Currying and Tanning.

LECTURERS, in England, are an order of preachers in pariſh churches, diſtinct from the rector, vicar, and curate. They are choſen by the veſtry, or chief inhabitants of the pariſh, ſupported by voluntary ſubſcriptions and legacies, and are uſually the afternoon preachers in the Sunday ſervice. The term is alſo more generally applied to thoſe who preach on Sunday, or on any ſtated day of the week, in churches, or other places of public worſhip. Where there are lectures founded by the donations of pious perſons, the *lecturers* are appointed by the founders, without any interpoſition or conſent of rectors of churches, &c. though with the leave and approbation of the biſhop; ſuch as that of lady Moyer's at St. Paul's. But the *lecturer* is not entitled to the pulpit, without the conſent of the rector or vicar, who is poſſeſſed of the freehold of the church.

LEDGER. See Book-keeping, Sect. IV.

LEECH, *hirudo*, in vermeology, an oblong animal, deſtitute of feet, and of a black colour, with various ſpots and lines, and a mouth with three diſtinct openings. This, in the Linnæan ſyſtem, is a genus of the inteſtine worms, comprehending nine different ſpecies. It moves by dilating the head and tail, and raiſing the body into an arched form. The *leech* is a well known inſect, common in waters, and uſed to draw blood in medicine. The common ſtanding waters afford us two ſpecies of this inſect; a larger, called the *horſe-leach*, and a ſmaller, diſtinguiſhed from this not only in ſize, but by its whole ſurface, being covered with ſmall tubercles. The larger kind grows to five inches long. See Syſtem of Vermeology.

LEEK, *porrum*, in botany. Linnæus joins this to the genus of *allium*. See Allium.

LEES, the groſſeſt and thickeſt parts of wine, oil, and other liquors; or the ſediment found at the bottom of the veſſel. A kind of pot aſh, called *cineres clavellati*, is made with the *lees* of wine burnt, and prepared, uſed by dyers, &c. which ought to be remembered by people troubled with the ſtone, &c. The vinegar makers make a great trade of the *lees* of wine dryed, and made into cakes, after having ſqueezed out the remains of the liquor in preſſes.

LEGACY, *legatum*, in the civil law, a donation by teſtament; anſwering to what in common law is called a *demiſe*; and the perſon to whom it is given is ſtyled the *legatee*.

LEGATE, a prelate, whom the pope ſends as ambaſſador to any ſovereign prince. There are three kinds of *legates*; viz. *legates à latere*, *legates de latere*, and *legates* by office, or *legati nati*. Of theſe, the moſt conſiderable are the *legates à latere*; ſuch are thoſe whom the pope commiſſions to take his place in councils; who are thus called, becauſe the pope never gives this office to any but his greateſt favourites and confidants, who are always at his ſide, *à latere*; that is to the cardinals.

LEGATEE, or Legatary, in law, the perſon to whom a *legacy* is left; which every perſon is capable of being, unleſs particularly diſabled by the common law or ſtatutes, as traitors, papiſts, and ſome others.

Reſiduary Legatee, in law, is the perſon to whom the *reſiduum*, or what remains of an eſtate, after funeral charges, debts, and legacies, are paid, is left by will.

LEGERDEMAIN, a denomination given to certain deceptive performances, which altogether depend on dexterity and addreſs, or derive but a ſmall degree of aid from philoſophical principles.

LEGISLATOR, *lawgiver*; a perſon who frames the laws of a kingdom or ſtate founded by him, ſuch was Moſes among the Hebrews.

LEGITIMATION, an act by which natural or illegitimate children are rendered legitimate. See Bastard, &c.

LEGS, the lower extremes of the bodies of moſt animals, ſerving them for ſupport and motion. For the bones and muſcles of the legs, ſee the Syſtem of Anatomy, Part II and III. For the repreſentation, See Plates I, II, and III.

LEGUMEN, *pod*, a ſpecies of ſeed-veſſel which has two valves or external openings, incloſing a number of ſeeds that are faſtened along one ſuture only. In this laſt circumſtance it differs from that termed by botaniſts *ſiliqua*, in which the encloſed ſeeds are faſtened alternately to both the ſutures or joinings of the pod. The *didelphia* of Linnæus is of this pod-kind. See the Syſtem, Sect. III. and V.

LEGUMINOUS, an appellation given to thoſe plants which yield legumes, or pulſe. Of this kind are moſt plants which grow in pods, as beans, peas, &c.

LEMMA, Λημμα, of λαμβανω, *I aſſume*, in mathematics, denotes a previous propoſition, laid down in order to clear the way for ſome following demonſtration; and prefixed either to theorems, in order to render their demonſtration leſs perplexed and intricate; or to problems, to make their reſolution more eaſy and ſhort.

LEMON, in botany. See Citron Tree.

LEMUR, or Maki, in zoology, the third genus of quadrupeds belonging to the *firſt* order *primates*, the characters of which are theſe: there are four fore-teeth in the upper jaw, the intermediate ones being remote; and ſix long, compreſſed, parallel teeth in the under jaw; the dog-teeth are ſolitary, and the grinders are ſomewhat labated. There are five ſpecies, viz.

1. The tardigradus, a ſmall animal found in the iſland of Ceylon.

It is of a very ſingular conſtruction, and perhaps longer in proportion to its thickneſs than any other quadruped. The head is roundiſh, with a prominent noſe; the legs are long and thick, and the feet reſemble thoſe of a monkey; it has no tail. 2. The mongooz inhabits Madagaſcar and the iſlands to the eaſtward as far as Celebes, is about the ſize of a cat. It lives on fruits, turns its tail over its head to protect it from rain, and ſleeps on trees; it is very ſportive and good-natured, and very tender. 3. The catta, or arch-tailed maki, inhabits Madagaſcar and the neighbouring iſles. It is of the ſize of a cat. It is very good-natured, and has all the life of a monkey, without its miſchievous diſpoſition; it is very cleanly, and has a weak cry. In a wild ſtate they go in troops of 30 or 40, and are eaſily tamed when taken young. 4. The caudatus niger, or ruffed maki, is alſo an inhabitant of Madagaſcar. It is ſomewhat larger than the laſt. In a wild ſtate it is very fierce; and makes ſuch a violent noiſe in the woods, that the cries of two might be eaſily miſtaken for the noiſe made by a hundred. 5. The volans, or flying maki, reſembles a bat; being furniſhed with a ſtrong membrane like that animal, by which it is enabled to fly. It inhabits the country about Guzarat, the Molucca iſles, and the Philippines; feeds on the fruits of the trees, and is very diſtinct both from the bat and flying ſquirrel. Its hiſtory, however, is very little known. See Syſtem of MAMMALIA, Plate I.

LENITIVE, in phyſic, ſometimes denotes a ſoftening, reſolutive remedy, that moiſtens the parts diſeaſed, and diſſipates any ſharp humour collected there.

LENS, in dioptrics, properly ſignifies a ſmall, roundiſh glaſs, of the figure of a *lentil*; but is extended to any optic glaſs, not very thick, which either collects the rays of light into a point, in their paſſage through it, or diſperſes them farther apart, according to the laws of refraction. See DIOPTRICS.

LENT, *Quadrageſima*, a time of mortification, during the ſpace of forty days, wherein Chriſtians are enjoined to faſt, in commemoration of our Saviour's miraculous faſting ſo long in the deſert, and by way of preparation for the feaſt of Eaſter. In the ancient Latin church, *lent* only conſiſted of thirty-ſix days. In the ninth century, to come ſomewhat nearer to the miracle, ſeveral took upon them to add four days more; which in time became a general practice; though the church of Milan is ſaid ſtill to take up with the ancient thirty-ſix.

The reformed, generally, hold *lent* to be a ſuperſtitious inſtitution, ſet on foot by ſome vain enthuſiaſts, who durſt undertake to ape the miracles of Jeſus Chriſt; as, in effect, it appears to have been from a paſſage of Irenæus, quoted by Euſebius. Some will have it to have been firſt inſtituted by pope Teleſphorus, in the ſecond century: others, who own that there was a kind of abſtinence obſerved in the ancient church before Eaſter, yet contend that it was entirely voluntary, and was never enjoined by any law till the third century. See FAST.

Political *lents* have been often enjoined by ſtatute and royal proclamation. King James I. iſſued a proclamation againſt eating fleſh in *lent* in 1619, and another in 1625. A ſimilar proclamation was alſo iſſued by Charles I. in 1627, and another in 1631. By the ninth canon of the eighth council of Toledo, it was ordained, "That if any perſon, without evident neceſſity, eat fleſh in lent, they ſhall be deprived the uſe of it all the reſt of the year."

LEO, *lion*, the fifth of the twelve ſigns of the zodiac. See the Syſtem of ASTRONOMY, Sect. IX.

LEO, the *lion*, in zoology, a ſpecies of the Genus *Felis*. For deſcription, ſee FELIS. For claſſification, ſee Syſtem of MAMMALIA. For repreſentation, ſee the Plates, Genus 13, Species 1.

LEONTODON, DANDELION; a genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants. There are nine ſpecies, of which the only remarkable one is the Taraxacum, or common dandelion, found on the road ſides, in paſtures, and on the banks of ditches. Early in the ſpring, the leaves whilſt yet white and hardly unfolded are an excellent ingredient in ſalads. The French eat the roots and tender leaves with bread and butter. Children that eat in the evening experience its diuretic effects in the night, which is the reaſon that other European nations as well as ourſelves vulgarly call it *piſs-a-bed*. When a ſwarm of locuſts had deſtroyed the harveſt in the iſland of Minorca, many of the inhabitants ſubſiſted upon this plant. The expreſſed juice has been given to the quantity of four ounces three or four times a-day; and Boerhaave had a great opinion of the utility of this and other lacteſcent plants in viſceral obſtructions. Goats eat it; ſwine devour it greedily; ſheep and cows are not fond of it, and horſes refuſe it. Small birds are fond of the ſeeds.

LEOPARD, in zoology, the Engliſh name of the long-tailed *felis*, or *felis pardus* of Linnæus. For deſcription, ſee FELIS. For claſſification, ſee the Syſtem. For repreſentation, ſee the Plates, Genus 13. Species 3.

LEPIDOPTERA, in entomology, from λεπις, *a ſcale*, and πτερον, *wing*, in the Linnæan ſyſtem, an order of inſects, with four wings, imbricated with ſcales: in the mouth is contained a ſpiral tongue, and the body is hairy. This order comprehends three genera, viz. the papilio or butterfly, the ſphinx and the phalæna, or moth; and each genus includes a number of ſpecies. See Syſtem.

LEPROSY, LEPRA, in medicine, a foul, cutaneous diſeaſe, appearing in dry, white, thin, ſcurfy ſcabs, either over the whole body, or only ſome part of it; and uſually attended with a vehement itching and other pains. The *leproſy* ſeems to ariſe from a great obſtruction of perſpiration, and a faulty ſerum; whereby the thin ſaline humours are thrown off from the blood, and detained by the denſity and cloſeneſs of the cuticula.

LEPUS, in zoology, a genus of quadrupeds belonging to the order of glires. The characters are theſe: They have two foreteeth in each jaw; thoſe in the upper jaw are double, the interior ones being ſmalleſt. There are four ſpecies, viz. 1. The timidus, or hare, has a ſhort tail; the points of the ears are black; the upper-lip is divided up to the noſtrils; the length of the body is generally about a foot and a half; and the colour of the hair is reddiſh, interſperſed with white. The hare is naturally a timid animal. He ſleeps in his form, or ſeat, during the day; and feeds, copulates, &c. in the night. In a moon-light evening, a number of them are ſometimes ſeen ſporting together, leaping and purſuing each other: But the leaſt motion, the falling of a leaf, alarms them, and then they all run off ſeparately, each taking a different route. They are extremely ſwift in their motion, which is a kind of gallop, or a ſucceſſion of quick leaps. When purſued, they always take to the higher grounds: as their fore-feet are much ſhorter than the hind-ones, they run with more eaſe up-hill than down-hill. The hare is endowed with all thoſe inſtincts which are neceſſary for his own preſervation. In winter he chuſes a form expoſed to the ſouth, and in ſummer to the north. He conceals himſelf among vegetables of the ſame colour with himſelf; and by this means evades the ſcent of the dogs. After being chaſed for a couple of hours, a hare will ſometimes puſh another from his form, and lie down in it himſelf. When hard preſſed, the hare will mingle with a flock of ſheep, run up an old wall and conceal himſelf among the graſs on the top of it, or croſs a river ſeveral times at ſmall diſtances. He never runs againſt the wind, or ſtraight forward; but conſtantly doubles about, in order to make the dogs loſe their ſcent.

It is remarkable, that the hare, although ever ſo frequently purſued by the dogs, ſeldom leaves the place where ſhe was brought forth, or even the form in which ſhe uſually ſits. It is common to find them in the ſame place next day, after being long and keenly chaſed the day before. The females are more groſs than the males, and have leſs ſtrength and agility; they are likewiſe more timid, and never allow the dogs to approach ſo near their form before riſing as the males. They likewiſe practice more arts, and double more frequently, than the males. The hare is diffuſed almoſt over every climate; and notwithſtanding they are every-where hunted, their ſpecies never diminiſhes. They are in a condition of propagating the firſt year of their lives; the females go with young about 30 days, and produce four or five at a time; and as ſoon as they have brought forth, they again admit the embraces of the male; ſo that they may be ſaid to be always pregnant. The eyes of the young are open at birth; the mother ſuckles them about 20 days, after which they ſeparate from her, and procure their own food. The young never go far from the place where they were brought forth; but ſtill they live ſolitary, and make forms about 30 paces diſtant from each other: Thus, if a young hare be found any-where, you may almoſt be certain of finding ſeveral others within a very ſmall diſtance.

Mr. Pennant deſcribes a ſpecies called the *Alpine hare*, which inhabits the ſummits of the Highland mountains, never deſcends into the vales, or mixes itſelf with the common kind, which is frequent in the bottoms; it lives among the rocks with ptarmigans, natives of the loftieſt ſituations. It does not run faſt; and, if purſued, is apt to take ſhelter beneath ſtones and in clefts of rocks: is eaſily tamed, and is very ſprightly and full of frolic. In winter it entirely changes to a ſnowy whiteneſs, except the edges and tips of the ears, which retain their black colour. The alteration begins in September, and firſt appears about the neck and rump. In April it again reſumes its grey coat. This is the caſe in Styria; but in the polar tracts it never varies from white, the perpetual colour of the country. In the intermediate climates between temperate and frigid, ſuch as Scotland and Scandinavia, it regularly experiences the viciſſitudes of colour.

Hares are very ſubject to fleas. Linnæus tells us, that the Dalecarlians make a ſort of cloth, called *filt*, of the fur; which, by attracting theſe inſects, preſerves the wearer from their troubleſome attacks. The hair of this creature makes a great article in the hat-manufacture; and, as our country cannot ſupply a ſufficient quantity, a great deal is annually imported from Ruſſia and Siberia. The hare was reckoned a great delicacy among the Romans; the Britons, on the contrary, thought it impious even to taſte it: yet this animal was cultivated by them, either for the pleaſure of the chace, or for the purpoſes of ſuperſtition; as we are informed, that Boadicea, immediately before her laſt conflict with the Romans, let looſe a hare ſhe had concealed in her boſom, which, taking what was deemed a fortunate courſe, animated her ſoldiers by the omen of an eaſy victory over a timid enemy.

2. The cuniculus, or rabbit, has a very ſhort tail, and naked ears. Its native country is Spain, where they were formerly taken with ferrets, as is practiſed in this country at preſent; which animals were firſt introduced into that country from Africa. The Engliſh counties moſtly noted for rabbits are Lincolnſhire, Norfolk,

and Cambridgeſhire. The fecundity of the rabbit is ſtill greater than that of the hare. They will breed ſeven times in the year, and the female ſometimes brings eight young ones at a time. Suppoſing this to happen regularly for four years, the number of rabbits from a ſingle pair will amount to 1,274,840. By this account we might juſtly apprehend being overſtocked with theſe animals: but a great number of enemies prevents their increaſe; not only men, but hawks and beaſts of prey making dreadful havock among them. Notwithſtanding all theſe different enemies, however, we are told by Pliny and Strabo, that they once proved ſuch a nuiſance to the inhabitants of the Balearic iſlands, that they were obliged to implore the aſſiſtance of a military force from Auguſtus, in order to exterminate them. They devour herbage of all kinds, roots, grain, fruits, &c. They are in a condition for generating at the end of ſix months; and, like the hare, the female is almoſt conſtantly in ſeaſon; ſhe goes with young about 30 days, and brings forth from ſix to eight at a litter.

3. The capenſis has a tail about the length of his head, and red legs. It is a native of the Cape of Good Hope.

4. The braſilienſis has no tail. It is a native of South-America. For repreſentation, ſee the Plate to the Syſtem of MAMMALIA.

LEPUS, the *Hare*, in aſtronomy, a conſtellation of the ſouthern hemiſphere; ſee the Syſtem, Sect. VIII.

LETHARGY, Λεθαργια, in medicine, from λεθη, *oblivion*, and αργια, *numbneſs*, *lazineſs*, a diſeaſe conſiſting of a profound drowſineſs or ſleepineſs, from which the patient can ſcarce be awaked; or, if awaked, he remains ſtupid, without ſenſe or memory, and preſently ſinks again into his former ſleep. The *lethargy* is uſually accompanied with a fever and delirium. Boerhaave makes the *lethargy* a gentle apoplexy ariſing from the ſame cauſes, and to be known and cured in the ſame manner.

LETHE, Λεθη, in the ancient mythology, one of the rivers of hell; ſignifying oblivion or forgetfulneſs: its waters, according to the poetic fiction, having the peculiar quality of making thoſe who drank them entirely forget every thing that was paſt; or, according to Virgil, *longa potant oblivia vitæ*.

LETTER, a character uſed to expreſs one of the ſimple ſounds of the voice; and as the different ſimple ſounds are expreſſed by different letters, theſe, by being differently compounded, become the viſible ſigns or characters of all the modulations and mixtures of ſounds uſed to expreſs our ideas in a regular language. Thus, as by the help of ſpeech we render our ideas audible; by the aſſiſtance of letters we render them viſible, and by their help we can wrap up our thoughts, and ſend them to the moſt diſtant parts of the earth, and read the tranſactions of different ages. As to the firſt letters, what they were, who firſt invented them, and among what people they were firſt in uſe, there is ſtill room to doubt: Philo attributes this great and noble invention to Abraham; Joſephus, St. Irenæus, and others, to Enoch; Bibliander, to Adam; Euſebius, Clemens Alexandrinus, Cornelius Agrippa, and others to Moſes; Pomponius Mela, Herodian, Rufus Feſtus, Pliny, Lucan, &c. to the Phœnicians; St. Cyprian, to Saturn; Tacitus, to the Egyptians; ſome, to the Ethiopians; and others, to the Chineſe, who make Fohi, the firſt of their kings, ſuppoſed by many learned and judicious writers to have been no other than the patriarch Noah, the inventor of their *letters*, and compute him to have lived two thouſand nine hundred and fifty years before Chriſt; during all which time they pretend to have certain and written accounts in their books. If this holds true, their character muſt be older than Moſes by fourteen hundred years, and even prior to Menes, the firſt king of Egypt, by five hundred years; ſo that the Chineſe *letters* appear to be the moſt ancient of that kind; and the book Yekim, ſaid to be written by Fohi, the moſt ancient book. But they can never be entitled to this honour, ſince all their characters are the ſigns of words, formed without the uſe of letters; which renders it impoſſible to read and write their language, without a vaſt expence of time and trouble; and abſolutely impoſſible to print it by the help of types, or any other manner but by engraving, or cutting in wood. See PRINTING.

This multitude of *letters* ſeems the ſource of that ignorance which we find among the Chineſe; their whole lives being ſpent in learning their *letters*, they have no time to apply themſelves to the ſtudy of things, but think themſelves very learned when they are able to read. There are ſcarce any of them that know all their *letters*; they think it is a great progreſs they have made, when, after forty or fifty years hard ſtudy, they are able to underſtand fifteen or twenty thouſand. But the generality of their learned men come ſhort of this. Father Le Compte is of opinion that the greateſt doctor among them never underſtood half of their letters well; for the whole number he reckons eighty thouſand. This is a prodigious inconvenience to foreigners, of which the miſſionaries in that country make loud complaints.

Among the Chineſe *letters* there are ſome now almoſt worn out of uſe, and only preſerved out of reſpect to antiquity. There is a ſecond claſs much leſs ancient than the former, only uſed in public inſcriptions. A third, much more regular and beautiful, uſed in printing, and even in ordinary writing. However, as the ſtrokes are to be diſtinctly formed, they cannot be wrote with any expedition. For this reaſon they have invented a fourth kind, where the ſtrokes, being cloſer, and leſs diſtant from each other, allow them to be writ with more eaſe and readineſs; and this they call the *running letter*. See CHINESE *Tongue*.

There have alſo been various conjectures about the different kinds of letters uſed in different languages; thus, according to Crinitus, Moſes invented the Hebrew letters; Abraham, the Syriac and Chaldee; the Phœnicians, thoſe of Attica, brought into Greece by Cadmus, and from thence into Italy by the Pelaſgians; Nicoſtrata, the Roman; Iſis, the Egyptian; and Vulſilas, thoſe of the Goths. It is probable, that the Egyptian hieroglyphics were the firſt manner of writing: but whether Cadmus and the Phœnicians learned the uſe of letters from the Egyptians, or from their neighbours of Judea or Samaria, is a queſtion; for ſince ſome of the books of the Old Teſtament were then written, they are more likely to have given them the hint, than the hieroglyphics of Egypt. But whereſoever the Phœnicians learned this art, it is generally agreed, that Cadmus, the ſon of Agenor, firſt brought letters into Greece; whence, in following ages, they ſpread over the reſt of Europe.

Letters make the firſt part or elements of grammar; an aſſemblage of theſe compoſe ſyllables and words, and theſe compoſe ſentences. The alphabet of every language conſiſts of a number of letters, which ought each to have a different ſound, figure, and uſe. As the difference of articulate ſounds was intended to expreſs the different ideas of the mind, ſo one letter was originally intended to ſignify only one ſound, and not, as at preſent, to expreſs ſometimes one ſound and ſometimes another; which practice has brought a great deal of confuſion into the languages, and rendered the learning of the modern tongues much more difficult than it would otherwiſe have been. This conſideration, together with the deficiency of all the known alphabets, from their wanting ſome letters to expreſs certain ſounds, has occaſioned ſeveral attempts towards an univerſal alphabet, to contain an enumeration of ſuch ſingle ſounds or letters as are uſed in any language. See ALPHABET.

Grammarians diſtinguiſh letters into vowels, conſonants, mutes, liquids, diphthongs, and characteriſtics. They are likewiſe divided into capital and ſmall letters. They are alſo denominated from the ſhape and turn of the letters; and in writing are diſtinguiſhed into different hands, as round-text, German-text, round-hand, Italian, &c. and in printing, into roman, italic, and black-letter.

LETTER is alſo a writing addreſſed and ſent to a perſon. See EPISTLE.

LETTERS *of Attorney*, in law, a writing authorizing an attorney to do ſome legal act in our ſtead: as, to give ſeiſin of lands, to receive debts, to ſue a third perſon, &c. And *letters of attorney* are either general or ſpecial. The nature of this inſtrument is to give the attorney the full power and authority of the maker, to accompliſh the act intended to be performed. Sometimes theſe writings are revocable, and ſometimes not ſo; but when they are revocable, it is uſually a bare authority only; and they are irrevocable, when debts, &c. are aſſigned to another; in which caſe the word irrevocable is inſerted.

LETTERS *of Marque*, in the Britiſh dominions, are to be granted by the admiralty; and they empower the commander of a merchant ſhip or privateer, to cruiſe againſt and make prizes of the enemies ſhips and veſſels, either at ſea, or in their harbours.

LETTERS *Patent*, or *Overt*, are writings ſealed with the great-ſeal of England, whereby a man is authorized to do or enjoy any thing, which of himſelf he could not do. They are ſo called, on account of their form; as being open with the ſeal affixed, ready to be ſhewn for the confirmation of the authority given by them.

LETTUCE, *lactuca*, in botany, a genus of the *ſyngeneſia polygamia æqualis* claſs. See Syſtem of GARDENING, Part II. *Kitchen-Garden*, for the month of February.

LEVATOR, in anatomy, an epithet which anatomiſts give to ſeveral muſcles, whoſe uſe is to raiſe, or lift up, the parts to which they belong. See ELEVATOR.

LEVEL, an inſtrument wherewith to draw a line parallel to the horizon, and continue it out at pleaſure; and, by this means, to find the true *level*, or the difference of aſcent or deſcent, between ſeveral places, for conveying water, draining-fens, &c. There are ſeveral inſtruments, of different contrivance and matter, invented for the perfection of *levelling*; for account of which, and the repreſentation, ſee Treatiſe on SURVEYING and the Plate.

LEVELLING, the art or act of finding a line parallel to the horizon, at one or more ſtations, in order to determine the height of one place with reſpect to another; for the laying grounds even, regulating deſcents, draining moraſſes, conducting waters, &c. See Treatiſe on SURVEYING.

LEVER, in mechanics, is a bar of iron or wood, one part of which being ſupported by a prop, all other parts turn upon that prop as their centre of motion. This inſtrument is of two kinds. Firſt, the common ſort, where the weight we deſire to raiſe, reſts at one end of it, our ſtrength is applied at the other end, and the prop is between both. When we ſtir up the fire with a poker, we make uſe of this lever; the poker is the lever, it reſts upon one of the bars of the grate as a prop, the incumbent fire is the weight to be overcome, and the other end held in the hand is the ſtrength or power. In this, as in all the reſt, we have only to increaſe the diſtance between the ſtrength and prop, to give the man that works the inſtrument greater power. The lever of the ſecond kind, has the prop at one end, the ſtrength is applied to the other, and the weight to be raiſed reſts between them. Thus in raiſing the water plug in the ſtreets, the workman puts his iron lever through the hole of the plug till he reaches the ground on the other ſide, and, making that his prop, lifts the plug with his ſtrength at the other end of the lever. In this lever alſo, the greater the diſtance of the prop from the ſtrength, the greater is the workman's power. See Syſtem of MECHANICS.

LEVERET, amongſt ſportſmen, a young hare, in the firſt year of its age.

LEVIGATION, the reduction of hard and ponderous bodies, as coral, tutty, precious ſtones, &c. into a fine ſubtil powder, by grinding them with water upon porphyry, or the like, as painters do their colours. *Levigation* is much uſed in pharmacy and chymiſtry; but unleſs the grinding inſtruments be extremely hard, they will wear away, ſo as ſometimes to double the weight of the medicine thus managed.

LEVITE, an inferior kind of miniſter in the Jewiſh tabernacle and temple, who had the care and management of the ſacred utenſils. The word comes from the Greek λευιτης, the root of which is the name *Levi*; wfiich was given to that patriarch by his mother Leah, from the Hebrew לוה, *lavah, to be tied*, or *united*; Leah hoping, by the birth of this ſon, to be more cloſely linked to her huſband Jacob; and, therefore, in a large ſenſe, the Levites were the poſterity of this patriarch, and conſtituted one of the twelve tribes of Iſrael. But the ſons of Levi were appointed to this office, in conſequence of the extraordinary zeal they diſcovered againſt idolatry, in the caſe of a golden calf. Exod. xxxii. 26. 28. They were originally divided into three claſſes or families, from the three ſons of Levi, Kohath, Gerſhon, and Merari, but afterwards by David into twenty-four courſes.

The Levites, in the Jewiſh church, were an order inferior to the prieſts; and anſwered, in ſome meaſure, to deacons, in the Chriſtian church. The Levites of the old law had no ſettled lands allotted them for their maintenance, as the other tribes had, but lived chiefly on the offerings made to God. They were diſtributed through all the tribes, each of which gave ſome of their cities to the Levites, amounting in all to the number of thirty five, with grounds in their neighbourhood for the ſubſiſtence of their flocks. In the weeks of their attendance at the ſanctuary, they were maintained by the dues ariſing from the ſacrifices; beſides theſe dues, the firſt fruits, which were brought to the temple, and the money paid for the redemption of the firſt born, contributed to their ſubſiſtence. But the maintenance chiefly aroſe from the tithes of the produce of the whole country, which was the law allotted to the tribe of Levi, Numb. xviii. 31. a tenth of which they paid to the prieſts.

According to the numeration made by Solomon, from the age of twenty, there were thirty-eight thouſand Levites capable of ſerving; twenty four thouſand of theſe he appointed for the daily miniſtry under the prieſts, ſix thouſand to be inferior judges in the cities, and to decide matters relating to religion, and of no great conſequence to the ſtate; four thouſand to be door-keepers, and to take care of the riches of the temple; and the reſt to do the office of chanters, or ſingers.

LEVITICUS, a canonical book of the Old Teſtament, ſo called from its containing the laws and regulations relating to the prieſts, Levites, and ſacrifices.

LEWDNESS is puniſhable by our law by fine, impriſonment, &c. And Mich. 15 Car. II. a perſon was indicted for open *lewdneſs*, in ſhewing his naked body in a balcony, and other miſdemeanors, and was fined two thouſand marks, impriſoned for a week, and bound to his good behaviour for three years. 1 Sid. 168. In times paſt, when a man granted a leaſe of his houſe, it was uſual to inſert an expreſs covenant, that the tenant ſhould not entertain any lewd women, &c. See BAWD, INCEST, &c.

LEXICON, Λεξικον, the ſame with dictionary. The word is chiefly uſed in ſpeaking of Greek dictionaries: it is derived from the Greek λεξις, *word, diction*, of λεγω, *I ſpeak*.

LEYDEN *Phial*, in electricity, is a glaſs phial or jar coated both on the inſide and outſide with ſome conducting ſubſtance, for the purpoſe of being charged, and employed in a variety of entertaining and uſeful experiments. See the Syſtem, Sect. II. Art. III.

LIBATION, LIBATIO, a ceremony in the heathen ſacrifices, wherein the prieſt ſpilt ſome wine, milk, or other liquor, in honour of the deity to whom the ſacrifice was offered; after having firſt taſted it himſelf. Libations were alſo in uſe under the law of Moſes, being enjoined by God in Exodus xxix. and Numbers xv.

LIBEL, *libellus famoſus*, taken in its largeſt and moſt extenſive ſenſe, ſignifies any writing, picture, or the like, of an immoral or illegal tendency; but, in a peculiar ſenſe, is uſed to denote a malicious defamation of any perſon, and eſpecially a magiſtrate, made public by either printing, writing, ſigns or pictures, in order to provoke him to wrath, or expoſe him to public hatred, contempt, and ridicule. The direct tendency of theſe libels is the breach of the public peace, by ſtirring up the objects of them to revenge, and perhaps to bloodſhed. The communication of a libel to any one perſon is a publication in the eye of the law: and therefore the ſending an abuſive private letter to a man is as much a libel as if it were openly printed, for it equally tends to a breach of the peace.

With regard to libels in general, there are, as in many other caſes, two remedies; one by indictment and another by action. The former for the *public* offence, for every libel has a tendency to break the peace, or provoke others to break it: which offence is the ſame whether the matter contained be true or falſe; and therefore the defendant, on an indictment for publiſhing a libel, is not allowed to allege the truth of it by way of juſtification. But in the remedy by action on the caſe, which is to repair the party in damages for the injury done him, the defendant may, as for words ſpoken, juſtify the truth of the facts, and ſhew that the plaintiff has received no injury at all. What was ſaid with regard to words ſpoken, will alſo hold in every particular in regard to libels by writing, or printing, and the civil actions conſequent thereupon: but as to ſigns or pictures, it ſeems neceſſary always to ſhow, by proper *innuendos* and averments of the defendant's meaning, the import and application of the ſcandal, and that ſome ſpecial damage has followed; otherwiſe it cannot appear, that ſuch libel by picture was underſtood to be levelled at the plaintiff, or that it was attended with any actionable conſequences.

In a civil action, then, a libel muſt appear to be falſe, as well as ſcandalous; for if the charge be true, the plaintiff has received no private injury, and has received no ground to demand a compenſation from himſelf, whatever offence it may be againſt the public peace: and therefore, upon a civil action, the truth of the accuſation may be pleaded in bar of the ſuit. But, in a criminal proſecution, the tendency which all libels have to create animoſities, and to diſturb the public peace, is the ſole conſideration of the law. And therefore, in ſuch proſecutions, the only points to be conſidered are, firſt, the making or publiſhing of the book or writing; and, ſecondly, whether the matter be criminal, and if both theſe points are againſt the defendant, the offence againſt the public is complete. The puniſhment of ſuch libellers for their making, repeating, printing, or publiſhing the libel, is a fine, and ſuch corporal puniſhment as the court in its diſcretion ſhall inflict; regarding the quantity of the offence, and the quality of the offender. By the law of the twelve tables at Rome, libels, which affected the reputation of another, were made a capital offence: but, before the reign of Auguſtus, the puniſhment became corporal only. Under the emperor Valentinian it was again made capital, not only to write, but to publiſh, or even to omit deſtroying them. Our law, in this and many other reſpects, correſponds rather with the middle age of Roman juriſprudence, when liberty, learning, and humanity, were in their full vigour, than with the cruel edicts that were eſtabliſhed in the dark and tyrannical ages of the ancient *decemviri*, or the later emperors.

In this, and other inſtances, where blaſphemous, immoral, treaſonable, ſchiſmatical, ſeditious, or ſcandalous libels are puniſhed by the Engliſh law, ſome with a greater, others with a leſs degree of ſeverity; the *liberty of the preſs*, properly underſtood, is by no means infringed or violated. See LIBERTY *of the Preſs*.

With reſpect to libels the following inſtance of a trial which lately took place in Dublin, is ſo truly intereſting to the preſs, and of courſe to the nation in general, that we cite it as a glorious proof that a jury is found of men whoſe good ſenſe and independent ſpirit were neither to be cajoled nor intimidated; and we have no doubt, but the conſtitutional example which they have ſet will be followed by every Jury in the three kingdoms. The printer of a public paper, called the *Phœnix*, was proſecuted at the ſuit of a Rev. Divine, for having publiſhed in his paper of the 19th of May, 1790, a falſe, ſcandalous, and ſeditious libel, reflecting injuriouſly on the character and conduct of the proſecutor, and accuſing him with having aſſociated at a late election at Kilmainham, in the direction of a tumultuous mob, of having worn election ribbons in his hat and breaſt, and having uttered oaths and blaſphemous expreſſions, unbecoming the character of a Clergyman.

The counſel, on behalf of the defendant, made ſeveral objections to the admiſſion of evidences adduced for the proſecution, ſupported by eminent authorities. It was alſo objected, that comparing the atteſted copy of the indictment with that read in court, there appeared to be material interlineations of innuendos in the original, ſince the atteſted copy was obtained.

Objection was alſo made to the admiſſibility of the proſecutor's own evidence, as he did not produce the certificate of his ordination. And to the inſufficiency of the indictment itſelf; firſt, as founding a criminal proſecution for a libel, where not even an actual breach of the peace was alledged; and ſecondly, as not originally alledging, before the interlineation, any innuendo, ſtating that the proſecutor was the perſon meant under the name the paragraph alluded to. All thoſe objections the Court thought fit to over-rule, and the Proſecutor, who was the only evidence examined on the facts ſtated in the indictment, having given his teſtimony to the proſecution, admitted in his croſs-examination, the truth of all the circumſtances above ſtated.

The evidence being cloſed, the learned Judge ſummed up the particulars, and gave charge to the Jury, who retired; but not having agreed to their verdict before the other buſineſs of the Court was cloſed for the day, the Judge called on them to know if their verdict was ready; but one of the Jury came forward and ſaid they had not agreed to it. He was told by the learned Judge, that there could be no difficulty on the points for their conſideration; but if they did not agree ſpeedily he muſt go away, and leave them locked up till the morrow. The Jury ſhortly afterwards returned with a verdict of "we find that the defendant is Printer and Publiſher; not guilty of any libel."

This verdict the learned Judge refuſed to accept, and ſaid they muſt return a general verdict on the general ground in the indictment, in which there was but one charge, and ſent them back to the jury room; where they remained locked up till next morning at nine o'clock, when the Court opened, and they returned a general verdict of *not Guilty*.

The learned Judge, who ſeemed to expreſs ſome aſtoniſhment at this verdict, thanked God it was not his verdict but that of the Jury. One of the Jury anſwered his Lordſhip that they could not conſiſtently with their oaths, or their conſciences, return any other verdict. The indictment ſtated, that the alledged libel was falſe, but the proſecutor in his own evidence admitted it to be true. This of courſe juſtified the verdict in their minds. The learned Judge quoted the opinion of Lord Mansfield, which ſaid that the truth of a libel is an aggravation of its guilt. The Juror anſwered, "My Lord, we cannot hold that opinion."

It is neceſſary to obſerve, that if the Jury had brought in the Defendant Guilty, it would have left him entirely at the mercy of the Court, who could have affixed what puniſhment they pleaſed, as claiming the authority of judging of the malignity of the libel; but the Jury, by their verdict of Printing and Publiſhing only, aſſerted their rights as men, and determined agreeable to their conſcience, and common ſenſe; they found the printing of the publication, which was unavoidable, but found it was no libel.

The reſpectable characters who formed this Jury well deſerve to be commemorated as ſtrenuous aſſertors of the Liberty of the Preſs, the Liberty of the Subject, and the Rights of Juries.

LIBELLULA, in entomology, the name of a genus of the *Neuroptera* claſs of inſects. See Syſtem, Part II. Order IV. Genus 46.

LIBER, in botany, the bark or rind, principally of trees. This is to be conceived as conſiſting of a number of cylindric and concentric ſurfaces, whoſe texture is reticular, and in ſome trees plainly extruſible every way, by reaſon that the fibres are ſoft and flexible. While in this condition they are either hollow regular canals, or, if not ſo, they have interſticial ſpaces, which ſerves the office of canals. The nutritious juice, which they are continually receiving, remains in part in them, and makes them grow in length and thickneſs, and ſtrengthens and brings them cloſer together; and by this means the texture, which was before reticular, becomes an aſſemblage of ſtraight fibres, ranged vertically, and parallel to each other; that is, as they are thus altered behind one another, they, by degrees, become a new ſubſtance more woody, and called *Blea*. See BARK.

LIBERAL *Arts*, are ſuch as depend more on the labour of the mind than on that of the hand; or, that conſiſt more in ſpeculation than operation; and have a greater regard to amuſement and curioſity than to neceſſity. The word comes from the Latin *liberalis*; which, among the Romans, ſignified a perſon who was not a ſlave; and whoſe will, of conſequence, was not checked by the command of any maſter. Such are grammar, rhetoric, painting, ſculpture, architecture, muſic, &c. The *liberal arts* uſed formerly to be ſummed up in the following Latin verſe:

Lingua Tropus, Ratio, Numerus, Tonus, Angulus, Aſtra.

And the *mechanical arts*, which, however, are innumerable, under this:

Rus, Nemus, Arma, Faber, Vulnera, Lana, Rates.

See the Article ART, and the ſeveral Syſtems and Treatiſes in the Order of the Alphabet.

LIBERTAS *Eccleſiaſtica, Church Liberty*, a frequent phraſe in old writers, who treat of eccleſiaſtical immunities. The right of inveſtiture, extorted from our kings by the papal power, was at firſt the only thing challenged by the clergy, as their *libertas eccleſiaſtica*, but by degrees, under the title of *church liberty*, they contended for a freedom of their perſons and poſſeſſions, from all ſecular power and juriſdiction; as appears from the canons and decrees of the councils held by Boniface, archbiſhop of Canterbury, at Merton, ann. 1258, and at London, ann. 1260, &c.

LIBERTY, denotes a ſtate of freedom, in contradiſtinction to *ſlavery* or *reſtraint*; and may be conſidered as either *natural* or *civil*. The abſolute rights of man, conſidered as a free agent, endowed with diſcernment to know good from evil, and with power of chooſing thoſe meaſures which appear to him to be moſt deſirable, are uſually ſummed up in one general appellation, and denominated the *natural liberty of mankind*. This natural liberty conſiſts properly in a power of acting as one thinks fit, without any reſtraint or controul, unleſs by the law of nature; being a right inherent in us by birth, and one of the gifts of God to man at his creation, when he endued him with the faculty of free-will. But every man, when he enters into ſociety, gives up a part of his natural liberty, as a price of ſo valuable a purchaſe; and, in conſideration of receiving the advantages of mutual commerce, obliges himſelf to conform to thoſe laws which the community has thought proper to eſtabliſh. And this ſpecies of legal obedience and conformity is infinitely more deſirable than that wild and ſavage liberty which is ſacrificed to obtain it. For no man, that conſiders a moment, would wiſh to retain the abſolute and uncontrouled power of doing whatever he pleaſes: the conſequence of which is, that every other man would alſo have the ſame power; and then there would be no ſecurity to individuals in any of the enjoyments of life.

Political, therefore, or *civil* liberty, which is that of a member of ſociety, is no other than natural liberty ſo far reſtrained by human laws (and no farther) as is neceſſary and expedient for the general advantage of the public. Hence we may collect, that the law, which reſtrains a man from doing miſchief to his fellow citizens, though it diminiſhes the natural, increaſes the civil liberty of mankind: but every wanton and cauſeleſs reſtraint of the will of the ſubject, whether practiſed by a monarch, a nobility, or a popular aſſembly, is a degree of tyranny. Nay, that even laws themſelves, whether made with or without our conſent, if they regulate and conſtrain our conduct in matters of mere indifference, without any good end in view, are laws deſtructive of liberty: whereas if any public advantage can ariſe from obſerving ſuch precepts, the controul of our private inclinations, in one or two particular points, will conduce to preſerve our general freedom in others of more importance; by ſupporting that ſtate of ſociety, which alone can ſecure our independence. Thus the ſtatute of king Edward IV. which forbad the fine gentlemen of thoſe times (under the degree of a lord) to wear pikes upon their ſhoes or boots of more than two inches in length, was a law that ſavoured oppreſſion; becauſe, however ridiculous the faſhion then in uſe might appear, the reſtraining it by pecuniary penalties could ſerve no purpoſe of common utility. But the ſtatute of king Charles II. which preſcribes a thing ſeemingly as indifferent, viz. a dreſs for the dead, who were all ordered to be buried in woollen, is a law conſiſtent with public liberty; for it encourages the ſtaple trade, on which in great meaſure depends the univerſal good of the nation. So that laws, when prudently framed, are by no means ſubverſive, but rather introductive of liberty; for (as Mr. Locke has well obſerved) where there is no law there is no freedom. But then, on the other hand, that conſtitution or frame of goverment, that ſyſtem of laws, is alone calculated to maintain civil liberty, which leaves the ſubject entire maſter of his own conduct, except in thoſe points wherein the public good requires ſome direction or reſtraint.

The idea and practice of this political or civil liberty flouriſh in their higheſt vigour in theſe kingdoms, where it falls little ſhort of perfection, and can only be loſt or deſtroyed by the folly or demerits of its owner; the legiſlature, and of courſe the laws of Britain, being peculiarly adapted to the preſervation of this ineſtimable bleſſing even in the meaneſt ſubject. Very different from the modern conſtitution of other ſtates on the continent of Europe, and from the genius of the imperial law; which in general are calculated to veſt an arbitrary and deſpotic power, of controuling the actions of the ſubject, in the prince, or in a few grandees. And this ſpirit of liberty is ſo deeply implanted in our conſtitution, and rooted even in our very ſoil, that a ſlave or a negro, the moment he lands in Britain falls under the protection of the laws, and ſo far becomes a freeman; though the maſter's right to his ſervice may poſſibly ſtill continue. The abſolute rights of every Briton, (which, taken in a political and extenſive ſenſe, are uſually called their *liberties*) as they are founded on nature and reaſon, ſo they are coeval with our form of government; though ſubject at times to fluctuate and change, their eſtabliſhment (excellent as it is) being ſtill human. At ſome times we have ſeen them depreſſed by overbearing and tyrannical princes; at others ſo luxuriant as even to tend to anarchy, a worſe ſtate than tyranny itſelf, as any government is better than none at all. But the vigour of our free conſtitution has always delivered the nation from theſe embarraſſments: and, as ſoon as the convulſions conſequent on the ſtruggle have been over, the balance of our rights and liberties has ſettled to its proper level; and their fundamental articles have been from time to time aſſerted in parliament, as often as they were thought to be in danger.

Firſt, by the great charter of liberties, which was obtained, ſword in hand, from king John, and afterwards, with ſome alterations, confirmed in parliament by king Henry III. his ſon. Which charter contained very few new grants; but, as Sir Edward Coke obſerves, was for the moſt part declaratory of the principal grounds of the fundamental laws of England. Afterwards, by the ſtatute called *confirmatio chartarum*, whereby the great charter is directed to be allowed as the common law; all judgments contrary to it are declared void; copies of it are ordered to be ſent to all cathedral churches, and read twice a-year to the people; and ſentence of excommunication is directed to be as conſtantly denounced againſt all thoſe that by word, deed, or council, act contrary thereto, or in any degree infringe it. Next by a multitude of ſubſequent corroborating ſtatutes (Sir Edward Coke reckons 32,) from the firſt Edward to Henry IV. Then, after a long interval, by *the petition of right*; which was a parliamentary declaration of the liberties of the people, aſſented to by king Charles I. in the beginning of his reign. This was cloſely followed by the ſtill more ample conceſſions made by that unhappy prince to his parliament, before the fatal rupture between them; and by the many ſalutary laws, particularly the *habeas corpus* act, paſſed under Charles II. To theſe ſucceeded *the bill of rights*, or declarations delivered by the lords and commons to the prince and princeſs of Orange 13th February 1688; and afterwards enacted in parliament, when they became king and queen: which declaration concludes in theſe remarkable words; "and they do claim, demand, and inſiſt upon, all and ſingular the premiſes, as their undoubted rights and liberties." And the act of parliament itſelf recognizes "all and ſingular the rights and liberties aſſerted and claimed in the ſaid declaration to be the true, ancient, and indubitable rights of the people of this kingdom." Laſtly, theſe liberties were again aſſerted at the commencement of the preſent century, in the *act of ſettlement*, whereby the crown was limited to his preſent majeſty's illuſtrious houſe: and ſome new proviſions were added, at the ſame fortunate æra, for better ſecuring our religion, laws, and liberties; which the ſtatute declares to be "the birthright of the people of England," according to the ancient doctrine of the common law.

Thus much for the declaration of our rights and liberties. The rights themſelves, thus defined by theſe ſeveral ſtatutes, conſiſt in a number of private immunities; which will appear, from what has been premiſed, to be indeed no other, than either that *reſiduum* of natural liberty, which is not required by the laws of ſociety to be ſacrificed to public convenience; or elſe thoſe civil privileges, which ſociety hath engaged to provide, in lieu of the natural liberties ſo given up by individuals. Theſe therefore were formerly, either by inheritance or purchaſe, the rights of all mankind; but, in moſt other countries of the world, being now more or leſs debaſed and deſtroyed, they at preſent may be ſaid to remain, in a peculiar and emphatical manner, the rights of the people of Britain. And theſe may be reduced to three principal or primary articles; the right of perſonal ſecurity, the right of perſonal liberty, and the right of private property: becauſe, as there is no other known method of compulſion, or of abridging man's natural free-will, but by an infringement or diminution of one or other of theſe important rights, the preſervation of theſe inviolate, may juſtly be ſaid to include the preſervation of our civil immunities in their largeſt and moſt extenſive ſenſe. See the article RIGHTS.

In vain, however, would theſe rights be declared, aſcertained, and protected by the dead letter of the laws, if the conſtitution had provided no other method to ſecure their actual enjoyment. It has therefore eſtabliſhed certain other auxiliary ſubordinate rights of the ſubject, which ſerve principally as barriers to protect and maintain inviolate the three great and primary rights, of perſonal ſecurity, perſonal liberty, and private property. Theſe are,

1. The conſtitution, powers, and privileges of parliament; for which ſee PARLIAMENT.

2. The limitation of the king's prerogative, by bounds ſo certain and notorious, that it is impoſſible he ſhould exceed them without the conſent of the people; as to which, ſee PARLIAMENT. The former of theſe keeps the legiſlative power in due health and vigour, ſo as to make it improbable that laws ſhould be enacted deſtructive of general liberty; the latter is a guard upon the executive power, by reſtraining it from acting either beyond or in contradiction to the laws that are framed and eſtabliſhed by the other.

3. A third ſubordinate right of every Briton is that of applying to the courts of juſtice for redreſs of injuries. Since the law is, in this realm, the ſupreme arbiter of every man's life, liberty, and property, courts of juſtice muſt at all times be open to the ſubject, and the law be duly adminiſtered therein. The emphatical words of *magna charta*, ſpoken in the perſon of the king, who in judgment of law (ſays Sir Edward Coke) is ever preſent and repeating them in all his courts, are theſe; *Nulli vendimus, nulli negabimus, aut differemus rectum vel juſtitiam:* "and therefore every ſubject," continues the ſame learned author, "for injury done to him *in bonis, in terris, vel perſona*, by any other ſubject, be he eccleſiaſtical or temporal, without any exception, may take his remedy by the courſe of the law, and have juſtice and right for the injury done to him, freely without ſale, fully without any denial, and ſpeedily without delay." It were endleſs to enumerate all the *affirmative* acts of parliament, wherein juſtice is directed to be done according to the law of the land: and what that law is, every ſubject knows; or may know if he pleaſes: for it depends not upon the arbitrary will of any judge; but is permanent, fixed, and unchangeable, unleſs by authority of parliament. Not only the ſubſtantial part, or judicial deciſions, of the law, but alſo the formal part, or method of proceeding, cannot be altered but by parliament: for, if once thoſe outworks were demoliſhed, there would be an inlet to all manner of innovation in the body of the law itſelf. The king, it is true, may erect new courts of juſtice; but then they muſt proceed according to the old eſtabliſhed forms of the common law. For which reaſon it is declared in the ſtatute 16 Car. I. c. 10. upon the diſſolution of the court of ſtar-chamber, that neither his majeſty, nor his privy counſel, have any juriſdiction, power, or authority by Engliſh bill, petition, articles, libel (which were the courſe of proceeding in the ſtar-chamber, borrowed from the civil law) or by any other arbitrary way whatſoever, to examine, or draw into queſtion, determine, or diſpoſe of the lands or goods of any ſubjects of this kingdom; but that the ſame ought to be tried and determined in the ordinary courts of juſtice, and by *courſe of law*.

4. If there ſhould happen any uncommon injury, or infringement of the rights before-mentioned, which the ordinary courſe of law is too defective to reach, there ſtill remains a fourth ſubordinate right, appertaining to every individual, namely, the right of petitioning the king, or either houſe of parliament, for the redreſs of grievances; it is declared by the ſtatute 1 W. & M. ſt. 2. c. 2. that the ſubject hath a right to petition; and that all commitments and proſecutions for ſuch petitioning are illegal.

5. The fifth and laſt auxiliary right of the ſubject, that we ſhall at preſent mention, is that of having arms for their defence, ſuitable to their condition and degree, and ſuch as are allowed by law. Which is alſo declared by the ſame ſtatute 1 W. & M. ſt. 2. c. 2. and is indeed a public allowance, under due reſtrictions, of the natural right of reſiſtance and ſelf-preſervation, when the ſanctions of ſociety and laws are found inſufficient to reſtrain the violence of oppreſſion. In theſe ſeveral articles conſiſts the rights, or, as they are frequently termed, *the liberties of Britons:* liberties more generally talked of, than thoroughly underſtood; and yet highly neceſſary to be perfectly known and conſidered by every man of rank or property, leſt his ignorance of the points whereon they are founded ſhould hurry him into faction and licentiouſneſs on the one hand, or a puſillanimous indifference and criminal ſubmiſſion on the other. And we have ſeen that theſe rights conſiſt, primarily, in the free enjoyment of perſonal ſecurity, of perſonal liberty, and of private property. So long as theſe remain inviolate, the ſubject is perfectly free; for every ſpecies of compulſive tyranny and oppreſſion muſt act in oppoſition to one or other of theſe rights, having no other object upon which it can poſſibly be employed. To preſerve theſe from violation, it is neceſſary that the conſtitution of parliaments be ſupported in its full vigour; and limits, certainly known, be ſet to the royal prerogative. And, laſtly, to vindicate theſe rights, when actually violated or attacked, the ſubjects of Britain are entitled, in the firſt place, to the regular adminiſtration and free courſe of juſtice in the courts of law; next, to the right of petitioning the king and parliament for redreſs of grievances; and laſtly, to the right of having and uſing arms for ſelf-preſervation and defence. And all theſe rights and liberties it is our birthright to enjoy entire; unleſs where the laws of our country have laid them under neceſſary reſtraints. Reſtraints in themſelves ſo gentle and moderate, as will appear upon farther enquiry, that no man of ſenſe or probity would wiſh to ſee them ſlackened. For all of us have it in our choice to do every thing that a good man would deſire to do; and are reſtrained from nothing, but what would be pernicious either to ourſelves or our fellow-citizens. So that this review of our ſituation may fully juſtify the obſervation of a learned French author, who indeed generally both thought and wrote in the ſpirit of genuine freedom; and who hath not ſcrupled to profeſs, even in the very boſom of his native country, that the Britiſh is the only nation in the world, where political or civil liberty is the direct end of its conſtitution. Recommending therefore to the ſtudent in our laws a farther and more accurate ſearch into this extenſive and important title, we ſhall cloſe our remarks upon it with the expiring wiſh of the famous father Paul to his country, "ESTO PERPETUA!"

LIBERTY *of Conſcience*, a right or power of making profeſſion of any religion, or of ſerving God in any manner that a man thinks proper. This ſeems to be a natural right; it is vigorouſly oppoſed by the generality of the Romaniſts, and even by many of the reformed, though it ſeems as if the reformation could ſcarce ſubſiſt without it. See TOLERATION and PERSECUTION.

The nature of liberty may be better underſtood by dividing it, with an excellent writer, into *phyſical*, *moral*, *religious*, and *civil*.

Phyſical LIBERTY, is that principal of ſpontaneity or ſelf-determination, which conſtitutes us agents; or which gives us a command over our actions, rendering them properly our's and not effects of the operation of any foreign cauſe. Without this *liberty*, or being under a neceſſity of always following ſome will different from his own, man would be a machine acted upon by mechanical ſprings, having no principle of motion in himſelf or command over events; and, therefore, incapable of all merit and demerit. Whether man is endued with this kind of *liberty* or ſelf-determining power has been a ſubject of much controverſy: it was agitated at the beginning of this century between Leibnitz, Collins, &c. on one ſide, and Clarke, Jackſon, &c. on the other; and has been lately revived by Dr. Prieſtley.

Religious LIBERTY, is the ſame with LIBERTY *of Conſcience*, and ſignifies the power of exerciſing, without moleſtation, that mode of religion which we think beſt; or of making the deciſions of our own conſciences, reſpecting religious truths, the rule of our conduct, and not any of the deciſions of others.

LIBERTY *of the Preſs*. The art of printing, ſoon after its introduction, was looked upon in England, as well as in other countries, as merely a matter of ſtate, and ſubject to the coercion of the crown. It was therefore regulated with us by the king's proclamations, prohibitions, charters of privilege and licence, and finally by the decrees of the court of ſtar-chamber, which limited the number of printers, and of preſſes which each ſhould employ, and prohibited new publications unleſs previouſly approved by proper licenſers. On the demolition of this odious juriſdiction in 1641, the long parliament of Charles I. after their rupture with that prince, aſſumed the ſame powers as the ſtar-chamber had exerciſed with reſpect to the licenſing of books: and in 1634, 1647, 1649, and 1652 (Scobell. i. 44, 134. ii. 88, 230.) iſſued their ordinances for that purpoſe, founded principally on the ſtar-chamber decree of 1637. In 1662, was paſſed the ſtatute 13 & 14 Car. II. c. 33. which, with ſome few alterations, was copied from the parliamentary ordinances. This act expired in 1679; but was revived by ſtatute 1 Jac II. c. 17. and continued till 1692. It was then continued for two years longer by ſtatute 4 W. & M. c. 24. but though frequent attempts were made by the government to revive it, in the ſubſequent part of that reign (Com. Journ. 11 Feb. 1694. 26 Nov. 1695. 22 Oct. 1696. 9 Feb. 1697. 31 Jan. 1698.) yet the parliament reſiſted it ſo ſtrongly, that it finally expired, and the preſs became properly free in 1698; and has continued ſo ever ſince.

The liberty of the preſs, however, ſo eſſential to the nature of a free ſtate, conſiſts not in freedom from cenſure for any criminal matter that may be publiſhed, but in laying no previous reſtraints upon publications. Every freeman has undoubtedly a right to lay what ſentiments he pleaſes before the public; to forbid this, is to deſtroy the freedom of the preſs: but if he publiſhes what is improper, miſchievous, or illegal, he muſt take the conſequence of his temerity. See LIBEL.

To ſubject the preſs to the reſtrictive power of a licenſer in the manner abovementioned, is to ſubject all freedom of ſentiment to the prejudices of one man, and make him the arbitrary and infallible judge of all controverted points in learning, religion, and government. But to puniſh (as the law does at preſent) any dangerous or offenſive writings which, when publiſhed, ſhall, on a fair and impartial trial, be adjudged of a pernicious tendency, is neceſſary for the preſervation of peace and good order, of government and religion, the only ſolid foundations of civil liberty. Thus the will of individuals is ſtill left free; the abuſe only of that free-will is the object of legal puniſhment. Neither is any reſtraint hereby laid upon freedom of thought or inquiry; liberty of private ſentiment is ſtill left; the diſſeminating or making public of bad ſentiments, deſtructive of the ends of ſociety, is the crime which ſociety corrects. A man (ſays a fine writer on this ſubject) may be allowed to keep poiſons in his cloſet, but not publicly to vend them as cordials. And to this we may add, that the only plauſible argument heretofore uſed for reſtraining the juſt freedom of the preſs, "that it was neceſſary to prevent the daily abuſe of it," will entirely loſe its force, when it is ſhewn, (by a ſeaſonable exertion of the laws) that the preſs cannot be abuſed to any bad purpoſe without incurring a ſuitable puniſhment: whereas, it can never be uſed to any good one when under the controul of an inſpector. So true will it be found, that to cenſure the licentiouſneſs, is to maintain the liberty of the preſs.

LIBRA, *balance*, one of the mechanical powers. See BALANCE.

LIBRA is one of the twelve ſigns of the zodiac; exactly oppoſite to Aries; ſo called, becauſe when the ſun is in this ſign, at the autumnal equinox, the days and nights are equal, as if weighed in a balance. See Syſtem of ASTRONOMY, Sect. IX.

LIBRARY, an edifice or apartment deſtined for the placing of of books; or the collection of books themſelves lodged therein. See BOOK.

The Bodleian *library* at Oxford, built on the foundation of that of duke Humphry, exceeds that of any univerſity in Europe, and even thoſe of all the ſovereigns of Europe, except the Emperor's and French king's, which are each of them older by a hundred years. It was firſt opened in 1602, and has ſince found a great number of benefactors; particularly ſir Robert Cotton, ſir H. Savil, archbiſhop Laud, ſir Kenelm Digby, Mr. Allen, Dr. Pococke, Mr. Selden, and others. The Vatican, the Medicean, that of Beſſarion at Venice, and thoſe juſt mentioned, exceed the Bodleian in Greek manuſcripts; which yet outdoes them all in Oriental manuſcripts. As to printed books, the Ambroſian at Milan, and that of Wolfenbuttle, are two of the moſt famous, and yet both inferior to the Bodleian.

King's LIBRARY, at St. James's, was founded by Henry, eldeſt ſon of James I. and made up partly of books, and partly of manuſcripts with many other curioſities; for the advancement of learning. It has received many additions from the *libraries* of Iſaac Caſaubon, and others.

Cottonian LIBRARY, originally conſiſted of nine hundred and fifty eight volumes of original charters, grants, inſtruments, letters of ſovereign princes, tranſactions between this and other kingdoms and ſtates, genealogies, hiſtories, regiſters of monaſteries, remains of Saxon laws, the book of Geneſis, thought to be the moſt ancient Greek copy extant, and ſaid to have been writ by Origen in the ſecond century, and the curious Alexandrian copy or manuſcript, in Greek capitals. This *library* is kept in the Britiſh Muſeum, with the large and valuable *library* of ſir Hans Sloane, amounting to upwards of forty-two thouſand volumes, &c. There are many public *libraries* belonging to the ſeveral colleges at Oxford and Cambridge, and the univerſities in North Britain. The principal public *libraries* in London, beſide that of the Muſeum, are thoſe of the college of heralds, of the college of phyſicians, of Doctors Commons, to which every biſhop, at the time of his conſecration, gives at leaſt 20*l.* ſometimes 50*l.* for the purchaſe of books; thoſe of Gray's Inn, Lincoln's Inn, the Inner Temple, and Middle Temple; that of Lambeth, founded by archbiſhop Bancroft in 1610, for the uſe of ſucceeding archbiſhops of Canterbury, and increaſed by the benefactions of archbiſhops Abbot, Sheldon, and Tenniſon, and ſaid to conſiſt of, at leaſt, fifteen thouſand printed books, and ſix hundred and ſeventeen volumes in manuſcript; that of Red-Croſs ſtreet, founded by Dr. Daniel Williams, a preſbyterian divine, and ſince enriched by many private benefactions; that of the *Royal Society*, called the Arundelian or Norfolk *library*, becauſe the principal part of the collection formerly belonged to the family of Arundel, and was given to the ſociety by Henry Howard, afterwards duke of Norfolk, in 1666, which *library* has been increaſed by the valuable collection of Francis Aſton, eſq. in 1715, and is continually increaſing by the numerous benefactions of the works of its learned members, and others; that of St. Paul's, of *Sion College*, the Queen's *library*, erected by queen Caroline in 1737; and the ſurgeon's *library* kept in their hall in the Old Bailey, &c.

LIBRATION, in aſtronomy, an apparent irregularity in the motion of the moon, by which ſhe ſeems to *librate* or waver about her own axis; ſometimes from the eaſt to the weſt; and ſometimes from the weſt to the eaſt.

LICE, the Engliſh name of the Genus Pediculus in Entomology; for deſcription, ſee PEDICULUS.

Crab-LICE, ſo called from their reſemblance to crab-fiſh. They infeſt the arm-pits, eye-lids, eyebrows, and pudenda of grown perſons. They are flattiſh, and ſtick ſo cloſe to the ſkin, that they can ſcarce be removed. They are alſo called *plactulæ*, *petolæ*, *peſſolatæ*, and, from their often infeſting the pubes, they are called *pediculi inguinales*. They are deſtroyed either with black ſoap, mercurial ointments, oil of lavender, or a ſolution of ſublimate in roſe-water; of which laſt the proportion may be one drachm of ſublimate to a pound of the water.

LICENCE, in law, an authority given to a perſon to do ſome lawful act.

LICENSER *of the Preſs*. See LIBERTY *of the Preſs*.

LICENTIATE, one who has obtained the degree of a licence. The greateſt number of the officers of juſtice in Spain are diſtinguiſhed by no other title than that of *licentiate*. In order to paſs *licentiate* in common law, civil law, and phyſic, they muſt have ſtudied ſeven years, and in divinity ten. Among us a *licentiate* uſually means a phyſician who has a licence to practiſe, granted by the college of phyſicians.

LIEGE, *Ligeus*, in law, is uſed for *liege-lord*, and ſometimes for *liege-man*: liege-lord is he that acknowledgeth no ſuperior, and liege-man is he who owneth allegiance to his liege-lord, 34 & 35 H. VIII. The king's ſubjects are called *lieges* or *liege-people*, becauſe they owe and are bound to pay allegiance to him. Stat. 8 H. VI. *c.* 10, 14. H. VIII. *c.* 2. But in ancient times, private perſons, as lords of manors, &c. had their lieges.

LIEUTENANT, an officer who ſupplies the place and diſcharges the office of a ſuperior in his abſence. Of theſe, ſome are civil, as the lords lieutenants of counties; and others are military, as the lieutenant-general, lieutenant-colonel, &c.

Lord-LIEUTENANT *of Ireland*, is properly a viceroy; and has all the ſtate and grandeur of a king of England, except being ſerved upon the knee. He has the power of making war and peace, of beſtowing all the offices under the governmeut, of dubbing knights, and of pardoning all crimes except high treaſon; he alſo calls and prorogues the parliament, but no bill can paſs without the royal aſſent. He is aſſiſted in his government by a privy-council; and, on his leaving the kingdom, he appoints the lords of the regency, who governs in his abſence.

Lord LIEUTENANTS *of Counties*, are officers, who, upon any invaſion or rebellion, have power to raiſe the militia, and to give commiſſions to colonels and other officers, to arm and form them into regiments, troops, and companies. Under the lords-lieutenant, are deputy-lieutenants, who have the ſame power; theſe are choſen by the lords-lieutenant, out of the principal gentlemen of each county, and preſented to the king for his approbation.

LIEUTENANT-*Colonel*. See COLONEL.

LIEUTENANT-*General*. See GENERAL.

LIFE, *Vita*, is a very ambiguous term. For both God and man, and a ſoul, and an animal, and a plant, are ſaid *to live*; yet there is not any thing common to all theſe beſides a kind of active exiſtence; which, however, is of very different kinds. See ANIMAL and VEGETABLE. *Life*, then, in the general, expreſſes a kind of active, operative exiſtence; and it is therefore conceived to conſiſt in motion. But particularly,

LIFE *of Body*, *vita corporis*, conſiſts in an uninterrupted motion therein. A body, therefore, ſaid to be *living*, muſt conſiſt of various parts or members, both internal and external, ſo framed and put together, as to conſtitute one whole. And theſe members may be moved and warmed by ſome fluid ſubſtance, permeating the whole frame; by which heat and motion, the vital functions are to be performed. Such are nutrition, generation, local motion, &c.

Prolongation of LIFE, is made, by lord Bacon, one of the three branches of medicine; the other two relating to the preſervation of health, and the cure of diſeaſes. See the article LONGEVITY.

Life-Annuities, are annuities the payments of which are ſuſpended on the continuance of any given life or lives; and they may be diſtinguiſhed into annuities to commence *immediately*, and annuities to commence at ſome future period, or *reverſionary life-annuities*. The value of a *life-annuity* is properly the ſum that will be ſufficient to enable a *ſeller* (allowing for the chances of mortality) to pay the annuity without loſs; and, ſuppoſing money to bear no intereſt, it is always equal to the expectation of the life. For a copious account, ſee Syſtem of Annuities.

LIGAMENT, in anatomy, a ſtrong compact ſubſtance, ſerving to join two bones together. See Syſtem, Part I. Sect. VIII.

LIGATURE, in ſurgery, is a cord, band, or ſtring; or the binding any part of the body with a cord, band, fillet, &c. whether of leather, linen, or any other matter. Ligatures are uſed to extend or replace bones that are broken or diſlocated; to tie the patients down in lithotomy and amputations; to tie up the veins in phlebotomy, or the arteries in amputations, or in large wounds; to ſecure the ſplints that are applied to fractures; to tie up the proceſſes of the peritonæum with the ſpermatic veſſels in caſtration; and, in taking off warts or other excreſcences by ligature.

LIGHT, in the moſt common acceptation of the word, ſignifies that inviſible etherial matter which makes objects perceptible to our ſenſe of ſeeing. It is alſo uſed for whatever conveys inſtruction to our minds, and likewiſe for that inſtruction itſelf.

Opinions of the Firſt Philoſophers concerning Light. The nature of light hath been a ſubject of ſpeculation from the earlieſt ages of philoſophy. Some of thoſe firſt diſtinguiſhed by the appellation of philoſophers even doubted whether objects became viſible by means of any thing proceeding from them, or from the eye of the ſpectator. The fallacy of this notion muſt very ſoon have been apparent, becauſe, in that caſe, we ought to have ſeen as well in the night as in the day. The opinion was therefore qualified by Empedocles and Plato; who maintained, that viſion was occaſioned by particles continually flying off from the ſurfaces of bodies which met with others proceeding from the eye; but Pythagoras aſcribed it ſolely to the particles proceeding from the external objects and entering the pupil of the eye.

Opinion of Des Cartes. Among the modern philoſophers there have been two celebrated opinions, viz. the Carteſian and Newtonian. According to the former, light is an inviſible fluid preſent at all times and in all places, but which requires to be ſet in motion by an ignited or otherwiſe properly qualified body, in order to make objects viſible to us.

Of Sir Iſaac Newton. The Newtonians maintain, that light is not a fluid *per ſe*, but conſiſts of a vaſt number of exceedingly ſmall particles ſhaken off in all directions from the luminous body with inconceivable velocity by a repulſive power; and which moſt probably never return again to the body from which they were emitted. Theſe particles are alſo ſaid to be emitted in right lines by the body from whence they proceed: and this rectilinear direction they preſerve until they are turned out of their original path by the attraction of ſome other body near which they paſs, and which is called *inflection*; by paſſing through a medium of different denſity, which is called *refraction*; or by being thrown obliquely or directly forward by ſome body which oppoſes their paſſage, and which is called *reflection*; or, laſtly, till they are totally ſtopped by the ſubſtance of any body into which they penetrate, and which is called their *extinction*. A ſucceſſion of theſe particles following one another in an exactly ſtraight line is called a *ray of light*; and this ray, in whatever manner it hath its direction changed, whether by refraction, reflection, or, inflection, always preſerves its rectilinear courſe, neither is it poſſible by any art whatever to make it paſs on in the ſegment of a circle, ellipſis, or other curve. From ſome obſervations on the eclipſes of Jupiter's ſatellites, and alſo on the aberration of the fixed ſtars, it appears that the particles of light move at the rate of little leſs than 200,000 miles in a ſecond of time.

Objections to the Newtonian Doctrine. To this doctrine concerning the nature of light ſeveral objections have been made; the moſt conſiderable of which is, That in this caſe, as rays of light are continually paſſing in different directions from every viſible point, they muſt neceſſarily interfere with and deſtroy each other in ſuch a manner as entirely to confound all diſtinct perception of objects, if not to deſtroy the ſenſe of ſeeing altogether; not to mention the continual waſte of ſubſtance which a conſtant emiſſion of particles muſt occaſion in the luminous body, and which ſince the creation ought to have greatly diminiſhed the ſun and ſtars, as well as increaſed the bulk of the earth and planets by the vaſt quantity of particles of light abſorbed by them in ſuch a long period of time.

It is obvious, however, that, whatever ſide we take concerning the nature of light, many, indeed almoſt all the circumſtances concerning it, are incomprehenſible, and beyond the reach of human underſtanding.

Unaccountable Properties of Light. Moſt of the diſcous flowers, by ſome power unknown to us, follow the ſun in his courſe. They attend him to his evening retreat, and meet his riſing luſtre in the morning with the ſame unerring law. If a plant alſo is ſhut up in a dark room, and a ſmall hole is afterwards opened by which the light of the ſun may enter, the plant will turn towards that hole, and even alter its own ſhape in order to get near it; ſo that though it was ſtraight before, it will in time become crooked, that it may get near the light. It is not the *heat*, but the *light* of the ſun, which it thus covets; for, though a fire be kept in the room, capable of giving a much ſtronger heat than the ſun, the plant will turn away from the fire in order to enjoy the ſun's light. The green colour of plants alſo depends on the ſun's light being allowed to ſhine upon them; for without this they are always white. From this laſt circumſtance, and likewiſe the property which the ſolar light has of blackening precipitates of ſilver from the nitrous acid, it hath been thought that light either contains the *phlogiſton* in very conſiderable quantity, or is itſelf a modification of that unknown ſubſtance.

Is not a Modification of the Phlogiſton. But that this cannot be the caſe, we have now a proof little ſhort of demonſtration, from the laſt experiments of Dr. Prieſtley concerning the production of pure dephlogiſticated air from pump water, by means of the ſolar light. If light either were the phlogiſton itſelf, or contained it in very conſiderable quantity, it is impoſſible the air produced by its means could be pure and dephlogiſticated. See the articles Gas and Air. For the properties of light acting as the medium of our perceptions by the ſenſe of ſight, ſee the article Optics.

Light *independent of Heat.* In general, a very conſiderable degree of heat is requiſite to the emiſſion of light from any body; but there are ſeveral exceptions to this, eſpecially in light proceeding from putreſcent ſubſtances and phoſphorus, together with that of luminous animals, and other ſimilar appearances. Light proceeding from putreſcent animal and vegetable ſubſtances, as well as from glow worms, is mentioned by Ariſtotle. Thomas Bartholin mentions four kinds of luminous inſects, two with wings, and two without; but in hot climates travellers ſay they are found in much greater numbers, and of different ſpecies. Columna, an induſtrious naturaliſt, obſerves, that their light is not extinguiſhed immediately upon the death of the animal.

Mr. Boyle's obſervation of light proceeding from fleſh-meat was quite *caſual*. On the fifteenth of February 1662, one of his ſervants was greatly alarmed with the ſhining of ſome veal, which had been kept a few days, but had no bad ſmell, and was in a ſtate very proper for uſe. The ſervant immediately made his maſter acquainted with this extraordinary appearance; and though he was then in bed, he ordered it to be immediately brought to him, and he examined it with the greateſt attention. Suſpecting that the ſtate of the atmoſphere had ſome ſhare in the production of this phænomenon, he takes notice, after deſcribing the appearance, that the wind was ſouth-weſt and bluſtering, the air hot for the ſeaſon, the moon was paſt its laſt quarter, and the mercury in the barometer was at 29 $\frac{3}{16}$ inches.

Light from Fiſhes. Mr. Boyle was often diſappointed in his experiments on ſhining-fiſhes; finding, that they did not always ſhine in the very ſame circumſtances, as far as he could judge, with others which had ſhined before. At one time that they failed to ſhine, according to his expectations, he obſerved that the weather was variable, and not without ſome days of froſt and ſnow. In general, he made uſe of whitings, finding them the fitteſt for his purpoſe. In a diſcourſe, however, upon this ſubject at the Royal Society in 1681, it was aſſerted, that, of all fiſhy ſubſtances, the eggs of lobſters, after they had been boiled, ſhone the brighteſt. Olig. Jacobœus, obſerves, that, upon opening a ſea-polypus, it was ſo luminous, as to ſtartle ſeveral perſons who ſaw it; and he ſays that the more putrid the fiſh was, the more luminous it grew. The nails alſo and the fingers of the perſons who touched it became luminous; and the black liquor which iſſued from the animal, and which is its bile, ſhone alſo, but with a very faint light.

Of the Pholas, a remarkably luminous Fiſh. There is a remarkable ſhell-fiſh called *pholas*, which forms for itſelf holes in various kinds of ſtone, &c. That this fiſh is luminous, was noticed by Pliny; who obſerves, that it ſhines in the mouth of the perſon who eats it, and, if it touch his hands or cloaths, makes them luminous. He alſo ſays that the light depends upon its moiſture. The light of this fiſh has furniſhed matter for various obſervations and experiments to M. Reaumur, and the Bolognian academicians, eſpecially Beccarius, who took ſo much pains with the ſubject of phoſphoreal light.

Beccarius obſerved, that though this fiſh ceaſed to ſhine when it became putrid; yet that, in its moſt putrid ſtate, it would ſhine, and make the waters in which it was immerſed luminous, when they were agitated. Of all the liquors to which he put the pholades, milk was rendered the moſt luminous. A ſingle pholas made ſeven ounces of milk ſo luminous, that the faces of perſons might be diſtinguiſhed by it, and it looked as if it was tranſparent.

Experiments by M. Ant. Martin. M. Ant. Martin made many experiments on the light of fiſhes, with a view to diſcover the cauſe of the light of the ſea. He thought that he had reaſon to conclude, from a great variety of experiments, that all ſea-fiſhes have this property; but that it is not to be found in any that are produced in freſh water. Light from the fleſh of birds or beaſts is not ſo bright, he ſays, as that which proceeds from fiſh. Human bodies, he ſays, have ſometimes emitted light about the time that they began to putrefy, and the walls and roof of a place in which dead bodies had often been expoſed, had a kind of dew or clammineſs upon it, which was ſometimes luminous; and he imagined that the lights which are ſaid to be ſeen in burying-grounds may be owing to this cauſe.

It appeared by ſome of the firſt obſervations on this ſubject, that *heat* extinguiſhes the light of putreſcent ſubſtances. Mr. Canton alſo attended to this circumſtance; and obſerves, that though the greateſt ſummer heat is well known to promote putrefaction, yet 20 degrees more than that of the human blood ſeems to hinder it. For putting a ſmall piece of a luminous fiſh into a thin glaſs ball, he found, that water of the heat of 118 degrees would extinguiſh its light in leſs than half a minute; but that, on taking it out of the water, it would begin to recover its light in about ten ſeconds; but it was never afterwards ſo bright as before.

Ignis fatuus. To putrefaction, alſo, ſome are willing to attribute that luminous appearance which goes by the name of *ignis fatuus*, or in common Engliſh *Will with a wiſp*, to which the credulous vulgar aſcribe very extraordinary and eſpecially miſchievous powers. This phenomenon is chiefly viſible in damp places; and is alſo ſaid to be very often ſeen in burying-grounds, and near dunghills. Travellers ſay, that it is very frequent near Bologna in Italy, and in ſeveral parts of Spain and Ethiopia. The form and ſize of it are very various, and often variable. It was the opinion of many philoſophers, and eſpecially Willoughby and Ray, that the ignis fatuus is made by ſhining inſects; but this opinion was never well ſupported. Sir Iſaac Newton calls it *a vapour ſhining without heat*; and ſuppoſes that there is the ſame difference between this vapour and flame, that there is between wood ſhining without heat, and burning coals of fire. That this opinion is juſt, and, moreover that the light of this vapour ſhining without heat is of the ſame nature with light from putreſcent ſubſtances, according to the ſupporters of the putrefactive hypotheſis, may be concluded from the following circumſtances relating to them, as deſcribed by Dr. Derham and G. B. Becari.

The former of theſe gentlemen, having obſerved an ignis fatuus in ſome boggy ground, between two rocky hills, in a dark and calm night, got by degrees within two or three yards of it, and thereby had an opportunity of viewing it to the greateſt advantage. It kept ſkipping about a dead thiſtle, till a ſlight motion of the air, occaſioned, as he ſuppoſed, by his near approach to it, made it jump to another place; and as he advanced, it kept flying before him. He was ſo near to it, that, had it been the ſhining of glowworms, he was ſatisfied that he could not but have diſtinguiſhed the ſeparate lights of which it muſt have conſiſted; whereas it was one uniform body of light. He therefore thought that it muſt be an ignited vapour.

Phoſphoric Light. A light in ſome reſpects ſimilar to thoſe abovementioned has been found to proceed from that celebrated chymical production called *phoſphorus*, which always tends to decompoſe itſelf, ſo as to take fire by the acceſs of *air* only. Phoſphorus, therefore, when it emits light, is properly a body ignited; though when a very ſmall quantity of it is uſed, as what is left after drawing it over paper, or what may be diſſolved in eſſential oil, the heat is not ſenſible. But perhaps the matter which emits the light in what we call *putreſcent ſubſtances* may be ſimilar to it, though it be generated by a different proceſs, and burn with a leſs degree of heat. Putreſcence does not ſeem to be neceſſary to the light of glowworms, or of the pholades; and yet their light is ſufficiently ſimilar to that of ſhining wood or fleſh. Electric light is unqueſtionably ſimilar to that of phoſphorus, though the ſcource of it is apparently very different.

The greateſt variety of experiments with the light of phoſphorus was made by Dr. Slare; who ſays, that the liquid phoſphorus (which is nothing more than the ſolid phoſphorus diſſolved in any of the eſſential oils) would not hurt even a lady's hand; or that, when the hands or face were waſhed with it, it would not only make them viſible to other perſons in the dark, but that the light was ſo conſiderable as to make other neighbouring objects viſible. The phoſphorus of which we have been treating is prepared from urine; but in ſome caſes the ſweat, which is ſimilar to urine, has been obſerved to be phoſphoraceous, without any preparation. This once happened to a perſon who uſed to eat great quantities of ſalt, and who was a little ſubject to the gout, after ſweating with violent exerciſe. Stripping himſelf in the dark, his ſhirt ſeemed to be all on fire, which ſurpriſed him very much. Upon examination, red ſpots were found upon his ſhirt; and the phyſician who was preſent perceived an urinous ſmell, though it had nothing in it of volatile alkali, but of the muriatic acid; the ſame, that iſſues from cabbage much ſalted, and ſtrongly fermenting.

All theſe Lights accounted for from Electricity. The eaſieſt method of accounting for all theſe kinds of lights, perhaps, is from electricity. If light conſiſts in a certain vibration of the electric fluid, then it follows, that in whatever ſubſtance ſuch a vibration takes place, there light muſt appear, whether in prutefcent animal ſubſtances, ſea-water, phoſphorus, or any thing elſe. We know that the electric matter pervades all terreſtrial ſubſtances, and is very liable to be ſet in motion from cauſes of which we are ignorant. The action of the air by which putrefaction is produced may be one of theſe cauſes; and it can by no means appear ſurpriſing that the electric matter ſhould act in the bodies of living animals in ſuch a manner as to produce a permanent light, when we certainly know it acts in ſome of them ſo powerfully as to produce a ſhock ſimilar to that of a charged vial. On this ſubject we ſhall only obſerve farther, that when this vibration becomes ſo powerful as to penetrate the ſolid ſubſtance of the body itſelf, the luminous body then becomes tranſparent, as in the milk beforementioned; but, when it is only ſuperficial, the body, though it emits light, is itſelf opaque.

LIGHTNING, a bright and vivid flaſh of fire, ſuddenly appearing in the atmoſphere, and commonly diſappearing in an inſtant, ſometimes attended with clouds and thunder, and ſometimes not.

Different Appearances of Lightning. The phænomena of lightning are always ſurpriſing, and ſometimes very terrible. But the moſt formidable and deſtructive form which lightning is ever known to aſſume is that of balls of fire. The motion of theſe is very often eaſily perceptible to the eye; but whereever they fall, much miſchief is occaſioned by their burſting, which they always do with a ſudden exploſion, like that of fire-arms. Sometimes they will quickly run along, or reſt for a little upon any thing, and then break into ſeveral pieces, each of which will explode; or the whole ball will burſt at once, and produce its miſchievous effects only in one place. The next to this in its deſtructive effects is the zig-zag kind; for that which appears like indiſtinct flaſhes, whoſe form cannot be readily obſerved, is ſeldom or never known to do hurt. The colour of the lightning alſo indicates in ſome meaſure its power to do miſchief; the paleſt and brighteſt flaſhes being moſt deſtructive; ſuch as are red or of a darker colour, commonly doing leſs damage.

Its ſeeming Omnipreſence. A very ſurpriſing property of lightning, the zig-zag kind eſpecially, when near, is its ſeeming omnipreſence. If two perſons are ſtanding in a room looking different ways, and a loud clap of thunder accompanied with zig-zag lightning happens, they will both diſtinctly ſee the flaſh, not only by that indiſtinct illumination of the atmoſphere which is occaſioned by fire of any kind; but the very form of the lightning itſelf, and every angle it makes in its courſe, will be as diſtinctly perceptible, as though they had looked directly at the cloud from whence it proceeded. If a perſon happened at that time to be looking on a book, or other object which he held in his hand, he would diſtinctly ſee the form of the lightning between him and the object at which he looked. This property ſeems peculiar to lightning, and to belong to no other kind of fire whatever.

Remarkable Effects of Lightning. The effects of lightning are generally confined within a ſmall ſpace; and are ſeldom ſimilar to thoſe which accompany exploſions of gun-powder, or of inflammable air in mines. Inſtances of this kind, however, have occurred; the following is one of the moſt remarkable of which we have any diſtinct account. "Auguſt 2d 1763, about ſix in the evening, there aroſe at Anderlicht, about a league from Bruſſels, a conflict of ſeveral winds borne upon a thick fog. This conflict laſted four or five minutes, and was attended with a frightful hiſſing noiſe, which could be compared to nothing but the yellings of an infinite number of wild beaſts. The cloud then opening, diſcovered a kind of very bright lightning, and in an inſtant the roofs of one ſide of the houſes were carried off and diſperſed at a diſtance; above 1000 large trees were broken off, ſome near the ground, others near the top, ſome torn up by the roots; and many both of the branches and tops carried to the diſtance of 60, 100, or 120 paces; whole coppices were laid on one ſide, as corn is by ordinary winds. The glaſs of the windows which was moſt expoſed was ſhivered to pieces. A tent in a gentleman's garden was carried to the diſtance of 4000 paces; and a branch torn from a large tree, ſtruck a girl in the forehead as ſhe was coming into the town, at the diſtance of 40 paces from the trunk of the tree, and killed her on the ſpot."

Theſe terrible effects ſeem to have been owing to the prodigious agitation in the air, occaſioned by the emiſſion of ſuch a vaſt quantity of lightning at once; or perhaps to the agitation of the electric fluid itſelf, which is ſtill more dangerous than any concuſſion of the atmoſpherere; for thunder-ſtorms will ſometimes produce moſt violent whirlwinds, ſuch as are by the beſt philoſophers attributed to electricity, nay, even occaſion an agitation of the waters of the ocean itſelf, and all this too after the thunder and lightning have ceaſed. In Auguſt 1763, a moſt violent ſtorm of thunder, rain, and hail, happened at London, which did damage in the adjacent country, to the amount of 50,000l. Hailſtones fell of an immenſe ſize, from two to ten inches circumference; but the moſt ſurpriſing circumſtance was the ſudden flux and reflux of the tide in Plymouth pool, exactly correſponding with the like agitation in the ſame place, at the time of the great earthquake at Liſbon.

Inſtances are alſo to be found, where lightning, by its own proper force, without any aſſiſtance from thoſe leſs common agitations of the atmoſphere or electric fluid, hath thrown ſtones of immenſe weight to conſiderable diſtances; torn up trees by the root, and broke them in pieces; ſhattered rocks; beat down houſes, and ſet them on fire, &c. All theſe however, are to be conſidered as the more unuſual phænomena of lightning; its common mode of action being entirely ſimilar to that of a charged Leyden vial, where the electric matter diſcharges itſelf from a ſubſtance poſitively electrified to one that is negatively ſo. The identity of electric matter and lightning ſeems now, indeed, ſo well eſtabliſhed; that there is not the leaſt foundation for ſeeking any other ſolution of the phænomena of lightning, than what may be obtained by comparing them with thoſe of our electrical experiments.

Similarity between electric Sparks and Lightning. The different forms of the flaſhes are all exemplified in thoſe of electrical ſparks. Where the quantity of electricity is ſmall, and conſequently incapable of ſtriking at any conſiderable diſtance, the ſpark appears ſtraight, without any curvature or angular appearance: but where the electricity is very ſtrong and of conſequence capable of ſtriking an object at a pretty conſiderable diſtance, it aſſumes a crooked or zig-zag form. This is always the caſe with Mr. Nairn's very powerful machines, the conductors of which are ſix feet in length and one foot in diameter. Sparks may be taken from them at the diſtance of 16, 27, or even 20 inches; and all of theſe put on the angular zig-zag form of lightning.

Why it aſſumes a zig-zag Form. The reaſon of this appearance, both in theſe ſparks and in the lightning, is, that the more fluid electric matter hath to paſs through the denſer and leſs fluid atmoſphere with great rapidity; and in fact, this is the way in which all the more fluid ſubſtances paſs through thoſe that are leſs ſo, at leaſt when their velocity becomes conſiderable.

Why ſuch kind of Lightning is very dangerous. Hence we may underſtand the reaſon why the zigzag kind of lightning is ſo dangerous, namely, becauſe it muſt overcome a very violent reſiſtance of the atmoſphere; and wherever that reſiſtance is in the ſmalleſt degree leſſened, there it will undoubtedly ſtrike, and at a very conſiderable diſtance too. It it otherwiſe with that kind which appears in flaſhes of no determinate form. The electric matter of which theſe are compoſed, is evidently diſſipated in the air by ſome conducting ſubſtances which are preſent there; and of conſequence, though a man, or other conducting body, happened to be very near ſuch a flaſh, he would not be ſtruck or materially injured by it, though a zig-zag flaſh, in ſuch circumſtances, would have probably diſcharged its whole force upon him.

Why Lightning aſſumes the Form of Balls. The moſt deſtructive kind of lightning, however, as we have already obſerved, is that which aſſumes the form of balls. Theſe are produced by an exceeding great power of electricity gradually accumulated till the reſiſtance of the atmoſphere is no longer able to confine it. In general, the lightning breaks out from the electrified cloud by means of the approach of ſome conducting ſubſtance; either a cloud, or ſome terreſtrial ſubſtance: but the fire-balls ſeem to be formed, not becauſe there is any ſubſtance at hand to attract the electric matter from the cloud, but becauſe the electricity is accumulated in ſuch quantity that the cloud itſelf can no longer contain it. Hence ſuch balls fly off ſlowly, and have no particular deſtination. Their appearance indicates a prodigious commotion and accumulation of electricity in the atmoſphere, without a proportionable diſpoſition in the earth to receive it. This diſpoſition, however, we know is perpetually altered by a thouſand circumſtances, and the place which firſt becomes moſt capable of admitting electricity will certainly receive a fire-ball. Hence this kind of lightning has been known to move ſlowly backwards and forwards in the air for a conſiderable ſpace of time, and then ſuddenly to fall on one or more houſes, according to their being more or leſs affected with an electricity oppoſite to that of the ball at the time. It will alſo run along the ground, break into ſeveral parts, and produce ſeveral exploſions at the ſame time.

Phenomena of Lightning in general accounted for. Hence we may account for the ſeemingly capricious nature of lightning of all kinds, but eſpecially of that kind which appears in the form of balls. Sometimes it will ſtrike trees, high houſes, ſteeples, and towers, without touching cottages, men, or other animals, who are in the neighbourhood. In ſuch caſes, people would be apt to ſay that the neighbourhood of theſe higher objects *preſerved* the others from the ſtroke; but with little reaſon, ſince low houſes, men walking in the fields, cattle, nay, the ſurface of the earth itſelf, have all been ſtruck, while high trees and ſteeples in the neighbourhood have not been touched. In like manner, fire-balls have paſſed very near certain perſons without hurting them, while they have, as it were, gone conſiderably out of their way to kill others. The reaſon of all this is, that in thunder-ſtorms there is conſtantly a certain zone of earth conſiderably under the ſurface, which the lightning deſires (if we may uſe the expreſſion) to ſtrike, becauſe it hath an electricity oppoſite to that of the lightning itſelf. Thoſe objects, therefore, which form the moſt perfect conductors between the electrified clouds and that zone of earth, will be ſtruck by the lightning, whether they are high or low; and becauſe we know not the conducting quality of the different terreſtrial ſubſtances, the ſuperſtitious are apt to aſcribe ſtrokes of lightning to the Divine vengeance againſt particular perſons, whereas it is certain that this fluid, as well as others, acts according to invariable rules, from which it is never known to depart.

It appears, that the electric fluid is altogether incapable either of *accumulation* or *diminution* in quantity in any particular part of ſpace. What we call *electricity* is only the motion of this fluid made perceptible to our ſenſes. Poſitive electricity is when the current of electric matter is directed from the electrified body. Negative electricity is when the current is directed towards it. Let us now ſuppoſe, that a poſitively electrified cloud is formed over a certain part of the earth's ſurface. The electric matter flows out from it firſt into the atmoſphere all round; and while it is doing ſo, the atmoſphere is negatively electrified. In proportion, however, as the electric current pervades greater and greater portions of the atmoſpherical ſpace, the greater is the reſiſtance to its motion, till at laſt the air becomes poſitively electrified as well as the cloud, and then both act together as one body. The ſurface of the earth then begins to be affected, and it ſilently receives the electric matter by means of the trees, graſs, &c. which grow upon its ſurface, till at laſt it becomes poſitively electrified alſo, and begins to ſend off a current of electricity from the ſurface downwards. The cauſes which at firſt produced the electricity of the clouds, ſtill continuing to act, the power of the electric current becomes inconceivably great. The danger of the thunder-ſtorm now begins; for as the force of the lightning is directed to ſome place below the ſurface of the earth, it will certainly dart towards that place, and ſhatter every thing to pieces which reſiſts its paſſage.

Uſe of conducting Rods. The benefit of conducting rods will now alſo be evident: for we are ſure that the electric matter will in all caſes take the way where it meets with the leaſt reſiſtance; and this is through the ſubſtance, or rather over the ſurface, of metals. In ſuch a caſe therefore, if there happen to be a houſe furniſhed with a conductor directly below the cloud, and at the ſame time a zone of negatively electrified earth not very far below the foundation of the houſe, the conductor will almoſt certainly be ſtruck, but the building will be unhurt. If the houſe wants a conductor, the lightning will neverthelеſs ſtrike in the ſame place, in order to get at the negatively electrified zone before-mentioned; but the building will now be damaged, becauſe the materials of it cannot readily conduct the electric fluid.

Dr. Franklin and his followers have concluded, that a pointed conductor will effectually prevent any kind of danger from a ſtroke of lightning. Their reaſoning on this ſubject, they think, is confirmed by the following fact among many others. "Dr. Franklin's houſe at Philadelphia was furniſhed with a rod extending nine feet above the top of the chimney. To this rod was connected a wire of the thickneſs of a gooſe-quill, which deſcended through the well of the ſtair-caſe; where an interruption was made, ſo that the ends of the wire, to each of which a little bell was fixed, were diſtant from each other about ſix inches; an inſulated braſs ball hanging between the two bells. The author was one night waked by loud cracks, proceeding from his apparatus in the ſtair-caſe. He perceived, that the braſs ball, inſtead of vibrating as uſual between the bells, was repelled and kept at a diſtance from both; while the fire ſometimes paſſed in very large quick cracks directly from bell to bell; and ſometimes in a continued denſe white ſtream, ſeemingly as large as his finger; by means of which the whole ſtair-caſe was enlightened, as with ſunſhine, ſo that he could ſee to pick up a pin. From the apparent quantity of electric matter, of which the cloud was thus evidently robbed, by means of the pointed rod (and of which a blunt conductor would not have deprived it), the author conceives, that a number of ſuch conductors muſt conſiderably leſſen the quantity of electric fluid contained in any approaching cloud, before it comes ſo near as to deliver its contents in a general ſtroke."

Uſe of Conductors. On the whole, it ſeems to be pretty certain, that both pointed and knobbed metalline conductors have the power of preſerving any body placed at a ſmall diſtance from them from being ſtruck by lightning. This they do, not becauſe they can *attract* the lightning far out of its way, but becauſe the reſiſtance to its paſſage is always leaſt on that ſide where they are; and as pointed conductors diminiſh the reſiſtance more conſiderably than blunt ones, they ſeem in all caſes to be preferable. It appears, however, that a ſingle conductor, whether blunt or pointed, is not capable of ſecuring all the parts of a large building from ſtrokes of lightning; and therefore ſeveral of them will be required for this purpoſe: but to what diſtance their influence extends, hath not been determined, nor does it ſeem eaſily capable of being aſcertained.

Why Lightning ſometimes kills alternately. It now remains only to explain ſome of the more uncommon appearances and effects of lightning. One of theſe is, that it is frequently obſerved to kill alternately: that is, ſuppoſing a number of people ſtanding in a line; if the firſt perſon was killed, the ſecond perhaps would be ſafe; the third would be killed, and the fourth ſafe; the fifth killed, &c. Effects of this kind are generally produced by the moſt violent kind of lightning; namely, that which appears in the form of balls, and which are frequently ſeen to divide themſelves into ſeveral parts before they ſtrike. If one of theſe parts of a fire-ball ſtrikes a man, another will not ſtrike the perſon who ſtands immediately cloſe to him; becauſe there is always a repulſion between bodies electrified the ſame way. Now, as all theſe parts into which the ball breaks have all the ſame kind of electricity, it is evident that they muſt for that reaſon repel one another; and this repulſion is ſo ſtrong, that a man may be interpoſed within the ſtroke of two of them, without being hurt by either.

Theſe obſervations may ſerve to give ſome idea of the nature of lightning, and its operations after it appears in its proper form and burſts out from the cloud; but for an account of its original formation, and of the powers by which the clouds are at firſt electrified,

trified, and their electricity kept up notwithſtanding many ſucceſſive diſcharges of lightning, and the quantity of electric matter continually carried off by the rain, &c. See the article THUNDER.

Artificial LIGHTNING. Before the diſcoveries of Dr. Franklin concerning the identity of electricity and lightning, many contrivances were invented in order to repreſent this terrifying phænomenon in miniature: the coruſcations of phoſphorus in warm weather, the accenſion of the vapour of ſpirit of wine evaporated in a cloſe place, &c. were uſed in order to ſupport the hypotheſis which at that time prevailed; namely, that lightning was formed of ſome ſulphureous, nitrous, or other combuſtible vapours, floating in long trains in the atmoſphere, which by ſome unaccountable means took fire, and produced all the deſtructive effects of that phenomenon. Theſe repreſentations, however, are now no more exhibited; and the only true artificial lightning is univerſally acknowledged to be the diſcharge of electric matter from bodies in which it is artificially ſet in motion hy our machines.

LILAC, *ſyringa*, in botany, a genus of the diandria order, belonging to the monogynia claſs. Linnæus reckons two ſpecies. Theſe are frequently cultivated in gardens; and ſome growing, with good management, to eighteen or twenty feet high, are with their large tufts of flowers very ornamental. They will grow almoſt any where; but they are obſerved to flower beſt in a light, rich ſoil, as indeed do moſt other ſhrubs, though they grow faſteſt in a wet one. For the cultivation and management, ſee Syſtem of GARDENING, article flower garden, throughout the year.

LILI, the name of one of the favourite remedies of Paracelſus, the baſis of which is antimony; but he has not given us the proceſs for preparing it.

LILIAGO, in botany, a name uſed by Cordus and ſome other authors for the phalangium or ſpiderwort.

LILIACEOUS, in botany, a term uſed to expreſs the flowers of ſome plants, which approach to thoſe of the lily in ſhape. Of this ſort are the flowers of the tulip, hyacinth, aſphodel, ephemerum, and the like; many of which, though they leſs reſemble the lily flowers than the others, yet are to be diſtinguiſhed by this title, becauſe they leave behind them the *liliaceous* ſeed-veſſel which is long, and divided into three cells. See the Syſtem.

LILY, *lilium*, in botany, a genus of the monogynia order, belonging to the hexandria claſs of plants. Linnæus enumerates nine ſpecies. The roots of the *white lily* are emollient, maturating, and greatly ſuppurative. They are uſed externally in cataplaſms for theſe purpoſes with ſucceſs. The common form of applying them is boiled and bruiſed; but ſome prefer the roaſting them till tender, and then beating them to a paſte with oil, in which form they are ſaid to be excellent againſt burns. Gerard recommends them internally in dropſies. See GARDENING.

LIMARIA, in ichthyology, a name given by Gaza and ſome other writers to the *thynnus* or *tunny-fiſh*, called the *Spaniſh mackrel.*

LIMAX, in vermeology, the *ſlug*, or *naked ſnail*; a genus of inſects, belonging to the order of vermes molluſca; the characters of which are theſe: there are eight ſpecies, diſtinguiſhed entirely by their colour; as the black ſlug, the white ſlug, the reddiſh ſlug, the aſh-coloured ſlug, &c. The laſt of theſe, the agreſtis or field ſlug, is very common in gardens, and deſtructive to plants. They are ſometimes ſwallowed by conſumptive perſons, to whom they are thought to be of ſervice. Snails are ſaid to be hermaphrodites, and mutually to impregnate each other.

LIMB, in anatomy, is uſed to denote certain parts of the human body, proceeding from the trunk.

LIME, *calx of ſtone*, a white, ſoft, friable ſubſtance, prepared of ſtone, marble, chalk, or ſome other ſtony ſubſtance, by burning in a kiln. The great uſe of *lime* is in the compoſition of mortar for building; the fire taking away a great part of its humidity, and opening its pores, ſo that it becomes eaſily reducible to powder, and miſcible with ſand or burnt clay.

Quick LIME, or *calx viva*, is ſuch as it comes out of the kiln, or furnace. And thoſe earths or ſtones, which yield this acrimonious, friable ſubſtance, are called calcareous or calcinable. The method of converting earths and ſtones into *quick-lime* is very ſimple: it conſiſts in expoſing them to the action of fire, in kilns made for this purpoſe, till they become of a white red heat, and in keeping them in this degree of heat during twelve or fifteen hours: good *quick-lime* may alſo be made with a leſs heat continued for a long time, or in leſs time with a more intenſe heat; but care muſt be taken that the heat is not ſufficiently violent to vitrify the calcareous ſtone. The effects of calcination, and the principal properties that diſtinguiſh *quick-lime* from uncalcined calcareous earths, are the following: the earths and ſtones, from which *quick-lime* is produced, contain a large quantity of air in a fixed ſtate, called *fixed air*, and by ſome writers calcareous gas, which, in calcination, is expelled; and therefore, in this proceſs, they are rendered more friable, and their weight is very conſiderably diminiſhed.

LIME-*Water*. The general opinion of *lime* acting as a cauſtic, and conſuming the bodies it was made to act upon, by means of the great quantity of particles of fire it contained, long denied any preparation of it a place among internal medicines; at length water poured upon it was found to take in a part of its virtues, and to be a valuable medicine, and very ſafely to be given internally in large quantities.

LIMITATION, *limitatio*, in law, is a certain time aſſigned by ſtatute, within which an action muſt be brought; and *limitation* of time is two-fold; viz. to make title to an inheritance by the common law; and in writs by ſeveral ſtatutes. By ſtatute, actions of debt, actions upon the caſe, except for words, actions of account (except concerning merchandize), of detinue, trover, and treſpaſs, are to be commenced within ſix years after the cauſe of action, and not after; actions of aſſault and battery, wounding and impriſoning, within four years; and for ſlander within two years after the cauſe of action, &c. 21 Jac. I. cap. 16.

LIMITATION *of the Crown*. The ſtatutes 1 W. and M. cap. 8. 12 W. III. cap. 2. and 1 & 2 Ann. cap. 17. 4 Ann. cap. 8, &c. are acts for the *limitation of the crown*, and ſettling it on proteſtant heirs in the houſe of Hanover. See CROWN.

LIMPET, the Engliſh name of the genus *patella*. See PATELLA.

LINE, in geometry, a quantity extended in length only, without any breadth or thickneſs. It is formed by the flux or motion of a point. See FLUXIONS, and GEOMETRY.

Equinoctial LINE, in geography, is a great circle on the earth's ſurface, exactly at the diſtance of 90° from each of the poles, and of conſequence biſecting the earth in that part. From this imaginary line, the degrees of longitude and latitude are counted. In aſtronomy, the equinoctial line is that circle which the ſun ſeems to deſcribe round the earth on the days of the equinox in March and September. See ASTRONOMY, and GEOGRAPHY, N° 28.

Meridian LINE, is an imaginary circle drawn through the two poles of the earth and any part of its ſurface. See GEOGRAPHY.

LINEN, in commerce, a well-known kind of cloth chiefly made of flax. The linen manufacture was probably introduced into Britain with the firſt ſettlements of the Romans. The flax was certainly firſt planted by that nation in the Britiſh ſoil. The plant itſelf indeed appears to have been originally a native of the eaſt. The woollen drapery would naturally be prior in its origin to the linen; and the fibrous plants from which the threads of the latter are produced, ſeem to have been firſt noticed and worked by the inhabitants of Egypt. In Egypt, indeed, the linen manufacture appears to have been very early; for even in Joſeph's time it had riſen to a conſiderable height. From the Egyptians the knowledge of it proceeded probably to the Greeks, and from them to the Romans. Even at this day the flax is imported among us from the Eaſtern nations; the weſtern kind being merely a degenerate ſpecies of it. In order to ſucceed in the linen manufacture, one ſet of people ſhould be confined to the ploughing and preparing the ſoil, ſowing and covering the ſeed, to the weeding, pulling, rippling, and taking care of the new ſeed, and watering and dreſſing the flax till it is lodged at home: others ſhould be concerned in the drying, breaking, ſcutching, and heckling the flax, to fit it for the ſpinners; and others in ſpinning and reeling it, to fit it for the weaver: others ſhould be concerned in taking due care of the weaving, bleaching, beetling, and finiſhing the cloth for the market. It is reaſonable to believe, that if theſe ſeveral branches of the manufacture were carried on by diſtinct dealers in Scotland and Ireland, where our home-made linens are manufactured, the ſeveral parts would be better executed, and the whole would be afforded cheaper, and with greater profit. The *linen* trade of Europe is chiefly in the hand of the Ruſſians, Germans, Swiſs, Flemings, Hollanders, and French. *Linen* is the ſtaple of Scotland; but it was long neglected. The Scots at preſent are not, however, in ſo bad a ſituation in reſpect to this trade, as the French were in the reign of king Henry IV. or the Iriſh at the revolution; where, by the force of public encouragement, it has arrived to an extraordinary pitch, and it is to be hoped will daily advance: the Scots have it not to begin, they want only to improve and extend it to the height it will admit. The balance of trade between England and Scotland, and England and Ireland, is on the Engliſh ſide; and ſo far as England and its dependencies can be ſerved with *linen* from Scotland and Ireland, inſtead of Holland, France, Germany and Ruſſia, ſo far will England be a gainer by this change in the courſe of trade. The more *linen* the Scots and Iriſh can ſell in England, the more of the Engliſh commodities will they be able to purchaſe; and it may be reaſonably ſuppoſed that their demands from England will always increaſe in proportion to the increaſe of their people and *linen* manufactures. It is then evidently the intereſt of England to promote and advance the manufacture of *linen* in Scotland and Ireland, and to give them all reaſonable advantages in the trade, in preference to foreigners, where the balance of trade is againſt us; and this ſeems to be the ſenſe of the nation, ſince all foreign *linen*, for home conſumption, pays a duty. For the method of dyeing linens, ſee the Treatiſe on DYEING.

LING, the Engliſh name of a ſpecies of the Gadus. See GADUS.

LINNÆAN *Syſtem of Botany*. See FLOWERS, and SEXUAL *Syſtem*, ſeverally deſcribed in our Syſtem.

LINNET, in ornithology, the Engliſh name of a ſpecies of the genus Fringilla, ſee FRINGILLA.

LINSEED, the ſeed of the plant linum. Lintſeed bruiſed and ſteeped in water gives it very ſoon a thick mucilaginous nature, and communicates much of its emollient virtue to it. See LINUM.

LINUM, FLAX; a genus of the pentagynia order, belonging to the pentandria claſs of plants.

Species. 1. The uſitatiſſimum, or common annual flax, hath a taper fibrous root; upright, ſlender, unbranched ſtalks, two feet and a half high; garniſhed with narrow, ſpear-ſhaped, alternate grey-coloured leaves; and the ſtalks divided into footſtalks at top, terminated by ſmall blue crenated flowers in June and July; ſucceeded by large round capſules of ten cells, containing each one ſeed. 2. The perenne, or perennial Siberian flax, hath a fibrous perennial root, ſending up ſeveral upright, ſtrong, annual ſtalks, branching four or five feet high; garniſhed with ſmall, narrow, ſpear-ſhaped, alternate leaves of a dark-green colour; and terminated by umbellate cluſters of large blue flowers in June, ſucceeded by ſeeds in autumn. There are 20 other ſpecies of linum, but theſe are the moſt remarkable.

Culture. The firſt ſpecies is cultivated in the fields according to the directions given under the article FLAX. The ſecond ſort is raiſed from ſeed in a bed or border of common garden-earth, in ſhallow drills ſix inches aſunder; and when the plants are two or three inches high, thin them to the ſame diſtance; and in autumn plant them out where they are wanted.

Uſes. The firſt ſpecies may juſtly be looked upon as one of the moſt valuable of the whole vegetable kingdom; as from the bark of its ſtalks is manufactured the lint or flax for making all ſorts of linen-cloth; from the rags of the linen is made paper; and from the ſeeds is expreſſed the lintſeed oil ſo uſeful in painting and other trades. The ſeeds themſelves are eſteemed an excellent emollient and anodyne: they are uſed externally in cataplaſms, to aſſwage the pain of inflamed tumours: internally, a ſlight infuſion of linſeed, by way of tea, is recommended in coughs as an excellent pectoral, and of great ſervice in pleuriſies, nephritic complaints, and ſuppreſſions of urine.

LION, *leo*, a ſpecies of quadrupeds belonging to the genus felis. See FELIS.

LIQUEFACTION, an operation, by which a ſolid body is reduced into a liquid; or the action of fire or heat on fat, and other fuſible bodies, which puts their parts into a mutual inteſtine motion. The *liquefaction* of wax, &c. is performed by a moderate heat, that of ſal tartari, by the mere moiſture of the air. All ſalts liquefy; ſand, mixed with alkalis, becomes liquefied by a reverberatory fire, in the making of glaſs. In ſpeaking of metals, inſtead of *liquefaction*, we ordinarily uſe the word FUSION.

LIQUORICE, *glycyrrhiza*, in botany, a genus of the diadelphia decandria claſs. The common liquorice is a plant propagated in many parts of England to very great advantage. It delights in a rich light ſandy ſoil, which ſhould be three feet deep at leaſt; for the greateſt advantage conſiſts in the length of the roots. The native *liquorice* juice is very ſweet upon the palate, even more than ſugar, or honey; and is yet accounted a great quencher of thirſt: on which account Galen preſcribes it in dropſies. It is very balſamic and detergent; inſomuch that there is ſcarce any medicinal compoſition for diſeaſes of the breaſt, in which it is not an ingredient.

LITANY, a ſolemn form of ſupplication to God, in which the prieſt utters ſome things fit to be prayed for, and the people join in their interceſſion, ſaying, *we beſeech thee to hear us, good Lord*, &c. The word comes from the Greek λιτανεια, "ſupplication;" of λιτανυω, "I beſeech."

At firſt the uſe of litanies was not fixed to any ſtated time, but were only employed as exigencies required. They were obſerved, in imitation of the Ninevites, with ardent ſupplications and faſtings, to avert the threatned judgments of fire, earthquakes, inundations, or hoſtile invaſions. About the year 400, litanies began to be uſed in proceſſions, the people walking barefoot, and repeating them with great devotion; and it is pretended, that by this ſeveral countries were delivered from great calamities. The days on which theſe were uſed, were called *rogation days*: theſe were appointed by the canons of different councils, till it was decreed by the council of Toledo, that they ſhould be uſed every month throughout the year; and thus by degrees they came to be uſed weekly on Wedneſdays and Fridays, the ancient ſtationary days for faſting. To theſe days the rubric of our church has added Sundays, as being the greateſt days for aſſembling at divine ſervice. Before the laſt review of the common prayer, the litany was a diſtinct ſervice by itſelf, and uſed ſome time after the morning prayer was over; at preſent it is made one office with the morning ſervice, being ordered to be read after the third collect for grace, inſtead of the interceſſional prayers in the daily ſervice.

LITERARY *Property*, is that property which an author, or his aſſignee, may be ſuppoſed to have in his own *literary* compoſition; ſo that no other perſon without his leave may publiſh or make profit of the copies. In caſe of a bargain for a ſingle impreſſion, or a ſale or gift of the copy right, the reverſion is plainly continued in the original proprietor, or the whole property is transferred to another. It has been a queſtion much agitated in our ſuperior courts of judicature, and at length determined by the houſe of lords againſt authors and their aſſigns, whether the copy-right of a book belongs to the author by common law. But, excluſive of ſuch copy-rights as may ſubſiſt by the rules of the common law, the ſtatute 8 Ann. cap. 19. has protected by additional penalties, the property of authors and their aſſigns for the term of fourteen years; and hath directed, that if, at the end of that term, the author himſelf be living, the right ſhall then return to him for another term of the ſame duration: and this is the ſole right now veſted in the proprietors of copies.

LITERATI, a particular ſect among the Chineſe, either in religion, philoſophy, or politics; conſiſting principally of the learned men of that country: among whom it is called *jukiao*, i. e. *learned*. It had its riſe in the year of Chriſt 1400, when the emperor, to awaken the native affection of the people for knowledge, which had been quite baniſhed by the preceding civil wars among them, and to ſtir up emulation among the mandarins, choſe out forty-two of the ableſt among their doctors, to whom he gave a commiſſion to compoſe a body of doctrine, agreeable to that of the ancients, which was then become the rule, or ſtandard, of the learned. The delegates applied themſelves to the buſineſs with very great attention; but ſome fancied them rather to have wreſted the doctrine of the ancients, to make it conſiſt with their's, than to have built up their's on the model of the ancients.

They ſpeak of the Deity, as if it were no more than mere nature, or the natural power or virtue that produces, diſpoſes, and preſerves the ſeveral parts of the univerſe. It is, ſay they, a pure, perfect principle, without beginning or end; it is the ſource of all things, the eſſence of every being, and that which determines it to be what it is. They make God the ſoul of the world: they ſay, he is diffuſed throughout all matter, and produces all the changes that happen there. In ſhort, it is not eaſy to determine, whether they reſolve God into nature, or lift up nature into God; for they aſcribe to it many of thoſe things which we attribute to God. This doctrine, in lieu of the idolatry that prevailed before, introduced a refined kind of atheiſm. The work, being compoſed by ſo many perſons of learning and parts, and approved by the emperor himſelf, was received with infinite applauſe by all the people. Many were pleaſed with it, becauſe it ſeemed to ſubvert all religion; others approved it, becauſe the little religion that is left them, could not give them much trouble. And thus was formed the ſect of the *Literati*; which conſiſts of the maintainers and adherents to this doctrine. The court, the mandarins, and the perſons of fortune and quality, &c. are generally retainers of it; but a great part of the common people ſtill hold to their worſhip of idols. The *literati* freely tolerate the Mahometans, becauſe they adore, with them, the king of heaven, and author of nature; but they bear a perfect averſion to all ſorts of idolaters among them: and it was once reſolved to extirpate them. But the diſorder this would have occaſioned in the empire prevented it: they now content themſelves with condemning them, in general, as heretics; which they do ſolemnly every year at Pekin.

LITHOPHYTA, in the Linnæn ſyſtem of natural hiſtory, the fourth order of *vermes* or *worms*, being compoſite animals, affixed to and fabricating a fixed calcareous baſe, called *coral*: this order contains fifty-nine ſpecies, under four genera, viz. the *tubipora* or red tubular coral, *madrepora* or brain-ſtones, *millepora*, and *cellipora*. One of the moſt remarkable ſpecies of the ſmall *lithophyta* we have any where an account of, is that deſcribed by Mr. Leewenhoek, though without any particular name, in the Philoſophical Tranſactions, N° 286. p. 1430.

LITHOTOMY, formed of λιθος, *ſtone*, and τεμνω, *I cut*, in ſurgery, an operation performed upon a human body, in order to extract the ſtone out of the bladder. It appears, that cutting was in uſe for the ſtone, even in the time of Hippocrates, though we are perfectly in the dark as to the manner in which they performed it: it was however, wholly diſuſed in the after ages; inſomuch, that in the beginning of the ſixteenth century, no body durſt practice it. The faculty of medicine at Paris were obliged to petition the parliament to obtain leave to make a trial on a criminal condemned to death, who had the ſtone in the bladder: the operation ſucceeding, the practice became popular. See Syſtem of SURGERY.

LITURGY, a name given to thoſe ſet forms of prayer which have been generally uſed in the Chriſtian church. Of theſe there are not a few aſcribed to the apoſtles and fathers, but they are almoſt univerſally believed to be ſpurious. The word comes from the Greek λειτουργια, *ſervice*, or public miniſtry.

The liturgy of the church of England was compoſed in the year 1547, ſince which time it has undergone ſeveral alterations; the laſt of which was in the year 1661, and of this liturgy Dr. Comber gives the following character. "No church was ever bleſſed with ſo comprehenſive, ſo exact, and ſo inoffenſive a liturgy as ours: which is ſo judiciouſly contrived, that the whole may exerciſe at once their knowledge and devotion; and yet ſo plain, that the moſt ignorant may pray with underſtanding; ſo full, that nothing is omitted, which ought to be aſked in public; and ſo particular, that it compriſeth moſt things which we would aſk in private; and yet ſo ſhort as not to tire any that have true devotion. Its doctrine is pure and primitive; its ceremonies ſo few and innocent, that moſt of the Chriſtian world agree in them: its method is exact and natural; its language ſignificant and perſpicuous, moſt of the words and phraſes being taken out of the holy ſcripture, and the reſt are the expreſſions of the firſt and pureſt ages." And in the opinion of the moſt impartial and excellent

Grotius, (who was no member of, nor had any obligation to, this church) " the Engliſh liturgy comes ſo near the primitive pattern, that none of the reformed churches can compare with it." Again, he ſays, " In the prayers, a ſcholar can diſcern cloſe logic, pleaſing rhetoric, pure divinity, and the very marrow of the ancient doctrine and diſcipline, and yet all made ſo familiar, that the unlearned may ſafely ſay Amen."

LIVER, in anatomy, a large, glandulous viſcus, of a dark red colour, a little inclined to yellow, ſituated immediately under the diaphragm, partly in the right hypochondrium, which it always fills, and partly in the epicaſtrium ; ſtretching itſelf over the right ſide of the ſtomach, towards the left hypochondrium, and reaching behind the cartilago enſiformis, growing gradually thinner and narrower : it ſerves to purify the maſs of blood, by making a ſecretion of the billious humour it contains. See the Syſtem, Part V. Sect. IX. For the repreſentation, ſee plate V. and VI.

LIVERYMEN *of London*, are a number of perſons choſen out of the freemen of each *Company*. Out of this body the common-council, ſheriffs, aldermen, and other officers for the government of the city, are elected ; and they only have the privilege of giving their votes in common hall for members of parliament, &c. from which the reſt of the citizens are excluded. If any one of a company refuſe to become a *liveryman*, he may be fined, and an action of debt will lie for the ſum.

LIVRE, a French money of account conſiſting of twenty ſols ; each ſol containing twelve deniers. The *livre* is of two kinds, *Tournois* and *Pariſis*. *Livre Tournois*, as above, contains twenty ſols Tournois, and each ſol twelve deniers Tournois. *Livre Pariſis*, is twenty ſols Pariſis, each ſol Pariſis worth twelve deniers Pariſis, or fifteen deniers Tournois ; ſo that a *livre Pariſis* is equivalent to twenty-five ſols Tournois ; the word *Pariſis* being uſed in oppoſition to *Tournois*, on account of the rate of money, which was one fourth higher at Paris than at Tours.

LIZARD, in mammalia, the Engliſh name of the genus of lacerta. See LACERTA.

LOADSTONE. See MAGNET.

LOCHIA, or LOCHES, Λοχια, the evacuations conſequent on the delivery of a woman in child-bed. See Syſtem of MIDWIFRY.

LOCUST, a genus of inſects, comprehending the *locuſt*, ſimply ſo called, the ſeveral ſpecies of other *locuſts* and graſhoppers, with the crickets of the houſe and field. Linnæus has claſſed all theſe under the genus of gryllus. See GRYLLUS.

LOBE, Λοϐος, among anatomiſts, is applied to each of the two parts whereof the lungs conſiſt. This ſeparation into *lobes* is of uſe in dilating the lungs, by cauſing them to receive more air, and preventing their being too much ſqueezed, when the back is bent. For this reaſon it is, that beaſts, which are always inclining towards the earth, have more *lobes* in their lungs than men: even their *liver* is divided into *lobes*, whereas that of man is continued.

LOGARITHM CURVE, and LOGARITHM SPIRAL, are lines whoſe properties are ſimilar to the nature and properties of logarithms, and by which they may be explained. See Sect. V. and VI. Part II. Syſtem of GEOMETRY.

LOGARITHMS.

SECT. I. NATURE OF LOGARITHMS.

LOGARITHMS are a ſet of artificial numbers ſo proportioned among themſelves, and adapted to the natural numbers, as to perform the ſame things by addition and ſubtraction, as the latter do by multiplication and diviſion. The word is from the Greek λογος, *ratio* ; and αριθμος, *number*.

Logarithms, juſtly eſteemed one of the greateſt and moſt uſeful diſcoveries that the laſt century has produced, were firſt invented by John Napier, baron of Marchiſton in Scotland, and by him firſt publiſhed at Edinburgh in the year 1614, and ſoon after by himſelf and Mr. Briggs (then Savilian profeſſor of geometry in the univerſity of Oxford) reduced into a better form, and publiſhed in London in the year 1624, in the ſame form and manner as they are uſed at this day. Logarithms may be conſidered as, and are uſually defined to be, a ſeries or rank of numbers in an arithmetical progreſſion, fitted or adapted to a ſeries of numbers in a geometrical progreſſion ; that is, If to a rank of continual proportionals in a geometric progreſſion, from 1 ſuppoſe, 1, 2, 4, 8, 16, 32, 64, 128, &c. be accommodated a rank of numbers, continually proportional in an arithmetical progreſſion beginning from 0. Suppoſe 0, 1, 2, 3, 4, 5, 6, 7, &c. Inſomuch as, for every multiplication or diviſion of the terms in the geometrical progreſſion, there is an anſwerable addition or ſubtraction of the correſpondent terms in the arithmetical progreſſion ; that is, as 2, the ſecond term in the geometric ſeries, multiplied by 4, the third term produces 8, the fourth term in the ſame ſeries ; ſo 1, the ſecond term in the arithmetic ſeries, added to 2, the third term, produces 3, the fourth term in the ſame ſeries ; and again as 16, the fifth term in the geometric ſeries, divided by 2, the ſecond term, produces 8, the fourth term in the ſame ſeries ; or univerſally, if inſtead of 2, the ſecond term in the geometric ſeries, we ſubſtitute x, and, in the room of 1, the ſecond term in the arithmetical ſeries, we ſubſtitute a, that is, if to a ſeries of geometrical mean proportionals as, $1, x, xx, x^3, x^4, x^5, x^6, x^7$, &c. be accommodated a ſeries of arithmetical mean proportionals, as, $0, a, 2a, 3a, 4d, 5a, 6a, 7a$, &c. inſomuch as the multiplication of any two terms in the geometric ſeries, as x and x^2, produces the term x^3, which anſwers or correſponds to the term $3a$ in the arithmetic ſeries, the ſum of the terms a and $2a$ in the ſame ſeries, and the diviſion of any two terms in the firſt ſeries as x^3 by x, produces x^2, which correſponds with the term $2a$ in the ſecond ſeries, the difference between the correſpondent terms $3a$ and a in the ſame ſeries ; and inaſmuch as this is the eſſential property of the logarithms, therefore, the terms in the latter ſeries are the logarithms of their correſpondent terms in the firſt ſeries ; and becauſe the terms a and x may ſtand for any numbers taken at pleaſure, therefore logarithms may be of as many different ſorts as there can be aſſumed different values of the quantities x and a.

If the quantity a in the ſecond ſeries be put equal to 1, then the ſeveral terms of the ſecond ſeries, viz. 0, 1, 2, 3, 4, 5, 6, 7, &c. become the indices or exponents of the ſeveral reſpective terms or powers in the firſt progreſſional ſeries of geometrical proportions whoſe firſt term is 1 and ſecond term x, inaſmuch as they point out the places or diſtances that each term obtains from unity ; for example, as the number 5 in the ſecond ſeries ſtands againſt the quantities x^5 in the firſt ſeries, it points out and ſhews that the quantity x^5 is the fifth place from unity ; in like manner, as the number 6 in the ſecond ſeries ſtands againſt x^5 in the firſt ſeries, it ſhews that the quantity x^6 is the ſixth place from unity, and that the quantity x is that which immediately follows : and hence it is that logarithms are ſometimes defined to be the exponents of indices of the powers of the reſpective numbers to which they belong. In the progreſſional ſeries of geometric proportionals, if between the terms 1 and x be inſerted a mean proportional, which is $\sqrt{x}$, its index will be $\frac{1}{2}$, inaſmuch as its diſtance from unity will be but one half of the diſtance of x from unity ; and conſequently the root of x will be expreſſed by $\frac{1}{2}$: in like manner, if between x and x^2 we inſert a mean proportional, its index will be 1 and $\frac{1}{2}$ or $\frac{2}{3}$, inaſmuch as its diſtance from unity is one and a half the diſtance of x from the ſame place of unity.

Again, if between 1 and x be inſerted two mean proportionals, the firſt of theſe will be the cube root of x or $\sqrt{}^{3}\,x$, and its index will be $\frac{1}{3}$, inaſmuch as its diſtance from the units place is but $\frac{1}{3}$ of the diſtance from x, from the ſame place of unity ; and, conſequently, $\sqrt{}^{3}\,x$ is expreſſed by $x^{\frac{1}{3}}$, whence it follows, that the index of unity is 0, inaſmuch as unity cannot be removed at any diſtance from itſelf. And the ſame ſeries of geometrical proportionals may be continued on the contrary ſide of unity, or towards the left hand, and which therefore will decreaſe in the ſame manner, or in the ſame ratio, as the terms placed on the right hand increaſes.

For the terms, $\frac{1}{x^5}, \frac{1}{x^4}, \frac{1}{x^3}, \frac{1}{x^2}, \frac{1}{x}, 1, x, x^2, x^3, x^4, x^5$, &c. are in the ſame geometrical progreſſion continued, and have all the ſame common ratio ; wherefore, inaſmuch as the diſtance of x from unity towards the right hand is poſitive, or $+1$, the diſtance of $\frac{1}{x}$ from unity towards the left hand, which is equal to the former, is negative, or -1, which is therefore the index of $\frac{1}{x}$, and conſequently, for $\frac{1}{x}$ may be written x^{-1}.

Again, becauſe x^2 is on the right ſide of unity, and poſitive, and its index $+2$ the index of $\frac{1}{x^2}$, which is as far diſtant from unity on the contrary ſide, or towards the left hand, will be negative, and -2, and conſequently $\frac{1}{x^2}$, is the ſame with x^{-2} : in like manner x^{-3} is the ſame with $\frac{1}{x^3}$, and x^{-4} ſame with $\frac{1}{x^4}$; whence it comes to paſs that the negative indices ſhew that the terms to which they belong, are as far diſtant from unity towards the left hand, as the terms whoſe indices are the ſame and poſitive, are removed from unity on the contrary ſide, or towards the right hand. Again, as between 1 and x, in the ſeries in increaſing from or on the right hand of unity, may be inſerted a mean proportional as $\sqrt{x}$, and between this mean proportional and unity be inſerted another mean proportional, as ${}^{4}\sqrt{x}$, and between the laſt mean proportional and unity be inſerted another mean proportional as ${}^{8}\sqrt{x}$, &c. whoſe reſpective indices will be $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$, &c. ſo between unity and the next term $\frac{1}{x}$ in the ſeries decreaſing from unity, or on the left hand of unity, may be inſerted a mean proportional as $\frac{1}{\sqrt{x}}$, whoſe correſpondent index will be $-\frac{1}{2}$; and, again, between this mean proportional and unity, may another mean proportional as $\frac{1}{{}^{4}\sqrt{x}}$ be inſerted, whoſe correſpondent index will be $-\frac{1}{4}$; and between this and unity may another mean proportional be inſerted ; the index will be $-\frac{1}{8}$, &c. and, as this may be done between any other two terms of the progreſſion, it follows, that between any two terms may an infinite number of mean proportionals be inſerted, whoſe reſpective indices will become the logarithms of the reſpective terms to which they belong : and as theſe mean proportionals, the greater they are in number between the two terms of any ratio, the nearer do they approach to a ratio of equality, with their correſpondent indices or exponents.

SECT. II. CONSTRUCTION OF LOGARITHMS.

From what has been obſerved we are let into the reaſon of the ancient way of making logarithms, and which was made uſe of by their firſt inventors, and that was to extract the ſquare root out of the ſquare root, &c. of any number, in order to find out a ſeries of continual mean geometrical proportionals; till the number of cyphers contained between unity and the firſt ſignificant figure of the root was equal to the number of places that the intended logarithm ſhould conſiſt of, and at the ſame time to find out a large number of correſpondent arithmetical means, which would be the true logarithms of the geometrical means reſpectively.

And how operoſe this method is, may be eaſily gueſſed at by any one who has been at the pains to extract the root of a large number; and may be gathered from this, that to find a logarithm to ſeven places only requires at leaſt 27 extractions of root out of root, the ſquare conſiſting of 16 figures at leaſt; and that, if in any one of the operations an error happens to creep in, the whole work muſt be repeated. Some have conſidered the logarithm of a number as the logarithm of the ratio of unity to that number itſelf, or as the diſtance between unity and that number in a geometrical ſcale of proportionals, and conſequently meaſured by the number of proportionals contained between them: logarithms therefore expound the place or order that every number obtains from the unit's place in a continued ſeries or ſcale of proportionals indefinite in number. Thus, if between unity and the number 10, there be ſuppoſed 10000000, &c. mean proportionals, that is, if the number 10 be placed in the 10000000th place from unity, between 1 and 2, there will be found 3010300 of ſuch proportionals; that is, the number 2 will be placed in the 3010300th place from unity; between 1 and 3 there will be found 4771213 of the ſame proportionals, or the number 3 will ſtand in the 4771213th place in the indefinite ſcale of proportionals; their numbers 10000000, 3010300, and 4771213, are therefore the logarithms of 10, 2, and 3; or, more properly, the logarithms of the ratios of thoſe numbers one to the other.

Again, if between unity and the number 10, there be ſuppoſed an indefinite ſcale of mean proportionals, whoſe number is 23025851; that is, if the number 10 be placed in the 23025851ſt place from unity, in the indefinite ſcale of proportionals, between 1 and 2, there will be found to be 6931471 ſuch mean proportionals; and between 1 and 3, there will be found 10986122 of the ſame proportionals: ſo that if the firſt term of the ſeries be called x, the ſecond term will be x^2, the third x^3, &c. and if the number 10 be ſuppoſed to be the 10000000th term in the ſeries, the number 2 will be the 3010300th term, and the number 3 will be the 4771213th term in the ſame ſeries; and conſequently $x^{10000000}=10$, $x^{3010200}=2$, and $x^{4771212}=3$, &c. and again, if the number 10 be ſuppoſed the 23025851ſt term in the ſeries, the number 2 will be the 6931471ſt term, and the number 3 the 10986122d term in the ſame ſeries; and conſequently, in this caſe, $x^{23025851}=10$, $x^{6931471}=2$, and $x^{10986122}=3$, &c. And as the indefinite number of mean proportionals betwixt any two numbers may be aſſumed at pleaſure, hence logariths may be of as many different forms (that is, there may be as many different ſcales of logarithms) as there can be aſſumed different ſcales of mean proportionals between any two numbers. Every number therefore is ſome certain power of that number which is placed next to unity in the indefinite ſcale of proportionals between unity and the given number, and the index of that power is the logarithm of the number. Logarithms therefore may be of as many ſorts as you can aſſume different indices of the power of that number whoſe logarithm is required. But ſince fluxions and the higher geometry have been ſo well underſtood, mathematicians have directed their views towards facilitating thoſe laborious and operoſe calculations formerly made uſe of for conſtructing tables of logarithms, by help of converging ſeries, and other means, whereby the logarithms of any propoſed numbers may now be obtained with very little trouble: an example of this kind may be ſeen in Mac Laurin's Fluxions, volume ii. page 678, where that celebrated mathematician ſhews that the logarithm of m being given, the logarithm of $\overline{m+2}$ — log. m is equal to $\frac{2z}{2m\times z}$ multiplied by the ſeries $1-\frac{z}{12}\times\overline{\frac{1}{m+z}-\frac{1}{m}}\times\frac{z^3}{360}\times\overline{\frac{1}{\overline{m+z}^3}-\frac{1}{m^3}}-\frac{z^5}{1260}\times\overline{\frac{1}{\overline{m+z}^5}-\frac{1}{m^5}}+$, &c. This ſeries converges ſo very ſwift, that two or three terms are ſufficient in almoſt any caſe whatſoever.

Dr. Keil, in his Treatiſe of Logarithms, at the end of his Commandine's Euclid, gives a ſeries, by means of which may be found eaſily and expeditiouſly the logarithms of large numbers. Thus, let z be an odd number, whoſe logarithm is ſought: then ſhall the numbers $z-1$ and $z+1$ be even, and accordingly their logarithms, and the difference of the logarithms will be had, which let be called y. Therefore, alſo the logarithm of a number, which is a geometrical mean between $z-1$ and $z+1$, will be given, *viz.* equal to half the ſum of the logarithms.

Now the ſeries $y\times\frac{1}{4z}+\frac{1}{24z^3}+\frac{181}{15120z^7},+\frac{25200z^9}{13}$, &c ſhall be equal to the logarithm of the ratio, which the geometrical mean between the numbers $z-1$ and $z+1$, has to the arithmetical mean, *viz.* to the number z. If the number exceeds 1000, the firſt term of the ſeries, *viz.* $\frac{y}{4z}$, is ſufficient for producing the logarithm to 13 or 14 places of figures, and the ſecond term will give the logarithm to 20 places of figures. But if z be greater than 10000, the firſt term will exhibit the logarithm to 18 places of figures. For example, it is required to find the logarithm of 20001; the logarithm of 20000 is the ſame as the logarithm of 2, with the index 4 prefixed to it; and the difference of the logarithms of 20000 and 20001, is the ſame as the difference of the logarithms of the numbers 10000 and 10001, *viz.* 0.0000434272, &c. And if this difference be divided by $4z$, or 80004, the quotient $\frac{y}{4z}$ ſhall be

0.000000000542813; and if the logarithm of the geometrical mean, *viz.*
4.301051709302416 be added to the quotient, the ſum will be

4.301051709845229 = the logarithm of 20001.

Wherefore it is manifeſt, that to have the logarithm to 14 places of figures, there is no neceſſity of continuing out the quotient beyond 6 places of figures. But if you have a mind to have the logarithm to 10 places of figures only, the two firſt figures are enough. And if the logarithms of the numbers above 20000 are to be found by this way, the labour of doing them will moſtly conſiſt in ſetting down the numbers. The firſt figure of every logarithm towards the left hand, which is ſeparated from the reſt by a point, is called the *index of that logarithm*; becauſe it points out the higheſt or remoteſt place of that number from the place of unity in the infinite ſcale of proportionals towards the left hand: thus, if the index of the logarithm be 1, it ſhews that its higheſt place towards the left hand is the tenth place from unity; and therefore all logarithms which have 1 for their index, will be found between the tenth and hundredth place, in the order of numbers. And for the ſame reaſon all logarithms which have 2 for their index, will be found between the hundredth and thouſandth place, in the order of numbers, &c. Whence univerſally the index or characteriſtic of any logarithm is always leſs by one than the number of figures in whole numbers, which anſwer to the given logarithm; and, in decimals, the index is negative.

HYPERBOLIC LOGARITHMS.

The hyperbolic *logarithm* of any number is the index of that term of the logarithmic progreſſion, agreeing with the propoſed number, multiplied by the exceſs of the common ratio above unity: thus if e be an indefinite ſmall quantity, the hyperbolic *logarithm* of the natural number agreeing with any term $\overline{1+e}|^n$ of the logarithmic progreſſion $1, 1+e, \overline{1+e}|^2, \overline{1+e}|^3$, &c. will be expreſſed by ne. And ſince $\overline{1+e}|^n=N$ or the number, we ſhall have $1+e=N^{\frac{1}{n}}=\overline{1+x}|^m$, by putting $1+x=N$, and $m=\frac{1}{n}$. Therefore, $\overline{1+x}|^m$, being $=1+mx+m\times\frac{m-1}{2}\times x^2+m\times\frac{m-1}{2}\times\frac{m-2}{3}\times x^3$, &c. we have $e=mx+m\times\frac{m-1}{2}\times x^2$, &c. where m being rejected in the factors $m-1$, $m-2$, &c. as indefinitely ſmall in compariſon of 1, 2, &c. becauſe n is, from the nature of *logarithms*, indefinitely great, the equation will become $e=mx-\frac{mx^2}{2}+\frac{mx^3}{3}-\frac{mx^4}{4}$, &c. whence $\frac{e}{m}\ (=ne=L)=x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}$, &c. But this ſeries, though the moſt eaſy and natural, is of little uſe in determining the *logarithms* of large numbers, becauſe, in all ſuch caſes, it diverges, inſtead of converging. In order to obtain a ſeries that will always converge, let the number, whoſe *logarithm* is wanted, be denoted by $\frac{1}{1-x}$, in which quantity x will be always leſs than unity; and let $\overline{1+e}|^n$ as before be $=\frac{1}{1-x}$; then $1+e=\overline{\frac{1}{1-x}}|^{\frac{1}{n}}=\overline{1-x}|^{-\frac{1}{n}}=\overline{1-x}|^m$ (by making $m=-\frac{1}{n}$) $=1-mx+m\times\frac{m-1}{2}\times x^2-m\times\frac{m-1}{2}\times\frac{m-2}{3}\times x^3$, where m being rejected in the factors $m-1$, $m-2$, &c. as before, the equation will become $1+e=1-mx-\frac{mx^2}{2}-\frac{mx^3}{3}$, &c. whence $x+\frac{x^2}{2}+\frac{x^3}{3}$, &c. $=\frac{e}{-m}=ne=$ the hyperbolic *logarithm* of $\frac{1}{1-x}$; which ſeries will always converge, let the value of $\frac{1}{1-x}$ be ever ſo great, becauſe x will be always leſs than unity. But this ſeries being added to the former, expreſſing the *logarithm* of $1+x$, the ſeries $2x+\frac{2x^3}{3}+\frac{2x^3}{5}+\frac{2x^7}{7}$, &c. thence ariſing will be more ſimple than either of them, ſince one half of the terms will be entirely deſtroyed thereby: conſequently, as the ſum of the *logarithm* of any two numbers is equal to the *logarithm* of the product of thoſe numbers, the ſeries $2x+\frac{2x^3}{3}+\frac{2x^3}{5}$, &c. will truly expreſs the *logarithm* of $\frac{1+x}{1-x}$, or $\frac{1}{1-x}\times 1+x$. In order to find the value of x, let $\frac{1+x}{1-x}=N$, and x will be $=\frac{N-1}{N-2}$: but if the quantity propoſed be a fraction $\frac{P}{Q}$, make $\frac{P}{Q}=\frac{1+x}{1-x}$, and x will be $=\frac{P-Q}{P+Q}$; either of which values ſubſtituted in the foregoing ſeries $2x+\frac{2x^3}{3}$, &c. will give the hyperbolic *logarithm* of the reſpective number.

To find, for example, the *logarithm* of 2, from this expreſſion of the *logarithm* of $\frac{1+x}{1-x}$. Then $\frac{1+x}{1-x}=2$, or $1+x=2-2x$, and $3x=1$, or $x=\frac{1}{3}$; that is in decimals:

$$\begin{array}{llll}
x & (= \frac{1}{3}) & = & 0.333333333, \text{\&c.} \\
x^3 & (= \frac{1}{9}x) & = & .037037037, \text{\&c.} \\
x^5 & (= \frac{1}{9}x^3) & = & .004115226, \text{\&c.} \\
x^7 & (= \frac{1}{9}x^5) & = & .000457247, \text{\&c.} \\
x^9 & (= \frac{1}{9}x^7) & = & .000050805, \text{\&c.} \\
x^{11} & (= \frac{1}{9}x^9) & = & .000005645, \text{\&c.} \\
x^{13} & (= \frac{1}{9}x^{11}) & = & .000000627, \text{\&c.} \\
x^{15} & (= \frac{1}{9}x^{13}) & = & .000000069, \text{\&c.}
\end{array}$$

Theſe values being reſpectively divided by the numbers 1,3,5,7,9, &c. and the ſeveral quotients added together, we ſhall have .346573590, &c. whoſe double being .693147180, &c. is the hyperbolic or Napier's *logarithm* of the number 2. In the ſame manner the hyperbolic *logarithms* of any other numbers may be determined.

All ſyſtems of logarithms whatever, being compoſed of ſimilar quantities, it will be eaſy to form, from any ſyſtem of logarithms, another ſyſtem in any given ratio; and conſequently to reduce one table of logarithms into another of any given form. For as any one logarithm in the given form, is to its correſpondent logarithm in another form; ſo is any other logarithm in the given form, to its correſpondent logarithm in the required form; and hence we may reduce the hyperbolic logarithms into the common form; and contrarywiſe. For as 2.302585092, &c. the hyperbolic logarithm of 10, is to 1.0000000000, the common logarithm of 10; ſo is any other logarithm in the hyperbolic form, to the correſpondent logarithm in the common form: And becauſe the two firſt numbers conſtantly remain the ſame: if the hyperbolic logarithm of any one number be divided by 2.302585, &c. or multiplied by 4342944, &c. the ratio of 1.0000, &c. to 2.30258, &c. as is found by dividing 1.00000, &c. by 2.30258, &c. the quotient in the former, and the product in the latter, will give the correſpondent logarithm in the common form, and the contrary.

PROBLEM I. *To find the Logarithm for a Number greater than any in the common Tables, but leſs than* 10000000.

Cut off four figures on the left hand of the given number, and ſeek the logarithm in the table; add as many units to the index, as there are figures remaining on the right; ſubtract the logarithm found, from the next following it, in the table; then, as the difference of numbers in the canon is to the tabular difference of the logarithms anſwering to them, ſo are the remaining figures of the given number to the logarithmic difference; which, if it be added to the logarithm before found, the ſum will be the logarithm required. Suppoſe the logarithm of the number 92375 were required: cut off the four figures 9237, and to the characteriſtic of the logarithm correſponding to them, add an unit; then,

From the logarithm of the number - - 9238 = 3,9655780
Subtract logarithmic number - - - 9237 = 3,9655309
Remains tabular difference - - - 471

$$\text{As } 10 : 471 :: 5 : \frac{471\times 5}{10} = 235$$

Now to the logarithm - - - - 4,9655309
Add the difference found - - - - 235
The ſum is the logarithm required - - 4,9655544

PROB. II. *To find the Logarithm of a proper Fraction.* Subtract the logarithm of the numerator from that of the denominator, and to the remainder prefix the ſign of ſubtraction. Thus, ſuppoſe it were required to find the logarithm of $\frac{3}{7}$,

Logarithm of 7 = 0,8450980
Logarithm of 3 = 0.4771213
Logarithm $\frac{3}{7}$ = — 0,3679767

PROB. III. *To find the Number correſponding to a Logarithm greater than any in the Table.* Firſt, from the given logarithm, ſubtract the logarithm of 10, or 100, or 1000, or 10000, till you have a logarithm that will come within the compaſs of the table; find the number correſponding to this, and multiply it by 10, or 100, or 1000, or 10000, the product is the number required. Suppoſe, for inſtance, the number correſponding to the logarithm 7,7589982 be required; ſubtract the logarithm of the number 10000, which is 4,0000000, from 7,589982; the remainder is 3,7589982, the number correſponding to which is 5741,1, which, multiplied by 10000, gives 57411000, the number required.

PROB. IV. *To find the Number correſponding to a Negative Logarithm.* To the given negative logarithm, add the laſt logarithm of the table, or that of the number 10000, i. e. ſubtract the firſt from the ſecond, and find the number correſponding to the remainder; this will be the numerator of the fraction, whoſe denominator will be 10000. Suppoſe it be required to find the fraction correſponding to the negative logarithm 0,3679767
ſubtract this from —— —— —— 4,0000000
the remainder is —— —— —— 3,6320233

the number correſponding to which is $4285\frac{71}{100}$; the fraction ſought therefore is $\frac{4285}{10000000}$. The reaſon of the rule is, that as a fraction is the quotient, ariſing from the diviſion of the numerator by the denominator, unity will be to the fraction, as the denominator to the numerator; but as unity is to the fraction correſponding to the given negative logarithm, ſo is 10000 to the number correſponding to the remainder: therefore if 10000 be taken for the denominator, the number will be the numerator of the fraction.

SECT. III. USE AND APPLICATION OF LOGARITHMS.

The moſt correct book of logarithms is generally ſuppoſed to be the quarto edition of Mr. Gardiner, printed in the year 1742. Sherwin's octavo book printed in the ſame year, and reviſed by Gardiner is alſo in great eſteem. But if Dr. Hutton's book printed in 1785 is really as correct as is ſuggeſted by the author, of which we have not yet had any reaſon to doubt, it is certainly preferable to any work that we know of. The Doctor informs us that he has corrected ſeveral errors, beſides ſome thouſands of inaccuracies that ſtood in Sherwin's beſt edition.

The tables contained in the above-mentioned books give the logarithms of all numbers not exceeding 5 places, and the logarithm of a number containing ſix or ſeven places may be eaſily found by proportion.

PROBLEM I. *To Multiply or Divide by Logarithms.*

It is evident from what has been ſaid of the conſtruction of logarithms, that addition of logarithms muſt be the ſame thing as multiplication in common arithmetic; and ſubtraction in logarithms the ſame as diviſion: therefore in multiplication by logarithms, add the logarithms of the multiplicand and multiplier together, their ſum is the logarithm of the product.

		num.	logarithms.
Example.	Multiplicand	8.5 =	0.1294189
	Multiplier	10 =	1.0000000
	Product	85 =	1.9294189

And in diviſion, ſubtract the logarithm of the diviſor from the logarithm of the dividend, the remainder is the logarithm of the quotient.

		num.	logarithms.
Example.	Dividend	9712.8 =	3.9873444
	Diviſor	456 =	2.6589648
	Quotient	21.3 =	1.3283796

PROB. II. *To raiſe Powers by Logarithms.* Multiply the logarithm of the number given, by the index of the power required; the product will be the logarithm of the power ſought.

Example. Let the cube of 32 be required by logarithms. The logarithm of 32 = 1.5051500, which multiplied by 3, is 4.5154500, the logarithm of 32768, the cube of 32. But in raiſing powers, viz. ſquaring, cubing, &c. of any decimal fraction by logarithms, it muſt be obſerved, that the firſt ſignificant figure of the power be put ſo many places below the place of units, as the index of its logarithm wants of 10, 100, &c. multiplied by the index of the power.

PROB. III. *To extract the Roots of Powers by Logarithms.* Divide the logarithm of the number by the index of the power, the quotient is the logarithm of the root ſought.

PROB. IV. *To extract the Roots of Fractions by Logarithms.* The eaſieſt way to explain this, is firſt to give an example of *involving* ſuch numbers.

Let —3.301029995664 be the logarithm of the fraction given.
7 the power to which it is to be raiſed.
Then —19.107209969648 is the logarithm of the anſwer.

This differs from the like work in whole numbers only in this, that in multiplying the decimals, one has at laſt 2 to be carried from them to the whole numbers; this is to be conſidered as +2, then $-3\times 7=-21$, and $-21+2=-19$ to be noted the index of the anſwer. Extraction of the roots is only the converſe of this. Suppoſe —19.107209969648 given, to find that root whoſe exponent number is 7. As 7 is the exponent number here, one may in his mind multiply it by 2 for a trial, as in common diviſion; but the product = 14 being leſs than 19, muſt be rejected; then he may try it with 3, this yields 21 for a product. This 3 muſt be noted with a negative ſign for the index of the new logarithm. Then, on comparing 19 with 21, the difference is 2. This 2 muſt be carried as 20 to the decimals, and one muſt from that carry on the diviſion of the decimals with 7 for a diviſor, as is uſually done in other caſes.

— 19.107209969648
— 3.301029995664

SYSTEM OF LOGIC.

LOGIC is the art of thinking and reaſoning juſtly; or, it may be defined the ſcience or hiſtory of the human mind, inaſmuch as it traces the progreſs of our knowledge from our firſt and moſt ſimple conceptions through all their different combinations, and all thoſe numerous deductions that reſult from variouſly comparing them one with another. The preciſe buſineſs of logic, therefore, is to explain the nature of the human mind, and the proper manner of conducting its ſeveral powers, in order to the attainment of truth and knowledge. It lays open thoſe errors and miſtakes we are apt, through inattention, to run into; and teaches us how to diſtinguiſh between truth, and what only carries the appearance of it. By this means we grow acquainted with the nature and force of the underſtanding; ſee what things lie within its reach; where we may attain certainty and demonſtration; and when we muſt be contented with probability. The ſcience is generally divided into four parts, viz. *Perception*, *Judgment*, *Reaſoning*, and *Method*. This diviſion comprehends the whole hiſtory of the ſenſations and operations of the human mind.

PART I. OF PERCEPTION.

We find ourſelves ſurrounded with a variety of objects, which acting differently upon our ſenſes, convey diſtinct impreſſions into the mind, and thereby rouſe the attention and notice of the underſtanding. By reflecting too on what paſſes within us, we become ſenſible of the operations of our own minds, and attend to them as a new ſet of impreſſions. But in all this there is only bare *conſciouſneſs*. The mind, without proceeding any farther, takes notice of the impreſſions that are made upon it, and views things in order, as they preſent themſelves one after another. This attention of the underſtanding to the object acting upon it, whereby it becomes ſenſible of the impreſſions they make, is called by logicians *perception*; and the notices themſelves, as they exiſt in the mind, and are there treaſured up to be the materials of thinking and knowledge, are diſtinguiſhed by the name of *ideas*.

SECT. I. *Of Words, conſidered as the Signs of our Ideas.*

Our ideas, though manifold and various, are nevertheleſs all within our own breaſts, inviſible to others, nor can of themſelves be made appear. But God, deſigning us for ſociety, and to have fellowſhip with thoſe of our kind, has provided us with organs fitted to frame articulate ſounds, and given us alſo a capacity of uſing thoſe ſounds as ſigns of internal conceptions. Hence ſpring words and language; for, having once pitched upon any ſound to ſtand as the mark of an idea in the mind, cuſtom by degrees eſtabliſhes ſuch a connection between them, that the appearance of the idea in the underſtanding always brings to our remembrance the ſound or name by which it is expreſſed; as in like manner the hearing of the ſound never fails to excite the idea for which it is made to ſtand. And thus it is eaſy to conceive how a man may record his own thoughts, and bring them again into view in any ſucceeding period of life. For this connection being once ſettled, as the ſame ſounds will always ſerve to excite the ſame ideas; if he can but contrive to regiſter his words in the order and diſpoſition in which the preſent train of his thoughts preſent them to his imagination, it is evident he will be able to recal theſe thoughts at pleaſure, and that too in the very manner of their firſt appearance. Accordingly we find, that the inventions of writing and printing, by enabling us to fix and perpetuate ſuch periſhable things as ſounds, have alſo furniſhed us with the means of giving a kind of permanency to the tranſactions of the mind, inſomuch that they may be in the ſame manner ſubjected to our review, as any other abiding objects of nature. But, beſides the ability of recording our own thoughts, there is this farther advantage in the uſe of external ſigns, that they enable us to communicate our ſentiments to each other, and alſo receive information of what paſſes in their breaſts. For any number of men, having agreed to eſtabliſh the ſame ſounds as ſigns of the ſame ideas, it is apparent that the repetition of theſe ſounds muſt excite the like perceptions in each, and create a perfect correſpondence of thoughts. When, for inſtance, any train of ideas ſucceed one another in my mind, if the names by which I am wont to expreſs them have been annexed by thoſe with whom I converſe to the very ſame ſet of ideas, nothing is more evident, than that, by repeating thoſe names according to the tenor of my preſent conceptions, I ſhall raiſe in their minds the ſame courſe of thought as has taken poſſeſſion of my own. Hence, by barely attending to what paſſes within themſelves, they will alſo become acquainted with the ideas of my underſtanding, and have them in a manner laid before their view. So that we here clearly perceive how a man may communicate his ſentiments, knowledge and diſcoveries to others, if the language in which he converſes be extenſive enough to mark all the ideas and tranſactions of his mind. If the terms denote ſimple perceptions, he muſt refer us to theſe objects of nature whence the perceptions themſelves are to be obtained; but, if they ſtand for complex ideas, their meaning may be explained by a *definition*.

SECT. II. *Of Definitions.*

A definition *is the unfolding of ſome conception of the mind, anſwering to the word or term made uſe of as the ſign of it*. Now, as in exhibiting any idea to another, it is neceſſary that the deſcription be ſuch as may excite that preciſe idea in his mind; hence it is plain that definitions, properly ſpeaking, are not arbitrary, but confined to the repreſenting of certain determinate ſettled notions, ſuch namely as are annexed by the ſpeaker or writer to the words he uſes. As nevertheleſs it is univerſally allowed that the ſignification of words is perfectly voluntary, and not the effect of any natural and neceſſary connection between them and the ideas for which they ſtand; ſome may perhaps wonder why definitions are not ſo too. In order therefore to unravel this difficulty, and ſhew diſtinctly what is and what is not arbitrary in ſpeech, we muſt carefully diſtinguiſh between the connection of our words and ideas, and the unfolding of the ideas themſelves. As to the connection of our words and ideas; this, it is plain, is a purely arbitrary inſtitution. When for inſtance, we have in our minds the idea of any particular ſpecies of metals, the calling it by the name of *gold* is an effect of the voluntary choice of men ſpeaking the ſame language, and not of any particular aptneſs in that ſound to expreſs that idea. Other nations we find make uſe of different ſounds, and with the ſame effect. Thus *aurum* denotes that idea in Latin, and *or* in French, and even the word *gold* itſelf would have as well ſerved to expreſs the idea of that metal which we call *ſilver*, had cuſtom in the beginning eſtabliſhed it. But although we are thus entirely at liberty in connecting any idea with any ſound, yet it is quite otherwiſe in unfolding the ideas themſelves. For every idea having a preciſe appearance of its own, by which it is diſtinguiſhed from every other idea; it is manifeſt, that in laying it open to others, we muſt ſtudy ſuch a deſcription as ſhall exhibit that peculiar appearance. When we have formed to ourſelves the idea of a figure bounded by four equal ſides, joined together at right angles, we are at liberty to expreſs that idea by any ſound, and call it either a *ſquare* or a *triangle*. But which ever of theſe names we uſe, ſo long as the idea is the ſame, the deſcription by which we would ſignify it to another muſt be ſo too. Let it be called *ſquare* or *triangle*, it is ſtill a figure having four equal ſides, and all its angles right ones. Hence we clearly ſee what is and what is not arbitrary in the uſe of words. The eſtabliſhing any ſound as the mark of ſome determinate idea in the mind, is the effect of free choice, and a voluntary combination among men. And as different nations make uſe of different ſounds to denote the ſame ideas, hence proceeds all that variety of languages which we meet with in the world. But when a connection between our ideas and words is once ſettled, the unfolding of the idea anſwering to any word, which properly conſtitutes a definition, is by no means an arbitrary thing. For here we are bound to exhibit that preciſe conception which either the uſe of language, or our own particular choice, hath annexed to the term we uſe. Thus it appears, that definitions, conſidered as deſcriptions of ideas in the mind, are ſteady and invariable, being bounded to the repreſentation of theſe preciſe ideas. But then, in the application of definitions to particular names, we are altogether left to our own free choice. Becauſe as the connecting of any idea with any ſound is a perfectly arbitrary inſtitution; the applying the deſcription of that idea to that ſound muſt be ſo too. When therefore logicians tell us that the definition of the name is arbitrary, they mean no more than this; that as different ideas may be connected with any term, according to the good pleaſure of him that uſes it, in like manner may different deſcriptions be applied to the term ſuitable to the ideas ſo connected. Definitions, are pictures or repreſentations of our ideas; and as theſe repreſentations are then only poſſible when the ideas themſelves are complex, it is obvious to remark, that definitions cannot have place but where we make uſe of terms ſtanding for ſuch complex ideas. But our complex ideas, being nothing more than different combinations of ſimple ideas; we then know and comprehend them more perfectly, when we know the ſimple ideas of which they conſiſt, and can ſo put them together in our minds as is neceſſary towards the framing of that peculiar connection which gives every idea its diſtinct and proper appearance. Two things are therefore required in every definition. Firſt, that all the original ideas, out of which the complex one is formed, be diſtinctly enumerated. Secondly, that the order and manner of combining them into one conception be clearly explained. Where a definition has theſe requiſites, nothing is wanting to its perfection; becauſe every one who reads it and underſtands the terms, ſeeing at once what ideas he is to join together, and alſo in what manner, can at pleaſure form in his own mind the complex conception anſwering to the term defined.

It will now be obvious to every one in what manner we ought to proceed, in order to arrive at juſt and adequate definitions. Firſt, we are to take an exact view of the idea to be deſcribed, trace it to its original principles, and mark the ſeveral ſimple perceptions that enter into the compoſition of it. Secondly we are to conſider the particular manner in which theſe elementary ideas are combined, in order to the forming of that preciſe conception for which the term we make uſe of ſtands. When this is done, and the idea wholly unravelled, we have nothing more to do than fairly tranſcribe the appearance it makes to our own minds. Such a deſcription, by diſtinctly exhibiting the order and number of our primitive conceptions, cannot fail to excite at the ſame time in the mind of every one that reads it, the complex idea reſulting from them; and therefore attains the true and proper end of a definition.

SECT. III. *Of the Compoſition and Reſolutions of our Ideas, and the Rules of Definition thence ariſing.*

Many of our ideas are extremely complicated, inſomuch that to enumerate

enumerate all the ſimple perceptions out of which they are formed, would be a very troubleſome and tedious work. For this reaſon logicians have eſtabliſhed certain compendious rules of defining, of which it may not be amiſs here to give ſome account. But in order to the better underſtanding of what follows, it will be neceſſary to obſerve that there is a certain gradation in the compoſition of our ideas. The mind of man is very limited in its views, and cannot take in a great number of objects at once. We are therefore fain to proceed by ſteps, and make our firſt advances ſubſervient to thoſe which follow. Thus in forming our complex notions, we begin at firſt with but a few ſimple ideas, ſuch as we can manage with eaſe, and unite them together into one conception. When we are provided with a ſufficient ſtock of theſe, and have by habit and uſe rendered them familiar to our minds, they become the component parts of our ideas ſtill more complicated, and form what we may call a ſecond order of compound notions. This proceſs, as is evident, may be continued to any degree of compoſition we pleaſe, mounting from one ſtage to another, and enlarging the number of combinations.

All the ideas we receive from the ſeveral objects of nature that ſurround us, repreſent diſtinct individuals. Theſe individuals, when compared together, are found in certain particulars to reſemble. Hence, by collecting the reſembling particulars into one conception, we form the notion of a *ſpecies*. And here let it be obſerved, that this laſt idea is leſs complicated, than that by which we repreſent any of the particular objects contained under it. For the idea of the ſpecies excludes the peculiarities of the ſeveral individuals, and retains only ſuch properties as are common to them all. Again, by comparing ſeveral ſpecies together, and obſerving their reſemblance, we form the idea of a *genus*; where, in the ſame manner as before, the compoſition is leſſened, becauſe we leave out what is peculiar to the ſeveral ſpecies compared, and retain only the particulars wherein they agree. It is eaſy to conceive the mind proceeding thus from one ſtep to another, and advancing through its ſeveral claſſes of general notions, until at laſt it comes to the higheſt genus of all, denoted by the word *being*, where the bare idea of exiſtence is only concerned.

Thus the mind, in compounding its ideas, begins, we ſee, with the moſt general notions, which, conſiſting of but a few ſimple notices, are eaſily combined and brought together into one conception. Thence it proceeds to the ſpecies comprehended under this general idea, and theſe are formed by joining together the genus and ſpecific difference. And as it often happens, that theſe ſpecies may be ſtill farther ſubdivided, and run on in a long ſeries of continued gradations, producing various orders of compound perceptions; ſo all theſe ſeveral orders are regularly and ſucceſſively formed by annexing in every ſtep the ſpecific difference to the neareſt genus. When by this method of procedure we are come to the loweſt order of all, by joining the ſpecies and numeric difference we frame the ideas of individuals. And here the ſeries neceſſarily terminates, becauſe it is impoſſible any farther to bound or limit our conceptions. This view of the compoſition of our ideas, repreſenting their conſtituent parts in every ſtep of the progreſſion, naturally points out the true and genuine form of a definition. For as definitions are no more than deſcriptions of the ideas for which the term defined ſtand; and as ideas are then deſcribed, when we enumerate diſtinctly and in order the parts of which they conſiſt; it is plain that, by making our definitions follow one another according to the natural train of our conceptions, they will be ſubject to the ſame rules, and keep pace with the ideas they deſcribe.

As therefore the firſt order of our compound notions, or the ideas that conſtitute the higheſt genera in the different ſcales of perception, are formed by uniting together a certain number of ſimple notices; ſo the terms expreſſing theſe genera are defined *by enumerating the ſimple notices ſo combined*. And as the ſpecies comprehended under any genus, or the complex ideas of the ſecond order, ariſe from ſuperadding the ſpecific difference to the ſaid general idea; ſo the definition of the names of the ſpecies is abſolved, in a detail of the ideas of the ſpecific difference, connected with the term of the genus. For the genus having been before defined, the term by which it is expreſſed ſtands for a known idea, and may therefore be introduced into all ſubſequent definitions, in the ſame manner as the names of ſimple perceptions. It will now be ſufficiently obvious, that the definitions of all the ſucceeding orders of compound notions will every where conſiſt of the term of the neareſt genus, joined with an enumeration of the ideas that conſtitute the ſpecific difference; and that the definition of individuals unites the names of the loweſt ſpecies with the terms by which we expreſs the ideas of the numeric difference.

Here then we have the true and proper form of a definition, or that method of defining which is commonly called *logical*, and which we ſee is perfect in its kind, inaſmuch as it preſents a full and adequate deſcription of the idea for which the term defined ſtands.

PART II. OF JUDGMENT.

SECT. I. *Of the Grounds of Human Judgment.*

The mind being furniſhed with ideas, its next ſtep in the way to knowledge is, the comparing theſe ideas together, in order to judge of their agreement or diſagreement. But what then are the grounds of our judgment in relation to facts? *experience* and *teſtimony*. By experience we are informed of the exiſtence of the ſeveral objects which ſurround us, and operate upon our ſenſes. Teſtimony is of a wider extent, and reaches not only to objects beyond the preſent ſphere of our obſervation, but alſo to facts and tranſactions, which being now paſt, and having no longer any exiſtence, could not without this conveyance have fallen under our cognizance.

There are three foundations of human judgment, from which the whole ſyſtem of our knowledge may with eaſe and advantage be derived. Firſt, intuition, which reſpects our ideas themſelves, and their relations, and is the foundation of that ſpecies of reaſoning which we call *demonſtration*. For whatever is deduced from our intuitive perceptions, by a clear and connected ſeries of proofs, is ſaid to be demonſtrated, and produces abſolute certainty in the mind. Hence the knowledge obtained in this manner is what we properly term *ſcience*; becauſe in every ſtep of the procedure it carries its own evidence along with it, and leaves no room for doubt or heſitation. And what is highly worthy of notice; as the truths of this claſs expreſs the relation between our ideas, and the ſame relations muſt ever and invariably ſubſiſt between the ſame ideas, our deductions in the way of ſcience conſtitute what we call *eternal*, *neceſſary*, and *immutable truths*. If it be true that the whole is equal to all its parts, it muſt be ſo unchangeably; becauſe the relation of equality being attached to the ideas themſelves, muſt ever intervene where the ſame ideas are compared. Of this nature are all the truths of natural religion, morality, and mathematics, and, in general, whatever may be gathered from the bare view and conſideration of our ideas.

The ſecond ground of human judgment is *experience*; from which we infer the exiſtence of thoſe ſubjects that ſurround us, and fall under the immediate notice of our ſenſes. When we ſee the ſun, or caſt our eyes towards a building, we not only have ideas of theſe objects within ourſelves, but aſcribe to them a real exiſtence out of the mind. It is alſo by the information of the ſenſes, that we judge of the qualities of bodies; as when we ſay that *ſnow is white*, *fire hot*, or *ſteel hard*. For as we are wholly unacquainted with the internal ſtructure and conſtitution of the bodies that produce theſe ſenſations in us, nay, and are unable to trace any connection between that ſtructure and the ſenſations themſelves, it is evident, that we build our judgments altogether upon obſervation, aſcribing to bodies ſuch qualities as are anſwerable to the perceptions they excite in us. Hence it is evident, that as intuition is the foundation of what we call *ſcientifical* knowledge, ſo is experience of *natural*. For this laſt being wholly taken up with objects of ſenſe, or thoſe bodies that conſtitute the natural world; and their properties, as far as we can diſcover them, being to be traced only by a long and painful ſeries of obſervations; it is apparent, that in order to improve this branch of knowledge, we muſt betake ourſelves to the method of trial and experiment. But though experience is what we may term the immediate foundation of natural knowledge, yet with reſpect to particular perſons its influence is very narrow and confined. The bodies that ſurround us are numerous, many of them lie at a great diſtance, and ſome quite beyond our reach. Life is too ſhort, and ſo clouded with cares, that but little time is left for any ſingle man to employ himſelf in unfolding the myſteries of nature. Hence it is neceſſary to admit many things upon the teſtimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aqua regia* to diſſolve gold, though perhaps he never himſelf made the experiment. In theſe therefore and ſuch like caſes we judge of the facts and operations of nature, upon the mere ground of teſtimony. However, as we can always have recourſe to experience where any doubt or ſcruple ariſes, this is juſtly conſidered as the true foundation of natural philoſophy; being indeed the ultimate ſupport upon which our aſſent reſts, and whereto we appeal when the higheſt degree of evidence is required.

As there are many facts that will not allow of an appeal to the ſenſes, in this caſe teſtimony is the true and only foundation of our judgments. All human actions of whatever kind, when conſidered as already paſt, are of the nature here deſcribed; becauſe having now no longer any exiſtence, both the facts themſelves, and the circumſtances attending them, can be known only from the relations of ſuch as had ſufficient opportunities of arriving at the truth. *Teſtimony* therefore is juſtly accounted a third ground of human judgment; and as from the other two we have deduced *ſcientifical* and *natural* knowledge, ſo we may from this derive *hiſtorical*; by which we mean, not merely a knowledge of the civil tranſactions of ſtates and kingdoms, but of all facts whatſoever, where teſtimony is the ultimate foundation of our belief.

SECT. II. *Affirmative and Negative Propoſitions.*

While the comparing of our ideas is conſidered merely as an act of the mind, aſſembling them together, and joining or disjoining them according to the reſult of its perceptions, we call it *judgment*; but when our judgments are put into words, they then bear the name of *propoſitions*. A propoſition therefore is a ſentence expreſſing ſome judgment of the mind, whereby two or more ideas are affirmed to agree or diſagree. Now as our judgments include at leaſt two ideas, one of which is affirmed or denied of the other, ſo muſt a propoſition have terms anſwering to theſe ideas. The idea of which we affirm or deny, and of courſe the term expreſſing that idea, is called the *ſubject* of the propoſition. The idea affirmed or denied, as alſo the term anſwering it, is called the *predicate*. Thus in the propoſition, *God is omnipotent: God* is the ſubject, it being of him that we affirm omnipotence; and *omnipotent* is the predicate, becauſe we affirm the idea expreſſed by that word to belong to God.

But as in propoſitions, ideas are either joined or disjoined; it is not enough to have terms expreſſing thoſe ideas, unleſs we have alſo ſome words to denote their agreement or diſagreement. That word in a propoſition, which connects two ideas together, is called the *copula*; and if a negative particle be annexed, we thereby underſtand that the ideas are disjoined. When the mind joins two ideas, we call it an *affirmative* judgment; when it ſeparates them, a *negative*: and as any two ideas compared together muſt neceſſarily either agree or not agree, it is evident, that all our judgments fall under theſe two diviſions. Hence likewiſe the propoſitions expreſſing theſe judgments are all either affirmative or negative. An affirmative propoſition connects the predicate with the ſubject, as *a ſtone is heavy*; a negative propoſition ſeparates them, as *God is not the author of evil. Affirmation* therefore is the ſame as joining two ideas together, and this is done by means of the copula. *Negation* on the contrary marks a repugnance between the ideas compared, in which caſe a negative particle muſt be called in, to ſhew that the connection included in the copula does not take place.

SECT. III. *Univerſal and Particular Propoſitions.*

The next conſiderable diviſion of propoſitions is into *univerſal* and *particular*. Our ideas, according to what has been already obſerved in the firſt Part, are all ſingular as they enter the mind, and repreſent individual objects. But as by abſtraction we can render them univerſal, ſo as to comprehend a whole claſs of things, and ſometimes ſeveral claſſes at once; hence the terms expreſſing theſe ideas muſt be in like manner univerſal. If therefore we ſuppoſe any general term to become the ſubject of a propoſition, it is evident, that whatever is affirmed of the abſtract idea belonging to that term may be affirmed of all the individuals to which that idea extends. Thus when we ſay, *Men are mortal*; we conſider mortality, not as confined to one or any number of particular men, but as what may be affirmed without reſtriction of the whole ſpecies.

From this different appearance of the general idea, that conſtitutes the ſubject of any judgment, ariſes the diviſion of propoſitions into *univerſal* and *particular*. An univerſal propoſition is that wherein the ſubject is ſome general term taken in its full latitude, inſomuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper ſpecies; and to all the ſeveral ſpecies, and their individuals, if it marks an idea of a higher order. The words *all, every, no, none*, &c. are the proper ſigns of this univerſality; and as they ſeldom fail to accompany general truths, ſo they are the moſt obvious criterion whereby to diſtinguiſh them. *All animals have a power of beginning motion.* This is an univerſal propoſition; as we know from the word *all* prefixed to the ſubject *animal*, which denotes that it muſt be taken in its full extent. Hence the power of beginning motion may be affirmed of all the ſeveral ſpecies of animals.

A *particular* propoſition has in like manner ſome general term for its ſubject, but with a mark of limitation added, to denote, that the predicate agrees only to ſome of the individuals comprehended under a ſpecies, or to one or more of the ſpecies belonging to any genus, and not to the whole univerſal idea. Thus, *Some ſtones are heavier than iron; ſome men have an uncommon ſhare of prudence.* In the laſt of theſe propoſitions, the ſubject *ſome men* implies only a certain number of individuals, comprehended under a ſingle ſpecies. In the former, where the ſubject is a genus that extends to a great variety of diſtinct claſſes, *ſome ſtones* may not only imply any number of particular ſtones, but alſo ſeveral whole ſpecies of ſtones; inaſmuch as there may be not a few with the property there deſcribed. Hence we ſee that a propoſition does not ceaſe to be particular by the predicate's agreeing to a whole ſpecies, unleſs that ſpecies, ſingly and diſtinctly conſidered, makes alſo the ſubject of which we affirm or deny. We ſee therefore that all propoſitions are either *affirmative* or *negative* nor is it leſs evident, that in both caſes they may be *univerſal* or *particular*.

SECT. IV. *Of Abſolute and Conditional Propoſitions.*

Abſolute propoſitions are thoſe wherein we affirm ſome property inſeparable from the idea of the ſubject, and which therefore belongs to it in all poſſible caſes; as *God is infinitely wiſe. Virtue tends to the ultimate happineſs of man.* But where the predicate is not neceſſarily connected with the idea of the ſubject, unleſs upon ſome conſideration diſtinct from that idea, there the propoſition is called *conditional*. The reaſon of the name is taken from the ſuppoſition annexed, which is of the nature of a condition, and may be expreſſed as ſuch. Thus, *If a ſtone is expoſed to the rays of the ſun, it will contract ſome degree of heat. If a river runs in a very declining channel, its rapidity will conſtantly increaſe.* There is not any thing of greater importance in philoſophy than a due attention to this diviſion of propoſitions. If we are careful never to affirm things abſolutely but where the ideas are inſeparably conjoined; and if in our other judgments we diſtinctly mark the conditions which determine the predicate to belong to the ſubject; we ſhall be the leſs liable to miſtake in applying general truths to the particular concerns of human life. It is owing to the exact obſervance of this rule that mathematicians have been ſo happy in their diſcoveries, and that what they demonſtrate of magnitude in general may be applied with eaſe in all obvious occurrencies.

SECT. V. *Of Simple and Compound Propoſitions.*

Hitherto we have treated of propoſitions, where only two ideas are compared together. Theſe are in the general called *ſimple*; becauſe, having but one ſubject and one predicate, they are the effect of a ſimple judgment that admits of no ſubdiviſion. But if it ſo happens that ſeveral ideas offer themſelves to our thoughts at once, whereby we are led to affirm the ſame thing of different objects, or different things of the ſame object; the propoſitions expreſſing theſe judgments are called *compound*: becauſe they may be reſolved into as many others as there are ſubjects or predicates in the whole complex determination of the mind. Thus, *God is infinitely wiſe and infinitely powerful.* Here there are two predicates, *infinite wiſdom and infinite power*, both affirmed of the ſame ſubject; and accordingly the propoſition may be reſolved into two others, affirming theſe predicates ſeverally. In like manner in the propoſition, *Neither kings nor people are exempt from death*; the predicate is denied of both ſubjects, and may therefore be ſeparated from them in diſtinct propoſitions. Nor is it leſs evident that if a complex judgment conſiſts of ſeveral ſubjects and predicates, it may be reſolved into as many ſimple propoſitions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind, and increaſe the number of our deſires.* In this judgment there are two ſubjects and two predicates, and it is at the ſame time apparent that it may be reſolved into four diſtinct propoſitions. *Riches are apt to elate the mind. Riches are apt to increaſe the number of our deſires.* And ſo of honours.

SECT. VI.

The Diviſion of Propoſitions into Self-evident and Demonſtrable.

When any propoſition is offered to the view of the mind, if the terms in which it is expreſſed and underſtood; upon comparing the ideas together, the agreement or diſagreement aſſerted is either immediately perceived, or found to lie beyond the preſent reach of the underſtanding. In the firſt caſe the propoſition is ſaid to be *ſelf-evident*, and admits not of any proof, becauſe a bare attention to the ideas themſelves produces full conviction and certainty; nor is it poſſible to call in any thing more evident by way of confirmation. But where the connection or repugnance comes not ſo readily under the inſpection of the mind, there we muſt have recourſe to reaſoning; and if by a clear ſeries of proofs we can make out the truth propoſed, inſomuch that ſelf-evidence ſhall accompany every ſtep of the procedure, we are then able to demonſtrate what we aſſert, and the propoſition itſelf is ſaid to be *demonſtrable*. When we affirm, for inſtance, *that it is impoſſible for the ſame thing to be and not to be*; whoever underſtands the terms made uſe of perceives at firſt glance the truth of what is aſſerted, nor can he by any efforts bring himſelf to believe the contrary. The propoſition therefore is *ſelf-evident*, and ſuch that it is impoſſible by reaſoning to make it plainer; becauſe there is no truth more obvious or better known, from which as a conſequence it may be deduced. But if we ſay, *This world had a beginning*; the aſſertion is indeed equally true, but ſhines not forth with the ſame degree of evidence. We find great difficulty in conceiving how the world could be made out of nothing: and are not brought to a free and full conſent, until by reaſoning we arrive at a clear view of the abſurdity involved in the contrary ſuppoſition. Hence this propoſition is of the kind we call *demonſtrable*, inaſmuch as its truth is not immediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable conſequence.

Self-evident propoſitions furniſh the firſt principles of reaſoning; and it is certain, that if in our reſearches we employ only ſuch principles as have this character of ſelf-evidence, and apply them according to the rules to be afterwards explained, we ſhall be in no danger of error in advancing from one diſcovery to another. For this we may appeal to the writings of the mathematicians, which, being conducted by the expreſs model here mentioned, are an inconteſtible proof of the firmneſs and ſtability of human knowledge, when built upon ſo ſure a foundation. For not only have the propoſitions of this ſcience ſtood the teſt of ages; but are found attended with that invincible evidence, as forces the aſſent of all who duly conſider the proofs upon which they are eſtabliſhed. It is to be obſerved, that they have been very careful in aſcertaining their ideas, and fixing the ſignification of their terms. For this purpoſe they begin with *definitions*, in which the meaning of their words is ſo diſtinctly explained, that they cannot fail to excite in the mind of an attentive reader the very ſame ideas as are annexed to them by the writer. And indeed the clearneſs and irreſiſtible evidence of mathematical knowledge is owing to nothing ſo much as this care in laying the foundation.

In all propoſitions we either affirm or deny ſome property of the idea that conſtitutes the ſubject of our judgment, or we maintain that ſomething may be done or effected. The firſt ſort are called *ſpeculative* propoſitions, as thus, *the radii of the ſame circle are all equal one to another.* The others are called *practical*, for a reaſon too obvious to be mentioned: thus *that a right line may be* *drawn from one point to another*, is a practical propoſition; inaſmuch as it expreſſes that ſomething may be done.

From this twofold conſideration of propoſitions ariſes the twofold diviſion of mathematical principles into axioms and poſtulates. By an axiom they underſtand any ſelf-evident ſpeculative truth; as, *that the whole is greater than its parts: That things equal to one and the ſame thing are equal to one another*. But a ſelf-evident practical propoſition is what they call a *poſtulate*. Such are thoſe of Euclid; *that a finite right line may be continued directly forwards*; *that a circle may be deſcribed about any centre with any diſtance*.

As ſelf-evident truths are diſtinguiſhed into different kinds, according as they are ſpeculative or practical; ſo is it alſo with demonſtrable propoſitions. A demonſtrable ſpeculative propoſition is by mathematicians called a *theorem*. On the other hand, a demonſtrable practical propoſition is called a *problem*; as where Euclid teaches us to deſcribe a ſquare upon a given right-line. Beſides the four kinds of propoſitions already mentioned, mathematicians have alſo a fifth, known by the name of *corollaries*. Theſe are uſually ſubjoined to theorems or problems, and differ from them only in this; that they flow from what is there demonſtrated in ſo obvious a manner as to diſcover their dependence upon the propoſition whence they are deduced, almoſt as ſoon as propoſed. The ſcholia of mathematicians are indifferently annexed to definitions, propoſitions, or corollaries; and anſwer the ſame purpoſes as annotations upon a claſſic author.

PART III. OF REASONING.

SECT. I.

Of Reaſoning in general, and the Parts of which it conſiſts.

It often happens in comparing ideas together, that their agreement or diſagreement cannot be diſcerned at firſt view, eſpecially if they are of ſuch a nature as not to admit of an exact application one to another. When, for inſtance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain, that by barely conſidering the figures themſelves, we cannot arrive at an exact determination; becauſe, by reaſon of their diſagreeing forms, it is impoſſible ſo to put them together, as that their ſeveral parts ſhall mutually coincide. Here then it becomes neceſſary to look out for ſome third idea that will admit of ſuch an application as the preſent caſe requires; wherein if we ſucceed, all difficulties vaniſh, and the relation we are in queſt of may be traced with eaſe. Thus right-lined figures are all reduced to ſquares, by means of which we can meaſure their areas, and determine exactly their agreement or diſagreement in point of magnitude. But how can any third idea ſerve to diſcover a relation between two others? The anſwer is, that by being compared ſeverally with theſe others; for ſuch a compariſon enables us to ſee how far the ideas with which this third is compared are connected or disjoined between themſelves. In the example mentioned above of two right-lined figures, if we compare each of them with ſome ſquare whoſe area is known, and find the one exactly equal to it, and the other leſs by a ſquare inch, we immediately conclude that the area of the firſt figure is a ſquare inch greater than that of the ſecond. This manner of determining the relation between any two ideas, by the intervention of ſome third with which they may be compared, is that which we call *reaſoning*; and is indeed the chief inſtrument by which we puſh on our diſcoveries, and enlarge our knowledge. The great art lies in finding out ſuch intermediate ideas, as, when compared with the others in the queſtion, will furniſh evident and known truths; becauſe, as will afterwards appear, it is only by means of them that we arrive at the knowledge of what is hidden and remote. Hence it appears, that every act of reaſoning neceſſarily includes three diſtinct judgments; two wherein the ideas whoſe relation we want to diſcover are ſeverally compared with the middle idea, and a third wherein they are themſelves connected or disjoined, according to the reſult of that compariſon. Now as in the ſecond part of logic our judgments, when put into words, were called propoſitions, ſo here in the third part the expreſſions of our reaſonings are termed *ſyllogiſms*. And hence it follows, that as every act of reaſoning implies three ſeveral judgments, ſo every ſyllogiſm muſt include three diſtinct propoſitions. When a reaſoning is thus put into words, and appears in form of a ſyllogiſm, the intermediate idea made uſe of, to diſcover the agreement or diſagreement we ſearch for, is called the *middle term*; and the two ideas themſelves, with which this third is compared, go by the name of the *extremes*.

But as theſe things are beſt illuſtrated by examples; let us, for inſtance, ſet ourſelves to enquire *whether men are accountable for their actions*. As the relation between the ideas of *man* and *accountableneſs* comes not within the immediate view of the mind, our firſt care muſt be to find out ſome third idea that will enable us the more eaſily to diſcover and trace it. A very ſmall meaſure of reflection is ſufficient to inform us, that no creature can be accountable for his actions, unleſs we ſuppoſe him capable of diſtinguiſhing the good from the bad; that is, unleſs we ſuppoſe him poſſeſſed of reaſon. Nor is this alone ſufficient. For what would it avail him to know good from bad actions, if he had no freedom of choice, nor could avoid the one and purſue the other? hence it becomes neceſſary to take in both conſiderations in the preſent caſe. It is at the ſame time equally apparent, that where ever there is this ability of diſtinguiſhing good from bad actions, and of purſuing the one and avoiding the other, there alſo a creature is accountable. We have then got a third idea, with which *accountableneſs* is inſeparably connected, viz. *reaſon and liberty*; which are here to be conſidered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the queſtion, viz. *man*, and we all know by experience that it may be affirmed of him. Having thus by means of the intermediate idea formed two ſeveral judgments, viz. *that man is poſſeſſed of reaſon and liberty*; and *that reaſon and liberty imply accountableneſs*; a third obviouſly and neceſſarily follows, viz. *that man is accountable for his actions*. Here then we have a compleat act of reaſoning, in which, according to what has been already obſerved, there are three diſtinct judgments; two that may be ſtiled previous, inaſmuch as they lead to the other, and ariſe from comparing the middle idea with the two ideas in the queſtion: the third is a conſequence of theſe previous acts, and flows from combining the extreme ideas between themſelves. If now we put this reaſoning into words, it exhibits what logicians term a ſyllogiſm; and, when propoſed in due form runs thus:

“ Every creature poſſeſſed of reaſon and liberty is accountable
“ for his actions.
“ Man is a creature poſſeſſed of reaſon and liberty;
“ Therefore man is accountable for his actions.”

In this ſyllogiſm we may obſerve, that there are three ſeveral propoſitions expreſſing the three judgments implied in the act of reaſoning; and ſo diſpoſed, as to repreſent diſtinctly what paſſes within the mind in tracing the more diſtant relations of its ideas. The two firſt propoſitions anſwer the two previous judgments in reaſoning, and are called the *premiſes*, becauſe they are placed before the other. The third is termed the *concluſion*, as being gained in conſequence of what was aſſerted in the premiſes. We are alſo to remember, that the terms expreſſing the two ideas whoſe relations we inquire after, as here *man* and *accountableneſs*, are in general called the *extremes*; and that the intermediate idea, by means of which the relation is traced, viz. *a creature poſſeſſed of reaſon and liberty*, takes the name of the *middle term*. Hence it follows, that by the *premiſes* of a ſyllogiſm we are always to underſtand the two propoſitions where the middle term is ſeverally compared with the *extremes*; for theſe conſtitute the previous judgments, whence the truth we are inqueſt of is by reaſoning deduced. The *concluſion* is that other propoſition, in which the *extremes* themſelves are joined or ſeparated agreeably to what appears upon the above compariſon.

The concluſion is made up of the extreme terms of the ſyllogiſm: and the extreme, which ſerves as the predicate of the concluſion, goes by the name of the *major term*: the other extreme, which makes the ſubject in the ſame propoſition, is called the *minor term*. From this diſtinction of the extremes ariſes alſo a diſtinction between the premiſes, where theſe extremes are ſeverally compared with the middle term. That propoſition which compares the greater extreme, or the predicate of the concluſion with the middle term, is called the *major propoſition*: the other, wherein the ſame middle term is compared with the ſubject of the concluſion or leſſer extreme, is called the *minor propoſition*. All this is obvious from the ſyllogiſm already given, where the concluſion is, *man is accountable for his actions*. For here the predicate *accountable for his actions*, being connected with the middle term in the firſt of the two premiſes; *every creature poſſeſſed of reaſon and liberty is accountable for his actions*, gives what we call the *major propoſition*. In the ſecond of the premiſes; *man is a creature poſſeſſed of reaſon and liberty*, we find the leſſer extreme, or ſubject of the concluſion, viz. *man*, connected with the ſame middle term, whence it is known to be the *minor propoſition*. When a ſyllogiſm is propoſed in due form, the major propoſition is always placed firſt, the minor next, and the concluſion laſt. Theſe things premiſed, we may in the general define reaſoning to be an act or operation of the mind, deducing ſome unknown propoſition from other previous ones that are evident and known. Theſe previous propoſitions, in a ſimple act of reaſoning, are only two in number; and it is always required that they be of themſelves apparent to the underſtanding, inſomuch that we aſſent to and perceive the truth of them as ſoon as propoſed.

SECT. II. *The ſeveral Kinds of Reaſoning*; *and firſt, of that by which we determine the Genera and Species of Things.*

All the aims of human reaſon may in general be reduced to theſe two: 1. To rank things under thoſe univerſal ideas to which they truly belong; and, 2. To aſcribe to them their ſeveral attributes and properties in conſequence of that diſtribution. One great aim of human reaſon is to determine the genera and ſpecies of things. We have ſeen in the firſt Part of this Treatiſe, how the mind proceeds in framing general ideas. We have alſo ſeen in the ſecond Part, how by means of theſe general ideas we come by univerſal propoſitions. Now as in theſe univerſal propoſitions we affirm ſome property of a genus or ſpecies, it is plain that we cannot apply this property to particular objects till we have firſt determined whether they are comprehended under that general idea of which the property is affirmed. Thus there are certain properties belonging to all *even* numbers, which nevertheleſs cannot be applied to any particular number, until we have firſt diſcovered it to be of the ſpecies expreſſed by that natural name. Hence reaſoning begins with referring things to their ſeveral diviſions and claſſes in the ſcale of our ideas; and as theſe diviſions are all diſtinguiſhed by particular ar names, we hereby learn to apply the terms expreſſing general conceptions to ſuch particular objects as come under our immediate obſervation.

Now in order to arrive at theſe concluſions, by which the ſeveral objects of perception are brought under general names, two things are manifeſtly neceſſary. Firſt, that we take a view of the idea itſelf denoted by that general name, and carefully attend to the diſtinguiſhing marks which ſerve to characterize it. Secondly, that we compare this idea with the object under conſideration, obſerving diligently wherein they agree or differ. If the idea is found to correſpond with the particular object, we then without heſitation apply the general name; but if no ſuch correſpondence intervenes, the concluſion muſt neceſſarily take a contrary turn. Let us, for inſtance, take the number *eight*, and conſider by what ſteps we are led to pronounce it an *even* number. Firſt then, we call to mind the idea ſignified by the expreſſion *an even number*, viz. that it is a number diviſible into two equal parts. We then compare this idea with the number *eight*, and, finding them manifeſtly to agree, ſee at once the neceſſity of admitting the concluſion. Theſe ſeveral judgments therefore transferred into language, and reduced to the form of a ſyllogiſm, appear thus:

"Every number that may be divided into two equal parts is an *even* number.

"The number *eight* may be divided into two equal parts;

"Therefore the number *eight* is an *even* number."

Nor let it be imagined that our reſearches here, becauſe in appearance bounded to the impoſing of general names upon particular objects, are therefore trivial and of little conſequence. Some of the moſt conſiderable debates among mankind, and ſuch too as nearly regard their lives, intereſt, and happineſs, turn wholly upon this article. Is it not the chief employment of our ſeveral courts of judicature to determine in particular inſtances, what is law, juſtice, and equity? Of what importance is it in many caſes to decide aright whether an action ſhall be termed *murder* or *manſlaughter?* We ſee then that no leſs than the lives and fortunes of men depend often upon theſe deciſions. The reaſon is plain. Actions, when once referred to a general idea, draw after them all that may be affirmed of that idea; inſomuch that the determining what proportion of praiſe or diſpraiſe, commendation or blame, &c. ought to follow them. For as it is allowed that murder deſerves death; by bringing any particular action under the head of murder, we of courſe decide the puniſhment due to it.

Thus we ſee of what importance it is towards the improvement and certainty of human knowledge, that we accuſtom ourſelves to clear and determinate ideas, and a ſteady application of words.

SECT. III. *Of Reaſoning, as it regards the Powers and Properties of Things, and the Relations of our general Ideas.*

We come now to the ſecond great end which men have in view in their reaſonings; namely, the diſcovering and aſcribing to things their ſeveral attributes and properties. And here it will be neceſſary to diſtinguiſh between reaſoning, as it regards the ſciences, and as it concerns common life. In the ſciences, our reaſon is employed chiefly about univerſal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the diviſion of things into various claſſes, called otherwiſe *genera* and *ſpecies*. For theſe univerſal ideas being ſet up as the repreſentatives of many particular things, whatever is affirmed of them may be alſo affirmed of all the individuals to which they belong. *Murder*, for inſtance, is a general idea, repreſenting a certain ſpecies of human actions. Reaſon tells us that the puniſhment due to it is *death*. Hence every particular action, coming under the notion of *murder*, has the puniſhment of *death* allotted to it. Here then we apply the general truth to ſome obvious inſtance; and this is what properly conſtitutes the reaſoning of common life. For men, in their ordinary tranſactions and intercourſe one with another, have, for the moſt part, to do only with particular objects. Our friends and relations, their characters and behaviour, the conſtitution of the ſeveral bodies that ſurround us, and the uſes to which they may be applied, are what chiefly engage our attention. In all theſe, we reaſon about particular things; and the whole reſult of our reaſoning is, the applying the general truths of the ſciences in the ordinary tranſactions of human life. When we ſee a viper, we avoid it. Wherever we have occaſion for the forcible action of water, to move a body that makes a conſiderable reſiſtance, we take care to convey it in ſuch a manner that it ſhall fall upon the object with impetuoſity. Now all this happens in conſequence of our familiar and ready application of theſe two general truths. *The bite of a viper is mortal. Water, falling upon a body with impetuoſity, acts very forcibly towards ſetting it in motion.* In like manner, if we ſet ourſelves to conſider any particular character, in order to determine the ſhare of praiſe or diſpraiſe that belongs to it, our great concern is to aſcertain exactly the proportion of virtue and vice. The reaſon is obvious. A juſt determination, in all caſes of this kind, depends entirely upon an application of theſe general maxims of morality. *Virtuous actions deſerve praiſe. Vicious actions deſerve blame.*

Hence it appears that reaſoning, as it regards common life, is no more than the aſcribing the general properties of things to thoſe ſeveral objects with which we are more immediately concerned, according as they are found to be of that particular diviſion or claſs to which the properties belong. The ſteps then by which we proceed are manifeſtly theſe. Firſt, we refer the object under conſideration to ſome general idea or claſs of things. We then recollect the ſeveral attributes of that general idea. And, laſtly, aſcribe all thoſe attributes to the preſent object. Thus, in conſidering the character of *Sempronius*, if we find it to be of the kind called *virtuous*, when we at the ſame time reflect that a virtuous character is deſerving of eſteem, it naturally and obviouſly follows that Sempronius is ſo too. Theſe thoughts put into a ſyllogiſm, in order to exhibit the form of reaſoning here required, run thus:

"Every virtuous man is worthy of eſteem.

"*Sempronius* is a virtuous man:

"Therefore *Sempronius* is worthy of eſteem."

By this *ſyllogiſm* it appears, that before we affirm any thing of a particular object, that object muſt be referred to ſome general idea. Sempronius is pronounced worthy of eſteem only in conſequence of his being a virtuous man, or coming under that general notion. Hence we ſee the neceſſary connection of the various parts of reaſoning, and the dependence they have one upon another. This is the higheſt exerciſe of the powers of the underſtanding, and that by means whereof we arrive at the diſcovery of univerſal truths: inſomuch that our deductions in this way conſtitute that particular ſpecies of reaſoning which regards principally the ſciences. In order to excel remarkably in any one branch of learning, it is neceſſary to have at leaſt a general acquaintance with the whole circle of arts and ſciences. The truth of it is, all the various diviſions human knowledge are very nearly related among themſelves, and in innumerable inſtances, ſerve to illuſtrate and ſet off each other. A general knowledge is a good preparation, and enables us to proceed with eaſe and expedition in whatever branch of learning we apply to. But then, in the minute and intricate queſtions of any ſcience, we are by no means qualified to reaſon with advantage until we have perfectly maſtered the ſcience to which they belong. If we would form our minds to a habit of reaſoning cloſely and in train, we cannot take any more certain method, than the exerciſing ourſelves in mathematical demonſtrations, ſo as to contract a kind of familiarity with them. Not that we look upon it as neceſſary that all men ſhould be deep mathematicians; but that having got the way of reaſoning which that ſtudy neceſſarily brings the mind to, they may be able to transfer it to other parts of knowledge, as they ſhall have occaſion.

SECT. IV. *Of the Forms of Syllogiſms.*

The diviſion of ſyllogiſms, reſpects thoſe eſpecially which are known by the name of plain ſimple ſyllogiſms; that is, which are bounded to three propoſitions, all ſimple, and where the extremes and middle term are connected, according to the rules laid down above. But as the mind is not tied down to any one preciſe form of reaſoning, but ſometimes makes uſe of more, ſometimes of fewer premiſes, and often takes in compound and conditional propoſitions, it may not be amiſs to take notice of the different forms derived from this ſource, and explain the rules by which the mind conducts itſelf in the uſe of them. When in any ſyllogiſm the major is a conditional propoſition the ſyllogiſm itſelf is termed *conditional*. Thus:

"If there is a God, he ought to be worſhipped.

"But there is a God:

"Therefore he ought to be worſhipped."

In this example, the major, or firſt propoſition, is, we ſee, conditional, and therefore the ſyllogiſm itſelf is alſo of the kind called by that name. Aud here we are to obſerve, that all conditional propoſitions are made of two diſtinct parts: one expreſſing the condition upon which the predicate agrees or diſagrees, with the ſubject, as in this now before us, *if there is a God*; the other joining or disjoining the ſaid predicate and ſubject, as here, *he ought to be worſhipped*. The firſt of theſe parts, or that which implies the condition, is called the *antecedent*; the ſecond, where we join or disjoin the predicate and ſubject, has the name of the *conſequent*.

As from the major's being a conditional propoſition, we obtain the ſpecies of conditional ſyllogiſms; ſo where it is a disjunctive propoſition, the ſyllogiſm to which it belongs, is alſo called *disjunctive*, as in the following example:

"The world is either ſelf-exiſtent, or the work of ſome finite,
"or of ſome infinite Being.

"But it is not ſelf-exiſtent, nor the work of a finite being:

"Therefore it is the work of an infinite Being."

In this disjunctive ſyllogiſm, the major affirms one of the three predicates to belong to the earth, *viz. ſelf-exiſtence*, or that it is the *work of a finite*, or that it is the *work of an infinite Being*. Two of theſe predicates are removed in the minor, *viz. ſelf-exiſtence*, and *the work of a finite being*. Hence the concluſion neceſſarily aſcribes to it the third predicate, and affirms that it is *the work of an infinite Being*. If now we give the ſyllogiſm another turn, inſomuch that the minor may eſtabliſh one of the predicates, by affirming the earth to be *the production of an infinite Being*; then the concluſion muſt remove the other two, aſſerting it to be neither *ſelf-exiſtent* nor *the work of a finite being*. Theſe are the forms of reaſoning in theſe ſpecies of ſyllogiſms, the juſtneſs of which appears at firſt ſight; and that there can be no other, is evident from the very nature of a disjunctive propoſition.

The laſt ſpecies of reaſoning we ſhall notice is what is commonly known by the name of a *ſorites*, or a plain ſimple ſyllogiſm. This is a way of arguing, in which a great number propoſitions are ſo linked together, that the predicate of one becomes continually the ſubject of the next following, until at laſt a concluſion is formed, by bringing together the ſubject of the firſt propoſition, and the predicate of the laſt. Of this kind is the following argument:

“ God is omnipotent.
“ An omnipotent being can do every thing poſſible.
“ He that can do every thing poſſible, can do whatever involves
“ not a contradiction.
“ Therefore God can do whatever involves not a contradiction.”

This particular combination of propoſitions may be continued to any length we pleaſe, without in the leaſt weakening the ground upon which the concluſion reſts. The reaſon is, becauſe the ſorites itſelf may be reſolved into as many ſimple ſyllogiſms as there are middle terms in it; where this is found univerſally to hold, that when ſuch a reſolution is made, and the ſyllogiſms are placed in train, the concluſion of the laſt in the ſeries is alſo the concluſion of the ſorites. This kind of argument, therefore, as it ſerves to unite ſeveral ſyllogiſms into one, muſt ſtand upon the ſame foundation with the ſyllogiſms of which it conſiſts, and is indeed, properly ſpeaking, no other than a compendious way of reaſoning ſyllogiſtically.

SECT. V. *Of Demonſtration.*

Having diſpatched what ſeemed neceſſary to be ſaid with regard to the forms of ſyllogiſms, we now proceed to explain their uſe and application in reaſoning in the following manner. When a propoſition is by means of ſyllogiſms collected from others more evident and known, it is ſaid to be *proved*; ſo that we may in the general define the proof of a propoſition to be a ſyllogiſm, or ſeries of ſyllogiſms, collecting that propoſition from known and evident truths. But more particularly, if the ſyllogiſms of which the proofs conſiſt admit of no premiſes but definitions, ſelf-evident truths, and propoſitions already eſtabliſhed, then is the argument ſo conſtituted called a *demonſtration*; whereby it appears that demonſtrations are ultimately founded on definitions and ſelf-evident propoſitions.

We may affirm that, in all ſyllogiſms, if the premiſes are true, the concluſion muſt needs be true. A demonſtration is a ſeries of ſyllogiſms, all whoſe premiſes are either definitions, ſelf-evident truths, or propoſitions already eſtabliſhed. Definitions are identical propoſitions, wherein we connect the deſcription of an idea with the name by which we chuſe to have that idea called, and therefore as to their truth there can be no diſpute. Self-evident propoſitions appear true of themſelves, and leave no doubt or uncertainty in the mind. Propoſitions, before eſtabliſhed, are no other than concluſions gained by one or more ſteps from definitions and ſelf-evident principles. Demonſtration therefore ſerving as an infallible guide to truth, and ſtanding on ſo ſure and unalterable a baſis, we may now venture to aſſert, that the rules of logic furniſh a ſufficient criterion for the diſtinguiſhing between truth and falſehood. For ſince every propoſition that can be demonſtrated is neceſſarily true, he is able to diſtinguiſh truth from falſehood who can with certainty judge when a propoſition is truly demonſtrated.

It is the buſineſs of logic, in explaining the ſeveral operations of the mind, fully to inſtruct us in all theſe points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the ſeveral ſpecies of propoſitions, and diſtinguiſhes the ſelf-evident from the demonſtrable. It delineates alſo the different forms of ſyllogiſms, and explains the laws of argumentation proper to each. In fine, it deſcribes the manner of combining ſyllogiſms, ſo as that they may form a train of reaſoning, and lead to the ſucceſſive diſcovery of truth. The precepts of logic therefore, as they enable us to judge with certainty when a propoſition is duly demonſtrated, furniſh a ſure criterion for the diſtinguiſhing between truth and falſehood.

Having evinced the certainty of demonſtration in its moſt important branches, and ſhown the rules by which we ought to proceed, in order to arrive at a juſt concluſion: We ſhall in the laſt place give ſome account of *Method*; which, though inſeparable from reaſoning, is nevertheleſs always conſidered by logicians as a diſtinct operation of the mind; becauſe its influence is not confined to the mere exerciſe of the reaſoning faculty, but extends in ſome degree to all the tranſactions of the underſtanding.

PART IV. OF METHOD.

We have gone through the three firſt operations of the mind, whoſe office it is to ſearch after truth, and enlarge the bounds of human knowledge. There is yet a fourth, which the diſpoſal and arrangement of our thoughts, when we endeavour ſo to put them together as that their mutual connection and dependence may be clearly ſeen. This is what logicians call *Method*, and place always the laſt in order in explaining the powers of the underſtanding; becauſe it neceſſarily ſuppoſes a previous exerciſe of our other faculties, and ſome progreſs made in knowledge, before we can exert it in any extenſive degree.

In this view, it is plain that we muſt be beforehand well acquainted with the truths we are to combine together; otherwiſe, how could we diſcern their ſeveral connections and relations, or ſo diſpoſe of them as their mutual dependence may require? But it often happens, that the underſtanding is employed, not in the arrangement and compoſition of known truths, but in the ſearch and diſcovery of ſuch as are unknown. And here the manner of proceeding is very different. We aſſemble at once our whole ſtock of knowledge relating to any ſubject, and, after a general ſurvey of things, begin with examining them ſeparately and by parts. Hence it comes to paſs, that whereas, at our firſt ſetting out, we were acquainted only with ſome of the grand ſtrokes and outlines of truth; by thus purſuing her through her ſeveral windings and receſſes, we gradually diſcover thoſe more inward and finer touches whence ſhe derives all her ſtrength, ſymmetry, and beauty. And here it is, that when, by a narrow ſcrutiny into things, we have unravelled any part of knowledge, and traced it to its firſt and original principles, and inſomuch that the whole frame and contexture of it lies open to the view of the mind; here it is, that, taking it the contrary way, and beginning with theſe principles, we can ſo adjuſt and put together the parts as the order and method of ſcience requires.

But as theſe things are beſt underſtood when illuſtrated by examples; let us ſuppoſe any machine, for inſtance a watch, preſented to us, whoſe ſtructure and compoſition we are as yet unacquainted with, but want, if poſſible, to diſcover. The manner of proceeding, in this caſe, is, by taking the whole to pieces, and examing the parts ſeparately, one after another. When, by ſuch a ſcrutiny, we have thoroughly informed ourſelves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence. By this means we gradually trace out the inward make and compoſition of the whole, and come at length to diſcern how parts of ſuch a form, and ſo put together as we found in unravelling and taking them aſunder, conſtitute that particular machine called a *watch*, and contribute to all the ſeveral motions and phænomena obſervable in it. This diſcovery being made, we can take things the contrary way, and, beginning with the parts, ſo diſpoſe and connect them as their ſeveral uſes and ſtructures require, until at length we arrive at the whole itſelf, from the unravelling of which theſe parts reſulted.

As it is in tracing and examining the works of art; ſo is it, in a great meaſure, in unfolding any part of human knowledge: for the relations and mutual habitudes of things do not always immediately appear upon comparing them one with another. Hence we have recourſe to intermediate ideas; and, by means of them, are furniſhed with thoſe previous propoſitions that lead to the concluſion we are in queſt of. And if it ſo happen that the previous propoſitions themſelves are not ſufficiently evident, we endeavour, by new middle terms, to aſcertain their truth; ſtill tracing things backward, in a continual ſeries, until at length we arrive at ſome ſyllogiſm where the premiſes are firſt and ſelf-evident principles. This done, we become perfectly ſatisfied as to the truth of all the concluſions we have paſſed through, inaſmuch as they are now ſeen to ſtand upon the firm and immoveable foundation of our intuitive perceptions.

When truths are ſo propoſed and put together as they were or might have been diſcovered, this is called the *analytic method*, or the *method of reſolution*; inaſmuch as it traces things backward to their ſource, and reſolves knowledge into its firſt and original principles. When, on the other hand, they are deduced from theſe principles, and connected according to their mutual dependence, inſomuch that the truths firſt in order tend always to the demonſtration of thoſe that follow; this conſtitutes what we call the *ſynthetic method*, or *method of compoſition*. For here we proceed by gathering together the ſeveral ſcattered parts of knowledge, and combining them into one whole or ſyſtem, in ſuch manner that the underſtanding is enabled diſtinctly to follow truth through all her different ſtages and gradations.

There is this farther to be taken notice of, in relation to theſe two ſpecies of method; that the *analytic* has alſo obtained the name of the *method of invention*, becauſe it obſerves the order in which our thoughts ſucceed one another in the invention or diſcovery of truth. The *ſynthetic* is often denominated the *method of doctrine* or *inſtruction*; inaſmuch as, in laying our thoughts before others, we generally chooſe to proceed in the ſynthetic manner, deducing them from their firſt principles.

Indeed the ſynthetic manner of diſpoſing our thoughts, is by far the moſt eligible: as we here begin with the intuitive truths, and advance by regular deductions from them, every ſtep of the procedure brings evidence and conviction along with it; ſo that, in our progreſs from one part of knowledge to another, we have always a clear perception of the ground on which our aſſent reſts. In communicating therefore our diſcoveries to others, this method is apparently to be choſen, as it wonderfully improves and enlightens the underſtanding, and leads to an immediate perception of truth.

My principal End in this Syſtem has been to explain and illuſtrate all the eſſential Principles of what is termed LOGIC, *without entering into thoſe minute Particulars which, from their abſtruſe and intricate Nature, tend rather to embarraſs than inſtruct; and have therefore been long exploded. In a Word, I have endeavoured to diſengage it from the jargon of the Schools, with which it has been confuſed, and reduce it to a clear and intelligible Method, in order to render it uſeful in the Attainment of Knowledge, and the Diſcovery of Truth.*

No. 10, SALISBURY SQUARE. T. L'LOYD.

LOLLARDS, in eccleſiaſtical hiſtory, a religious ſect, differing in many religious points from the church of Rome, which aroſe in Germany about the beginning of the fourteenth century; ſo called, as many writers have erroneouſly imagined, from Walter Lollard, who began to dogmatize in 1315, and was burnt at Cologn: but it is evident that Lollard was no ſurname, but merely a term of reproach applied to all heretics who concealed the poiſon of error under the appearance of piety.

LONGEVITY, length of life. From the different longevities of men in the beginning of the world, after the flood, and in theſe ages, Mr. Derham draws an argument, for the interpoſition of a divine Providence. Immediately after the creation, when the world was to be peopled by one man and one woman, the ordinary age was nine-hundred and upwards. Immediately after the flood, when there were three perſons to ſtock the world, their age was cut ſhorter, and none of thoſe patriarchs, but Shem, arrived at 500. In the ſecond century we find none that reached 240: in the third, none but Terah that came to 200 years; the world, at leaſt a part of it, by that time being ſo well peopled, that they had built cities, and were cantoned out into diſtant nations. By degrees, as the number of people increaſed, their longevity dwindled, till it came down at length to 70 or 80 years: and there it ſtood, and has continued to ſtand ever ſince the time of Moſes. This is found a good medium, and by means hereof the world is neither overſtocked, nor kept too thin; but life and death keep a pretty equal pace.

That the common duration of man's life has been the ſame in all ages ſince the world was peopled, is plain both from ſacred and profane hiſtory. To paſs by others, Plato lived to 81, and was accounted an old man: and the inſtances of *longevity* produced by Pliny, L. vii. c. 48. as very extraordinary. No certain cauſes have hitherto been diſcovered to which the longevity of mankind can always be attributed. Some have attributed it to temperance and a country life; but inſtances of longevity are as rare among people who live in this way as among others who live more freely, provided they go not to great exceſſes. It would ſeem therefore, that at the firſt formation of the human body, the original ſtamina in ſome are of ſuch a nature as to be capable of continuing life for a much longer time than in others, even where circumſtances are otherwiſe very much alike. Hence we may eaſily ſee how it becomes exceedingly difficult, or rather impoſſible, to lay down a rule by following of which a man may expect to attain to long life; a deficiency in the original ſtamina cannot be ſupplied by art, though temperance and ſobriety are undoubtedly the beſt methods of avoiding any waſte of that ſtrength which nature has originally given, or of ſhortening our life by bringing on diſeaſes.

The theory of prolonging life, Lord Bacon numbers among the deſiderata. Some means, or indications, that ſeem to lead to it, he lays down as follow: things are preſerved in two manners; either in their *identity*, or by *reparation*. In their *identity*, as a fly, or ant, in amber: a flower, or fruit, or wood, in a conſervatory of ſnow; a dead carcaſe, in balſams. By *reparation*, as a flame, or a mechanical engine, &c. To attain to the prolongation of *life*, both theſe methods muſt be uſed; and the human body muſt be preſerved both as inanimates, as flame, and as mechanical inſtruments are preſerved. Hence ariſe three intentions for the prolongation of *life*: *retardation* of conſumption, proper *reparation*, and *renovation* of what begins to grow old. Conſumption is occaſioned by two kinds of depradation; a depradation of the innate ſpirit, and a depredation of the ambient air. Theſe may be each prevented two ways; either by rendering thoſe agents leſs predatory, or by rendering the paſſive parts (viz. the juices of the body) leſs liable to be preyed on. The ſpirit will be rendered leſs predatory, if either its ſubſtance be condenſed, as by the uſe of opiates, grief, &c. or its quantity diminiſhed, as in ſpare and monaſtic diets: or its motion calmed, as in idleneſs and tranquility. The ambient air becomes leſs predatory if it be either leſs heated by the rays of the ſun, as in cold climates, in caves, mountains, and anchoret cells: or be kept off from the body, as by a denſe ſkin, the feathers of birds, and the uſe of oils and unguents, without aromatics. The juices of the body are rendered leſs liable to be preyed on, either by making them harder, or more moiſt and oily; harder, as by a coarſe ſharp diet, living in the cold, robuſt exerciſes, and ſome mineral baths: moiſter, as by the uſe of ſweet foods, &c. abſtaining from ſalts and acids; and eſpecially by ſuch a mixture of drink, as conſiſts wholly of fine ſubtile particles, without any acrimony or acidity. Reparation is performed by means of aliment; alimentation is promoted four ways; by the concoction of the viſcera, ſo as to extrude the aliment; by exciting the exterior parts to the attraction of the aliment, as in proper exerciſes and frications, and ſome unctions and baths; by the preparation of the food itſelf, ſo as it may more eaſily inſinuate itſelf, and in ſome meaſure, anticipate the digeſtion; as in various ways of dreſſing meats, mixing drinks, fermenting breads, and reducing the virtues of theſe three into one; by promoting the act of aſſimilation itſelf, as in ſeaſonable ſleep, ſome external application, &c. The renovation of what begins to grow old, is performed two ways; by the inteneration of the habit of the body, as in the uſe of emollients, emplaſters, unctions, &c. of ſuch a nature as do not extract, but impreſs; or by purging off the old juices and ſubſtituting freſh ones; as in ſeaſonable evacuations, attenuating diets, &c. The ſame author adds theſe three axioms; that the prolongation of *life* is to be expected rather from ſome ſtated diets, than either from any ordinary regimen, or any extraordinary medicines; more from operating on the ſpirits, and molifying the parts, than from the manner of feeding; and this molifying of the parts without, is to be performed by ſubſtantials, impriments, and occludents.

LONGIMETRY, the art of meaſuring lengths, both acceſſible as roads, &c. and, inacceſſible, as arms of the ſea, &c. *Longimetry* is a part of trigonometry, and a dependent on geometry, in the ſame manner as altimetry, planimetry, ſtereometry, &c.

LONGING, is a preternatural appetite in pregnant women, and in ſome ſick perſons when about to recover. It is called *pica*, from the bird of that name, which is ſaid to be ſubject to the ſame diſorder. The diſorder conſiſts of both a deſire of unuſual things to eat and drink, and being ſoon tired of one and wanting another. It is called *malacia*, from μαλακος, "weakneſs." In pregnant women it is ſomewhat relieved by bleeding, and in about the fourth month of their pregnancy it leaves them. Chlorotic girls, and men who labour under ſuppreſſed hæmorrhoids, are very ſubject to this complaint, and are relieved by promoting the reſpective evacuations. In general, whether this diſorder is obſerved in pregnant women, in perſons recovering from an acute fever, or in thoſe who labour under obſtructions of the natural evacuations, this craving of the appetite ſhould be indulged.

LONGISSIMUS, *dorſi*. See Syſtem of ANATOMY, Part III. Sect. XII. For repreſention, ſee Plate III. letters *c. d.*

LONGITUDE *of the Earth*, is ſometimes uſed to denote its extent from weſt to eaſt, according to the direction of the equator. By which it ſtands contradiſtinguiſhed from the *latitude of the earth*, which denotes its extent from one pole to the other.

LONGITUDE *of a Star*, in aſtronomy, is an arch of the ecliptic, counted from the beginning of Aries, to the place where a ſtar's circle of *longitude* cuts the ecliptic.

LONGITUDE, in navigation, is the diſtance of a ſhip, or place, eaſt or weſt, from another, counted in degrees of the equator. If this diſtance be counted in leagues, or miles, or in degrees of the meridian, and not in thoſe proper to the parallel of latitude, it is uſually called *departure*. For the method of finding the longitude at ſea, ſee NAVIGATION.

LONGITUDINAL, in general, denotes ſomething placed lengthwiſe; thus ſome of the fibres in the veſſels of the human body are placed longitudinally, others tranſverſely or acroſs.

LOOKING-*Glaſſes*, are nothing but plain mirrors of glaſs; which, being impervious to the light, reflect the images of things placed before them; for the theory whereof, ſee the articles MIRROR and REFLECTION. For the caſting, grinding, and poliſhing looking-glaſſes, ſee the article GLASS.

LOOM, a frame compoſed of a variety of parts, uſed in all the branches of weaving; for a particular deſcription of which, ſee the article WEAVING.

LOPHIUS, *Fiſhing-frog*, or *Sea-devil*, in ichthyology, a genus of the order of Nantes, whoſe head is in ſize equal to all the reſt of the body. There are three ſpecies, the moſt remarkable of which is the piſcatorius, or common fiſhing-frog, an inhabitant of the Britiſh ſeas, known to the ancients by the name of Βατραχος, and *Rana*; and to us by that of the *fiſhing-frog*, for it is of a figure reſembling that animal in a tadpole ſtate. Pliny takes notice of the artifice uſed by it to take its prey: *Eminentia ſub oculis cornicula turbato limo exerit, aſſultantes piſciculos attrahens, donec tam prope accedunt, ut aſſiliat.* "It puts forth the ſlender horns it has beneath its eyes, enticing by that means the little fiſh to play round, till they come within reach, when it ſprings on them." The fiſhing-frog grows to a large ſize, ſome being between four and five feet in length; and Mr. Pennant mentions one taken near Scarborough, whoſe mouth was a yard wide. The fiſhermen on that coaſt have a great regard for this fiſh, from a ſuppoſition that it is a great enemy to the dog-fiſh; and whenever they take it with their lines, ſet it at liberty; for claſſification ſee the Syſtem.

LORD, a title of honour given to thoſe who are noble either by birth or creation. In this ſenſe, it amounts to much the ſame as *peer of the realm*, or *lord of parliament*. The title is by courteſy alſo given to all the ſons of dukes and marquiſes, and to the eldeſt ſons of earls: and it is alſo a title of honour beſtowed on thoſe who are honourable by their employments; as *lord advocate*, *lord chamberlain*, *lord chancellor*, *&c.* "The etymology of the word (ſays J. Coates) is well worth obſerving: for it was compoſed of *illaf*, "a loaf of bread," and *ford*, "to give, or afford;" ſo that *Illaford*, now *Lord*, implies "a giver of bread;" becauſe, in thoſe ages, ſuch great men kept extraordinary houſes, and fed all the poor; for which reaſon they were called *givers of bread*, a thing now much out of date; great men being fond of retaining the title, but few regarding the practice for which it was firſt given.

Houſe of LORDS, one of the three eſtates of parliament, and compoſed of the Lords Spiritual and Temporal.

1. The *Spiritual Lords* conſiſt of 2 archbiſhops, and 24 biſhops; and, at the diſſolution of monaſteries by Henry VIII. conſiſted likewiſe of 26 mitred abbots, and two priors; a very conſiderable body, and in thoſe times equal in number to the temporal nobility,

All theſe hold, or are ſuppoſed to hold, certain ancient baronies under the king: for William the Conqueror thought proper to change the ſpiritual tenure of frank-almoign or free arms, under which the biſhops held their lands during the Saxon government, into the feodal or Norman tenure by barony; which ſubjected their eſtates to all civil charges and aſſeſſments, from which they were before exempt; and, in right of ſucceſſion to thoſe baronies, which were unalienable from their reſpective dignities, the biſhops and abbots were allowed their ſeats in the houſe of lords. But though theſe lords ſpiritual are in the eye of the law a diſtinct eſtate from the lords temporal, and are ſo diſtinguiſhed in moſt of our acts of parliament; yet in practice they are uſually blended together under the name of *the lords*; they intermix in their votes, and the majority of ſuch intermixture joins both eſtates. And from this want of a ſeparate aſſembly, and ſeparate negative of the prelates, ſome writers have argued very cogently, that the lords ſpiritual and temporal are now in reality only one eſtate: which is unqueſtionably true in every effectual ſenſe, though the ancient diſtinction between them ſtill nominally continues. For if a bill ſhould paſs their houſe, there is no doubt of its validity, though every lord ſpiritual ſhould vote againſt it; of which Selden and Sir Edward Coke give many inſtances: as, on the other hand, doubtleſs it would be equally good, if the lords temporal preſent were inferior to the biſhops in number, and every one of thoſe temporal lords gave his vote to reject the bill; though this Sir Edward Coke ſeems to doubt of.

2. The *temporal lords* conſiſt of all the peers of the realm, (the biſhops not being in ſtrictneſs held to be ſuch, but merely lords of parliament), by whatever title of nobility diſtinguiſhed; dukes, marquiſes, earls, viſcounts, or barons. Some of theſe ſit by deſcent as do all ancient peers; ſome by creation, as do all new-made ones; others, ſince the union with Scotland, by election, which is the caſe of the 16 peers, who repreſent the body of the Scots nobility. Their number is indefinite, and may be increaſed at will by the power of the crown: and once in the reign of queen Anne, there was an inſtance of creating no leſs than 12 together; in contemplation of which, in the reign of king George I. a bill paſſed the houſe of lords, and was countenanced by the then miniſtry, for limiting the number of the peerage. This was thought by ſome to promiſe a great acquiſition to the conſtitution, by reſtraining the prerogative from gaining the aſcendant in that auguſt aſſembly, by pouring in at pleaſure an unlimited number of new created lords. But the bill was ill reliſhed, and miſcarried in the houſe of commons, whoſe leading members were then deſirous to keep the avenues to the other houſe as open and eaſy as poſſible.

The diſtinction of ranks and honours is neceſſary in every well-governed ſtate: in order to reward ſuch as are eminent for their ſervices to the public, in a manner the moſt deſirable to individuals, and yet without burthen to the community; exciting thereby an ambitious yet laudable ardour and generous emulation in others. And emulation, or virtuous ambition, is a ſpring of action which, however dangerous or invidious in a mere republic or under a deſpotic ſway, will certainly be attended with good effects under a free monarchy; where, without deſtroying its exiſtence, its exceſſes may be continually reſtrained by that ſuperior power, from which all honour is derived. Such a ſpirit, when nationally diffuſed, gives life and vigour to the community; it ſets all the wheels of government in motion, which, under a wiſe regulator, may be directed to any beneficial purpoſe; and thereby every individual may be made ſubſervient to the public good, while he principally means to promote his own particular views. A body of nobility is alſo more peculiarly neceſſary in our mixed and compounded conſtitution, in order to ſupport the rights of both the crown and the people, by forming a barrier to withſtand the encroachments of both. It creates and preſerves that gradual ſcale of dignity, which proceeds from the peaſant to the prince; riſing like a pyramid from a broad foundation, and diminiſhing to a point as it riſes. It is this aſcending and contracting proportion that adds ſtability to any government; for when the departure is ſudden from one extreme to another, we may pronounce that ſtate to be precarious. The nobility therefore are the pillars, which are reared from among the people, more immediately to ſupport the throne; and, if that falls, they muſt alſo be buried under its ruins. Accordingly, when in the laſt century the commons had determined to extirpate monarchy, they alſo voted the houſe of lords to be uſeleſs and dangerous. And ſince titles of nobility are thus expedient in the ſtate, it is alſo expedient that their owners ſhould form an independent and ſeparate branch of the legiſlature. If they were confounded with the maſs of the people, and like them had only a vote in electing repreſentatives, their privileges would ſoon be borne down and overwhelmed by the popular torrent, which would effectually level all diſtinctions. It is therefore highly neceſſary that the body of nobles ſhould have a diſtinct aſſembly, diſtinct deliberations, and diſtinct powers from the commons. See alſo King, Nobility, Parliament, Commons, *and* Commonalty.

As to the peculiar laws and cuſtoms relating to the houſe of lords; they have a right to be attended, and conſtantly are, by the judges of the court of king's bench and common-pleas, and ſuch of the barons of the exchequer as are of the degree of the coif, or have been made ſerjeants at law; as likewiſe by the king's learned counſel, being ſerjeants, and by the maſters of the court of chancery; for their advice in point of law, and for the greater dignity of their proceedings. The ſecretaries of ſtate, with the attorney and ſolicitor general, were alſo uſed to attend the houſe of peers, and have to this day (together with the judges, &c.) their regular writs of ſummons iſſued out at the beginning of every parliament, *ad tractandum et conſilium impendendum*, though not *ad conſentiendum*: but, whenever of late years they have been members of the houſe of commons, their attendance here hath fallen into diſuſe.

Another privilege is, that every peer, by licence obtained from the king, may make another lord of parliament his proxy, to vote for him in his abſence: A privilege, which a member of the other houſe can by no means have, as he is himſelf but a proxy for a multitude of other people. Each peer has alſo a right, by leave of the houſe, when a vote paſſes contrary to his ſentiments to enter his diſſent on the journals of the houſe, with the reaſons for ſuch diſſent; which is uſually ſtyled his proteſt. All bills likewiſe, that may in their conſequences any way affect the rights of the peerage, are by the cuſtom of parliament to have their firſt riſe and beginning in the houſe of peers, and to ſuffer no changes or amendments in the houſe of commons. There is alſo one ſtatute peculiarly relative to the houſe of lords; 6 Ann. c. 23. which regulates the election of the 16 repreſentative peers of North Britain, in conſequence of the 22 and 23 articles of the union: and for that purpoſe preſcribes the oaths, &c. to be taken by the electors; directs the mode of balloting; prohibits the peers electing from being attended in an unuſual manner; and expreſsly provides, that no other matter ſhall be treated of in that aſſembly, ſave only the election, on pain of incurring a præmunire. See alſo the articles Nobility and Peers.

Lord *High Admiral* of England, is one of the great officers of the crown, whoſe truſt and honour is ſo great, that it was formerly ſeldom given, except to ſome of the king's youngeſt ſons, or near kinſmen. See Admiral.

Lord *Privy Seal*, has his office by patent: before the thirtieth of Henry VIII. he was generally an eccleſiaſtic; ſince which, the office has been uſually conferred on temporal peers, above the degrees of barons. The *lord privy-ſeal*, receiving a warrant from the ſignet office, iſſues the privy-ſeal, which is an authority to the lord chancellor to paſs the great-ſeal, where the nature of the grant requires the ſeal. But privy-ſeals for money begin in the treaſury, from whence the firſt warrant iſſues, counterſigned by the lord treaſurer. On the *lord privy ſeal* are attendant four clerks, who have two deputies to act for them.

Lord *Steward of the King's Houſhold*, is the principal officer for the civil government of the king's ſervants below-ſtairs; over the officers of which he has juriſdiction. See Household.

Lords *Lieutenants of Counties*, are officers of great diſtinction, appointed by the king for the managing the ſtanding militia of the county, and all military matters therein. See Lieutenant.

LORICATION, or Coating, in chymiſtry, is the covering a glaſs or earthen veſſel with a coat or cruſt of a matter able to reſiſt the fire, to prevent its breaking in the performing an operation that requires great violence of fire.

LOTION, Lotio, popularly called *waſh*, denotes a form of medicine made up of liquid matters, chiefly uſed for beautifying the ſkin, and cleanſing it from thoſe deformities which a diſtempered blood ſometimes throws on it; or rather, which are occaſioned by a preternatural ſecretion. For generally ſpeaking, thoſe diſtempers of the ſkin, which are accounted ſigns of a foul blood, proceed from the natural ſalts thrown off by the cutaneous glands, which ought to be waſhed away through the kidneys; ſo that inſtead of ſweetners, which are uſually preſcribed on thoſe occaſions, Dr. Quincy thinks the urinary diſcharge ſhould be promoted or that of the ſkin rectified by proper *lotions*, or ointments and frictions.

LOTTERY, a kind of public game at hazard, frequent in Britain, France, and Holland, in order to raiſe money for the ſervice of the ſtate; being appointed with us by the authority of parliament, and managed by commiſſioners appointed by the lords of the treaſury for that purpoſe. It conſiſts of ſeveral numbers of blanks and prizes, which are drawn out of wheels, one of which contains the numbers, and the other the correſponding blanks or prizes. The firſt Engliſh lottery we find mentioned in hiſtory, was drawn A. D. 1569. It conſiſted of 40,000 lots, at 10s. each lot: the prizes were plate; and the profits were to go towards repairing the havens of this kingdom. It was drawn at the weſt door of St. Paul's cathedral. The drawing began on the 11th of January 1569, and continued inceſſantly drawing, *day and night*, till the 6th of May following; as Maitland, from Stowe, informs us in his Hiſtory, Vol. I. p. 257. There were then only *three* lottery-offices in London. The propoſals for this lottery were publiſhed in the years 1567 and 1568. It was at firſt intended to have been drawn at the houſe of Mr. Dericke, her majeſty's ſervant (i. e. her jeweller), but was afterwards drawn as abovementioned. Dr. Rawlinſon ſhewed the Antiquary Society, 1748, "A propoſal for a very rich lottery, general without any blankes, contayning a great number of good prizes, as well of redy money as of plate and certain ſorts of merchandizes, having been valued and priſed by the commandment of the queene's moſt excellent majeſtie's order, to the intent that ſuch commodities as may chance to ariſe thereof after the charges borne may be converted towards the reparations of the havens and ſtrength of the realme, and towards ſuch other public good workes. The number of lotts ſhall be foure hundred thouſand, and no more; and every lott ſhall be the ſum of tenne ſhillings ſterling and no more. To be filled by the feaſt of St. Bartholomew. The ſhew of priſes are to be ſeen in Cheapſide, at the ſign of the Queene's Armes, the houſe of Mr. Dericke, goldſmith, ſervant to the queene. Some other orders about it in 1597-8. Printed by Hen. Bynneman."

"In the year 1612, king James, in ſpecial favour for the preſent plantation of Engliſh colonies in Virginia, granted a lottery, to be held at the weſt end of St. Paul's; whereof one Thomas Sharplys, a taylor of London, had the chief prize, which was 4000 crowns in fair plate." Baker's Chronicle. In the reign of queen Anne, it was thought neceſſary to ſuppreſs lotteries, as nuiſances to the public. Since that time, however, they have been licenſed by an act of parliament. See other remarks relating to *lotteries* under the article GAMING.

LOVE, in ethics, is one of the primitive paſſions; and may be generally defined to be the gravitation or tendency of the ſoul toward good. If this affection be conceived ſeparate from any alteration in the body, it is called intellectual or rational *love*; if it be attended with an agitation of blood and ſpirits, it is called ſenſative or paſſionate *love*. It is obſerved by moral writers, that thoſe paſſions in which *love* predominates are more agreeable to the original intention of nature than thoſe which are ranged under hatred; becauſe they are found to have a more friendly influence upon the body, and tend, within proper bounds, to the preſervation and happineſs of life, which the others do not. When the object of this affection is thought of, particularly if the idea is ſudden, the ſpirits are confuſed, the pulſe changes, and its force and time are very variable: in ſome inſtances, the perſon is ſad and watchful; in others, the perſon, not being conſcious of his ſtate, pines away, is ſlothful, and regardleſs of food; though the wiſer, when they find themſelves in love, ſeek pleaſant company and active entertainments. As the force of love prevails, ſighs grow deeper; a tremour affects the heart and pulſe; the countenance is alternately pale and red; the voice is ſuppreſſed in the fauces; the eyes grow dim; cold ſweats break out; ſleep abſents itſelf, at leaſt until the morning; the ſecretions become diſturbed; and a loſs of appetite, a hectic fever, melancholy, or perhaps madneſs, if not death, conſtitutes the ſad cataſtrophe. On this ſubject the curious may conſult Ægineta, lib. iii. cap. 17. Oribat. Synop. lib. viii. cap. 9. or a treatiſe profeſſedly written on love, as it is a diſtemper, by James Ferrard, Oxford, printed 1640.

LOUIS, LEWIS, LOUIS D'OR, or LEWIDORE, a French coin, firſt ſtruck in 1641, under the reign of Louis XIII. and which has now a conſiderable currency, and in value about 20s.

LOUSE, the Engliſh name of the *pediculus*, in entomology, a genus of inſects of the aptera order. For the claſſification, ſee the Syſtem. For the repreſentation magnified, ſee the ſecond Plate of *Microſcopical Objects*, *fig.* 3.

LOWERING, in the diſtillery, a term uſed to expreſs the debaſing the ſtrength of any ſpirituous liquor by mixing water with it. The ſtandard and marketable price of theſe liquors are fixed, in regard to a certain ſtrength in them called *proof*; this is that ſtrength, which makes them, when ſhook in a phial, or poured from on high into a glaſs, retain a froth or crown of bubbles for ſome time. In this ſtate ſpirits conſiſt of about half pure, or totally inflammable ſpirit and half water: and if any foreign or home ſpirit is to be expoſed to ſale, and is found to have that proof wanting, ſcarce any one will buy it, till it has been diſtilled again and brought to that ſtrength; and if it is above that ſtrength the proprietor uſually adds water to it to bring it down to that ſtandard. This addition of water, to debaſe the ſtrength, is what is called *lowering* it. People well acquainted with the goods, will indeed bye ſpirits at any ſtrength, only *lowering* a ſample to the proof ſtrength, and by that judging of the ſtrength of the whole; but the generality of buyers will not enter into this, but have it all *lowered* for them.

There is another kind of *lowering* in practice among the retailers of ſpirituous liquors to the vulgar, this is the reducing it under the ſtandard of proof. They buy it proof, and afterwards increaſe their profit upon it, by *lowering* it with water one eighth part. The quantity of ſpirit is what they generally allow themſelves for the addition of water; and whoever has the art of doing this, without deſtroying the bubble proof, as this is eaſily done by means of ſome addition, that gives a greater tenacity to the parts of the ſpirit, will deceive all that judge by this proof alone; that is, very nearly all who are concerned in the ſpirit trade. Such an additional quantity of water as one eighth, makes the ſpirit taſte ſofter and cooler, and will make many prefer it to the ſtronger ſpirit, which is hotter and more fiery; but unleſs the ſpirit, thus *lowered*, were tolerably clean, or the proof be ſome other way preſerved, the addition of the water lets looſe ſome of the coarſe oil, which makes the liquor milky, and leaves a very nauſeous taſte in the mouth. The way to judge of ſpirits not being thus *lowered*, or debaſed in ſtrength, is to examine them by the eye and tongue; and in buying a quantity of proof goods, ſuch ſhould always be choſen as are clean, thin, and light, and have a good crown of froth, which goes off in large bubbles, ſuch as taſte ſoft and uniform, and are not high flavoured, of an alkaline guſt, nor acrid and fiery, but ſoon quit the tongue.

LOXIA, in ornithology, the name of a genus of birds, according to Linnæus the 69th, and of the order of paſſeres: the diſtinguiſhing characters of which are, that the tongue is plain, equal, and whole; the beak large, thick, and ſhort, crooked and convex both ways. There are 48 ſpecies, principally diſtinguiſhed by the colour. The following are natives or viſitors of Britain. The coccothrauſtes, or haw-groſbeak, viſits us only at uncertain times, and is not regularly migrant. The great particularity of this bird, is the form of the ends of the middle quill-feathers; which Mr. Edwards juſtly compares to the figure of ſome of the ancient battle-axes: theſe feathers are gloſſed over with a rich blue; but are leſs conſpicuous in the female. There ſeems an agreement in colours, as well as food, between this ſpecies and the croſs-bill.

The curviroſtra, or croſs-bill. There are two varieties of this bird: Mr. Edwards has very accurately figured the leſſer, which is ſeen frequently; the other is very rare. Theſe birds change their colours, or rather the ſhades of the colours: that is, the males which are red, vary at certain ſeaſons to deep red, to orange, or to a ſort of a yellow; the females, which are green, alter to different varieties of the ſame colour. The pyrrhula, or bullfinch. The wild note of this bird is not in the leaſt muſical; but when tamed it becomes remarkably docile, and may be taught any tune after a pipe, or to whiſtle any notes in the juſteſt manner: it ſeldom forgets what it has learned; and will become ſo tame as to come at call, perch on its maſter's ſhoulders, and (at command) go through a difficult muſical leſſon. They may be taught to ſpeak, and ſome thus inſtructed are annually brought to London from Germany. For the Claſſification, ſee the Syſtem. For repreſentation of the firſt ſpecies of this genus, ſee Plate II.

LOZENGE, in heraldry, is a rhombus, or figure of equal ſides, but unequal angles; reſembling a quarry of glaſs in our old windows: placed erect, point-ways. See the Syſtem, Sect. VI. Article II. and Plate V.

LOZENGES, among jewellers, are common to brilliant and roſe diamonds. In the former they are formed by the meeting of the ſkill and ſtar-facets on the bezil; in the latter, by the meeting of the facets in the horizontal ribs of the crown.

LUCID *Intervals*, the fits of lunatics, or maniacs, wherein the phrenzy leaves them in poſſeſſion of their reaſon. It is ſaid, lunatics are capable of making a will in their *lucid intervals*.

LUCIFER, according to the poets, was the ſon of Jupiter and Aurora: in aſtronomy, Lucifer is the bright planet Venus, which either goes before the ſun in the morning, and is our morning ſtar; or in the evening follows the ſun, and then is called *Heſperus*, or the evening ſtar.

LUES, among phyſicians, is in general uſe for a diſeaſe of any kind; but in a more particular ſenſe is reſtrained to contagious and peſtilential diſeaſes: thus the *lues Gallica* or *venerea*, ſignifies the venereal diſeaſe. See MEDICINE.

LUKE, or *Goſpel of St. Luke*, a canonical book of the New Teſtament, written by *Luke* the Evangeliſt, who was probably an early Jewiſh believer, ſoon after the aſcenſion of Chriſt; if not a hearer of Chriſt, and one of the ſeventy diſciples. *Luke* was by profeſſion a phyſician; and is ſuppoſed to have died a natural death in the eightieth or eighty-fourth year of his age, about the year of Chriſt 70. Some think it was properly St. Paul's goſpel, and that when that apoſtle ſpeaks of his goſpel, he means what is called *St. Luke's*. Irenæus ſays, that *St. Luke* digeſted into writing what St. Paul preached to the Gentiles; and Gregory Nazianzen tells us, that *St. Luke* wrote with the aſſiſtance of St. Paul. This Goſpel, as well as the Acts of the Apoſtles, written by this evangeliſt, are ſuppoſed to have been two parts of the ſame volume, and to have been publiſhed in the year of Chriſt 63 or 64, as ſome ſay, in Alexandria, but according to others in Greece. *St. Luke* is pure, copious, and flowing in his language, and has a wonderful and entertaining variety of ſelect circumſtances in his narration of our Saviour's divine actions. He acquaints us with numerous paſſages of the evangelical hiſtory, not related by any other evangeliſt: both in his goſpel and Apoſtolical acts, he is accurate and neat, clear and flowing with a natural and eaſy grace: his ſtile is admirably accommodated to the deſign of hiſtory; it had a very conſiderable reſemblance to that of his great maſter St. Paul; and, like him, he had a learned and liberal education, and appears to have been very converſant with the beſt claſſics; for many of his words and expreſſions are exactly parallel to theirs.

LUMBAGO, pains about the loins, and the ſmall of the back; ſuch as precede ague fits, and fevers. They riſe commonly from fulneſs, and acrimony; in common with a diſpoſition to yawning, ſhuddering, and erratic pains in other parts; and go off with evacuation, generally by ſweat, and other critical diſcharges of fevers. This diſorder is a kind of rheumatiſm in the loins.

LUMBRICAL, LUMBRICALIS, in anatomy, an appellation given to four muſcles of the hand, and as many of the foot, which act as adducents of the fingers and toes. See the Syſtem, Part III. Sect. XIII and XIV.

LUMBRICUS, the earth worm in vermeology, a genus of inſects belonging to the order of vermes inteſtina. The body is cylindrical, annulated with an elevated belt near the middle. There is but one ſpecies of this animal: it lives under ground, and feeds upon the roots and ſeeds of plants. It comes above ground in the night, or during rain, for the purpoſe of copulation.

LUMINOUS, *emanations*, have been obſerved from human bodies, as alſo from thoſe of brutes. The light ariſing from currying a horſe, or from rubbing a cat's back, are known to moſt. Inſtances of a like kind have been known on combing a woman's head. Bartholin gives us an account, which he entitles *mulier ſplendens*, of a lady in Italy, whoſe body would ſhine, whenever ſlightly touched with a piece of linen. Theſe effluvia of animal bodies have many properties in common with thoſe produced in glaſs; ſuch as their being lucid, their ſnapping, and their not being excited without ſome degree of friction; and are undoubtedly electrical, as a cat's back has been found ſtrongly electrical when ſtroaked. See Electricity, and Light. Human bodies not only appear *luminous*, but even the exhalations from them adhering to their clothing will cauſe it to ſhine likewiſe.

LUNA, in aſtronomy, the moon. See the Syſtem, Sect. VIII.

LUNAR *Cycle*. See Cycle.

Lunar *Month*. See Month.

Lunar *Year*, conſiſts of three hundred and fifty four days, or twelve ſynodical months. See Year.

LUNETTE, in fortification, an inveloped counter guard, or elevation of earth, made beyond the ſecond ditch, oppoſite to the places of arms; differing from the ravelins only in their ſituation.

Lunettes are uſually made in ditches full of water, and ſerve to the ſame purpoſe as fauſſebrays, to diſpute the paſſage of the ditch. See the Syſtem, N° 4, and Plate I. *fig*. 5.

LUNGS, in anatomy, a part of the human body, compoſed of veſſels, and membranous veſicles; ſerving for reſpiration. See the Syſtem, Part V. Sect. XVIII.

Lungs *of Inſects*. In the fly claſs the ſtigmata are extremely numerous, and the tracheæ which they terminate, are branched and divaricated all over the body in an amazing manner, as if every part and particle of the bodies of theſe little animals had occaſion for its particular air-veſſels; beſides theſe, however, flies are provided with proper *lungs*. They have two, and thoſe ſo very large, that they frequently take up half, and ſometimes two thirds of the body of the animal.

LUPERCI, a name given to the prieſts of the god Pan. The *Luperci* were the moſt ancient order of prieſts in Rome; they were divided into two colleges, or companies; the one called *Fabii*, and the other *Quintilii*: to theſe Cæſar added a third, which he called *Julii*.

LUPUS, *Wolf*, in aſtronomy, a ſouthern conſtellation, joined to the Centaur. See the Syſtem, Sect. VIII.

Lupus, in zoology, a ſpecies of the genus *canis*. See Canis. For the claſſification, ſee Syſtem of Mammalia. For repreſentation, ſee the Plates, Genus 12.

Lupus *Marinus*, the *ſea-wolf*, the *anarhicas lupus* of Linnæus, in ichthyology, the fourth genus belonging to the firſt order called *Apodes*; but according to our arrangement we make it the 2d. order of *Apodes*, and the 18th genus *anarhicas*. It is a fierce and voracious ſea-fiſh, confined to the northern ſeas of our globe. It is found in thoſe of Greenland, Iceland, and Norway, on the coaſts of Scotland, and of Yorkſhire, and in that part of the German ocean which waſhes the ſhore of Holland. Its head is larger in proportion to its ſize than that of the ſhark, and rounder, a little flatted on the top; the noſe blunt; the noſtrils very ſmall; the eyes ſmall, and placed near the end of the noſe. The young are of a greeniſh caſt; the ſkin is ſmooth and ſoft, but his teeth ſo remarkably hard and ſtrong, that if he bites againſt an anchor of a ſhip, or other iron ſubſtance, he makes a loud noiſe, and leaves his marks in the iron. The two bones that form the under jaw are united before by a looſe cartilage, ſerving by a free motion to the purpoſe of breaking, grinding, and communicating its teſtaceous and cruſtaceous food, as crabs, lobſters, prawns, muſcles, &c. This fiſh grows to a large ſize, being ſometimes found on the Yorkſhire coaſt of the length of four feet, and near Shetland more than ſeven feet. For the claſſification, ſee the Syſtem.

LURCHER, a kind of hunting dog, like a mongrel greyhound, with pricked ears, a ſhaggy coat, and generally of a yellowiſh white colour; a ſpecies of the genus *canis*. See Canis. For the claſſification, ſee the Syſtem of Mammalia. For the repreſentation, ſee the Plates, Genus 12.

LUSTER, or Lustre, gloſs, or brightneſs appearing on any thing; particularly on manufactures of ſilk, wool, or ſtuff. The *luſtre* of ſilks, in which their chief beauty conſiſts, is given them by waſhing in ſoap, then clear water, and dipping them in alum water cold. The *luſtre* of black taffety is given by double-brewed beer, boiled with orange or lemon-juice; that of coloured taffetas with water of gourds, diſtilled in an alembic. Curriers give a *luſtre*, or gloſs, to the leather ſeveral ways, according to the colour to be illuſtrated. For blacks, the firſt *luſtre* is with juice of barberries; the ſecond with gum arabic, ale, vinegar, and Flanders glue, boiled together: for coloured leathers they uſe the white of an egg beaten in water: moroccos have their *luſtre* from juice of barberries, and lemon or orange. For hats, the *luſtre* is frequently given with common water; ſometimes a little black dye is added. The ſame *luſtre* ſerves ſkinners, except that in white furs they never uſe any black dye. For very black furs they ſometimes prepare a *luſtre* of galls, copperas, Roman alum, ox's marrow, and other ingredients. The luſtre is given to cloths and mohairs, by Preſſing them under the Calender.

LUSTRUM, in Roman antiquity, a general muſter and review of all the citizens and their goods, which was performed by the cenſors every fifth year, who afterwards made a ſolemn luſtration. This cuſtom was firſt inſtituted by Servius Tullius, about 180 years after the foundation of Rome. In courſe of time the luſtra were not celebrated ſo often, for we find the fifth luſtrum celebrated at Rome only in the 574th year of that city.

LUTE, or Luting. in chymiſtry, a compoſition of certain tenaceous ſubſtances, wherewith to cloſe the apertures and junctures of veſſels in diſtillation, &c.

LUTHERANISM, the ſentiments of Martin Luther with regard to religion. Lutheraniſm has undergone ſome alterations ſince the time of its founder. Luther rejected the epiſtle of St. James, as inconſiſtent with the doctrine of St. Paul, in relation to juſtification; he alſo ſet aſide the apocalypſe: both which are now received as canonical, in the Lutheran church. Luther reduced the number of ſacraments to two, viz. baptiſm, and the euchariſt: but he believed the impanation, or conſubſtantiation, that is, that the matter of the bread and wine, remain with the body and blood of Chriſt; and it is in this article that the main difference between the Lutheran and Engliſh churches conſiſt. Luther maintained the maſs to be no ſacrifice; exploded the adoration of the hoſt, auricular confeſſion, meritorious works, indulgences, purgatory, the worſhip of images, &c. which had been introduced in the corrupt times of the Romiſh church. He alſo oppoſed the doctrine of free will, maintained predeſtination, and aſſerted our juſtification to be ſolely by the imputation of the merits and ſatisfaction of Chriſt. He alſo oppoſed the faſtings in the Romiſh church, monaſtical vows, the celibate of the clergy, &c.

LUTHERANS, a ſect of Proteſtants who profeſs Lutheraniſm, or adhere to the doctrine and tenets of Luther. The *Lutherans*, of all Proteſtants, are thoſe who differ leaſt from the Romiſh church; as they affirm, that the body and blood of Chriſt are materially preſent in the ſacrament of the Lord's ſupper, though in an incomprehenſible manner; and likewiſe repreſent ſome religious rites and inſtitutions, as the uſe of images in churches, the diſtinguiſhing veſtments of the clergy, the private confeſſion of ſins, the uſe of wafers in the adminiſtration of the Lord's ſupper, the form of exorciſm in the celebration of baptiſm, and other ceremonies of the like nature, as tolerable, and ſome of them as uſeful. The *Lutherans* maintain, with regard to the divine decrees, that they reſpect the ſalvation or miſery of men, in conſequence of a previous knowledge of their ſentiments and characters, and not as free and unconditional, and as founded on the mere will of God. Towards the cloſe of the laſt century, the *Lutherans* began to entertain a greater liberality of ſentiment than they had before adopted; though in many places they perſevered longer in ſevere and deſpotic principles than other proteſtant churches. Their public teachers now enjoy an unbounded liberty of diſſenting from the deciſions of thoſe ſymbols or creeds, which were once deemed almoſt infallable rules of faith and practice, and of declaring their diſſent in the manner they judge the moſt expedient. Moſheim attributes this change in their ſentiments to the maxim, which they generally adopted, that Chriſtians were accountable to God alone for their religious opinions; and that no individual could be juſty puniſhed by the magiſtrate for his erroneous opinions, while he conducted himſelf like a virtuous and obedient ſubject, and made no attempts to diſturb the peace and order of civil ſociety. Eccl. Hiſt. vol. iv. p. 440. Eng. ed. 8vo.

LUXATION, Luxatio, in ſurgery, the ſlipping of the head of a bone from its proper receptacle into another place, whereby the natural motion of the joint is deſtroyed. *Luxation* is the ſame with what is otherwiſe called *diſlocation*; being the diſplacing of a bone, or rather the disjointing of two bones, articulated together for the motion of the part.

LUXURY, voluptuouſneſs, or an extravagant indulgence in diet and dreſs. Concerning the general utility of luxury to a ſtate, there is much controverſy among the political writers. Baron Monteſquieu lays it down, that luxury is neceſſary in monarchies as in Spain; but ruinous to democracies, as in Holland. With regard therefore to Britain, whoſe government is compounded of both ſpecies, it may ſtill be a dubious queſtion, how far private luxury is a public evil; and, as ſuch, cognizable by public laws. And indeed our legiſlators have ſeveral times changed their ſentiments as to this point: for formerly there were a number of penal laws exiſting, to reſtrain exceſs in apparel; chiefly made in the reigns of Edward III. IV. and Henry VIII. againſt picked ſhoes, ſhort doublets, and long coats; all of which were repealed by ſtatute 1 Jac. I. c. 25. But, as to exceſs in diet, there ſtill remains one ancient ſtatute unrepealed, 10 Edw. III. ſt. 3. which ordains, that no man ſhall be ſerved, at dinner or ſupper, with more than two courſes; except upon ſome great holidays there ſpecified, in which he may be ſerved with three.

LYCEUM, Λυκειον, in antiquity, the name of a celebrated ſchool, or academy at Athens, where Ariſtotle explained his philoſophy. The place was compoſed of porticoes, and trees planted in the quincunx form, where the philoſophers diſputed walking. Hence *philoſophy of the Liceum* is uſed to ſignify the philoſophy of Ariſtotle, or the Peripatetic philoſophy.

LYING-*in-women*. See MIDWIFRY.

LYMPH, LYMPHIA, in anatomy, a thin tranſparent humour, ſomething like water, ſecreted from the ſerum of the blood in all parts of the body, and returned to the blood again, by proper ducts of its own, called *lymphatics*, and ſuppoſed, by ſome, to be the immediate matter of nutrition. If the *lymph* be chymically examined, it will be found to contain a great deal of volatile, but no fixed ſalt, ſome phlegm, ſome ſulphur, and a little earth. The late ingenious Mr. Hewſon publiſhed a diſſertation on the lymph and lymphatic ſyſtem in the human body, and that of other animals. The lymph he conſiders both as contained in its proper veſſels, and exhaled into the different cavities of the body. In each of theſe ſtates, the lymph coagulated when expoſed to the air, and ſeemed more to reſemble the buffy coat of the blood than its watery parts, to which it hath been compared by authors. This coagulum, Mr. Hewſon found to vary conſiderably in its degree of coheſion, being always firm in ſtrong animals, but in weak ones of a much looſer texture. And, in the courſe of his experiments, he obſerved, that the fluid collected from the different cavities of the body uniformly agreed with that found in the lymphatic veſſels of the ſame animal, both in degree of tenacity, and time of coagulation. Thus far theſe fluids correſpond with the coagulable part of blood; but they differ from it in the time neceſſary to form the coagulum, the blood always jellying much ſooner than the lymph, and later in ſtrong than in weak animals; the very reverſe of what happens to that fluid.

From the following obſervations, Mr. Hewſon is of opinion, that the veſſels exhaling fluids into the cavities of the body, whatever their ſtructure may be, have a power of changing the nature of their contents. 1. A coagulum is often found covering the internal ſurface of inflamed cavities without the ſmalleſt eroſion. This can only be the natural exhalation, thrown out by inflamed veſſels, with a ſtrong diſpoſition to coagulate. 2. As the lymph is diſcharged, variouſly changed in tenacity and other properties, by diſeaſe; and as pus is ſometimes found in the ſame manner in cavities, without any ulceration; the author thinks it at leaſt probable, that this purulent matter is only the lymph itſelf, ſtill more altered by flowing through veſſels in a higher or different degree of inflammation; and in this notion he is confirmed, by obſerving, with the microſcope, globules in pus like thoſe of the milk, a ſecreted liquor. On a review of his experiments, he thinks they evidently point out the following general concluſions: that the lymph and exhalations are of a ſimilar nature, but differ widely from the watery part of the blood; that they coagulate on expoſure to air, and are probably a ſpecies of the lymph of the blood; that they differ in the time and firmneſs of coagulation, in various degrees, from the cachectic habit, where they ſcarcely jelly at all; to the inflammatory, where very ſhort time is requiſite to a ſtrong coheſion; and that, in ſome caſes, the inflamed veſſels can even convert the fluid paſſing through them into real purulent matter. Having thus given a correct idea of the properties of the lymph, he goes on to trace it from the circulating maſs, and to inveſtigate the manner of its ſeparation; with regard to which, he obſerves, two different opinions have been entertained. The firſt and moſt general is, that the lymph is poured into cavities, either by exhalent arteries, or pores of an organiſed nature on the ſides of veſſels. The other has ſince been ſtarted by Dr. Hunter, who conſiders the lymph as merely a tranſudation of the thinner parts of the blood through interſtices or inorganized pores in the veſſels circulating the red blood; which, though they retain the ſerum, allow the more fluid parts to paſs with eaſe. In ſupport of this new doctrine, Dr. Hunter adduces the following facts. 1. Water injected into the blood veſſels of a dead animal readily imitates this tranſudation. 2. Blood itſelf tranſudes after death, the lymph to which it owed its conſiſtence being coagulated. 3. Bile tranſudes through the gall-bladder; for, on opening an animal, all the adjacent parts are tinged. With a view to diſprove this notion, Mr. Hewſon maintains, that there is a tenſion in the veſſels of a living body, forſaking them with life; and that, did ſuch an exſudation take place, it would defeat one great intention of veſſels, the conveyance of fluids, and involve us in a continual round of exhalation and abſorption, very contrary to the common ſimplicity of nature.

A ſecond objection of Mr. Hewſon is, that, if liquors thus filtrate into cavities, not only muſt the veſſels, creeping on their ſides, but the membranes lining theſe cavities, be porous. But, if theſe pores are admitted in every part, we cannot deny them to the whole extent of theſe membranes. And, were this the caſe, a partial dropſy could never occur; as a fluid would as eaſily eſcape, from within, outwards, as it formerly inſinuated itſelf from the veſſels into any cavity. Another argument againſt the opinion of Dr. Hunter, is drawn by Mr. Hewſon from his former experiment, where he found the lymph, in different ſtates of the body, ſo various in degree of viſcidity. He is at a loſs to conceive, how pores of an inorganized nature ſhould pour out fluids ſo different in conſiſtence, much leſs filtrate pus from the blood, where it never exiſted. The argument of Dr. Hunter, founded on the tranſudation of blood, proceeds, he thinks, on an erroneous principle; for the blood of a living animal is actually thinned by the preſence of the coagulable lymph: and, if this tranſudation takes place in a dead, and not in a living animal, it ought rather to be attributed to a change in the veſſels, than their contents. And this is almoſt proved by the attentive examination of one of the ſtrongeſt of the doctor's own facts, viz. the bilious tinge on parts contiguous to the gall-bladder, which only takes place after an animal has been ſome time dead; but is never fonnd in one recently killed. From all theſe, the author concludes, that, as the lymph is very different from water, it cannot be filtrated by inorganical paſſages; and that the common opinion is founded on reaſon and experiment, the lymph being not only tranſmittted through exhalant veſſels, but by them changed in its properties, and adapted to the office of lubricating parts. The manner in which the lymph is diſcharged into the cavities of the body being thus aſcertained with a great degree of probability, Mr. Hewſon proceeds to examine how it is again abſorbed, whether by the common veins, or the lymphatic ſyſtem. Beſides the authority of all the antients, the advocates for the firſt opinion think they are poſſeſſed of ſeveral concluſive arguments in its favour. They alledge, that, in dead bodies, injunctions eaſily flow from the veins into ſeveral cavities. This Mr. Hewſon thinks, for many reaſons, to have little force. The veins are very delicate, and may be ruptured by a very ſmall diſtending power. And this ſeems in general to have been the caſe; for moſt of the injections uſed in theſe experiments were far too groſs to reach the extremities of the veins. And when thoſe of a more penetrating nature are employed, they imitate that tranſudation from vaſcular laxity, which takes place after death. A ſecond argument adduced in favour of the old opinion is, that chyle has been ſeen in the meſenteric veins. But this is a very inconcluſive one, as the whole ſerum has been found of a white colour, and, in theſe veſſels, might eaſily be miſtaken for chyle. Another has been furniſhed by the ſtructure of the penis: but this analogy is now given up; it being generally allowed, that the blood is not abſorbed, but forced from its cells into the venous ſyſtem.

Ligatures and compreſſion on veins have afforded a fourth argument; but two circumſtances unite to render this leſs ſatisfactory: 1*ſt*, The lymphatics, being contiguous to the veins, may be affected by the ſame cauſe. And 2*d*, the compreſſion of a vein will throw a greater quantity of fluids on the exhalant arteries, by obſtructing their flow through the red ones. It has been farther alleged, that there is no continuation of veſſels nor any lymphatics in the placenta, though abſorption evidently takes place. To this Mr. Hewſon replies, that there may be lymphatics, though not diſcovered, and continued veſſels from the mother to the fœtus, though never injected. The ſixth argument is ſupplied by an experiment of Kaau Boerhaave. He injected a fluid into the inteſtines, which ſoon appeared in the meſeraic veins. But Mr. Hewſon is much inclined to believe that there was ſome deception in this experiment, as it has been often repeated, without ſimilar ſucceſs. Did the fact even happen, it could never be by abſorption, that ceaſing ſoon after death, while this happened at the end of ſeveral hours; and, as preſſure was applied to the ſtomach, the author thinks a venous rupture might give riſe to the appearances obſerved by Kaau Boerhaave. The ſeventh and laſt argument in favour of abſorption by the veins was, that many animals were deſtitute of any other veſſels capable of performing that office, as birds, fiſhes, and amphibia; but the diſcovery of lymphatics in every one of theſe, has totally overthrown this argument.

To all theſe, the ingenious Mr. Meckel has, of late, added ſome others, derived from injections of mercury into the lymphatic glands, veſiculæ ſeminales, bladder, and lacteal ducts of the breaſt, which he found to paſs readily, and without extravaſation, into the adjacent veins. But Mr. Hewſon obſerves, that extravaſation is detected with difficulty; and as the lymphatic veſſels often lie contiguous to veins, it is not impoſſible that, in ſome caſes, the mercury might burſt from the one of them into the other, as often happened to Mr. Hewſon in the meſentery of the turtle. From all theſe, the author conſiders the old opinion as at leaſt open to many and weighty objections. Unſatisfied, however, with this negative proof, he goes on to ſhow, that abſorption in reality is carried on by the lymphatic ſyſtem, from the analogy of all theſe veſſels with the lacteals, which form a part of that ſyſtem, and are without doubt abſorbents. Beſides this, the courſe by which poiſons reach the circulating fluids when externally applied, evidently points out that they enter the lymphatic veſſels alone, and are by them conveyed towards the heart. To theſe Mr. Hewſon adds his obſervation, that the ſame fluid is always found in theſe veſſels, and the cavities whence they ariſe. Thus there will remain little doubt of the abſorbent power of lymphatics, a function of ſuch importance in the œconomy, that, for it alone, nature has provided a diſtinct ſet of veſſels: they had indeed, by ſome, been ſuſpected to be only reflected arterial branches; but this has been long confuted by the experiments of Dr. Monro and Dr. Hunter.

LYMPHATICS, in anatomy, the veſſels in which the lymph is contained, and the glands by which it is ſeparated in the human and other bodies. An account of the ſtructure and offices of the lymphatic glands and veſſels has lately been publiſhed, from Mr.

Hewſon's experiments, by Mr. Falconer of London. He obſerves, that each lymphatic gland is a congeries of tubes, conſiſting of arteries, veins, lymphatic veſſels, and nerves, connected by the cellular ſubſtance. Glands of this kind, he remarks, are no where to be found but in the courſe of the larger lymphatic veſſels. Theſe veſſels, in their paſſage from the extreme parts of the body towards the thoracic duct, enter and paſs through the lymphatic glands in the following manner. About a quarter of an inch before a lymphatic enters a gland, it divides into two, three, or four, ſmall branches, ſometimes into a greater number. Theſe enter the gland at the part fartheſt from the thoracic duct; and are then ſubdivided into branches, as ſmall as the ramifications of the arteries and veins which accompany them to every part of the gland. After being thus minutely divided, they reunite, and gradually become larger as they approach the oppoſite ſide of the gland, forming three or four branches, which are joined by other lymphatics that ariſe from the cells of the gland. All theſe branches unite together about a quarter of an inch from that part where they came out of the gland, and form a common trunk, larger than that below the gland, by the additional lymphatics it receives from the cells of the gland.

Altho', in every lymphatic gland, very ſmall cells can be diſcovered by the microſcope, thoſe appearances in ſuch glands which have commonly been called *cellular*, are by no means of that nature, being only little eminences formed by the bending one veſſel round another. On cutting into a freſh lymphatic gland, it is found to contain a thickiſh, white, milky fluid; and if this fluid be carefully waſhed from any part of it, and the gland then examined with the microſcope, an infinite number of very ſmall cells are obſerved, which cannot be diſcovered by the naked eye. Mr. Falconer adopts the opinion of the late Mr. Hewſon with reſpect to the *uſe* likewiſe of the lymphatic ſyſtem. The glands he conſiders as organs intended for the purpoſe of ſecreting a fluid of a particular nature from the blood; and the lymphatic veſſels he looks upon as ſo many excretory ducts. In proof of this aſſertion, he obſerves, that, if the arteries and veins of the lymphatic gland have been previouſly injected with a coloured fluid, and a part of the gland be then viewed through the microſcope, theſe cells, formerly taken notice of, appear extremely vaſcular. And it is into their cavities that the whole fluid found in a gland is ſecreted. This fluid is abſorbed by the lymphatic veſſels which ariſe from the cells of the glands, and is by them, in common with the other fluids, carried into the courſe of the circulation. The lymphatic veſſels, therefore, which originate from the cells of the gland, are, in the lymphatic glands, analogous to the excretory ducts of other glands. We have the ſame proofs, our author aſſerts, that the lymphatic glands ſecrete this white fluid, and that it is carried from the lymphatic glands by the lymphatic veſſels, that we have glands in other parts of the body ſeparating different fluids and having excretory ducts. For, if we cut into a lymphatic gland, we find a white fluid; and, if a ligature be made on the lymphatic veſſel coming from that gland, we find a fluid of the ſame kind contained in thoſe lymphatic veſſels. This, Mr. Falconer obſerves, is as convincing a proof that the lymphatic veſſels are excretory ducts to the lymphatic glands; and as ſatisfactory, as that the hepatic duct is the excretory duct of the liver. We know the liver ſecretes bile, becauſe we find it in that viſcus; and we know the ductus hepaticus is its excretory duct, becauſe we find bile contained in it. The proofs are ſimilar, and therefore equally concluſive.

Explanation of the Figure in Plate VI. *Syſtem of* ANATOMY.

This figure repreſents a general view of the abſorbents in the human body, which is ſuppoſed to be tranſparent in order to ſhew their connexion.

This ſubject was taken from Mr. de Pile's Anatomy for Painters, *Fig.* 1. but conſiderably improved by Mr. Edward Blake; and the abſorbents were added to it by Dr. Roberts, from the deſcriptions and repreſentations given by public Lecturers and Profeſſors in town, and from foreign writers on the ſubject, particularly Monſieur Maſcagni in Italy, who has given plates of them, and ſhewn them on every ſurface and cavity of the human body, and that they are equally numerous with the veins. Mr. John Hunter has proved their exiſtence even in the ſubſtance of bone itſelf. See his Treatiſe on the Animal Œconomy.

The deſcription of this figure muſt be very eaſily underſtood by any perſon who has ever viewed a vaſcular ſubject, or read the deſcription of the blood veſſels in the human body. The abſorbents are obſerved to have a peculiar affection to arteries, and their great trunks always accompany thoſe of arteries, and the larger the artery is the larger are the abſorbents, encreaſing in diameter as the artery encreaſes. They obtain the ſame name with the arteries they accompany, only when they come towards the ſurface of the body, they then leave the ſmaller ramifications of arteries, and attend the larger trunks of veins, and there again they receive their name from the neareſt vein, ſo that the reader has only to look back to the deſcription of the blood veſſels, in the Syſtem of ANATOMY in this Dictionary, to have a pretty clear idea of their ſize and ſituation.

In this figure we have ſuppoſed the parieties of the thorax and abdomen to be cut away in order to ſee the abſorbents upon the viſcera with greater preciſion, and the better to ſhew their variety and ſtructure; they ſeem to admit of very little change all over the body, excepting upon the lungs and liver. Upon the lungs they take the reticular form of the air veſicles, and appear hexagonal, octagonal, &c. according to the ſhape of the veſicle they accompany. Upon the liver they appear like a thorn buſh prodigiouſly knotted; this appearance of knots are valves, and for the ſize of the abſorbent, are cloſer together and more numerous than any where elſe in the body, are repreſented in the Figure.

The abſorbents, like the blood veſſels, are infinitely minute in their ramifications, and like them, the ſmaller branches go into larger and larger, until you come to the main trunk, which is called *Receptaculum Chyli*, or thoracic duct; ſo that ſuppoſing a tree dug out of the ground with its roots carefully ſaved, it is only taking a view of this tree with its roots, body and branches, to have a very full idea of the Syſtem at large. The upper extremities, head and arms, &c. reſemble the branches, the lower extremities, the roots, and the *Receptaculum Chyli*, the body of the tree.

The *Receptaculum Chyli* is repreſented in the Plate, ariſing from the loins in the middle of the body, running up its whole length, and terminating in the angle of the left jugular, and ſubclavian veins. The black knobs among the abſorbents, are repreſentations of glands, and the large veſſel in the middle, is the artery of the limb it belongs to. For the explanation of the viſcera ſhewn here, ſee the Plates upon the viſcera; the ſame view is given here as in thoſe plates, to keep up the connexion in the Treatiſe of Anatomy.

When the Syſtem of Anatomy was under contemplation, it was deemed by the author ſufficient to deſcribe and repreſent the abſorbents from *Hewſon*. But as the Proprietor has been ſo happy as to obtain further information and aſſiſtance from ſeveral profeſſional gentlemen, in this important part of the human œconomy; he was deſirous of availing himſelf of their favours, and has therefore introduced the deſcription under the article LYMPHATICS, as forming a part of the abſorbent Syſtem. For an account of the abſorbent veſſels as deſcribed in the Syſtem, ſee Part I. Sect. V. and Part IV. Sect. III. For the repreſentation ſee Plate VII.

LYNX, in zoology, a ſpecies of the 13th genus *felis*. See FELIS. For repreſentation ſee the Plates of MAMMALIA, Genus 13.

LYNX, in aſtronomy, is a conſtellation of the northern hemiſphere. See the Syſtem, Sect. VIII.

LYRE, a muſical inſtrument of the ſtringed kind, much uſed by the ancients. Concerning the number of ſtrings with which this inſtrument was furniſhed, there is great controverſy. Some aſſert it to be only three; and that the ſounds of the two remote were acute, and that of the intermediate one a mean between thoſe two extremes: that Mercury, the inventor, reſembled thoſe three chords to as many ſeaſons of the year, which were all that the Greeks reckoned, namely, Summer, Winter, and Spring; aſſigning the acute to the firſt, the grave to the ſecond, and the mean to the third. The moſt ancient repreſentations of this inſtrument agree very well with the account of its invention: the lyre, in particular on the old celeſtial globes, was repreſented as made of one entire ſhell of a tortoiſe; and that Amphion in the celebrated group of the Dirce, or Toro, in the Farneſe palace at Rome, which is of Greek ſculpture, and very high antiquity, is figured in the ſame manner. There have, however, been many other claimants to the ſeven ſtringed lyre. For though Mercury invented this inſtrument in the manner already related, it is ſaid he afterwards gave it to Apollo, who was the firſt that played upon it with method, and made it the conſtant companion of poetry. According to Homer's account of this tranſaction, in his hymn to Mercury, it was given by that god to Apollo, as a peace-offering and indemnification for the oxen which he had ſtolen from him:

> To Phœbus Maia's ſon preſents the lyre,
> A gift intended to appeaſe his ire.
> The god receives it gladly, and eſſays
> The novel inſtrument a thouſand ways:
> With dext'rous ſkill the plectrum wields; and ſings,
> With voice accordant to the trembling ſtrings,
> Such ſtrains as gods and men approv'd, from whence
> The ſweet alliance ſprung of ſound and ſenſe.

The different claimants among the Greeks to the ſame muſical diſcoveries, only prove, that muſic was cultivated in different countries; and that the inhabitants of each country invented and improved their own inſtruments, ſome of which happening to reſemble thoſe of other parts of Greece, rendered it difficult for hiſtorians to avoid attributing the ſame invention to different perſons.

LYRE, among painters, ſtatuaries, &c. is an ATTRIBUTE of Apollo and the Muſes.

LYRIC, ſomething ſung or played, on the LYRE or HARP. It is particularly applied to the ancient odes, and ſtanzas; which anſwer to our *airs*, or *ſongs*, and may be played on inſtruments. The ancients were great admirers of *lyric verſes*; which name they gave to ſuch verſes as were ſung to the lyre. See POETRY.

The characteriſtic of *lyric poetry*, which diſtinguiſhes it from all others, is *dignity* and *ſweetneſs*. As *gravity* rules in heroic verſe; *ſimplicity*, in paſtoral; *tenderneſs* and *ſoftneſs*, in elegy; *ſharpneſs* and *poignancy*, in ſatire; *mirth*, in comedy; the *pathetic*, in tragedy; and the *point*, in epigram: ſo in the *lyric*, the poet applies himſelf wholly to ſooth the minds of men, by the ſweetneſs and variety of the verſe, and the delicacy and elevation of the words and thoughts; the agreeableneſs of the numbers, and the deſcription of things moſt pleaſing in their own nature.

M

M, A liquid conſonant, and the 12th letter of the alphabet. The ſound of this letter is formed by ſhutting the lips, and thereby intercepting the breath, as it is ſtrongly expreſſed through the mouth and noſtrils jointly. Its ſound is always the ſame in Engliſh; it ſuffers no conſonant after it in the beginning of words and ſyllables, unleſs in ſome derived from the Greek, as *amneſty*, &c. M, in preſcription, ſignifies a *maniple*, or handful; and at the end of a receipt it imports *miſce*, or mingle. M, in aſtronomy, &c. denotes *meridional*, *ſouthern*; ſometimes *meridies*, or mid-day. M, in law, the brand of a perſon convicted of manſlaughter, and admitted to the benefit of clergy; it is burnt on the brawn of the left thumb. M, among the ancients, was a numeral letter, ſignifying *one thouſand*; and when a daſh was added at the top of it, as $\overline{\text{M}}$, it ſignified a *thouſand times a thouſand*.

MACACO, or Macauco, in zoology, a ſpecies of the third genus *Lemur*. See Lemur. For repreſentation, ſee plates of Mammalia; genus 3.

MACAW, Maccaw, or Macao, in ornithology, the Engliſh name of a ſpecies of the 5th genus *Pſittacus*. See Psittacus.

MACCABEES, two apocryphal books of Scripture; ſo called from Judas the ſon of Mattathias, ſurnamed *Maccabæus*, either on account of his valour, or becauſe he bore on his ſtandard the firſt letters of a ſentence in Exodus, which joined together, form the name *Maccabee*. The Hebrews call them *The books of the Aſſamonæans*, becauſe (according to Joſephus and Euſebius) Mattathias was the ſon of *Haſamonëus*, or *Aſſamonëus*, which was the name of the family. The firſt book of the Maccabees is an excellent hiſtory; and comes neareſt to the ſtyle and manner of the ſacred hiſtorians of any extant. The ſecond book does not by any means equal the accuracy and excellency of the firſt.

There is alſo a third book of the *Maccabees*, containing the hiſtory of the perſecution of Ptolemy Philopater againſt the Jews in Egypt, and their ſufferings under it; and ſeems to have been written by ſome Alexandrian Jew in the Greek language, not long after the time of Siracides. It is in moſt of the ancient manuſcript copies of the Greek Septuagint, particularly in the Alexandrian and Vatican, but was never inſerted into the vulgar Latin verſion of the Bible, nor conſequently into any of our Engliſh copies. Moreover Joſephus's hiſtory of the martyrs that ſuffered under Antiochus Epiphanes, is found in ſome manuſcript Greek Bibles, under the name of the fourth book of the *Maccabees*.

MACE, the ſecond coat or covering of the kernel of the nutmeg, is a thin and membranaceous ſubſtance, of an oleaginous nature, and a yellowiſh colour; being met with in flakes of an inch or more in length, which are divided into a multitude of ramifications. It is of an extremely fragrant, aromatic, and agreeable flavour; and of a pleaſant, but acrid, oleaginous taſte. Mace is carminative, ſtomachic, and aſtringent; and poſſeſſes all the virtues of nut-meg, but has leſs aſtringency. The oils of mace and nutmeg, whether prepared by diſtillation or expreſſion, are ſo much of the ſame nature, that they may be indiſcriminately uſed for one another on all occaſions. They give eaſe in cholics, and often in nephritic caſes, taken internally from one drop to five or ſix of the diſtilled oil, or an equal quantity of the expreſſed; and externally, they are of uſe to rub paralytic limbs: they alſo aſſiſt digeſtion; and will often ſtop vomitings and hiccoughs, only by being rubbed on the region of the ſtomach. The nurſes have a cuſtom of applying oil of mace by expreſſion to childrens navels to eaſe their gripes, and that often with ſucceſs; and we are aſſured, by authors of credit, that, when rubbed on the temples, it promotes ſleep.

MACERATION, in pharmacy, the operation of diſſolving a ſolid body by means of water, or ſome other liquor. In this ſenſe, the word amounts to much the ſame with liquefaction, or liquation.

MACKREL, in ichthyology, the Engliſh name of a well known ſea-fiſh of the ſcomber kind: it is a ſpecies of the genus *Scomber*. See Scomber.

MACROCOSM, a word denoting the great world or univerſe. It is compounded of the Greek words *μακρος*, "great," and *κοσμος*, "world."

MACULÆ, in aſtronomy, dark ſpots appearing on the luminary faces of the ſun, moon, and even ſome of the planets. In which ſenſe *maculæ* ſtand contradiſtinguiſhed from faculæ. See the Syſtem, Sect. VIII.

MADDER, in botany, the Engliſh name of the genus *Rubia*. See Rubia. The culture of that ſpecies of *madder*, which is uſed by the dyers and callico printers, and which grows naturally in the Levant, is an article of conſiderable advantage to the Dutch, inſomuch that at an average of ſeveral years paſt they have received from us more than 180,000*l.* per annum, and might be proſecuted here with equal ſucceſs. For the method of cultivation, ſee the Syſtem of Agriculture, Sect. VIII. See alſo Treatiſe on Dyeing, Sect. II.

It appears from the calculations of an ingenious writer, that, ſuppoſing the land to be worth 40*s.* per acre, and excluding the original price of the plants, the whole expence of cultivating it with *madder*, is 15*l.* 18*s.* 2*d.* and that the produce of it is 52*l.* 12*s.* 2*d.* ſo that the clear profit is 36*l.* 14*s.* The root of the common *madder* cultivated for the uſe of the dyers, is an excellent aperient and diuretic. It is preſcribed with great ſucceſs in obſtructions of the liver and ſpleen, in ſuppreſſions of the menſes and urine, and in dropſies, jaundices, and cachexies. It is alſo recommended as a vulnerary, and ſaid to be peculiarly excellent in the diſſolving coagulated blood. The college of Edinburgh makes it an ingredient in the icteric decoction, which is prepared by boiling an ounce of *madder*, the ſame quantity of turmeric, and the ſame quantity of the roots and leaves of celandine, in three pints of water to a quart, to which, then ſtrained and cooled, the juice of two hundred millepedes is added: a quarter of a pint of this liquor is taken twice a day, or oftener. The dyers prepare a red colour with it, and uſe it alſo as a firſt tint for ſeveral others.

MADNESS, *mania*, in medicine. See the Syſtem.

MAGDALEN. *Religious of St.* Magdalen, is a denomination given to divers communities of nuns, conſiſting, generally, of penitent courtezans; ſometimes alſo called *Magdalanettes*.

MAGGOT, the common name of the fly-worm, bred in fleſh, from the egg of the great blue-fleſh-fly. This animal is white and fleſhy; its body is compoſed of a number of rings, like the bodies of caterpillars, and other the like inſects, and is capable at the pleaſure of the animal, of aſſuming different figures.

MAGI, or Magians, an ancient religious ſect in Perſia, and other Eaſtern countries. Their prieſts were the moſt ſkilful mathematicians and philoſophers of the ages in which they lived, inſomuch that a learned man and a magian became equivalent terms. The vulgar looked on their knowledge as ſupernatural; and hence thoſe who practiſed wicked and miſchievous arts, taking upon themſelves the name of *magians*, drew on it that ill ſignification which the word magician now bears among us. This ſect ſtill ſubſiſts in Perſia under the denomination of *gaurs*, where they watch the ſacred fire with the greateſt care, and never ſuffer it to be extinguiſhed.

MAGIC, Magia, ΜΑΓΕΙΑ, in its ancient ſenſe, the ſcience, or diſcipline and doctrine of the magi, or wiſe men of Perſia. See Magi. Magic in a more general ſenſe, is a ſcience which teaches to perform wonderful and ſurpriſing effects. The word *magic* originally carried with it a very innocent, nay laudable, meaning; being uſed purely to ſignify the ſtudy of wiſdom, and the more ſublime parts of knowledge: but in regard the ancient magi engaged themſelves in aſtrology, divination, ſorcery, &c. the term *magic* in time became odious, and was only uſed to ſignify an unlawful and diabolical kind of ſcience. If any wonder how ſo vain and deceitful a ſcience ſhould gain ſo much credit and authority over mens minds, Pliny gives the reaſon of it. It is, ſays he, becauſe it has poſſeſſed itſelf of three ſciences of the moſt eſteem among men; taking from each, all that is great and marvellous in it. Nobody doubts but it had its firſt origin in medicine; and that it inſinuated itſelf into the minds of the people, under pretence of affording extraordinary remedies. To theſe fine promiſes it added every thing in religion that is pompous and ſplendid, and that appears calculated to blind and captivate mankind. Laſtly, it mingled judiciary aſtrology with the reſt; perſuading people, curious of futurity, that it ſaw every thing to come in the heavens.

Magic *Lantern*, an optic machine contrived by Kircher, (ſee his Ars Magna Lucis et Umbræ, p. 768, 769), by means whereof little painted images are repreſented on an oppoſite wall of a dark room, magnified to any bigneſs at pleaſure. See Syſtem of Optics.

MAGICAL *Picture*, in electricity, firſt contrived by Mr. Kinnerſley. For a copious deſcription, ſee the Syſtem, Sect. II. Art. III. Exp. IV.

MAGNA *Charta*, the great charter of the liberties of Britain, and the baſis of our laws and privileges. This charter may be ſaid to derive its origin from king Edward the Confeſſor, who granted ſeveral privileges to the church and ſtate by charter: theſe liberties and privileges were alſo granted and confirmed by king Henry I. by a celebrated great charter now loſt; but which was confirmed or re-enacted by king Henry II. and king John. Henry III. the ſucceſſor of this laſt prince, after having cauſed 12 men to make enquiry into the liberties of England in the reign of Henry I. granted a new charter; which was the ſame as the preſent magna charta. This he ſeveral times confirmed, and as often broke; till, in the 37th year of his reign, he went to Weſtminſter-hall, and there, in preſence of the nobility and biſhops, who held lighted candles in their hands, magna charta was read, the king all the time holding his hand to his breaſt, and at laſt ſolemnly ſwearing faithfully and inviolably to obſerve all the things therein contained, &c. Then the biſhops extinguiſhing the candles, and throwing them on the ground, they all cried out, "Thus let him be extinguiſhed, and ſtink in hell, who violates this charter." It is obſerved, that, notwithſtanding the ſolemnity of this confirmation, king Henry, the very next year, again invaded the rights of his people, till the barons entered into a war againſt him; when, after various ſucceſs, he confirmed this charter, and the charter of the foreſt, in the 52d year of his reign.

This charter confirmed many liberties of the church, and redreſſed many grievances incident to feodal tenures, of no ſmall moment at the time; though now, unleſs conſidered attentively and with this retroſpect, they ſeem but of trifling concern. But, beſides theſe feodal proviſions, care was alſo taken therein to protect the ſubject againſt other oppreſſions, then frequently ariſing from unreaſonable amercements, from illegal diſtreſſes or other proceſs for debts or ſervices due to the crown, and from the tyrannical abuſe of the prerogative of purveyance and pre-emption. It fixed the forfeiture of lands for felony in the ſame manner as it ſtill remains; prohibited for the future the grants of excluſive fiſheries; and the erection of new bridges ſo as to oppreſs the neighbourhood. With reſpect to private rights, it eſtabliſhed the teſtamentary power of the ſubject over part of his perſonal eſtate, the reſt being diſtributed among his wife and children; it laid down the law of dower, as it hath continued ever ſince; and prohibited the appeals of women, unleſs for the death of their huſbands. In matters of public police and national concern, it enjoined an uniformity of weights and meaſures; gave new encouragement to commerce, by the protection of merchant-ſtrangers; and forbad the alienation of lands in mortmain. With regard to the adminiſtration of juſtice: beſides prohibiting all denials or delays of it, it fixed the court of common-pleas at Weſtminſter, that the ſuitors might no longer be harraſſed with following the king's perſon in all his progreſſes: and at the ſame time brought the trial of iſſues home to the very doors of the freeholders, by directing aſſiſes to be taken in the proper counties, and eſtabliſhing annual circuits: it alſo corrected ſome abuſes then incident to the trials by wager of law and of battle; directed the regular awarding of inqueſts for life or member; prohibited the king's inferior miniſters from holding pleas of the crown, or trying any criminal charge, whereby many forfeitures might otherwiſe have unjuſtly accrued to the exchequer; and regulated the time and place of holding the inferior tribunals of juſtice, the county-court, ſheriff's torn, and court leet. It confirmed and eſtabliſhed the liberties of the city of London, and all other cities, boroughs, towns, and ports of the kingdom. And laſtly, (which alone would have merited the title that it bears, of the *great charter*) it protected every individual of the nation in the free enjoyment of his life, his liberty, and his property, unleſs declared to be forfeited by the judgment of his peers or the law of the land. This excellent charter, ſo equitable, and beneficial to the ſubject, is the moſt ancient written law in the kingdom. By the 25th Edward I. it is ordained, that it ſhall be taken as the common law; and by the 43d Edward III. all ſtatutes made againſt it are declared to be void.

MAGNET, Magnes, the loadſtone; a ſort of ferruginous ſtone, in weight and colour reſembling iron ore, and very hard and heavy; endued with divers extraordinary properties, attractive, inclinatory, &c. The *magnet* is indeed a true iron ore, from which a conſiderable portion of iron may be extracted, and is uſually found in iron mines, and ſometimes in very large pieces, half magnet, half common ore. Its colour is different, white, blue, red, black, but moſtly ferruginous, according to the different countries it is brought from. The ancients reckoned five kinds of magnets, different in colour and virtue; the Ethiopic, Magneſian, Bœotic, Alexandrian, and Natolian. They alſo took it to be of two kinds, male and female; but the chief uſe they made of it was in medicine; eſpecially for the cure of burns, and defluxion on the eyes. The moderns, more happy, take it to conduct them in their voyages. See Navigation.

The moſt diſtinguiſhing properties of the *magnet* are, that it attracts iron, thus ſerving the purpoſes of the chymiſt in diſcovering or ſeparating ſmall particles of iron, mixed with other matters, and that it points to the poles of the world; and in other circumſtances, alſo dips or inclines to a point beneath the horizon, directly under the pole; and that it communicates theſe properties, by touch, to iron. On which foundation are formed the mariners needles; both the horizontal, and the inclinatory, or dipping-needles.

The Attractive Power of the Magnet was known to the ancients, and is mentioned even by Plato and Euripides, who called it the *Herculean ſtone*; becauſe it commands iron, which ſubdues every thing elſe. The ancients ſeem alſo to have been acquainted with the communicative virtue of the *magnet*; but the knowledge of its directing power, whereby it diſpoſes its poles along the meridian of every place, and occaſions needles, pieces of iron, &c. touched with it, to point nearly north and ſouth, is of a much later date; though the exact time of its diſcovery, and the diſcoverer himſelf, are yet in the dark.

Variation of the Magnet, or its declination from the pole, was firſt diſcovered by Seb. Cabot, a Venetian, in 1500, who firſt ſerved our king Henry VII. then the king of Spain, and laſtly returning to England, was conſtituted grand pilot by king Edw. VI. with an annual ſalary of about 100*l.* though Ferdinand, the ſon of Columbus, aſſerts, that his father obſerved it on the 14th of September, 1492: and the variation of that variation by Mr. Gellibrand, an Engliſhman, who publiſhed his diſcovery in a ſmall quarto pamphlet, intitled A Diſcourſe Mathematical on the Variation of the Magnetic Needle, printed in 1635. Laſtly, the dip or inclination of the needle, when at liberty to play vertically, to a point beneath the horizon, was firſt diſcovered by another of our countrymen, Mr. R. Norman, who in 1581, publiſhed the diſcovery he had long before made, in a ſmall pamphlet, called the *Nerve Attractive*, where he ſhews how to determine its quantity. See Dipping-*Needle*.

The cauſe of the variation of the needle has remained hitherto without any demonſtrative diſcovery; yet ſince its declination, and inclination, or dipping, do both of them manifeſtly indicate the cauſe to be ſomewhere in the earth, it has given occaſion to philoſophy to frame hypotheſes for a ſolution, which makes the earth a large or general magnet or loadſtone, of which all the leſſer ones are but ſo many parts or fragments, and being poſſeſſed of the ſame virtue, will, when left to move freely, have the ſame diſpoſition and ſimilarity of poſition, and other circumſtances. The moſt conſiderable of theſe hypotheſes is that of the late ſagacious Dr. Halley, which is this: the globe of the earth is one great magnet, having four magnetical poles or points of attraction, near each pole of the equator two; and that in thoſe parts of the world which lie near adjacent to any one of thoſe magnetical poles, the needle is chiefly governed thereby, the neareſt pole being always predominant over the more remote one. Of the north poles, that which is neareſt to us he ſuppoſes to be in the meridian of the land's end, which governs the variations in European Tartary and the North Sea; the other he places is a meridian paſſing through California, about 15 degrees from the north pole of the world, which governs the needle in North America, and the oceans on either ſide. In like manner he accounts for the variations in the ſouthern hemiſphere.

The variation of the needle has, within a century paſt, undergone a remarkable alteration; for at London it was obſerved by Mr. Burrows, in the year 1580, to be 11° 15′ eaſt: after that, in the year 1622, it was obſerved by Mr. Gunter to be but 6° eaſt. In the year 1634, Mr. Gellibrand obſerved it to be 4° 5′ eaſt. In 1657, it was obſerved by Mr. Bond to be nothing at all, that is, the needle pointed directly to the north. After this, in the year 1672, Dr. Halley obſerved it to be 2° 30′ weſtward; and again, in the year 1692, he found it 6° weſt. Since then, in the year 1722, Mr. Graham, by moſt accurate experiments, found it to be 14° 13′, and at preſent it is between 19 and 20 degrees; and in ſome places it has been found to be 23° weſtward.

The ingenious Muſchenbroek has, with indefatigable pains and application, made experiments of the attractions and repulſions of loadſtones in reſpect to iron and to each other, but could never find any regular proportion in the increaſe of attraction in their approach to, or decreaſe of attraction in their receſs from, one another; only that the force of the magnetic virtue did increaſe in the approach to, and diminiſh in the receſs from, the ſtone, but not exactly as the diſtance, nor as the ſquare or cube of the diſtance reciprocally, nor in any proportion reducible to numbers; and therefore he very reaſonably conjectures, that the repulſions and attractions diſturb one another, ſo as to confound the proportion; nor are we able to hope for any other rule concerning this matter, till a way be found, if ever it can be, of ſeparating the attracting from the repelling parts. The poles of a loadſtone are not to be looked upon as two ſuch invariable points as never to change place; for according to Mr. Boyle, the poles of a little bit of magnet may be changed by applying them to the more vigorous poles of another, as has been confirmed by Dr. Knight, who can change at pleaſure the poles of a natural magnet, by means of iron bars magnetically impregnated. Upon gently cutting a magnet through the middle of its axis, each piece becomes a complete magnet; for the parts that were contiguous under the equator before the magnet was cut, become poles, and even poles of different names; ſo that each piece may become equally a north or ſouth pole, according as the ſection was made nearer the ſouth or north pole of the large magnet; and the ſame thing would happen in any other ſub-diviſions. But upon cutting a magnet longitudinally, there will then be four poles, the ſame as before the cutting; only that there ſhall be formed in each piece a new axis parallel to the former, and more or leſs in the inſide of the magnet. We find by experience, that two magnets attract each other by the poles of different denominations; whereas, on the contrary, the two ſimilar poles repel each other. By a great number of experiments we alſo learn that the force of a magnet in attraction and repulſion reaches ſometimes farther, ſometimes not ſo far. The activity of ſome reaches to fourteen feet, and that of others is inſenſible within eight or nine inches; the ſphere of activity is greater on certain days than on others, without its ever appearing that the heat, moiſture, or drought of the air contribute any thing to this effect.

In order to communicate the magnetic virtue effectually, theſe methods are made uſe of: 1. It has been diſcovered that iron rubbed upon one of the poles of the magnet, acquires a great deal more virtue than from any other part thereof, and this is more conſiderable from an armed than a naked magnet. 2. The more gently the iron is preſſed, and the more it is preſſed againſt the pole, the more magnetical it becomes. 3. It is more convenient to impregnate iron on one pole than on both ſucceſſively. 4. The iron is much better impregnated by preſſing it uniformly, and in the ſame direction, according to its length, than by rubbing it by the middle; and the extremity which touches the pole laſt, retains the moſt virtue. 5. A piece of poliſh ſteel, or a bit of pointed iron, receives more virtue than a ſimple piece of iron of the ſame figure; and, cæteris paribus, a piece of iron that is long, ſmall and pointed, is more ſtrongly impregnated than that of any other form. The communication of the magnetic virtue does not ſenſibly impair that of the loadſtone; though it has been obſerved that ſome magnets have communicated a greater power to iron to raiſe weights, than they had themſelves, but without impairing their own force, or adding any thing to the weight of the iron.

As ſeveral ways have been propoſed for recovering the decayed virtue of loadſtones, but to little purpoſe, eſpecially that of keeping the ſtone conſtantly in ſteel filings, we ſhall here relate the remarkable experiment of Mr. Haac for this purpoſe, as it was attended with great ſucceſs. This gentleman had a magnet weighing fourteen ounces and a half, armed, which would take up ſixteen times its weight; but having laid it by for ſome years unuſed, it loſt one fourth part of its virtue, or more; whereupon he hung as much weight to the ſtone as it would ſuſtain, and ſo left it for ſome weeks; then returning, he applied more weight to the former, which it eaſily bore, and then repeating the addition of more weight at ſeveral periods, in the ſpace of about two years, he found that the ſtone had not only recovered its former ſtrength, but increaſed it ſo far, that it would now take up more than twenty pounds, whereas at firſt it would not take up fifteen pounds.

Artificial MAGNETS, are ſteel bars impregnated with the virtues of the magnet, ſo that they poſſeſs all the properties, and may be uſed inſtead of the natural loadſtone.

MAGNETISM, the virtue or power that the magnet has of attracting iron, &c. The primary properties of magnetiſm are as follows: 1. Every loadſtone has two pints or poles, which emit the magnetic virtue moſt copiouſly. 2. One of thoſe poles attracts, the others repels iron, but no other body. 3. Their virtue is communicated to iron by the touch, which renders it magnetic. 4. A piece of iron ſo touched by the loadſtone, and nicely ſuſpended on a ſharp point will be determined to ſettle itſelf in a direction nearly north and ſouth. 5. The end of the needle touched by the ſouth pole of the ſtone will point northwards, and the contrary. 6. Needles touched by the ſtone will dip below the horizon, or be directed on the touched part to a point within the earth's ſurface. This is called the dipping-needle. 7. This virtue is alſo to be communicated to iron, by a ſtrong attrition all one way; whence files, drills, &c. are always found to be magnetical. 8. Iron rods or bars acquire a magnetic virtue by ſtanding long in one poſition. 9. Fire totally deſtroys this virtue, by making the ſtone or iron red-hot. 10. This power is exerted ſenſibly to the diſtance of ſeveral feet. 11. It is ſenſibly continued through the ſubſtance of ſeveral contiguous bodies or pieces of iron, as keys, &c. 12. It pervades the pores of the hardeſt bodies: and, 13. equally attracts the iron in vacuo as in open air. To the above properties of the loadſtone we ſhall add the following, viz. That the ſame pole of the ſtone will communicate to a piece of iron the power of attracting or repelling the ſame end of a touched needle, by drawing it different ways thereon: or thus, if a piece of iron be drawn to the right hand and attracts, it will repel if drawn to the left, which is not a little wonderful. By a ſmart ſtroke of a hammer on the untouched end of the dipping needle, the magnetic virtue may be cauſed to come all to that end from the other, ſo as to make it dip on that ſide, as much as it did on the other ſide before: and, on the contrary, by ſuch a ſtroke, ſometimes, it may be made to dip much more on the touched end than before. Again, ſometimes by ſtriking it, the needle which dipped before, will be reſtored to its equilibrium, as if the virtue had made its eſcape, or were uniformly diffuſed over all the needle. So capricious are the phænomena of this amazing power.

MAGNIFYING *Glaſs*, in optics, denotes a little ſpherical convex lens; which, in tranſmitting the rays of light, inflects them, ſo, as that the parallel ones become converging, and thoſe which were diverging become parallel; by means whereof, objects viewed through them appear larger than when viewed by the naked eye. See Syſtem of OPTICS.

MAGPYE, in ornithology, the Engliſh name of a well known ſpecies of the 10th Genus *Corvus*, or the *corvus pica*, in the Linnæan ſyſtem. For the Claſſification, ſee the ſyſtem. For the deſcription, ſee CORVUS.

MAHOGANY, a ſpecies of the Genus *Cedrus*. For a full deſcription. See CEDRUS.

MAHOMETANISM, MAHOMETISM, MOHAMMEDISM; the ſyſtem of religion broached by *Mahomet*, and ſtill adhered to by his followers. *Mahomet* was born at Mecca in Arabia, in the year of Chriſt 571 or 572 according to the moſt probable opinion: in the thirty-eighth year of his age he began to withdraw himſelf into a ſolitary cave near Mecca, called the cave of Hira, for the purpoſe of forming his ſyſtem of impoſture; the propagation of which he commenced in the fortieth year of his age, when he aſſumed the title of the apoſtle of God: and having gained nine diſciples, ſome of whom were the principal men of the city; in the forty-fourth year of his age he openly publiſhed his impoſture to the people of Mecca, and declared himſelf a prophet ſent by God to recover them from Paganiſm, and to teach them the true religion. However, he was obliged to abandon Mecca, and to ſettle at Medina, on the 16th of July, A. D. 622, the year of the hegira or *Mahometan* epocha: here his party conſiderably increaſed, and having made ſeveral ſucceſsful excurſions againſt the Arab tribes, and conſtrained them by force to embrace his religion, his ſovereignty was eſtabliſhed in 628, and he united in himſelf the ſacred character of chief pontiff of his religion, as well as the royal; both which characters he tranſmitted to all his ſucceſſors, who, by the title of caliphs, reigned after him. But they were afterwards deprived of the regal authority, firſt by the governors of the provinces, who, about the year of hegira, 325, aſſumed it to themſelves, and made themſelves kings in their reſpective governments; and then by others who aroſe on this diſtraction of the empire to uſurp upon them, till at laſt they had nothing left but the name and ſhadow of what they had once been. In the year of Chriſt 629 *Mahomet*, at the head of an army of ten thouſand men, reduced Mecca, and extended his conqueſts, with his religion, through moſt parts of Arabia: and the remaining Arabs ſubmitted and embraced his impoſture in 631. In the next year he died at Medina, being, according to ſome hiſtorians, ſixty-three years of age.

Mahometaniſm is embraced by the Turks, Perſians, and ſeveral nations among the Africans, and many among the Eaſt Indians. Brerewood ſays, that if we divide the known countries of the earth into thirty equal parts, five of them are Chriſtians, ſix Mahometan, and nineteen Pagan. The ſyſtem of *Mahometaniſm* is contained in the Koran, commonly called the Alcoran. See the article ALCORAN.

The firſt and chief article of the *Mahometan* creed is, that *there is no other God but one God*; which they have from the Koran, where theſe words are repeated inceſſantly: *there is no other God but he. Your God is the only God. I am God, and there is no other God but I.* This grand axiom of their theology ſeems to have been taken from the Jews, who were continually rehearſing thoſe words of Deuteronomy, *Hear, O Iſrael*; *the Lord our God is One.*

For this reaſon, the *Mahometans* account all ſuch as own any thing of number in the divinity, to be infidels or idolaters. And accordingly, one of the firſt leſſons they teach their children is, that God is neither male nor female, and conſequently can have no children. The ſecond article of *Mahometaniſm* conſiſts in this, *that Mahomet was ſent from God.* By which they exclude all other religions: under pretence that their prophet was the laſt and greateſt of all the prophets that God would ever ſend, and that as the Jewiſh religion ceaſed with the coming of the Meſſiah, ſo likewiſe the Chriſtian religion was to be abrogated with the coming of *Mahomet*. Not but they own Moſes and Jeſus Chriſt to have been great prophets; but *Mahomet* they hold to be *The Prophet*, by way of excellence, commiſſioned to purge the holy ſcriptures of the Old and New Teſtament, which they allow, from the corruption introduced in them by Jews and Chriſtians, and to reſtore the law of God to its original purity; and the paraclete or comforter promiſed in the ſcriptures.

The *Mahometans* call their religion *Iſlam*, denoting as ſome ſay, *reſignation* or *ſubmiſſion* to the ſervice and commands of God, but according to others, formed from the root *ſalama*, ſignifying to *be ſaved*, and therefore the ſame with *the religion* or *ſtate of ſalvation*; and they divide it into two diſtinct parts, viz. *mian*, i. e. *faith* or *theory*; and *din*, i. e. *religion* or *practice*: and teach, that it is built on five fundamental points, one belonging to faith, and the other four to practice. Under the confeſſion of faith already recited, they comprehend ſix diſtinct branches, viz. belief in God; in his angels; in his ſcriptures; in his prophets: in the reſurrection and day of Judgment; and in God's abſolute decree and predeſtination both of good and evil. The four points relating to practice, are prayer, under which are comprehended thoſe waſhings or purifications which are neceſſary preparations required before prayer; alms; faſting; and the pilgrimage to Mecca: the Mahometans are taught by the Koran, that God, in divers ages of the world, gave revelations of his will in writing to ſeveral prophets, the whole, and every word of which, it is abſolutely neceſſary for every good Moſlem to believe. Mahomet acknowledges the divine authority of the Pentateuch, Pſalms, and Goſpel, and often appeals to the conſonancy of the Koran with thoſe writings, and to the prophecies which he pretended were contained concerning himſelf, which the Jews and Chriſtians have ſuppreſſed. At death, they maintain, that the bodies of thoſe who believe the unity of God, and the miſſion of Mahomet, reſt in peace, and are refreſhed with the air of Paradiſe: otherwiſe they are grievouſly tormented. The ſouls of the former are conveyed to heaven, where a place is aſſigned them according to their merit and degree; thoſe of the wicked are tormented, till they are rejoined to their bodies at the reſurrection; the approach of which will be known by certain ſigns that precede it.

They maintain that infidels only will be liable to eternal puniſhment; but the Moſlems or believers will be delivered thence, after they have expiated their crimes by their ſufferings. This place of puniſhment is ſeparated from paradiſe by a wall, ſo ſmall in breadth as to admit the bleſſed and damned to converſe together. The righteous will be refreſhed by drinking at the pond of their prophet, and then admitted into paradiſe, ſituated in the ſeventh heaven, and next to the throne of God; where they will feed on the moſt delicious fruits; be clothed in the moſt ſplendid ſilken garments, refreſhed with rivers of water, wine, milk, and honey, and entertained with the moſt delightful muſic, and the raviſhing girls of paradiſe with black eyes, the enjoyment of whoſe company will be a principal felicity of the faithful.

It appears from the Koran, that women as well as men will not only be puniſhed for their evil actions, but alſo receive the reward of their good deeds, and that both will enjoy a perpetual youth. The orthodox doctrine with reſpect to predeſtination is, that every thing which happens in this world proceedeth entirely from the divine will, and is irrevocably fixed from all eternity. As to the four fundamental points of religious practice; *Mahomet* is ſaid to have declared, that the practice of religion is founded on cleanlineſs, which is one half of the faith, and the key of prayer, without which it will not be heard by God. Such is the opinion which the *Mahometans* entertain of cleanlineſs, that it is purely on this account they ſeem to have adopted circumciſion, though it be not mentioned in the Koran. *Mahomet* has obliged his followers to pray five times every twenty-four hours, at certain ſtated times, turning their faces towards the temple at Mecca, which is pointed by a niche in their moſques: the life and ſpirit of prayer, they hold, as the inward diſpoſing of the heart; nor do they ever perform this duty in ſumptuous apparel, nor ſuffer their women to attend them on theſe occaſions. Alms among the *Mahometans*, are legal and voluntary; the giving of which is frequently inculcated in the Koran. Faſting is called by *Mahomet*, the gate of religion; and his followers are expreſly required to faſt during the month of Ramadan; which they obſerve by abſtaining from meat, drink, and women, from day-break till ſun-ſet. Beſides this, they have ſeveral other voluntary faſts. The pilgrimage to Mecca is ſo neceſſary a point of practice, that according to a tradition of *Mahomet*, he who dies without performing it may as well die a Jew or a Chriſtian; and it is expreſsly commanded in the Koran. The various ceremonies preſcribed to thoſe who perform this pilgrimage are extremely abſurd and ridiculous, and appear to be relics of idolatrous ſuperſtition.

Beſides the fundamental points of faith and practice above recited, the Mahometans are required by the Koran, to abſtain from wine, gaming, uſury, divining by arrows, the eating of blood and ſwine's fleſh, and whatever dies of itſelf, or is ſlain in honour of any idol, or ſtrangled, or killed by accident, or by any other beaſt. The Koran allows polygamy within certain limits; forbidding any man to have more than four, whether wives or concubines; but Mahomet had the privilege of marrying as many wives, and keeping as many concubines as he pleaſed. It allows alſo of divorce; but ſeverely puniſhes fornication and adultery. The day of the week which Mahomet has ſet apart for public worſhip is Friday; beſides which they have two annual feaſts called BEIRAM. After the death of Mahomet, a ſchiſm aroſe among his followers, which divided them into two great factions, whoſe ſeparation not only gave riſe to variety of opinions and rites, but alſo excited the moſt implacable hatred, and the moſt deadly animoſities.

Beſides theſe two grand factions, there are other ſubordinate ſects among the Mahometans, which diſpute with warmth concerning ſeveral points of religion, though without violating the rules of mutual toleration. Of theſe ſects there are four, which far ſurpaſs the reſt in point of reputation and importance, viz. the Haneſites, the ſect of Malee, the ſect of Al Shafei, and that of Eon Hanbal, which are called the orthodox Mahometans. *Sale's Preliminary Diſcourſe.* The rapid ſucceſs, which attended the propagation of this new religion, was owing to cauſes that are plain and evident, and muſt remove, or rather prevent, our ſurprize, when they are attentively conſidered. The terror of Mahomet's arms, and the repeated victories which were gained by him and his ſucceſſors, were, no doubt, the irreſiſtible arguments that perſuaded ſuch multitudes to embrace his religion, and ſubmit to his dominion. Beſides, his law was artfully and marvellouſly adapted to the corrupt nature of man; and, in a more particular manner, to the manners and opinions of the eaſtern nations, and the vices to which they were naturally addicted: for the articles of faith which it propoſed were few in number, and extremely ſimple; and the duties it required were neither many nor difficult, nor ſuch as were incompatible with the empire of appetites and paſſions. It is to be obſerved farther, that the groſs ignorance under which the Arabians, Syrians, Perſians, and the greateſt part of the eaſtern nations laboured at this time, rendered many an eaſy prey to the artifice and eloquence of this bold adventurer. To theſe cauſes of the progreſs of *Mahometaniſm*, we may add the bitter diſſenſions and cruel animoſities that reigned among the Chriſtian ſects, particularly the Greeks, Neſtorians, Eutychians, and Monophyſites; diſſentions that filled a great part of the Eaſt with carnage, aſſaſſinations, and ſuch deteſtable enormities, as rendered the very name of Chriſtianity odious to many. We might add here that the Monophyſites and Neſtorians, full of reſentment againſt the Greeks, from whom they had ſuffered the bittereſt and moſt injurious treatment, aſſiſted the Arabians in the conqueſt of ſeveral provinces, into which, of conſequence, the religion of Mahomet was afterwards introduced. Other cauſes of the ſudden progreſs of that religion would naturally occur to ſuch as conſider attentively its ſpirit and genius and the ſtate of the world at this time. Moſheim's Eccl. Hiſt. vol. ii. p. 9. ed. 8vo.

MAIDEN, an edged inſtrument uſed in ſome countries, particularly Scotland, for the beheading of criminals. The maiden is a broad piece of iron, of a foot ſquare, ſharp on the lower part, and loaded above with lead, ſo as ſcarce to be lifted: at the time of execution, it is pulled up to the top of a narrow wooden frame ten feet high, with a groove on each ſide for the maiden to ſlide in. The priſoner's neck being faſtened to a bar underneath, on a ſign given, the maiden is let looſe, and the head in an inſtant ſeparated from the body.

MAJESTY, a title given to kings, which frequently ſerves as a term of diſtinction, Thus, the emperor is called *Sacred Majeſty, Imperial Majeſty*, and *Cæſarian Majeſty*: The king of France is called *His Moſt Chriſtian Majeſty*; and when he treats with the emperor, the word *ſacred* is added: And the king of Spain is termed *His Moſt Catholic Majeſty*. With reſpect to other kings, the name of the kingdom is added; as *His Britannic Majeſty, His Poliſh Majeſty*, &c. Formerly princes were more ſparing in giving titles, and more modeſt in claiming them: before the reign of Charles V. the king of Spain had only the title of *Highneſs*; and before that of Henry VIII. the kings of England were only addreſſed under the titles of *Grace* and *Highneſs*. Under the Roman republic, the title *majeſty, majeſtas*, belonged to the whole body of the people, and to the principal magiſtrates; ſo that to diminiſh or wound the *majeſty* of the commonwealth, was to be wanting in reſpect to the ſtate, or to its miniſters. But the power afterwards paſſing into the hands of a ſingle perſon, the appellation of *majeſty* was transferred to the emperor, and the imperial family. Pliny compliments Trajan on his being contented with the title of greatneſs; and ſpeaks very invidiouſly of thoſe who affected that of *majeſty*. And yet *majeſty* ſeems to be the moſt modeſt and juſt title that can be attributed to ſovereigns, ſince it ſignifies no more than the royalty, or ſovereign power.

MAJOR, in logic, is underſtood of the firſt propoſition of a regular ſyllogiſm. It is called *major*, becauſe it has a more extenſive ſenſe than the *minor* propoſition, as containing the principal term. See the Syſtem, Part III. Sect. V.

MAJOR, in the *Art of War*, a name given to ſeveral officers of different qualities and functions. See MILITARY *Affairs*.

MAIZE, or INDIAN CORN, in botany, the Engliſh name of the Genus *Zea*. For its deſcription and uſes, ſee ZEA

MALACHI, *the Prophecy of*, is one of the canonical books of the Old Teſtament, written by *Malachi*, who was probably contemporary with Nehemiah, and lived about 428 years before Chriſt. The chief corruptions which he charges upon the Jews are the ſame with thoſe for which they were reproved by Nehemiah; he forbids them to expect any farther ſucceſſion of prophets, exhorts them to obſerve the law of Moſes, and predicts the coming of Elias or John the Baptiſt, as the forerunner of the Meſſiah.

MALE, among zoologiſts, that ſex of animals which has the parts of generation ſituated externally. See SEX and GENERATION. The term *male* has alſo, from ſome ſimilitude to that ſex in animals, been applied to ſeveral inanimate things; thus we ſay, a male flower, a male ſcrew, &c. See MAS *Planta*, MASCULUS *Flos*, alſo FEMALE.

MALIGNANT, in medicine, that quality in a diſeaſe which renders it more than ordinarily dangerous, and difficult of cure. *Malignant* is generally applied to ſuch fevers as are epidemical or infectious, and are attended with ſpots and eruptions of various kinds.

MALLEABLE, ſomething hard and ductile, and that may be beaten, forged, and extended under the hammer, without breaking. All metals are *malleable*, not excepting even quick-ſilver; but gold is ſo in the greateſt degree of all. The chymiſts have long ſought the fixation of mercury, or to render it *malleable*. It is a popular error, that the art of making glaſs *malleable* was ever known; its nature is incapable of it. For if it were ductile, its pores would not be oppoſite to each other, and of conſequence it would not be tranſparent; ſo that its principal criterion would be loſt.

MALLEUS, in anatomy, denotes one of the bones of the ear; ſo called from its reſemblance to a hammer, or mallet. See the Syſtem. For deſcription, Part VI. Sect. X. For repreſentation, Plate XI. *fig*. 6. letter *c*.

MALT denotes barley cured, or prepared to fit it for making a potable liquor, under the denomination of beer or ale. Almoſt every maltſter has his ſecret in making *malt*, but there are ſome neceſſary cautions to be obſerved by all, which will enſure ſucceſs in the work; theſe are, 1. That the barley be newly thraſhed, or at leaſt newly winnowed. 2. That the whole be of one kind, not mixed up of ſeveral ſorts. 3. That it be not over-ſteeped in the ciſtern, or ſo long as to make it ſoft. 4. That it be well drained. 5. That it be carefully looked after in the wet couch, ſo as to ſtop the firſt tendency of the blade to ſhooting. 6. To turn the wet couch inſide outermoſt, if the barley comes, that is, ſhoots more in the middle than on the ſides. 7. To keep it duly turning after it is out of the wet couch. 8. To give it the proper heating in the dry heap. 9. To dry and criſp it thoroughly on the kiln, but without a fierce fire, ſo as to be ſeveral days in drying a kiln of pale *malt*. Shaw's Lectures, p. 187. For the manner of preparing liquors from *malt*, ſee BREWING.

MALT *Diſtillery*. See Treatiſe on DISTILLATION.

MALUS, in botany, a ſpecies of the genus *pyrus*. See the article PYRUS.

MAMMALIA, a name given by Linnæus to his firſt or principal claſs of animals, which comprehends not only all the animals generally ſtiled quadrupeds, but alſo the cetaceous order and the human ſpecies.

MAMMALIA; OR, SYSTEM OF QUADRUPEDS, &c.

COULD we penetrate into the inmoſt receſſes of nature, and diſcover the laws by which any thing is regulated and governed, there is no doubt, but we ſhould find a Syſtem noble, grand, and elevated; framed with exquiſite ſkill, renewed and kept in action by the niceſt principles of order, and ſupported by unerring wiſdom. But this is a taſk beyond the reach of human knowledge and ability; as the ſtudy even of one particular article is ſufficient for the life of man; we are therefore under the neceſſity of ſubſtituting artificial ſyſtems, which although they fall far ſhort of perfection, yet greatly facilitate each particular ſtudy, and enable every contemplative mind to ſelect that part moſt ſuited to his genius and inclination, by which means every ſeparate branch may be purſued through its orders and genera, without encroaching upon any other; this has increaſed the number of labourers; and their aggregate endeavours have greatly enriched the field of ſcience.

The branch of natural hiſtory now under our conſideration is the moſt comprehenſive of all others, extending not only throughout that part of the animal kingdom, generally termed *Quadrupeds*, (the lizard tribe excepted) but including alſo the cetaceous order, or whales, and the human ſpecies. This claſs at firſt ſight appears to unite animals, not only totally diſſimilar in their outward appearance, but in no reſpect analogous in their habits and diſpoſitions. A more nice inſpection and cloſer examination will however ſoon convince us of their ſimilarity and near alliance; the outward appearance indeed affords an aſtoniſhing variety, but the inward ſtructure is nearly alike in all the genera. They breathe through lungs, are viviparous, and ſuckle their young by means of mammillæ or teats, which differ in ſituation, and are more or leſs in proportion to the number of young brought forth by each ſpecies.

The placing of man at the head of this ſyſtem, by Linnæus, has given much offence to many naturaliſts, who think it a degradation to be ranked with the brutes that periſh; but if we take the pains to examine the internal ſtructure, and wonderful mechaniſm of the human frame, and compare it with that of beaſts, as exemplified in our Syſtems of Anatomy, and Comparative Anatomy; we ſhall find an aſtoniſhing ſimilarity and agreement: compoſed of the ſame materials, furniſhed with the ſame organs, which are acted upon exactly in the ſame manner; they are equally liable to accident, decay, and putrefaction. On the other hand we find agreeable to the Moſaic account of the creation, that man was the laſt of the Creator's work; created in the image of his maker, with an immortal ſoul, endowed with reaſon and reflection, which enable him to contemplate the works of that Omnipotent being, from whom his exiſtence is derived.

From many conſiderations we have ſufficient ground for believing that there are beings as far ſuperior to us as we are to the brutes; and although we are connected with the brutes by our corruptible or earthly bodies; ſo are we united with angels, and ultimately with God himſelf by our incorruptible, or heavenly ſouls. It appears evident that we are a connecting link of that great chain by which all beings are united, and it is poſſible that we are much further removed from the firſt great mover of all things, than from the moſt minute and apparently trifling part of the creation.

If we attempt a general view of the animal kingdom, a large and extenſive field opens to us, boundleſs on all ſides, and ſtored with an immenſe number of creatures, as different in their diſpoſitions and manners as in their make and form. We ſhall find each animal aſſigned its proper element, climate and means of ſubſiſtence; that ſome poſſeſs ſtrength and courage, accompanied with hunger and voracity, others gentleneſs, temperance, and agility, attended with reſtleſsneſs and timidity; ſome again are endued with faithfulneſs, patience and honeſty, others are ſtrongly charactериſed by deceit and treachery. Some animals, and thoſe the moſt gentle, innocent and tranquil, content themſelves in our paſtures enjoying the ſociety of men. Thoſe which are more fierce and ſuſpicious, hide themſelves in the deepeſt receſſes of the foreſt. Others, as if they knew there was no ſafety for them on the ſurface of the earth, dig ſubterraneous abodes, take refuge in caverns, or gain the ſummit of the moſt inacceſſible mountains. Laſtly, the moſt ferocious and formidable kinds, inhabit deſarts only, and reign as monarchs in thoſe burning climates, where man nearly ſavage with themſelves, are unable to conquer them.

The brute creation are in general confined to particular diſtricts and ſituations, ſuited to their reſpective wants and calls of nature. It is man alone that roves univerſally, impreſſed with an irreſiſtible curioſity, and an arduous thirſt after knowledge; we ſee him daily encounter the greateſt dangers, bid defiance to almoſt inſurmountable difficulties, quitting his native country, where he not only enjoys all the neceſſaries but even the luxuries of life, willingly to encounter ſtorms and tempeſts on the perilous ocean. We find him at one time almoſt naked, diſſolving beneath the fervent heat of the ſun, under the torrid zone, and at another wrapped in furs yet nearly petrified with cold, under the chilling influence of the frigid zone. The intenſe heat and almoſt inſupportable burning ſands in the ſouthern deſart, the mountains of ice, and chilling blaſts of the northern atmoſphere, have each attractions to employ his faculties, engage his attention, and gratify his enquiring ſpirit.

The influence of climate has a great effect upon the ferocity of moſt animals; thoſe of the temperate zone are not near ſo ferocious as thoſe of the torrid or frigid zones. In America the lion, tyger, panther, &c. are ſaid to have nothing terrible but the name; they generally fly from man, and only attack other wild beaſts by ſurpriſe; they are eaſily ſubdued and frequently tamed. Some animals are totally unable to propagate but in warm climates; others again can only ſubſiſt in cold. But man being formed to exerciſe dominion over the earth, and having the whole globe for his habitation; his nature ſeems accommodated to every ſituation. Under the fervours of the ſouth, or the chills of the frozen region of the north, he lives, multiplies, and is ſo univerſally diffuſed over every country, that he appears to have no peculiar climate. And according to Buffon the influence of climate on the human ſpecies is marked with only ſlight varieties. Man (ſays he) white in Europe, black in Africa, yellow in Aſia, and red in America, is the ſame animal, tinctured with colour peculiar to the climate.

Would the ſpace allotted for the preſent work, permit us to take an attentive view of the great ſcale of nature, we ſhould find a chain or connection run through the three ſeveral kingdoms, and that each reſolves, into the other, by an imperceptible gradation: and could we examine the extremes in each particular claſs alſo, we ſhould ſee them connected by regular and proper links, the removal of any one of which would cauſe a break or chaſm. If, for inſtance we compare the immenſe magnitude of the ***elephant*** with the diminitive ſmallneſs of the ***ſhrew***; the ſwiftneſs of the ***antelope*** with the almoſt imperceptible motion of the ***tortoiſe***; the courage of the ***lion***, with the timidity of the ***hare***; the ferocity of the ***tyger***, with the meakneſs and innocence of the ***lamb***; the crafty wiles and cunning artifice of the ***fox***, with the faithfulneſs and honeſt integrity of the ***dog***; the induſtry of the ***beaver***, with the idleneſs of the ***ſloth***: wide as their diſtance may appear, the gradual approach to each other is wonderfully ſupplied by intermediate animals.

Quadrupeds are in general either gregarious or ſolitary, carnivorous, or feeding on vegetables, as graſs, ſeeds, fruits, &c. there are few inſtances where they indiſcriminately eat fleſh and herbs. The more gentle and quiet live in ſocieties; the rapacious and cruel ſingly, and in ſecret: but to enter into a particular account of each animal, or even of each genus, would far exceed our limits in the preſent publication. Beſides, this claſs of animals is much better known, than any other part of the three kingdoms of nature; (botany not excepted) for in exploring countries that are new to us, we do not find new animals of this claſs in the ſame proportion we do plants, birds, inſects, fiſh, &c. This may proceed from ſeveral cauſes, viz. the ſmallneſs of their number, when compared with the other claſſes; their magnitude and inability to conceal themſelves; the great uſe they are of to mankind for food, cloathing, and various other purpoſes, which have cauſed them to be more ſought after; the aſſiſtance that many of them afford to man, to trace out and ſubdue others; the love of hunting and ſpirit for the chace, which ſeems nearly prevalent in all countries.

Animals uſeful to Man.

In purſuing our ſubject under this head, we ſhall firſt conſider thoſe that aſſiſt him in his labours; and here we ſhall find the goodneſs of Providence remarkably evinced, in furniſhing each particular country with animals peculiarly adapted to the climate. In India, the ſtupendous elephant ſubmits to the moſt toilſome drudgery; ever attentive to the commands of his guide, who ſits upon his neck; a word or look from whom, is ſufficient to ſtimulate him to the greateſt exertions. If is of great uſe in carrying vaſt quantities of baggage, and ammunition over large rivers. When ſwimming he raiſes his long trunk above the water, for the ſake of reſpiration, every other part of the body being below. He kneels down for the accommodation of thoſe who ſhould mount upon his back, and with his pliant trunk even aſſiſts them to aſcend. He ſuffers to be harneſſed, and ſeems to have pleaſure in the finery of his trappings: he is uſed in drawing chariots, waggons, and various kinds of machines, and one of theſe animals will do the work of many horſes. The Indians from very early periods have employed elephants in their wars; and the Indian princes in their travels are attended by hundreds of them. They are likewiſe made uſe of as the dreadful inſtruments for executing condemned criminals; a taſk which they perform with great dexterity. At the word of command, they break the limbs of the criminal with their trunks; they ſometimes trample him to death, or impale him on their enormous tuſks, juſt as they are directed by their barbarous keeper.

In the ſcorching ſands, and amidſt the barren and dreary deſarts of Arabia, where there is neither verdure to refreſh, nor ſhade to ſhelter; we find the mild and gentle camel, an animal ſo wonderful in its formation, and ſo admirable in its nature; that it is enabled to ſubſiſt in thoſe burning deſarts. This extraordinary animal poſſeſſes the various qualities of the horſe, the cow, and the ſheep: and is to the Arabian, in a great meaſure, what thoſe uſeful creatures are to us. Its milk is rich and nouriſhing; and being mixed with water, makes a wholeſome and refreſhing beverage, much uſed by the Arabs in their journeys: the fleſh of young camels is alſo an excellent and wholeſome food. Their hair, or fleece, which falls off entirely in the ſpring, is ſuperior to that of any other domeſtic animal, and is made into very fine ſtuffs for cloaths, ſhawls, coverings, tents, and furniture. In Turkey, Perſia, Barbary, and Egypt, every article of merchandize is carried by camels. Merchants and travellers unite together, and form themſelves into numerous bodies called caravans, to prevent the inſults of the Arabs. One of theſe caravans frequently conſiſt of many thouſands, the camels being always more numerous than the men. Each camel is loaded in proportion to its ſtrength. They always lie down to receive their burden, and as ſoon as they are loaded, riſe of their own accord: they walk only, and in that pace travel ten or twelve leagues each day.

There are two varieties of this uſeful animal, viz. the Bactrian camel with two bunches on its back, and the Arabian camel, or dromedary. The latter is the moſt numerous and uſeful, for carrying couriers, who can go above one hundred miles a day on them, and that for nine or ten days together over burning deſarts, uninhabitable by any living creature. They require neither whip, nor ſpur, but go freely, if gently treated.

Before the introduction of mules into Peru and Chili by the Spaniards, the lama, a ſpecies of camel, was the only beaſt of burden known to the Indians. They were employed by the natives to plow the land, and now ſerve to carry burdens; their pace is ſlow, and their journeys ſeldom extend above 5 leagues a day. They are ſure footed, and can travel in ſituations impaſſable to other animals; they are employed in vaſt numbers, in tranſporting the rich ores dug out of the mines of Potoſi, over the rugged hills and narrow paths of the Andes. They lie down to be loaded; and, like the camel, can abſtain from water ſeveral days: they are neither allowed corn or hay; green herbage, of which they eat moderately, being ſufficient for their nouriſhment. The lamas vary in colour, but in ſhape reſemble the camel without the dorſal bunch.

Having taken a view of the animals ſubſervient to the uſe of man in the warm climates; let us now turn our attention to thoſe of the cold and temperate climates. In more temperate regions, men are indebted to the unbounded liberality of nature, for a great variety of valuable creatures to ſerve, to nouriſh, and cloath them. To the poor Laplander, the rein-deer alone ſupplies the place of the horſe, the cow, the ſheep, the goat, &c. From it he derives the only comforts that tend to ſoften the ſeverity of his ſituation in that moſt inhoſpitable climate; yoked to a particular kind of ſledge by a collar; from which a trace is brought under the belly between the legs, and faſtened to the fore part of the ſledge which is covered at the bottom with the ſkin of the animal; the poor obedient creature, urged on by the goad, or encouraged by the voice of his maſter, who ſits in the ſledge and guides him with a cord faſtened to his horns, will go rapidly thirty miles without ſtopping, and that without any violent exertion.

Innumerable are the uſes, which the poor inhabitants of this dreary climate derive from this animal: of the ſkins they make garments, which are warm, and cover them from head to foot; they alſo ſerve for beds. The fleſh affords a conſtant ſupply of good and wholeſome food, which in the winter is their chief ſubſiſtence: the tongue is conſidered as a great delicacy; and when dried is ſold into other countries. The ſinews ſerve for thread, with which the Laplanders make their cloaths, ſhoes, and other neceſſaries: and when covered with the hair, ſerve them for ropes. The milk is thinner than that of a cow, but ſweeter and more nouriſhing: the quantity given by one female in a day, is about a pint. The inhabitants of Kamſchatka, employ dogs for the purpoſe of drawing their ſledges; the only method of travelling in that dreary country during winter. Theſe dogs are ſtrong, nimble, and active; and travel with great expedition. Captain King relates that during his ſtay there, a courier with diſpatches drawn by them, performed a journey of 270 miles in leſs than four days. The ſledges are uſually drawn by five dogs, four of them yoked two and two abreaſt: the foremoſt acts as a leader to the reſt. Great care and attention are neceſſary, in training up thoſe for leaders, which are more or leſs valuable according to their ſteadineſs and docility; the ſum of ten pounds being no unuſual price for them.

In Europe, and in this country, where agriculture is become a ſcience, and the right practice of farming and gardening, is ſo eſſentially neceſſary for the maintenance of the numerous inhabitants; the horſe, the aſs, the mule, and ox alſo, are ſeparately and jointly employed in the various branches of huſbandry. The extenſive uſefulneſs of the horſe in this kingdom, has made the breed of that noble animal an object of very conſiderable importance.

In Great Britain, the breed of horſes ſeems to be as mixed as that of its inhabitants. By great attention to the improvement of which, in a judicious mixture of ſeveral kinds, and by ſuperior ſkill in management, the Engliſh horſes are univerſally allowed to excel all others. The various excellencies of this noble animal, the grandeur of his ſtature, the elegance and proportion of his parts, the beautiful ſmoothneſs of his ſkin, the variety and gracefulneſs of his motions, and above all the ſweetneſs of his temper and docility of his manners, entitle him to a precedence beyond all the brute creation. We gaze with wonder and aſtoniſhment at the loaded elephant; we are much ſurpriſed to ſee the lofty camel kneel to take up its ponderous load; but we can ſee without emotion the noble and majeſtic horſe, ſubmit his back to the galling ſaddle, his mouth to the irritating curb, and his ſides wounded by the lacerating ſpur. By carefully ſtudying the nature and properties of this invaluable animal, and by a happy mixture and combination of the different kinds; the Engliſh have produced horſes adapted to the various purpoſes of pleaſure and convenience, equally ſerviceable in the draught, the field, or the race. From the different kinds of theſe animals various mixtures and varieties are produced, all uſeful in their particular ſituations; but to ſuch a pitch of luxury are we arrived, that beautiful hunters and of conſiderable value, are now employed to run in ſtages; and to the diſgrace of their maſters, we are ſorry to add, that many incomparable animals, who have ſpent the prime of their lives in the chaſe for their maſters pleaſure, are doomed to toil out a painful exiſtence, under that moſt mercileſs of all tyrants, a poſt chaiſe driver.

The next animal that comes under our conſideration is the aſs: the qualities of which are well known. This animal is very much neglected in this country, and never ſeen near the habitation of the rich, except the female who is kept for her milk, which is highly eſteemed in conſumptive caſes. The aſs, however, is a happy relief to the poor, aſſiſting them in their labours with the utmoſt gentleneſs, patience and perſeverance. He is temperate with regard to food, and too often condemned to gain its ſcanty pittance from the ſides of roads, and in ditches among thiſtles and other leſs nutritious plants. There is no doubt but with proper care and attention, this uſeful animal might be rendered at leaſt ſecond in value to the horſe. From the connection of the male aſs with the mare, is produced the *mule*, an animal partaking in ſome meaſure of the properties of both its parents. It is found very ſerviceable in mountainous and ſtony places for carrying burdens, being more ſure footed than the horſe; the Spaniards are very partial to theſe animals; and people of the firſt quality in Spain are drawn by mules, where 50 or 60 guineas is no uncommon price for them. They are alſo much uſed in our Weſt India Iſlands: this uſeful and hardy animal being barren, furniſhes us with a ſtriking proof of the wiſdom of providence, in confining each particular ſpecies to itſelf, thereby preventing thoſe heterogeneous productions, which would infallibly take place from an unlimited aſſociation, or connection of different animals.

The ox is the only horned animal in this kingdom, that contributes his labour for the benefit of mankind; he quietly and patiently endures the toil of ploughing the land, or aſſiſts in the cart, or waggon, in houſing or carrying to market the produce of the earth, contentedly feeding on a little clean ſtraw, or returning to the paſture when his labour is over; but we ſhall enter into the merits of and advantages derived from this uſeful animal, when we treat on the general uſes of animals, as they ſerve for food, cloathing, or the convenience of the human race.

Let us now turn our attention to the friend, the guardian, the companion, the ſervant of man, the *dog*, whoſe ſervices are ſo eminently uſeful, that without his aſſiſtance man would be deprived of many of the advantages and pleaſures which he now enjoys. Faithful to his maſter, and true to his truſt, he is conſtantly vigilant to protect and defend, not only the perſon, but alſo the property of his maſter. There is not perhaps in any kind of animal ſo great a variety, as in the canine race; indeed ſo wonderful is the difference, and ſo diſtinct the properties peculiar to each, that we ſhould certainly conclude they are diſtinct ſpecies, did not their mutual and promiſcuous intercourſe clearly prove the contrary. The dog is of all other domeſtic animals the moſt obedient, moſt docile, and ſubmiſſive to every reſtraint: he is capable of being inſtructed in every branch of knowledge, neceſſary to his maſters wants, but in general, particular kinds are preſerved, and inſtructed for particular purpoſes.

Having given a conciſe detail of thoſe animals in particular which aſſiſt man in his labour and amuſements, we come now to enumerate thoſe to whom he is beholden for food, raiment, medicine, and many other uſeful articles of importance. In England, we have the ox, the ſheep, the hog, as neceſſary articles of nouriſhment, and to ſatisfy a luxurious appetite we cultivate the fallow deer for veniſon; the fleſh of the hare is a delicacy much ſought after, and the wild rabbit is in much eſtimation. Even the tame rabbit is a very conſiderable article in our markets, and ſo great is the demand, that there are people in, and near the metropolis, who keep 1000 breeding does: and when it is remembered that the rabbit breeds 7 times in the year, and generally produces 8 young at a time; the increaſe will appear beyond belief; it being poſſible that the 1000 females may produce 56000 young, in one year.

The advantages we derive from the faithful ox and cow are innumerable: their fleſh is pleaſant, and nouriſhing, and the value of it, is much enhanced by the freedom with which it takes ſalt, and by that means is preſerved wholeſome and good to the mariner in long voyages; there is no part of this animal without its uſe. From the feet is extracted an oil of great value in preparing and ſoftening leather, various kinds of which are made from the hide. The hair is uſed by the plaſterer; the bones are an excellent ſubſtitute for ivory, and when calcined, are uſed to carry off the baſer metals in refining ſilver, &c. The articles made from the horns are innumerable: as combs, drinking cups, with a long train of articles in various buſineſſes; but above all the delicate thin plates called leaves, employed as a ſubſtitute for glaſs in lantherns, the preparing of which is a trade by itſelf, and from its toughneſs and tranſparency is much preferable to glaſs, being leſs liable to break. The tallow when made into candles, enlightens and makes chearful our winter evenings; and the blood, gall, liver, urine, and dung, have their reſpective uſes in manufactures, and medicines.

The greateſt and moſt ſolid advantage is derived from the cow, whoſe large capacious and flowing udder gives down twice each day, ſuch a luxurious banquet, the almoſt ſole ſupport of thouſands of people, but particularly children. The cow having four teats is a ſtriking peculiarity, the number of moſt other animals being, as we obſerved before, proportioned to the number of young they bring forth. The freedom with which ſhe gives down her milk, and continues to do, as long as if her calf had ſucked her, is alſo a diſtinguiſhing characteriſtic in this animal; and when we conſider the quantity of butter and cheeſe made in this country from the milk, not only for our own conſumption, but ſufficient to export a conſiderable quantity; we cannot be ſufficiently grateful to providence, for ſuch an ineſtimable bleſſing.

The next animal of importance that comes under our conſideration is the ſheep, in the produce of which no country can equal Great Britain: their fleeces are large, and well adapted to the various purpoſes of cloathing; which being the ſtaple manufacture of this kingdom, has conſtantly engaged the attention of the legiſlature, in forming laws for its preſervation, by preventing the exportation, not only of the living animal, but alſo of the wool. Our woollen manufactory ſtands unrivalled by any nation in the world, and the annual value of wool ſhorn in England, is eſtimated at two millions ſterling; and when manufactured, at no leſs than ſix millions. The different counties in England produce varieties of this uſeful animal, whoſe fleeces differ eſſentially in length and fineneſs. Their fleſh alſo is coarſer or more delicate according to the ſituation and food. There is ſcarce any part of this creature, but what is ſubſervient to ſome uſeful purpoſe: beſides the fleece which is annually ſhorn from the animal, the ſkin is made into leather for gloves, linings, covering of books, &c. They alſo make of it parchment; the entrails are worked into fiddle ſtrings, and coverings for whips; its milk is good, and may be made into butter and cheeſe: its fleſh is conſidered as the moſt wholeſome food.

The *Goat* is little known in the ſouthern parts of England, but in the northern and mountainous parts of Wales and Scotland, it is much propagated. The milk is ſweet, nouriſhing, and medicinal; not apt to curdle on the ſtomach, and therefore much recommended in vitiated and debilitated habits. It is frequently made into whey, and often into butter and cheeſe. In many of the mountainous parts of Europe, the goat ſupplies the natives with many neceſſaries of life; they make beds of their ſkins, and the butter, cheeſe and milk, with the fleſh of the animal, is their only food. The fleſh of the kid is by many people in England conſidered equal to veniſon.

The *Common Hog*, notwithſtanding its clumſy and diſguſting appearance, is an animal to which we are much indebted. His gluttonous and exceſſive appetite is of ſingular advantage to the farmer and gardener, as he lives luxuriouſly on the refuſe of the field, the garden, the barn, and the kitchen; and by that means is maintained at a trifling expence till put up to fatten. Its fleſh is of univerſal uſe, it not only being the ſolid, ſubſtantial, and almoſt only animal food of the farmer and his ſervants, and of poor people in the country; but, from the different manner in which it is cured, becomes a luxury at the tables of the great. It takes ſalt better than any other kind, and therefore can be preſerved longer. According to the different methods of cure, the fleſh acquires different names; thus we have brawn, pickled pork, bacon, ham, &c. It is alſo of great national advantage, making a principal part of the proviſions for the Britiſh navy. Of its briſtles they make a variety of brooms, bruſhes, &c.

From the *Fallow* and other kinds of deer, which abound in the parks of men of property, we have that dainty called veniſon, confined at preſent to the rich and middling ſtations of life; theſe animals are chiefly kept for the elegance of their appearance, and ſometimes for the pleaſure of the chace; their ſkins make a moſt excellent and beautiful leather for breeches, &c.

In England we are free from all thoſe blood thirſty and voracious animals which inhabit the deſarts and ſcorching plains of Aſia and Arabia. We have only to guard our poultry, granaries, and viands from trifling depredators, ſuch as rats, mice, weaſles, ſtoats, foxes, &c. and theſe are with very great difficulty ſubdued even with care, and by the aſſiſtance of dogs, cats, traps, &c. We purſue our journeys either by night or day, fearleſs of the prowling wolf, the roaring lion, or the mercileſs tyger; we are equally unacquainted with the leſſer animals, that are equally deſtructive in many parts; and can form little idea of the innumerable multitudes of rats that deſcend from the mountains in the North, over-whelming the plains, and deſtroying every thing in their way.

Notwithſtanding the immenſe ſtrength of ſome animals, the enormous bulk of others, the ferocity and courage which characterize a third ſort, and the artifice, cunning, and treachery of a ſtill greater number; man has been endowed with the faculty of conquering the whole race: his real and imaginary wants have led him to turn every thing to his advantage; and although the inſtinct, which appears little ſhort of reaſon by which moſt animals are enabled to counteract their enemies, and preſerve themſelves, ſucceeds in general; yet is man able by his ſuperior knowledge to counteract and render uſeleſs all thoſe aſtoniſhing arts, which he daily ſees practiſed.

Upon examination it will be found that our luxuries, rather than our wants, have cauſed and do daily cauſe the death of numberleſs animals; the noble elephant is ſhot for his tuſks which produce that unparalleled ſubſtance ivory. The lion, tyger, leopard, panther, and a numerous tribe of animals are purſued, harraſſed, and at laſt fall victims for their ſkins alone, their furs being conſidered as an elegant ornament for dreſs. The induſtrious beaver is unfeelingly deſtroyed becauſe his fur is of ſo extraordinary a quality in the manufacturing of hats. Even the enormous whale inhabiting the cold regions of the north, is purſued fearleſs of danger, for the whalebone, which grows within ſide the mouth, and for the immenſe quantities of oil which it produces. This latter article is become of immenſe conſequence, and if we take a view of the ſtreets of London, and the roads leading to the neighbouring villages all round, on an evening we ſhall be loſt in wonder and ſurpriſe, to know whence ſuch a ſupply of oil can be yearly obtained.

CLASSICAL CHARACTERS.

The term mammalia has been adopted by Linnæus in preference to any other, as being more expreſſive; for although all that claſs of animals called quadrupeds, the lizard tribe excepted, are arranged in this claſs, yet it alſo comprehends the cetaceous order, as whales, porpoiſes, &c. and alſo the human ſpecies, all of which are furniſhed with mammæ or breaſts, and univerſally ſuckle their young, which is their diſtinguiſhing characteriſtic.

The heart has two auricles, and two ventricles; with a warm red blood.

They breathe by means of the lungs reciprocally.

Their jaws are incumbent, covered, furniſhed with teeth.

The males have an external *penis*.

The females a *clitoris* and *nymphæ*; are viviparous and ſuckle.

The organs of ſenſe are the tongue, noſe, eyes, ears, papillæ.

The covering (a few genera and the whole of order 7 excepted) is hair.

They are ſupported by four legs (order 1, 7 and 8 excepted.)

The body is terminated by a tail, in moſt of the ſpecies.

The neck has ſeven vertebræ.

SYSTEMATIC ARRANGEMENT.

There are three particular diſtinctions in this claſs of animals: the firſt is *Digitated* or *Clawed*, the ſecond *Hoofed*, and the third *Deſtitute of Hoofs and Claws*; as follow:

I. DIGITATED OR CLAWED.

Order 1. *Primates.* Four teeth, fore canine ſingle.
Order 2. *Bruta.* Fore teeth or cutting teeth none.
Order 3. *Feræ.* Fore teeth, 6, 2, 10, conical, canine ſingle.
Order 4. *Glires.* Fore teeth, two; canine none.

II. HOOFED.

Order 5. *Pecora.* Fore teeth, none above.
Order 6. *Belluæ.* Fore teeth, above and below.

III. DESTITUTE OF HOOFS AND CLAWS.

Order 7. *Cete.* Teeth various in the different genera.

Characteriſtic Deſcription of the ORDERS.

ORDER I. PRIMATES.

Four parallel cutting teeth in the upper jaw; ſharp; one canine on each ſide. Two pectoral mammæ. Feet like hands, with flat nails. *Frugivorous*

ORDER II. BRUTA.

No cutting teeth; feet with ſtrong claws. *The two firſt genera feed on herbs and fruits, the two laſt on inſects.*

ORDER

Order III. FERÆ.

Six ſharp cutting teeth in the upper jaw, one canine on each ſide; feet digitated with ſubulate claws: for this order there are exceptions which will be ſhewn under the generic characters.

Order IV. GLIRES.

Two ſharp cutting teeth in each jaw; but remote from the grinders, no canine teeth; feet digitated. *Herbivorous or Frugivorous.*

Order V. PECORA.

No cutting teeth in the upper jaw; ſix or eight in the lower jaw, very remote from the grinders; feet hoofed, cloven; *Herbivorous.*

Order VI. BELLUÆ.

Cutting teeth in both jaws obtuſe; feet hoofed. *Herbivorous.*

Order VII. CETE.

Breathing apertures on the head; pectoral fins; tail placed horizontally; no claws. *Food moſtly fiſh, element the water.*

CLASSIFICATION of the GENERIC CHARACTERS.

Order I. PRIMATES.

Genus 1. Homo. *Man.* Linnæus has given great offence to many perſons by placing man among the brute creation, but we agree with Dr. Pulteney "that he, though human, ſtands as an animal in the ſyſtem of nature, at the head of this order; and as ſuch is here deſcribed, with his ſeveral varieties, obſervable in the different quarters of the globe, in a manner, and with an accuracy, peculiar to our author, and which we may venture to ſay is no where elſe to be met with. But man is not left by *Linnæus*, to contemplate himſelf merely as ſuch; but he is led to the conſideration of what he ought to be, as an *intelligent and moral being*; in a comment on the *Grecian* Sage's dictate, *Know Thyſelf*: by the true application of which, he cannot but be ſufficiently elevated above every humiliating idea which can otherwiſe ariſe from ſuch an aſſociation." There are five ſpecies of this genus according to Linnæus, viz. Americanus, Europæus, Aſiaticus, Afer, Monſtroſus.

Genus 2. Simia. *Ape.* Cutting teeth 4, above and below cloſe, one canine tooth on each ſide ſeparate; grinders obtuſe: this genus contains 33 ſpecies, and is divided into 3 families, viz. The firſt Family are without tails, and called *Apes*, of which there are three ſpecies, viz. Satyrus, Sylvanus, Inuus.

The ſecond Family have ſhort tails, and are called *Baboons.* There are three ſpecies, viz. Nemeſtrina, Apedia, Sphinx.

The third Family have long tails, and are called *Monkeys.* There are 27 ſpecies, viz. Maimon, Hamadryas, Veter, Silenu, Faunus, Belzebul, Seniculus, Paniſcus, Cynomolgus, Cynocephalus, Diana, Sabæa, Cephus, Trepida, Aygula, Pithecia, Nictitans, Jacchus, Oedipus, Roſalia, Midas, Fatuellus, Apella, Capucina, Sciura, Morta, Syrichta.

Genus 3. Lemur. *Macauco.* Cutting teeth, 4 above, 6 below; canine one, cloſe, grinders ſublobate; the firſt longer and ſharper. This genus comprehends five ſpecies, viz. Tardigradus, Mongoz, Macaco, Catta, Volans.

Genus 4. Vespertilio. *Bat.* Fore toes elongated, and connected by membranes, performing the office of wings. This genus comprehends ſix ſpecies, viz. Vampyrus, Spectrum, Perſpicillatus, Spaſma, Auritus, Murinus.

Order II. BRUTA.

Genus 5. Elephas. *Elephant.* Tuſks and grinders only: long proboſcis. There is only one ſpecies of this genus, viz. Elephas.

Genus 6. Trichechus. *Walrus.* Tuſks above only; grinders formed of a rugged bony ſubſtance; hinder feet formed into fins. There are two ſpecies of this genus, viz. Roſmarus, Manatus.

Genus 7. Bradypus. *Sloth.* Grinders only; firſt grinders long; body hairy. There are two ſpecies of this genus, viz. Tridactylus, Didactylus.

Genus 8. Myrmecophaga. *Ant-eater.* No teeth. Body hairy. This genus comprehends four ſpecies, viz. Didactyla, Tridactyla, Jubata, Tetradactyla.

Genus 9. Manis. No teeth, body ſcaly. There are two ſpecies of this genus, viz. Pentadactyla, Tetradactyla.

Genus 10. Dasypus. *Armadillo.* Grinders only: no canine teeth, covering of the body cruſtaceous. This genus comprehends ſix ſpecies, viz. Unicinctus, Tricinctus, Quadricinctus, Sexcinctus, Septemcinctus, Novemcinctus.

Order III. FERÆ.

Genus 11. Phoca. *Seal.* Fore-teeth above 6; below 4. There are three ſpecies of this genus, viz. Urſina, Leonina, Vitulina.

Genus 12. Canis. *Dog.* Fore-teeth 6, and 6: middle ones above; lobated. This genus comprehends nine ſpecies. As there are many varieties in the firſt ſpecies, called *Canis Familiaris*, or *Dog*, we have divided them into five families, viz. *Canes Venatici*, or Dogs of the Chace; *Canes Aucupientes*, or Fowling Dogs, *Canes Agreſtes*, or Farm Dogs, *Canes Hybrydes*, or Mongrel Dogs, and *Canes Acquatici*, or Water Dogs. The other ſpecies are the following; Lupus, Hyæna, Vulpes, Alopex, Lagopus, Aureus, Mexicanus, Thous.

Genus 13. Felis. *Cat.* Fore-teeth 6, and 6: lower ones, equal: tongue very rough. This genus comprehends ſeven ſpecies, viz. Leo, Tigris, Pardus, Onca, Pardalis, Catus, Lynx.

Genus 14. Viverra. *Civet.* Fore-teeth 6, and 6: middle ones below, ſhort. This genus comprehends ſix ſpecies, viz. Ichneumon, Naſur, Narica, Putorius, Zibetha, Genetta.

Genus 15. Mustela. *Weaſel.* Fore-teeth 6, and 6: lower ones cloſe together; 2 placed inwards. This genus comprehends eleven ſpecies, viz. Lutris, Lutra, Lutreola, Barbara, Gulo, Martes, Putorius, Furo, Zibellina, Erminea, Nivalis.

Genus 16. Ursus. *Bear.* Fore-teeth 6, and 6: upper ones hollowed. Toes 5 and 5: walks on the whole heel. Tongue ſmooth: ſnout long; nictitating membrane; a bent bone to the penis. This genus comprehends four ſpecies, viz. Arctos, Meles, Lotor, Luſcus.

Genus 17. Didelphis. *Opoſſum.* Fore-teeth above 10; below 8. Toes 5 and 5: hind-feet like a hand. A falſe belly in ſome ſpecies. This genus comprehends five ſpecies, viz. Marſupialis, Philander, Opoſſum, Murina, Dorſigera.

Genus 18. Talpa. *Mole.* Fore-teeth 6 above; 8 below: fore feet broad, hind ſmall. There are two ſpecies of this genus, viz. Europæa, Aſiatica.

Genus 19. Sorex. *Shrew.* Fore-teeth 2 above; 4 below: ears ſmall, ſnout long and ſlender. This genus comprehends five ſpecies, viz. Criſtatus, Minutus, Aquaticus, Murinus, Araneus.

Genus 20. Erinaceus. *Hedge-hog.* Fore-teeth, 2 above diſtant; 2 below nearer together. There are three ſpecies of this genus, viz. Europæus, Inauris, Malaccenſis.

Order IV. GLIRES.

Genus 21. Hystrix. *Porcupine.* Body covered with quills. This genus comprehends four ſpecies, viz. Criſtata, Prehenſilis, Dorſata, Macroura.

Genus 22. Lepus. *Hare.* Fore-teeth above double. This genus comprehends four ſpecies, viz. Timidus, Cuniculus, Capenſis, Braſilienſis.

Genus 23. Castor. *Beaver.* Fore-teeth above, truncated, and hollowed. There are three ſpecies of this genus, viz. Fiber, Moſchatus, Zibethicus.

Genus 24. Mus. *Rat.* Fore-teeth above ſubulated. This genus comprehends twenty-one ſpecies, viz. Porcellus, Aguti, Leporinus, Citellus, Lemmus, Paca, Marmota, Monax, Cricetus, Terreſtris, Amphibius, Rattus, Muſculus, Avellanarius, Quercinus, Gregarius, Sylvaticus, Striatus, Longipes, Jaculus, Volans.

Genus 25. Sciurus. *Squirrel.* Fore-teeth above cuneated; below compreſſed. This genus comprehends eleven ſpecies, viz. Vulgaris, Niger, Cinereus, Flavus, Palmatus, Getulus, Striatus, Glis, Æſtuans, Volans, Sagitta.

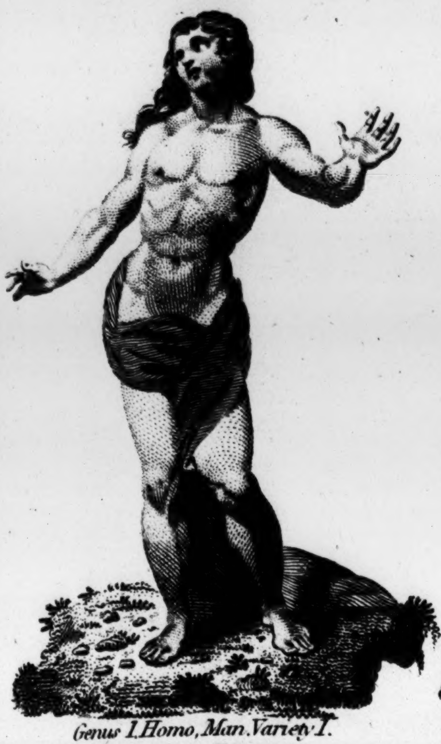
Genus 26. Noctilio.

There is but one ſpecies of this genus, viz. Americanus. We have omitted the deſcription and repreſentation of this genus, as it is the general opinion of naturaliſts at this time, that Sebal's figure from which Linnæus formed it, is only a

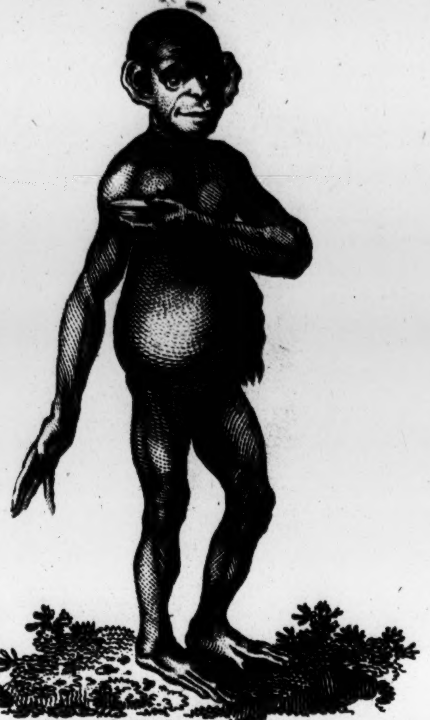
Plate 1.

Claſs 1. Mammalia. Order 1. Primates, Genus 1. Homo, Genus 2. Simia.

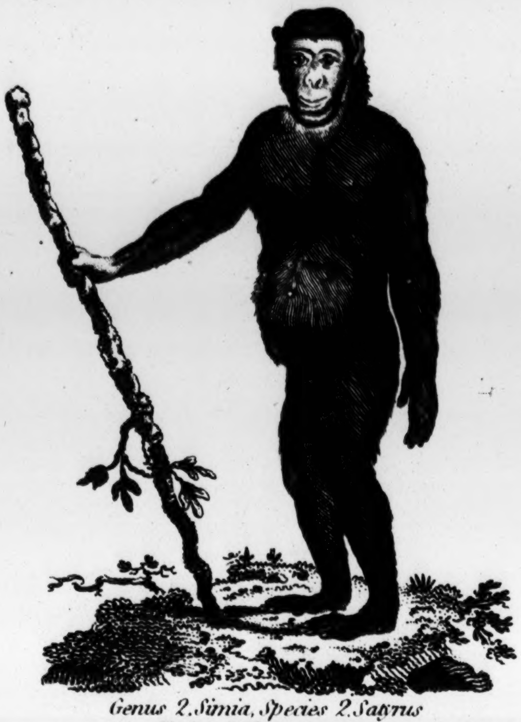
See System of Mammalia.



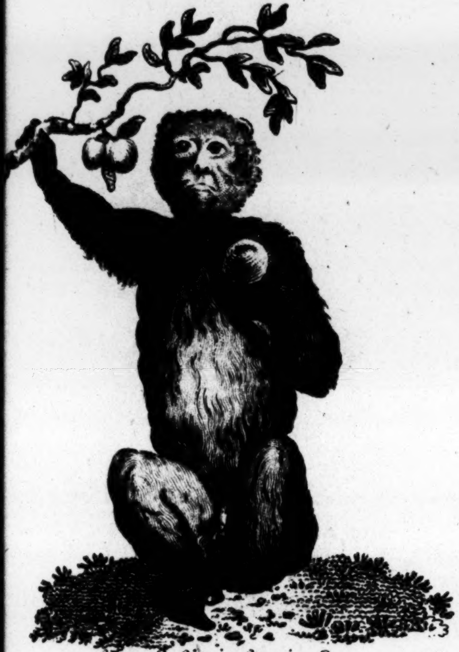
Genus 1. Homo, Man. Variety 1.
Europeus or European.



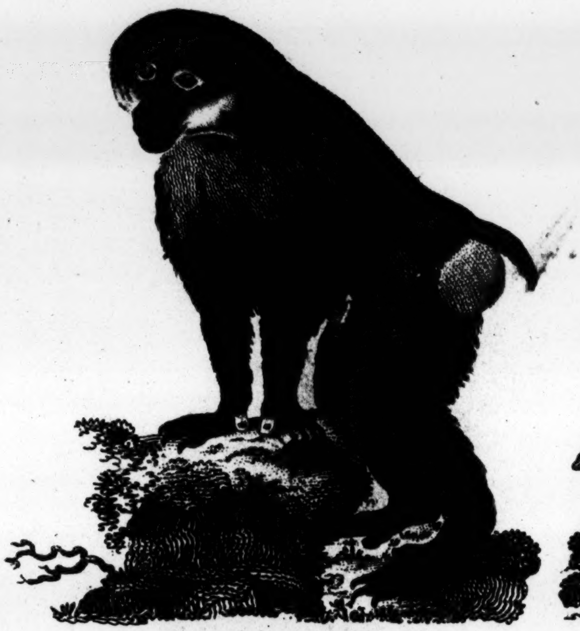
Genus 2. Simia, Species 2. Satyrus
Variety 2. Chimpanzee.



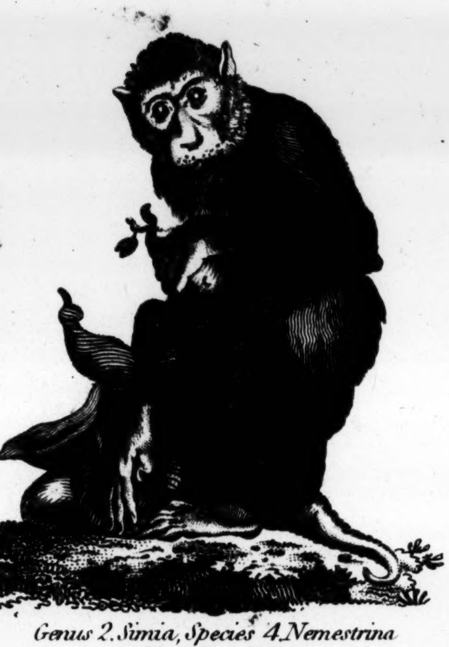
Genus 2. Simia, Species 2. Satyrus
Variety 1. Oranoutang.



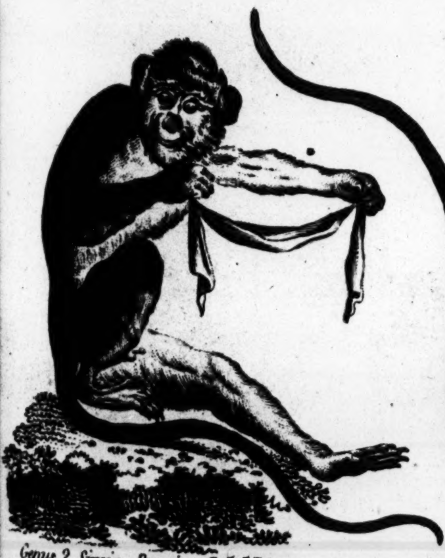
Genus 2. Simia, Species 3.
Inuus or Barbary Ape.



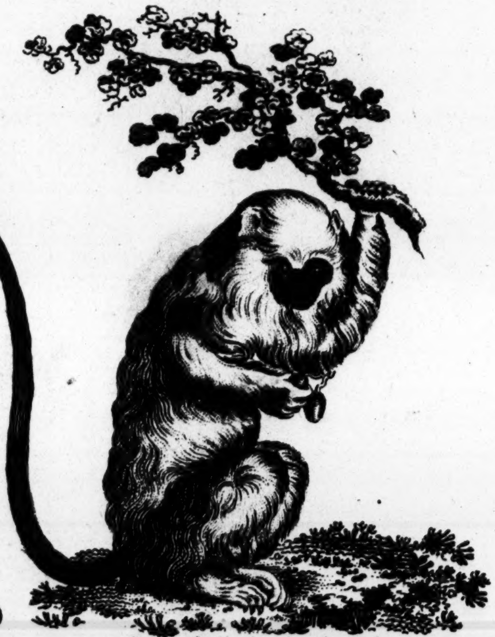
Genus 2. Simia, Species 6.
Sphinx or Great Baboon.



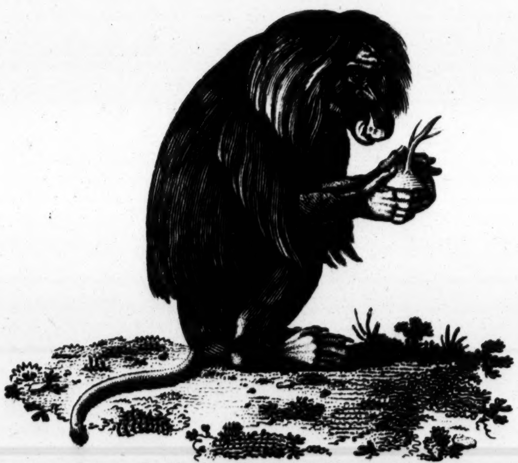
Genus 2. Simia, Species 4. Nemestrina
or Pig-tailed Baboon.



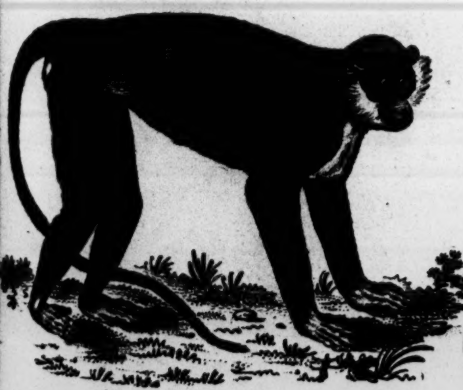
Genus 2. Simia, Species 35. Nasutus
Niger or black-nosed Monkey.



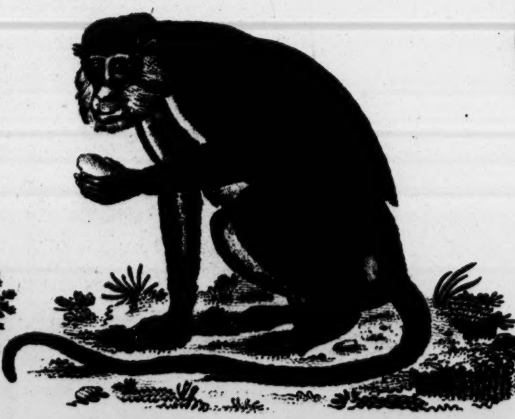
Genus 2. Simia, Species 34.
Mico or White Monkey.



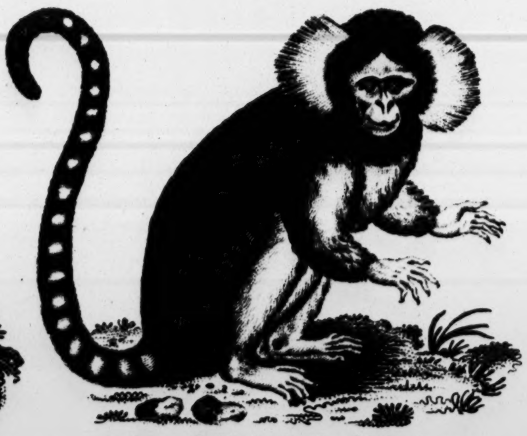
Genus 2. Simia, Species 8. Hamadryas
or Dog-faced Baboon.



Genus 2. Simia, Species 18.
Sabæa or Green Monkey.



Genus 2. Simia, Species 19. Cephus
or White-eyelid Monkey.



Genus 2. Simia, Species 24. Jacchus
or Striated Monkey.

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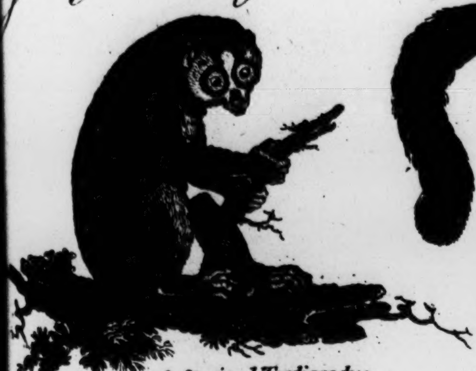
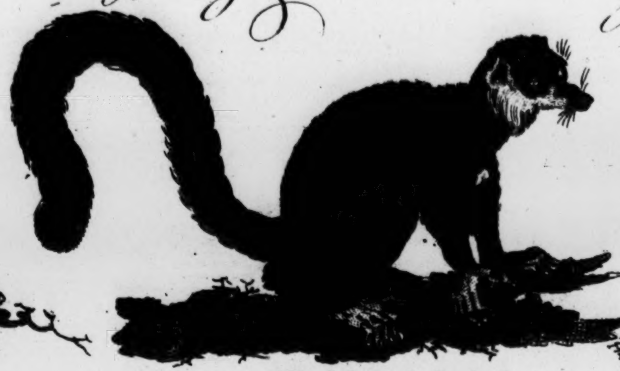
Plate 2 & 3.

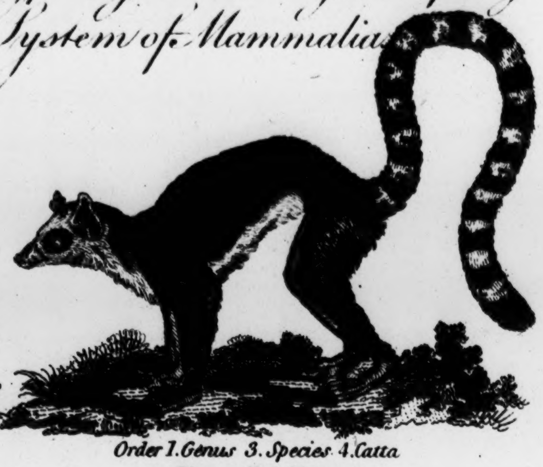
Claſs 1. Mammalia, Order 1. Primates, Order 2. Bruta, Order 3. Feræ, Genus 3. Lemur, Genus 4. Vespertillio, Genus 5. Elephas, Genus 6. Trichecus, Genus 7. Bradypus, Genus 8. Myrmecophaga, Genus 9. Manis, Genus 10. Dasypus, Genus 11. Phoca. See System of Mammalia.



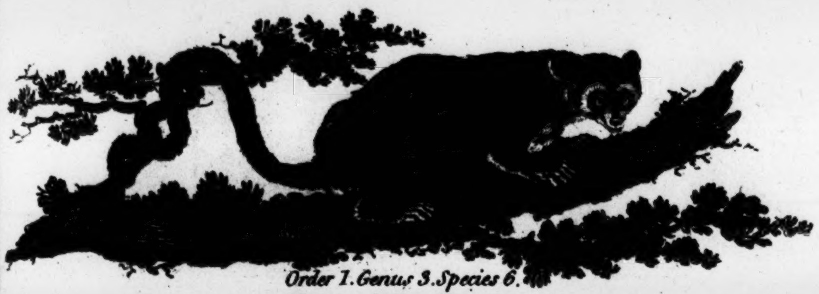
Order 1. Genus 3. Species 1. Tardigradus or Taileſs Macauco.



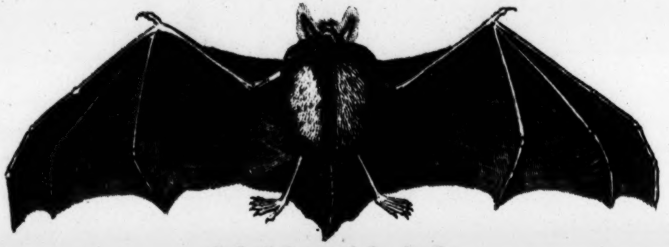
Order 1. Genus 3. Species 2. Mongoz or Mongooz.



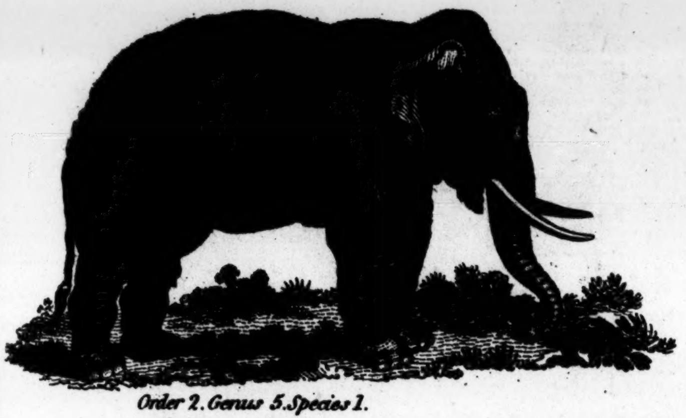
Order 1. Genus 3. Species 4. Catta or Ring-tailed Macauco.



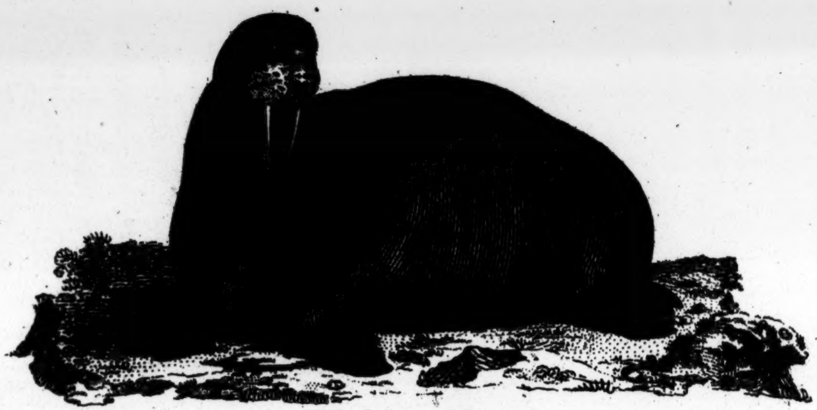
Order 1. Genus 3. Species 6. Flavus or Yellow Macauco.



Order 1. Genus 4. Species 6. Murinus or Short-eared Bat.

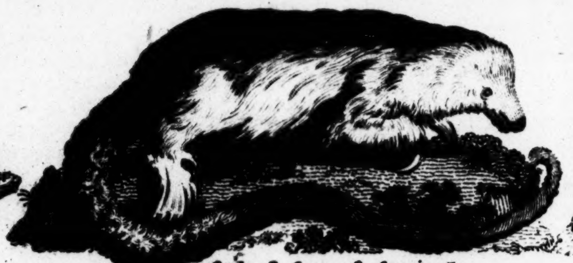


Order 2. Genus 5. Species 1. Elephas or Elephant.

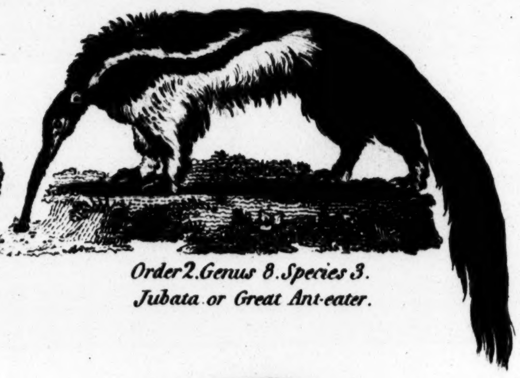


Order 2. Genus 6. Species 1. Rosmarus or Sea Horse.

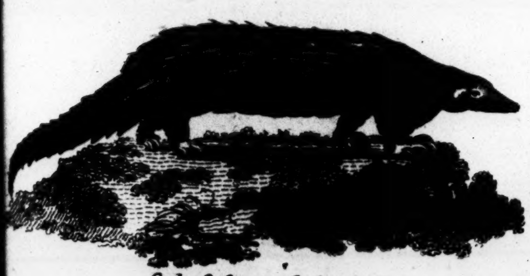
Order 2. Genus 7. Species 1. Tridactylus or Three-clawed Sloth.



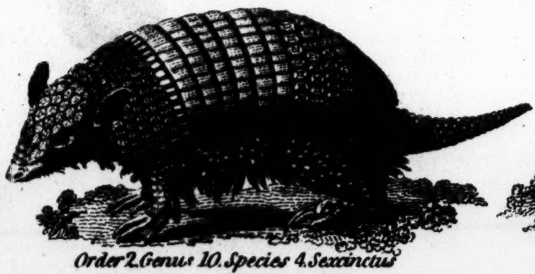
Order 2. Genus 8. Species 1. Didactylus or Leſser Ant-eater.



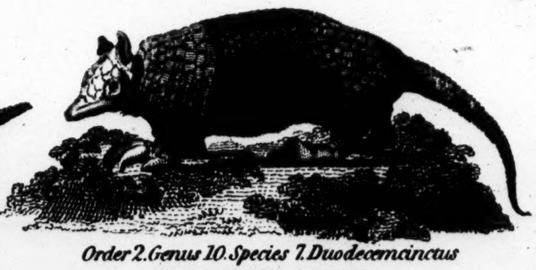
Order 2. Genus 8. Species 3. Jubata or Great Ant-eater.



Order 2. Genus 9. Species 1. Pentadactyla or Scaly Lizard.

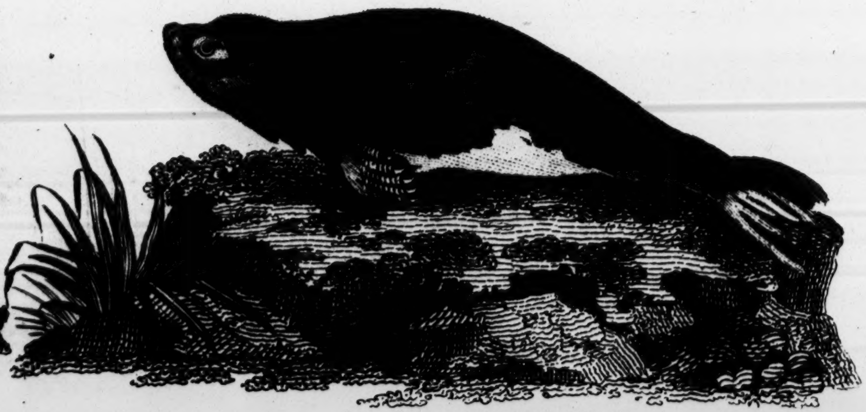


Order 2. Genus 10. Species 4. Sexcinctus or Six banded Armadillo.



Order 2. Genus 10. Species 7. Duodecemcinctus or Twelve-banded Armadillo.

Order 2. Genus 11. Species 1. Ursina, Ursine Seal or Sea Bear.



Order 3. Genus 11. Species 3 Vitulina, Vituline Seal or Sea Calf.

Engraved for the Royal Encyclopædia, & Published as the Act directs, by C. Cooke, No. 17, Paternoster Row.

Hawkins sculp.

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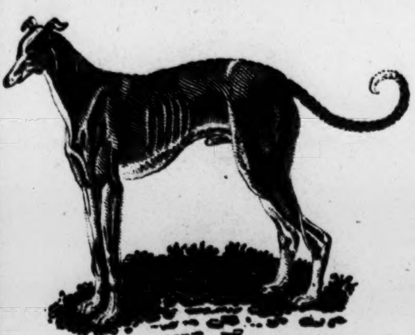
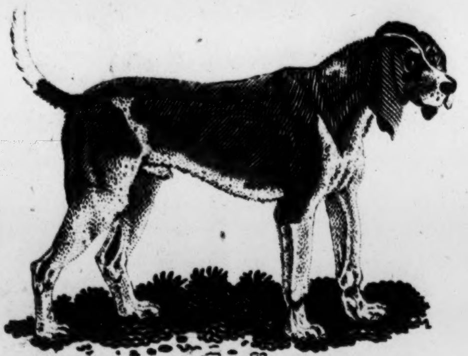
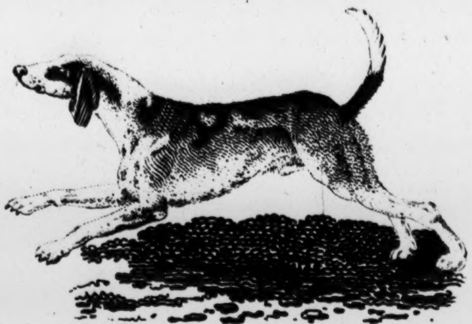
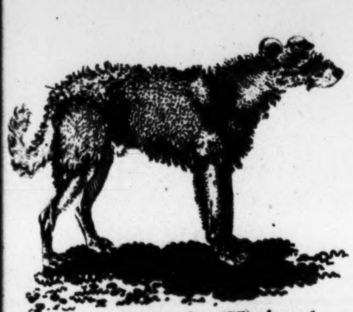
Plate 3.

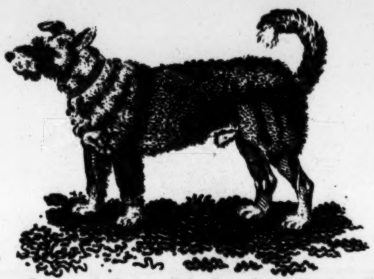
Claſs 1. Mammalia, Order 3. Feræ, Genus 12. Canis,
See System of Mammalia.

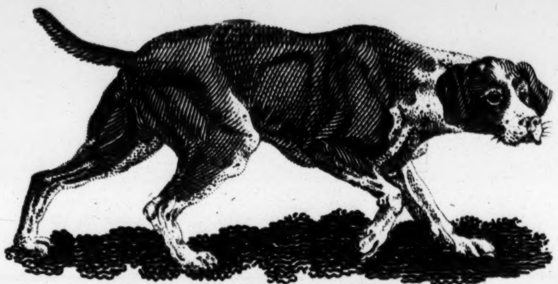

Order 3. Genus 12. Species 1. Familiaris, Variety 1. Leporarius or Grey hound.

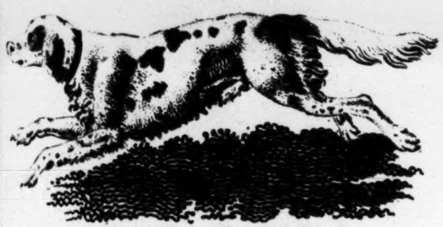

Order 3. Genus 12. Species 1. Variety 2. Cerverarius or Stag hound.

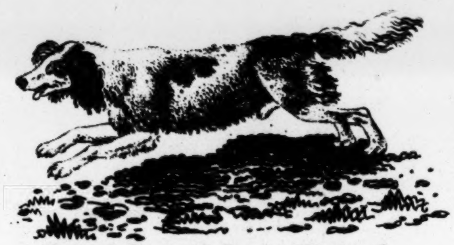

Order 3. Genus 12. Species 1. Variety 3. Vulperarius or Fox hound.

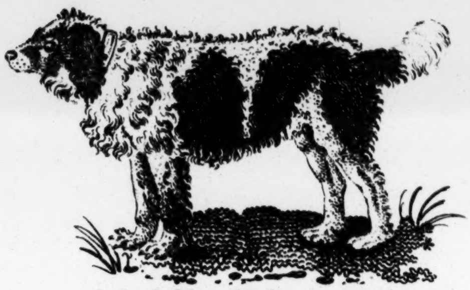

Order 3. Genus 12. Species 1. Variety 4. Vertagus or Lurcher.

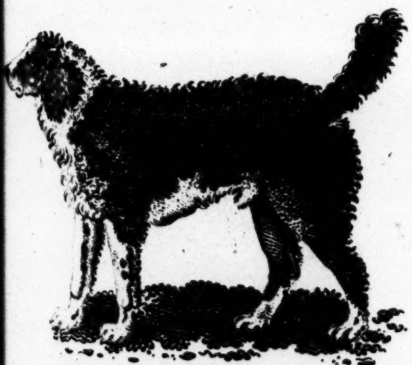

Order 3. Genus 12. Species 1. Variety 5. Terrarius or Terrier.

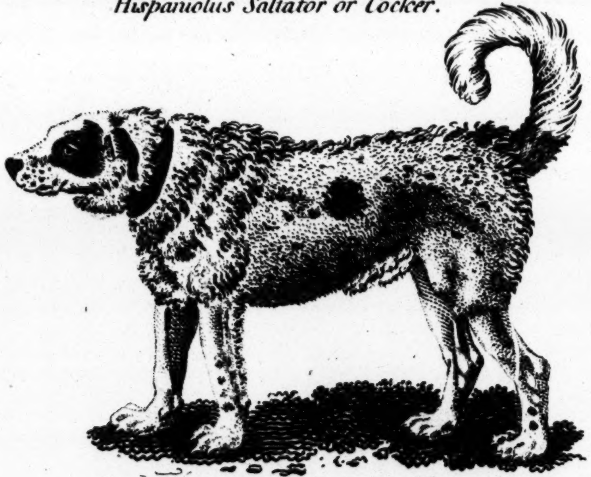

Order 3. Genus 12. Species 1. Variety 6. Hispaniolus, Index or Pointer.

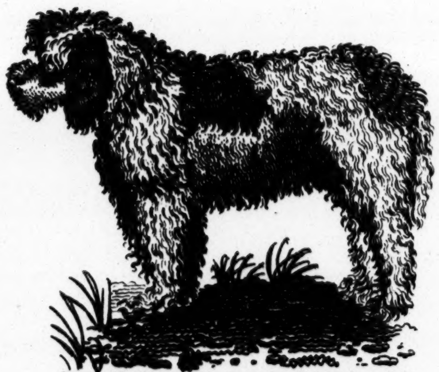

Order 3. Genus 12. Species 1. Variety 7. Hispaniolus, Subsidens or Setter.

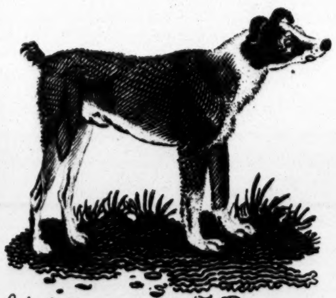

Order 3. Genus 12. Species 1. Variety 8. Hispaniolus Saltator or Cocker.

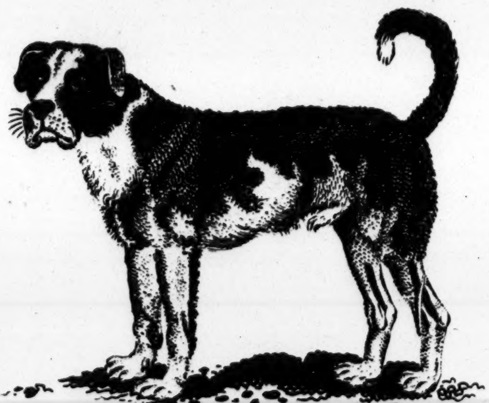

Order 3. Genus 12. Species 1. Variety 9. Aquaticus minor or Small Water Spaniel.

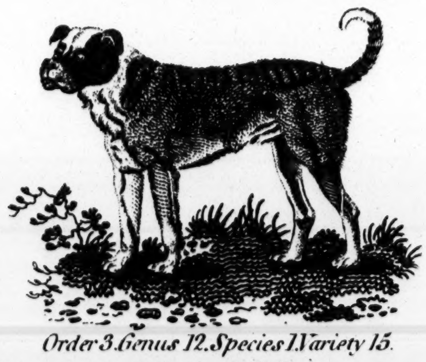

Order 3. Genus 12. Species 1. Variety 10. Aquaticus major or Large Water Spaniel.

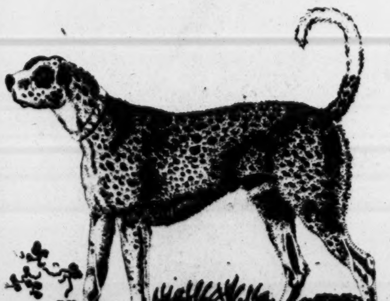

Order 3. Genus 12. Species 1. Variety 11. Aquaticus Americanus or Newfoundland Dog.

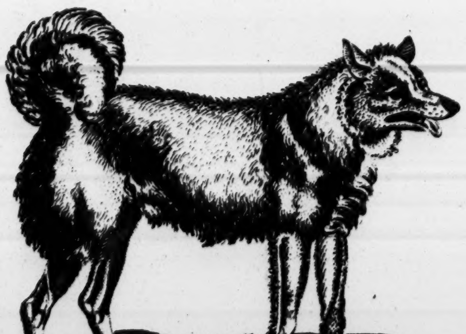

Order 3. Genus 12. Species 1. Variety 12. Aquaticus Hirsutus or Rough Water Dog.

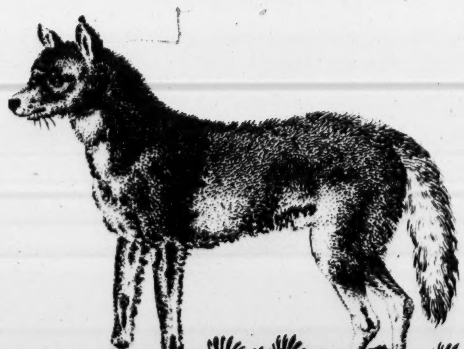

Order 3. Genus 12. Species 1. Variety 13. Pastoralis or Shepherds Dog.


Order 3. Genus 12. Species 1. Variety 14. Moloſsus or Mastiff.


Order 3. Genus 12. Species 1. Variety 15. Lanienus or Bull Dog.


Order 3. Genus 12. Species 1. Variety 16. Dalmaticus or Dalmatian Dog.


Order 3. Genus 12. Species 1. Variety 17. Septentrionalis or Greenland Dog.


Order 3. Genus 12. Species 1. Variety 18. Meridionalis or New South Wales Dog.

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W. Taylor sculp.

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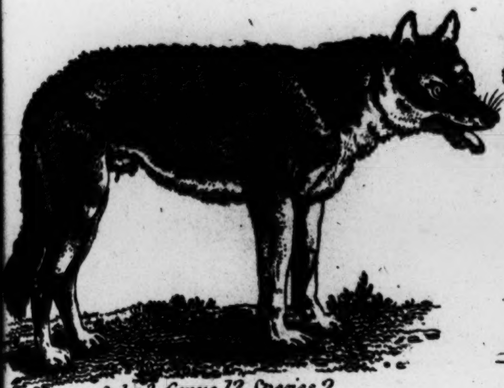
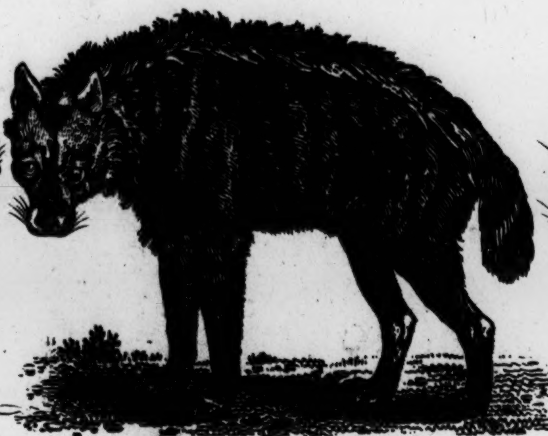
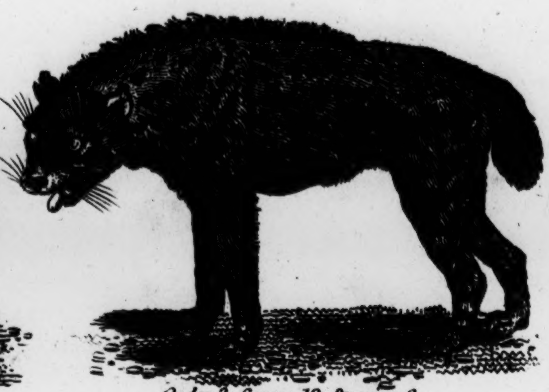
Plate 4.

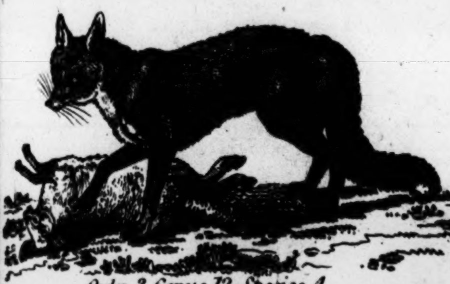
Claſs 1. Mammalia, Order 3. Feræ, Genus 12. Canis, Genus 13. Felis.

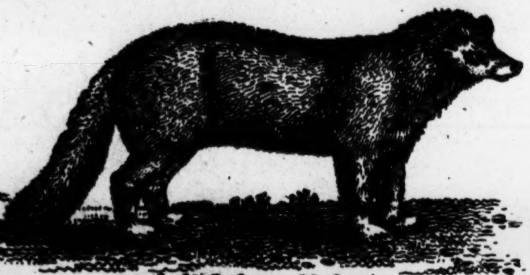
See System of Mammalia.

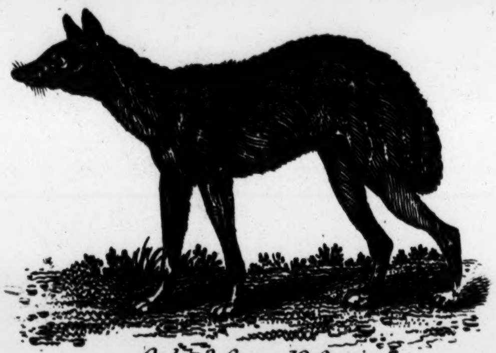

Order 3. Genus 12. Species 2.
Lupus or Wolf.

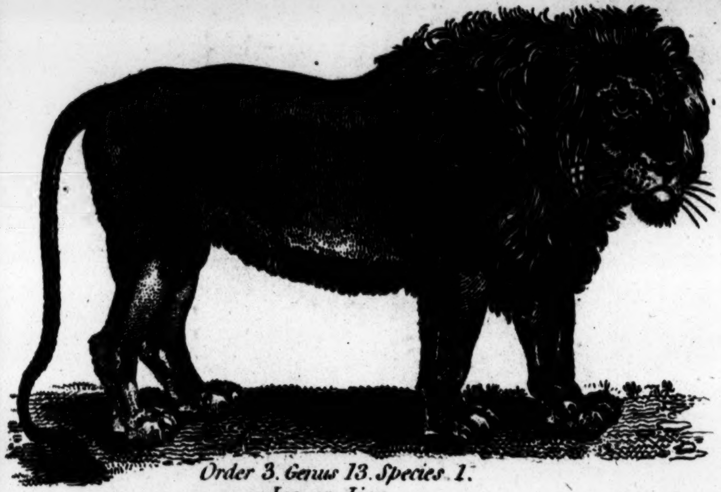

Order 3. Genus 12. Species 3.
Hyæna. Variety 1. Striatus.

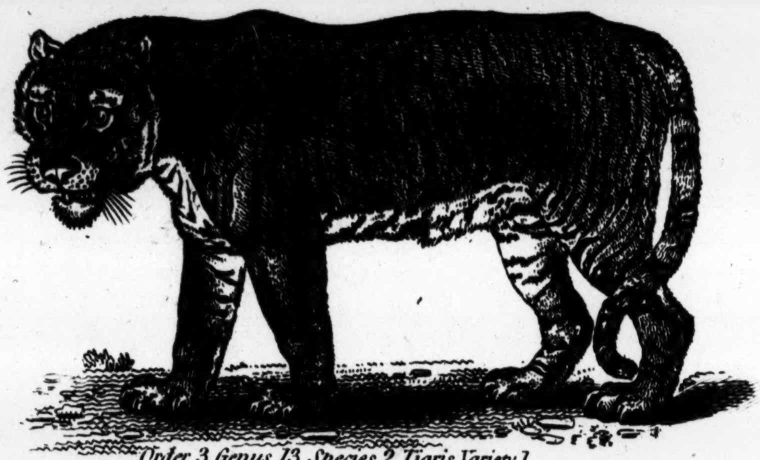

Order 3. Genus 12. Species 3.
Hyæna Variety 2. Maculatus.

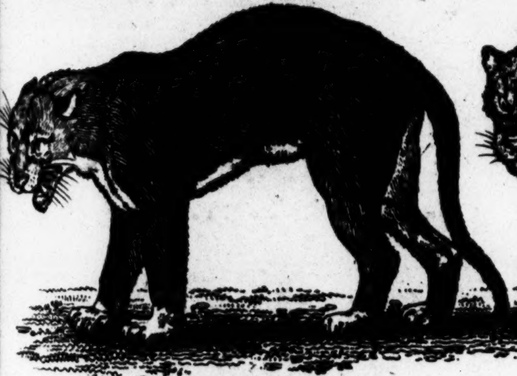

Order 3. Genus 12. Species 4.
Vulpes or Fox.

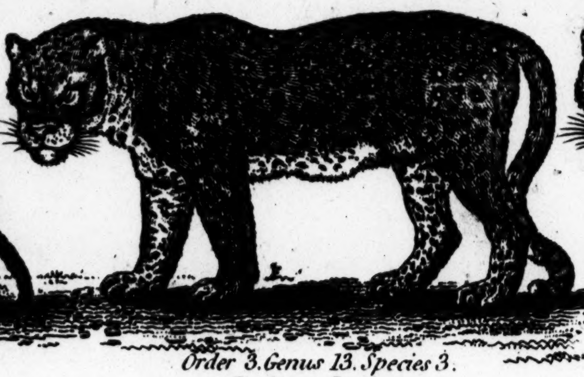

Order 3. Genus 12. Species 6.
Lagopus or Artic Fox.

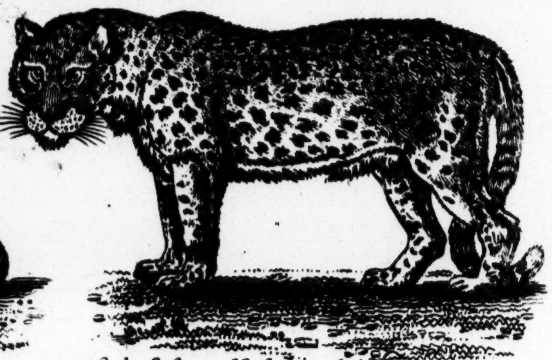

Order 3. Genus 12. Species 7.
Aureus or Jackal.

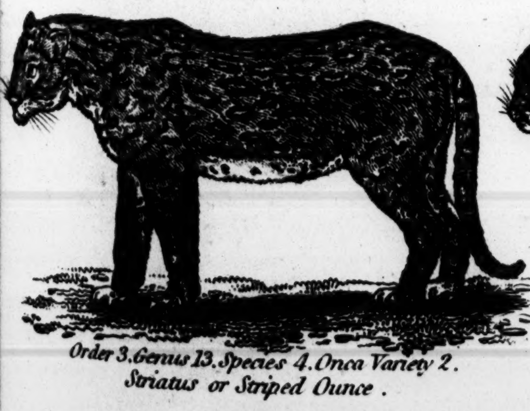

Order 3. Genus 13. Species 1.
Leo or Lion.

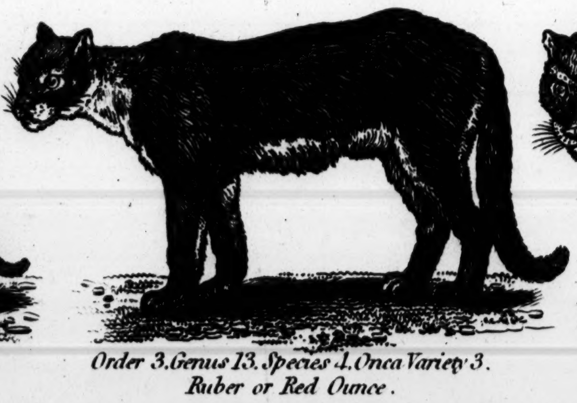

Order 3. Genus 13. Species 2. Tigris, Variety 1.
Striatus or Striped Tiger.

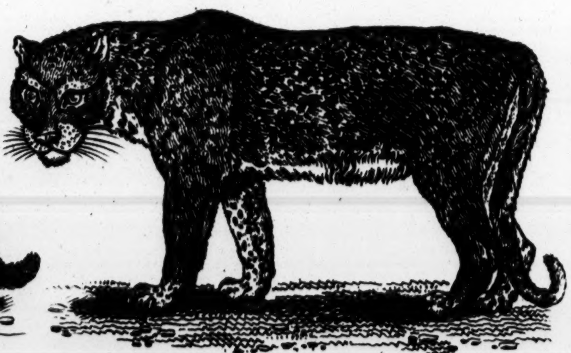

Order 3. Genus 13. Species 2. Tigris,
Variety 2. Niger or Black Tiger.

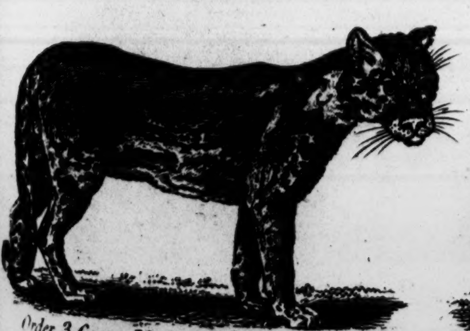

Order 3. Genus 13. Species 3.
Pardus or Panther.

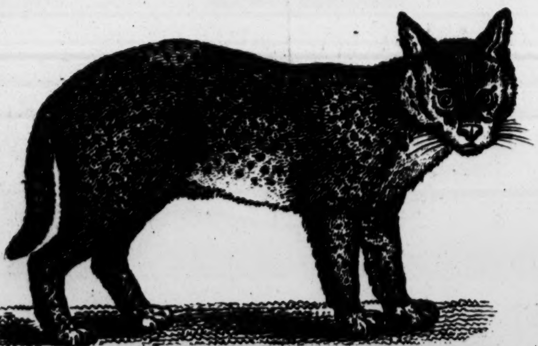

Order 3. Genus 13. Species 4. Onca, Variety 1.
Maculatus or Spotted Ounce.


Order 3. Genus 13. Species 4. Onca Variety 2.
Striatus or Striped Ounce.


Order 3. Genus 13. Species 4. Onca Variety 3.
Ruber or Red Ounce.


Order 3. Genus 13. Species 5. Pardalis Variety 1.
Americanus or American Leopard.


Order 3. Genus 13. Species 5. Pardalis Variety 2.
Mexicanus or Mexican Oscelot.


Order 3. Genus 13. Species 5. Pardalis Variety 3.
Montanus or Mountain Cat.

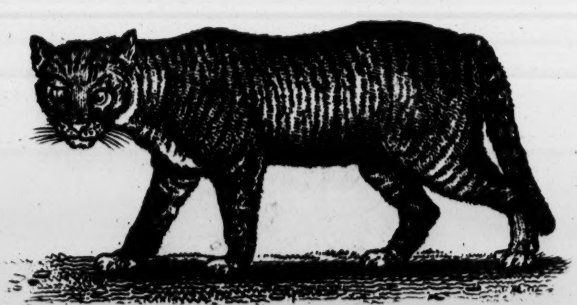

Order 3. Genus 13. Species 5. Pardalis Variety 4
Sylvastris or Cat of the Woods.

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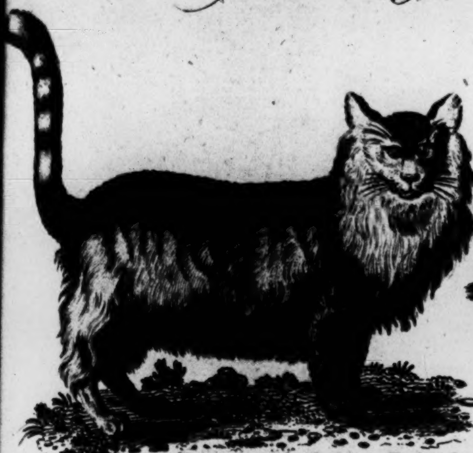
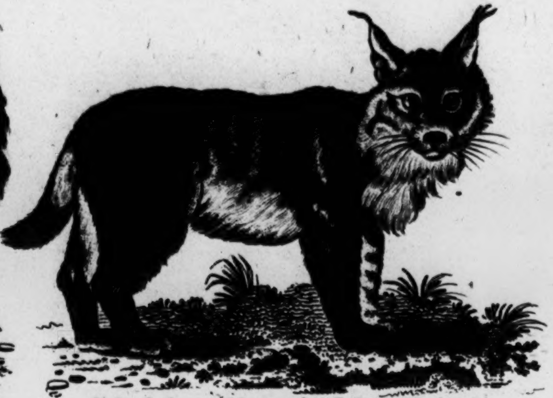
Plate 5.

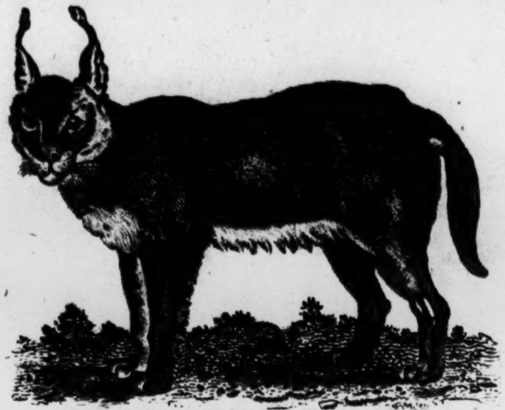
Claſs 1. Mammalia. Order 3. Feræ. Genus 13. Felis. Genus 14. Viverra. Genus 15. Mustela. Genus 16. Ursus. See System of Mammalia.



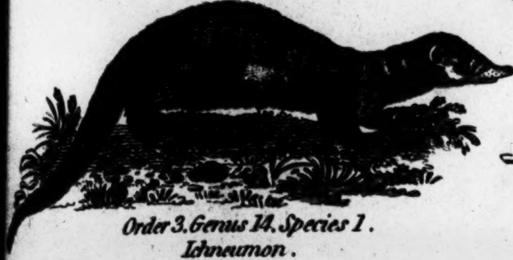
Order 3. Genus 13. Species 6. Catus, Variety 2.
Angorensis or Cat of Angora.



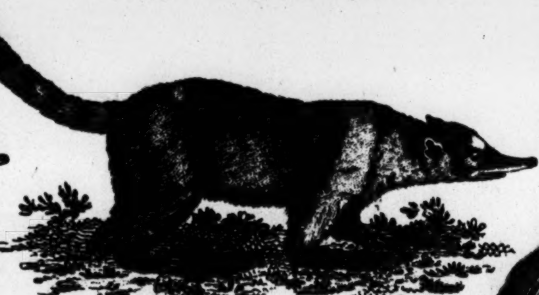
Order 3. Genus 13. Species 7. Lynx, Variety 1.
Europœus or Europœan Lynx.



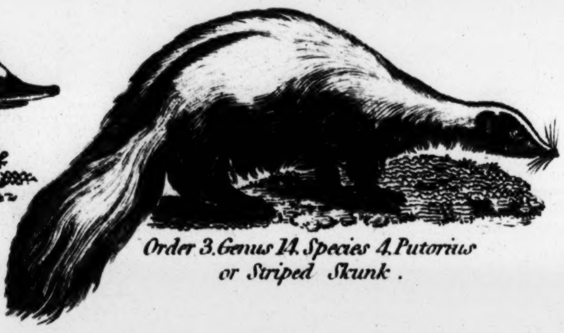
Order 3. Genus 13. Species 7 Lynx, Variety 2.
Indicus or Persian Lynx



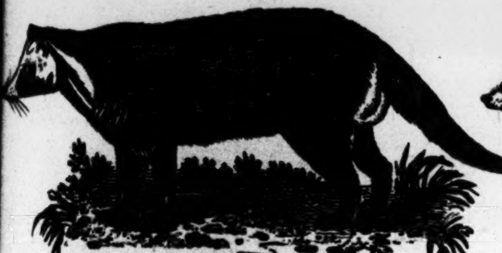
Order 3. Genus 14. Species 1.
Ichneumon.



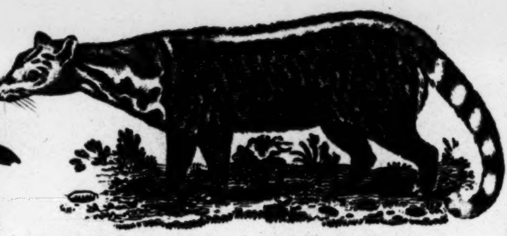
Order 3. Genus 14. Species 2. Nasua,
Coati or Brasilian Weasel.



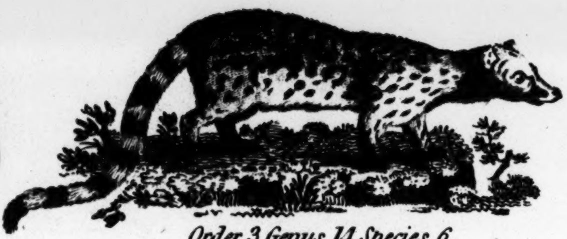
Order 3. Genus 14. Species 4. Putorius
or Striped Skunk.



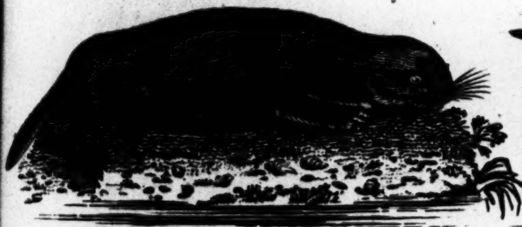
Order 3. Genus 14. Species 5. Zibetha,
Variety 2. Vulgaris or Common Civet.



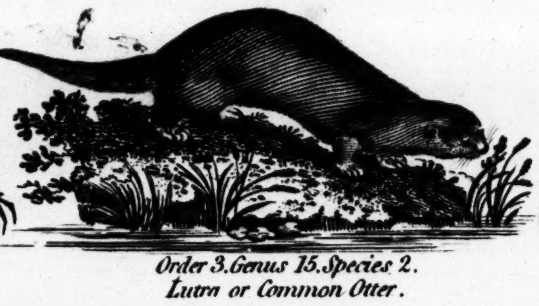
Order 3. Genus 14. Species 5. Zibetha, Variety 1.
Annulatus or Annulated Civet.



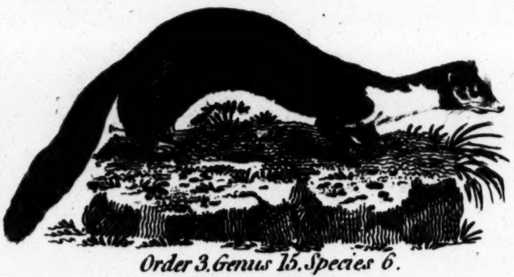
Order 3. Genus 14. Species 6.
Genetta or Genett.



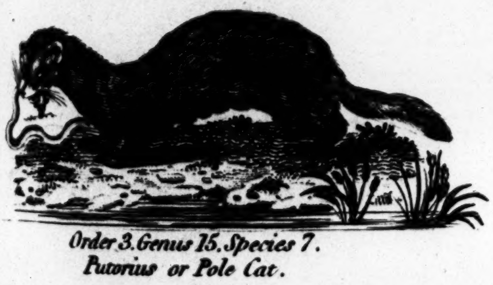
Order 3. Genus 15. Species 1.
Lutris or Sea Otter.



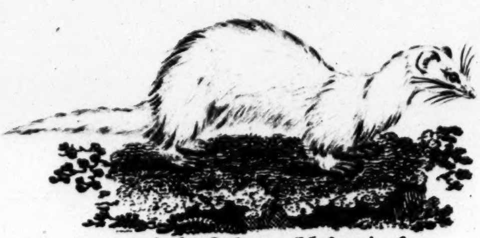
Order 3. Genus 15. Species 2.
Lutra or Common Otter.



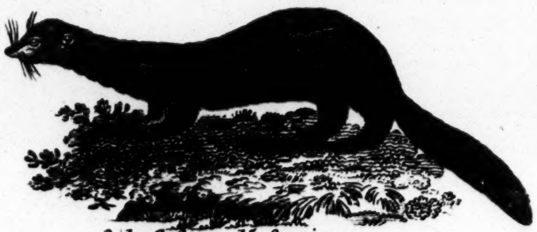
Order 3. Genus 15. Species 6.
Martes or Martin.



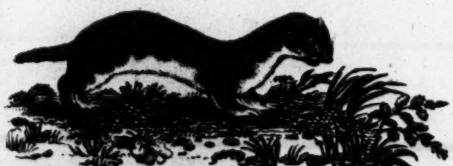
Order 3. Genus 15. Species 7.
Putorius or Pole Cat.



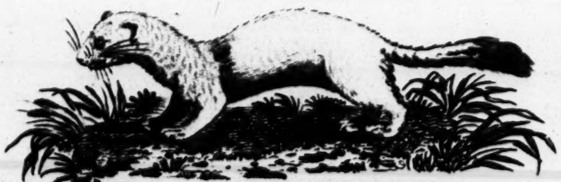
Order 3. Genus 15. Species 8.
Furo or Ferret.



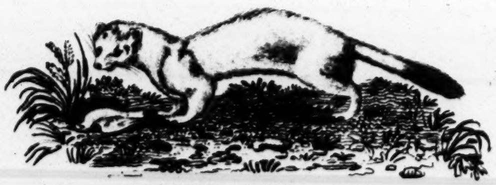
Order 3. Genus 15. Species 9.
Zibellina or Sable.



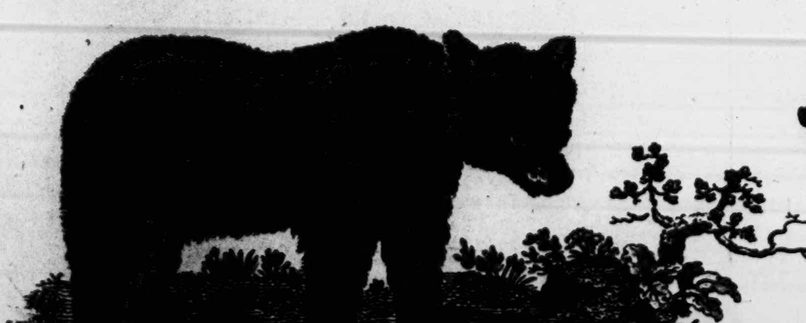
Order 3. Genus 15. Species 10. Ermina, Variety 2.
Vulgaris or Common Ermine.



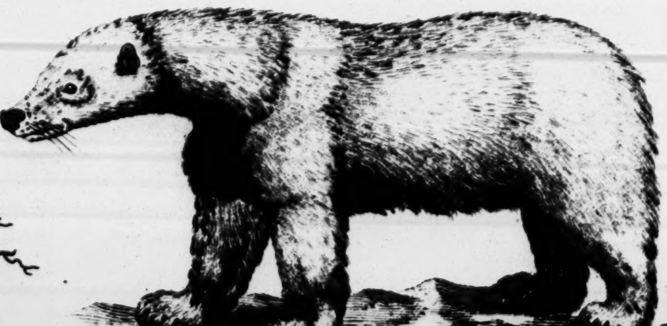
Order 3. Genus 15. Species 10. Ermina,
Variety 1. Albus or White Ermine.



Order 3. Genus 15. Species 11.
Nivalis or Stoat.



Order 3. Genus 16. Species 1. Arctos,
Variety 1. Fuscus or Brown Bear.



Order 3. Genus 16. Species 1. Arctos,
Variety 2. Albus or White Bear.

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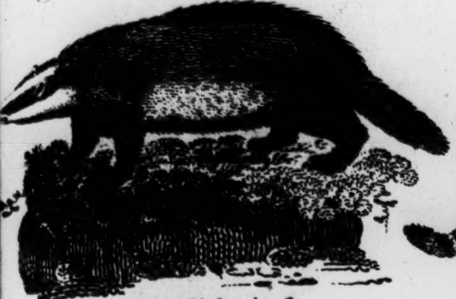
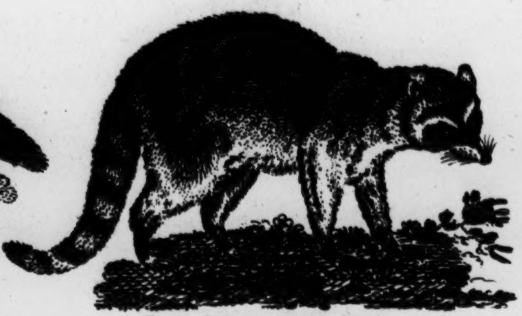
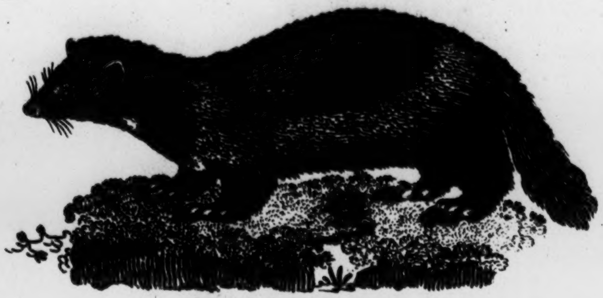
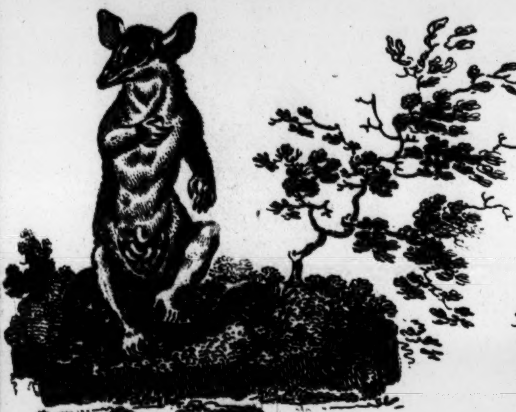
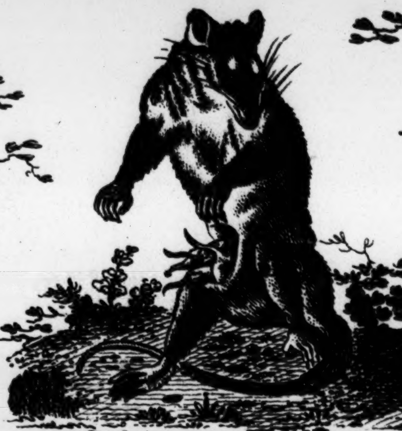
laſs 1. Mammalia, Order 3. Feræ, Order 4. Glires, Genus 16. Ursus, Genus 17. Didelphis, Genus 18. Talpa, Genus 19. Sorex, Genus 20. Erinaceus, Genus 21. Hystrix, See System of Mammalia.

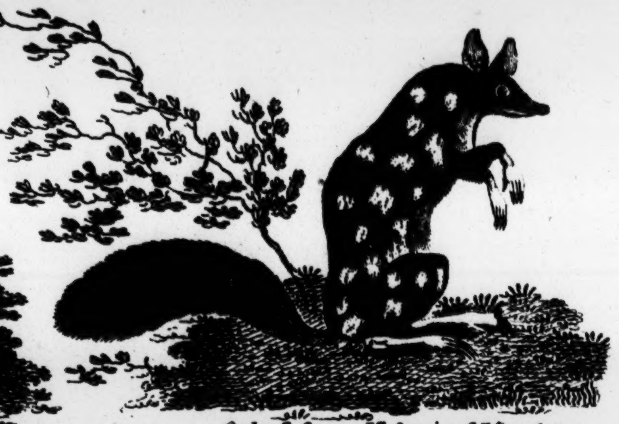

Order 3. Genus 16. Species 2.
Meles or European Badger.

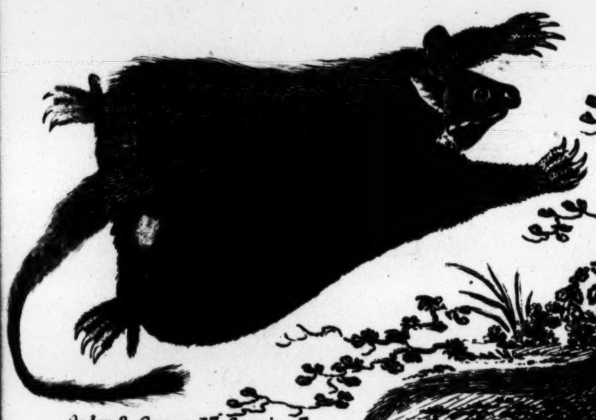

Order 3. Genus 16. Species 3.
Lotor or Racoon.

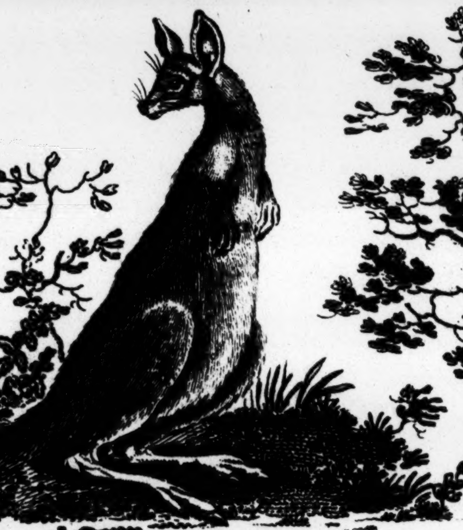

Order 3. Genus 16. Species 4.
Luscus or Glutton.

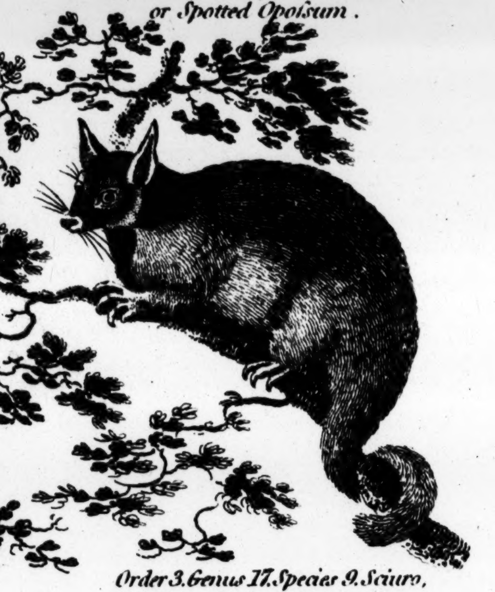

Order 3. Genus 17. Species 1. Marsupialis
or Murine Opoſsum.

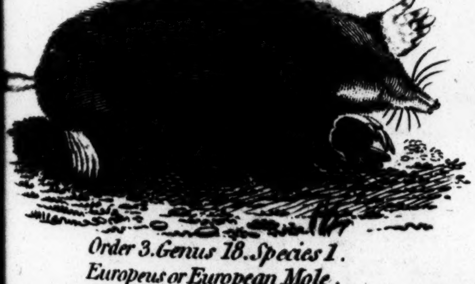

Order 3. Genus 17. Species 3.
Opoſsum or Sardgoy.

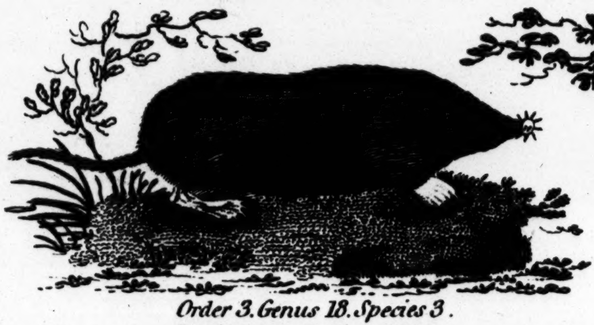

Order 3. Genus 17. Species 6. Maculatus
or Spotted Opoſsum.

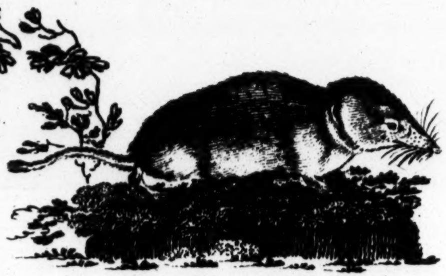

Order 3. Genus 17. Species 7.
Volans or Flying Opoſsum.

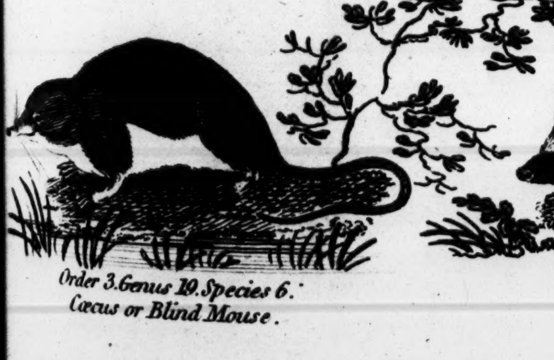

Order 3. Genus 17. Species 8. Kanguroo
or New Holland Opoſsum.

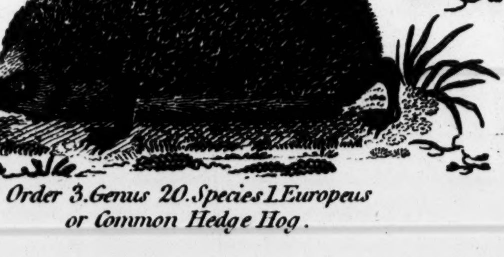

Order 3. Genus 17. Species 9. Sciuro,
Similis, or Squirrel-like Opoſsum.

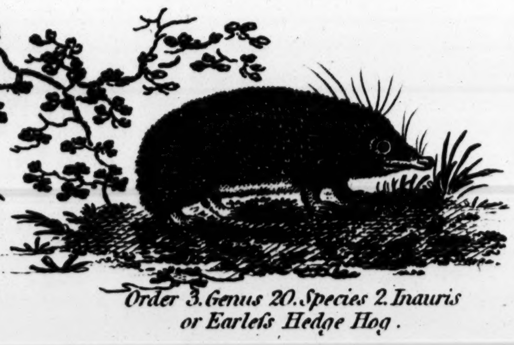

Order 3. Genus 18. Species 1.
Europeus or European Mole.

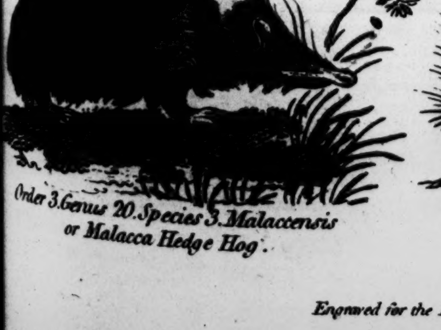

Order 3. Genus 18. Species 3.
Radiatus or Radiated Mole.

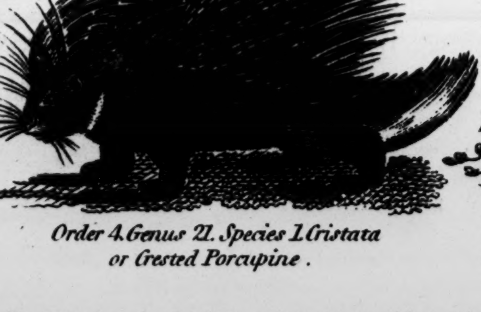

Order 3. Genus 19. Species 5.
Araneus or Field Mouse.

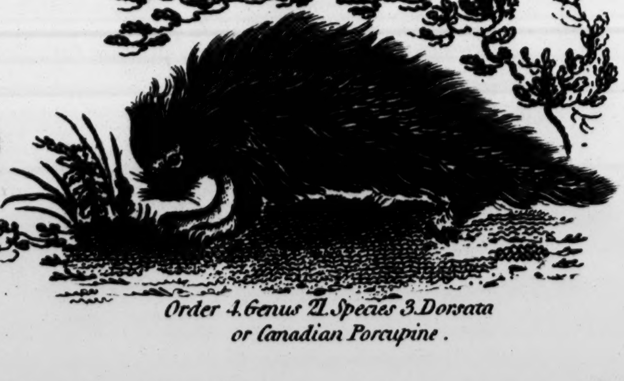

Order 3. Genus 19. Species 6.
Cœcus or Blind Mouse.


Order 3. Genus 20. Species 1. Europeus
or Common Hedge Hog.


Order 3. Genus 20. Species 2. Inauris
or Earleſs Hedge Hog.


Order 3. Genus 20. Species 3. Malaccensis
or Malacca Hedge Hog.


Order 4. Genus 21. Species 1. Cristata
or Crested Porcupine.


Order 4. Genus 21. Species 3. Dorsata
or Canadian Porcupine.

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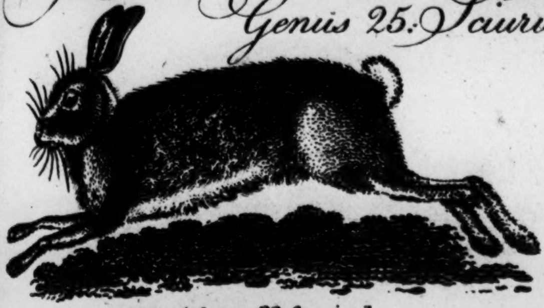
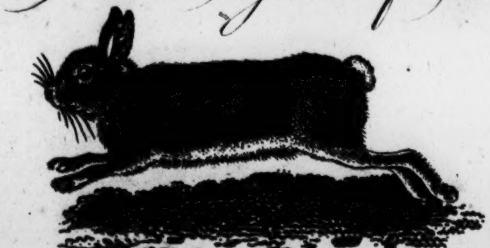
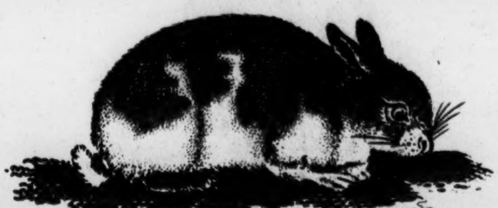
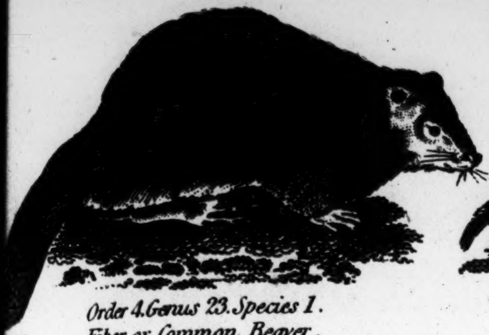
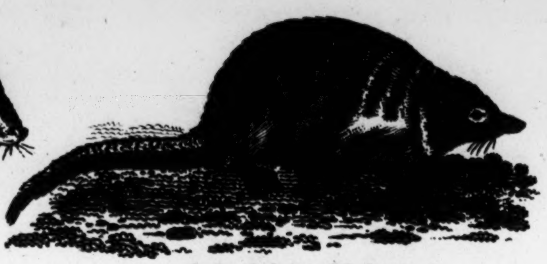
Claſs 1. Mammalia, Order 4. Glires, Genus 22. Lepus, Genus 23. Castor, Genus 24. Mus, Genus 25. Sciurus, See the System of Mammalia.

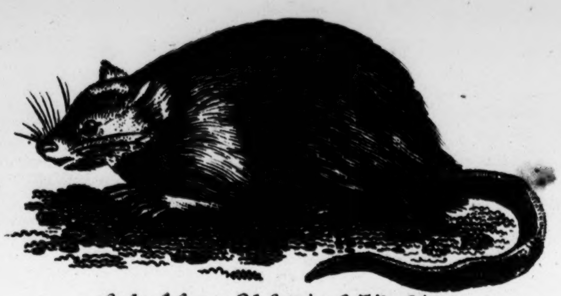

Order 4. Genus 22. Species 1.
Timidus or Hare.

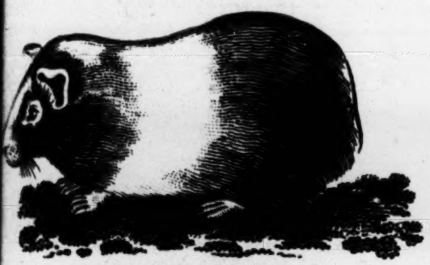

Order 4. Genus 22. Species 2.
Cuniculus, Variety 1. Wild Rabbit.

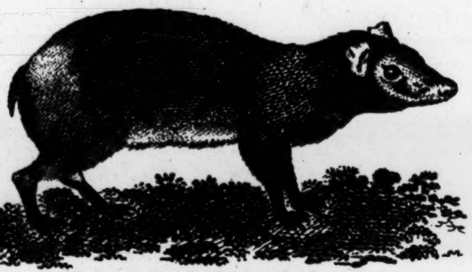

Order 4. Genus 22. Species 2.
Cuniculus, Variety 2. Tame Rabbit.

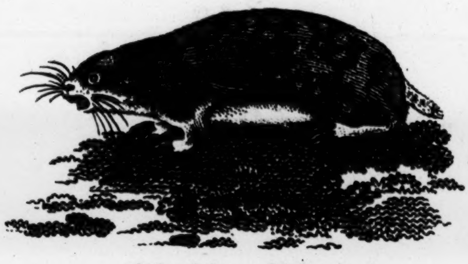

Order 4. Genus 23. Species 1.
Fiber or Common Beaver.

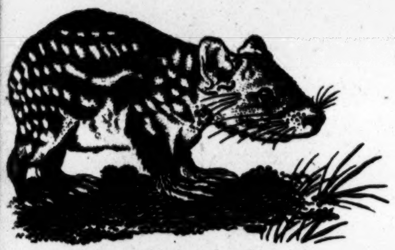

Order 4. Genus 23. Species 2.
Moschatus or Musk Rat.

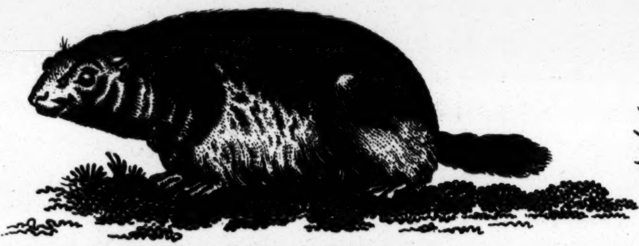

Order 4. Genus 24. Species 3. Zibethicus,
or Musk Rat of Canada.

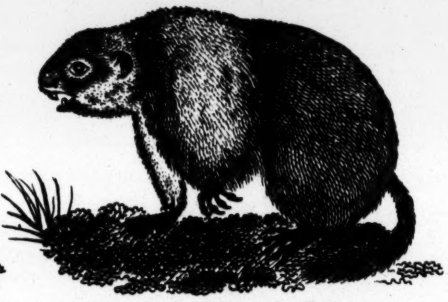

Order 4. Genus 24. Species 1.
Porcellus or Guinea Pig.

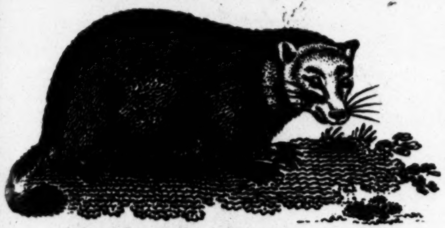

Order 4. Genus 24. Species 2.
Aguti or Long nosed Cavy.

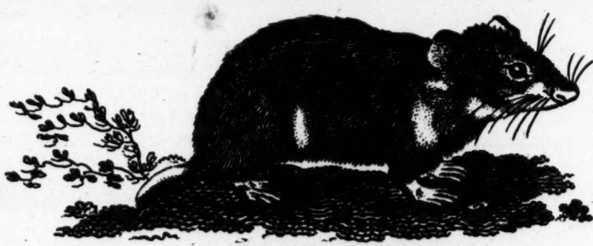

Order 4. Genus 24. Species 5.
Lemmus or Lapland Marmot.

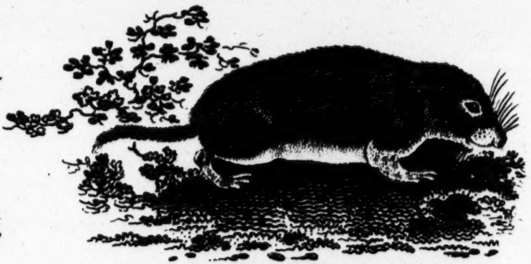

Order 4. Genus 24. Species 6.
Paca or Spotted Cavy.

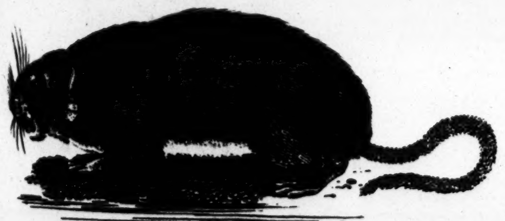

Order 4. Genus 24. Species 7. Marmota,
Variety 1. Alpinus or Alpine Marmot.

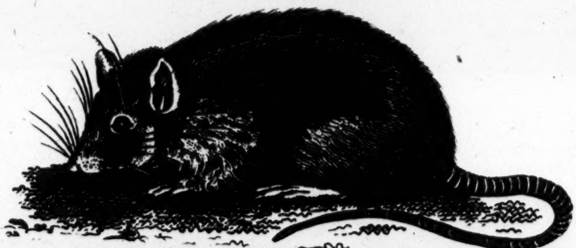

Order 4. Genus 24. Species 7. Marmota,
Variety 2. Americanus or American Marmot.

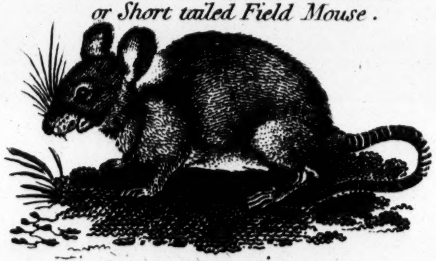

Order 4. Genus 24. Species 8.
Monax or Marmot of Canada.

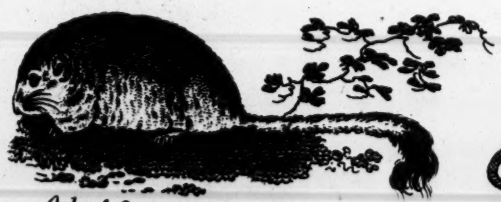

Order 4. Genus 24. Species 9.
Cricetus or German Marmot.

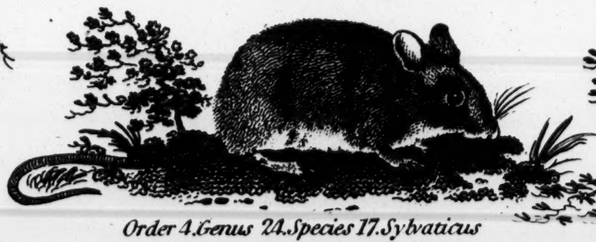

Order 4. Genus 24. Species 10. Terrestris
or Short tailed Field Mouse.

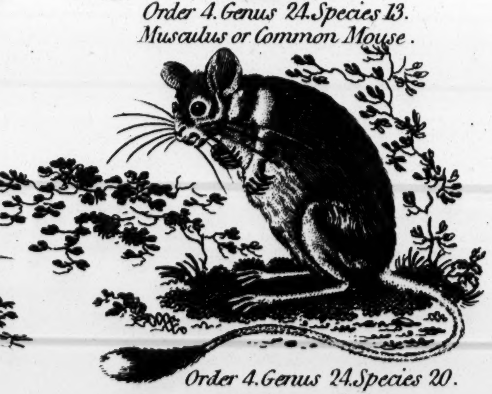

Order 4. Genus 24. Species 11.
Amphibius or Water Rat.

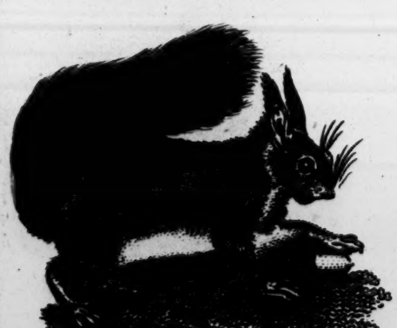

Order 4. Genus 24. Species 12.
Rattus or Common Rat.

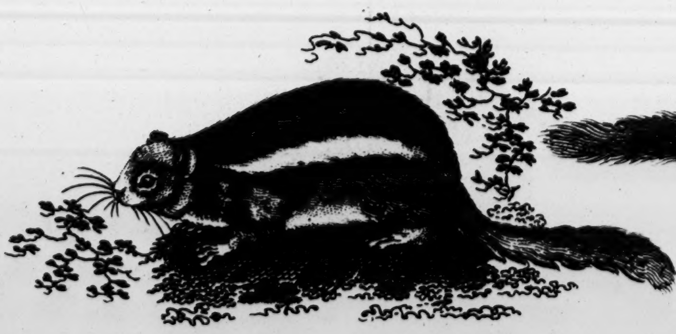

Order 4. Genus 24. Species 13.
Musculus or Common Mouse.

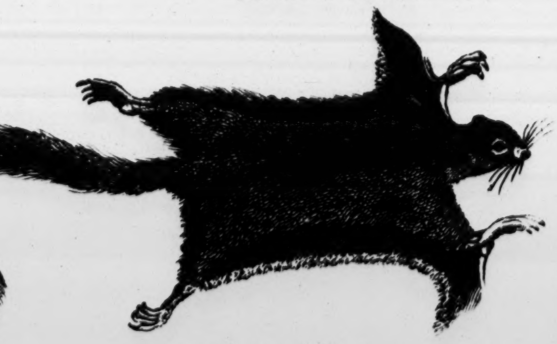

Order 4. Genus 24. Species 14.
Avellanarius or Dormouse.


Order 4. Genus 24. Species 17. Sylvaticus
or Long tailed Field Mouse.


Order 4. Genus 24. Species 20.
Jaculus or Jerboa


Order 4. Genus 25. Species 1.
Vulgaris or Common Squirrel.


Order 4. Genus 25. Species 2.
Striatus or Striped Squirrel.


Order 4. Genus 25. Species 3.
Volans or Flying Squirrel.

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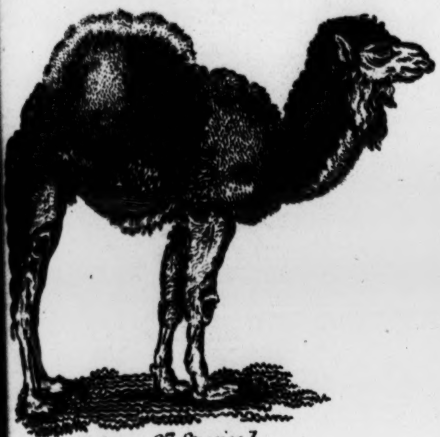
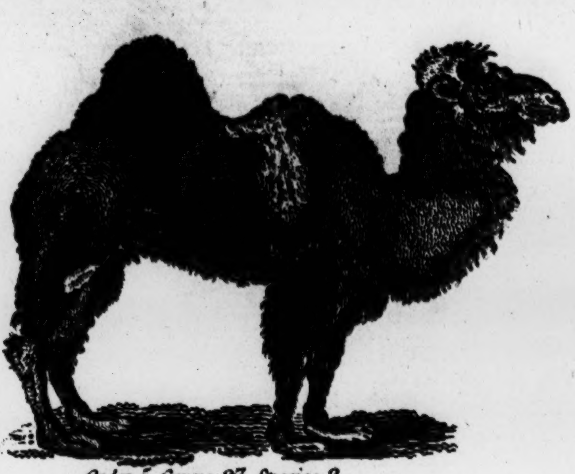
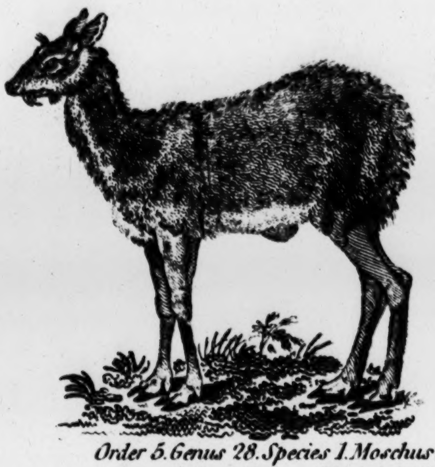
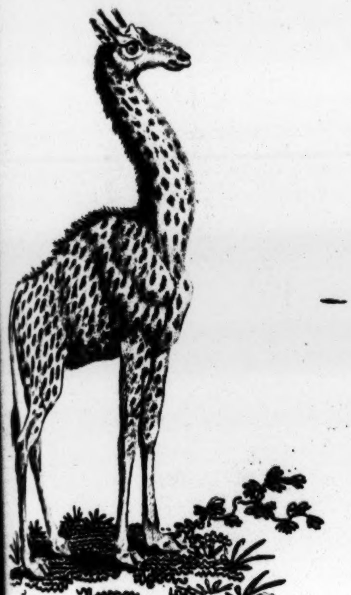
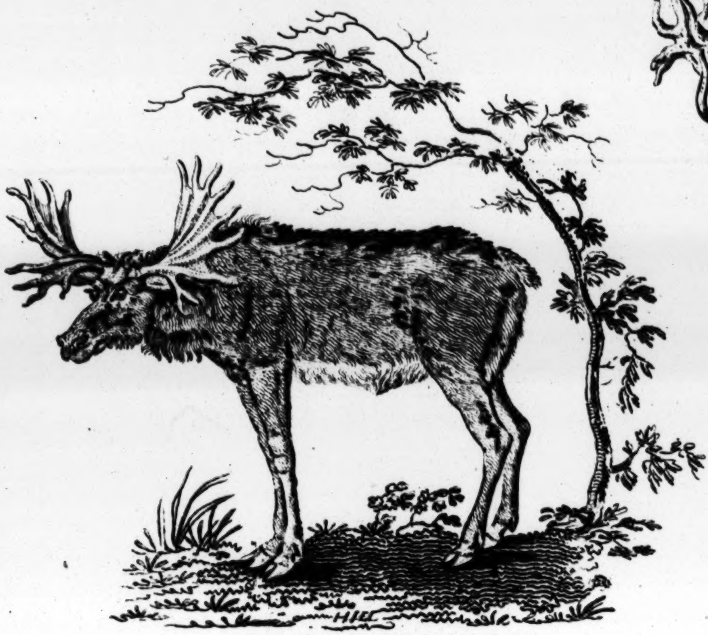
Claſs 1. Mammalia, Order 5. Pecora, Genus 27. Camelus, Genus 28. Moschus, Genus 29. Cervus, Genus 30. Capra. See System of Mammalia.


Order 5. Genus 27. Species 1.
Dromedarius or Dromedary.

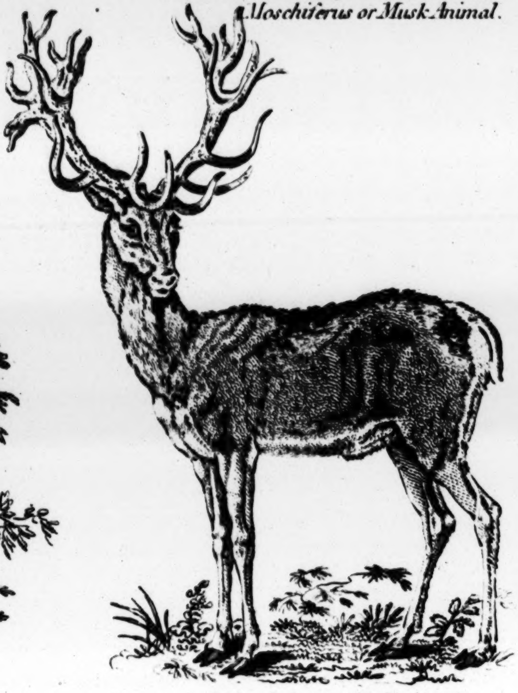

Order 5. Genus 27. Species 2.
Bactrianus or Bactrian Camel.

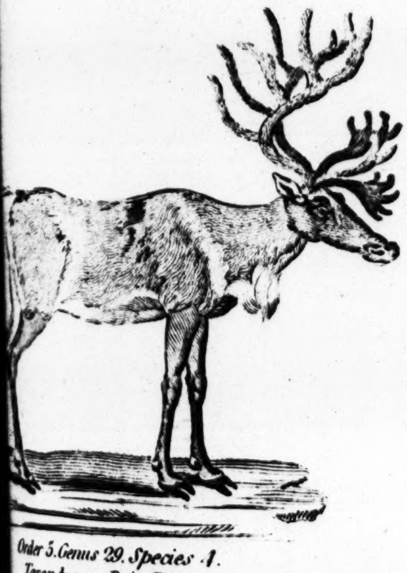

Order 5. Genus 28. Species 1. Moschus.
Moschiferus or Musk Animal.

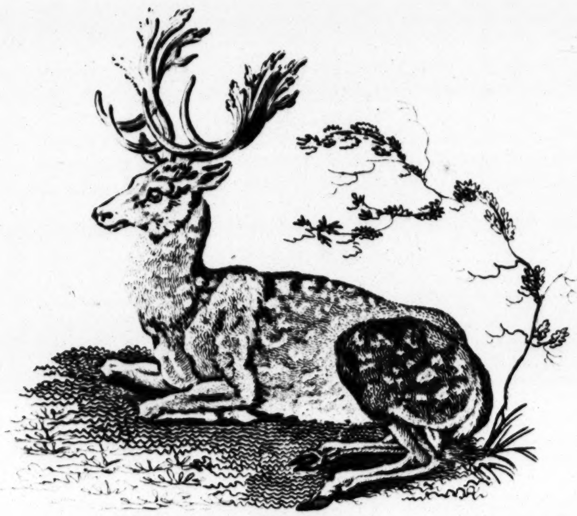

Order 5. Genus 29. Species 1.
amelopardalis or Cameleopard.

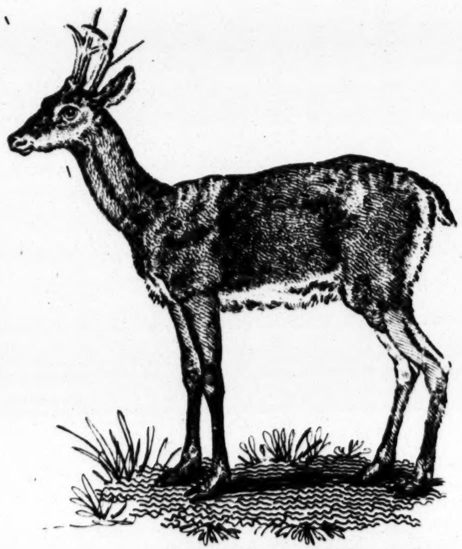


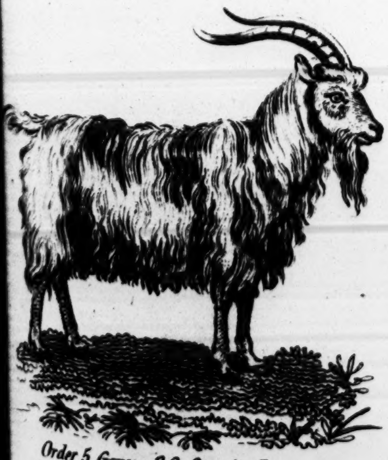
Order 5. Genus 29. Species 2.
Alces or Elk.

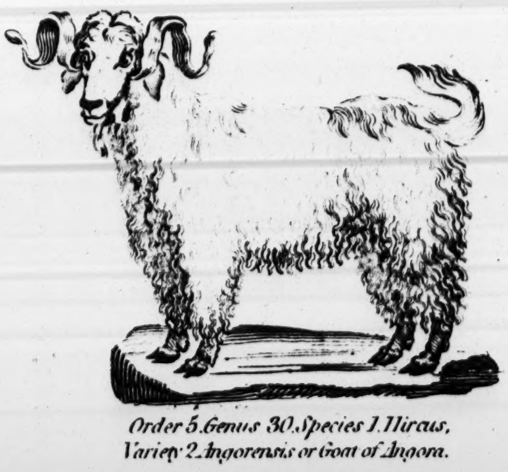

Order 5. Genus 29. Species 3.
Elaphus or Red Deer.

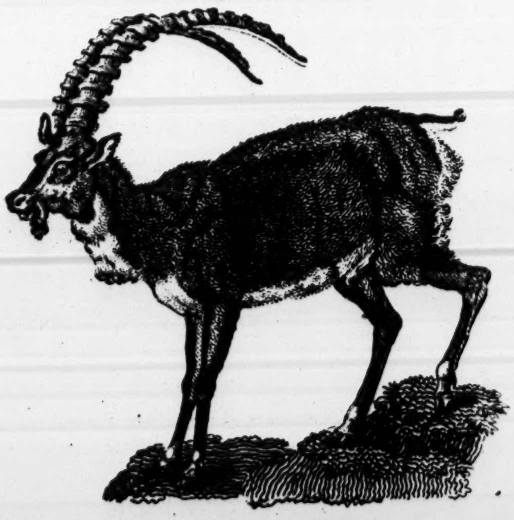

Order 5. Genus 29. Species 4.
Tarandus or Rein Deer.


Order 5. Genus 29. Species 5.
Dama or Fallow Deer.


Order 5. Genus 29. Species 6.
Capreolus or Roebuck.


Order 5. Genus 30. Species 1.
Hircus, Variety 1. Common Goat.


Order 5. Genus 30. Species 1. Hircus,
Variety 2. Angorensis or Goat of Angora.


Order 5. Genus 30 Species 2.
Ibex or Mountain Goat.

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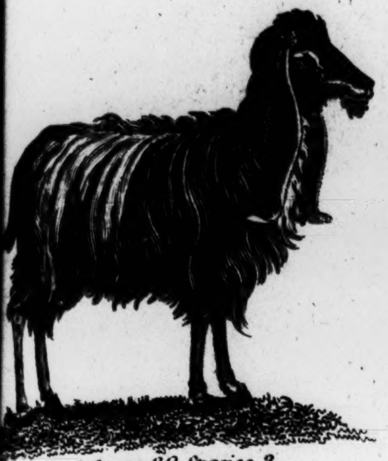
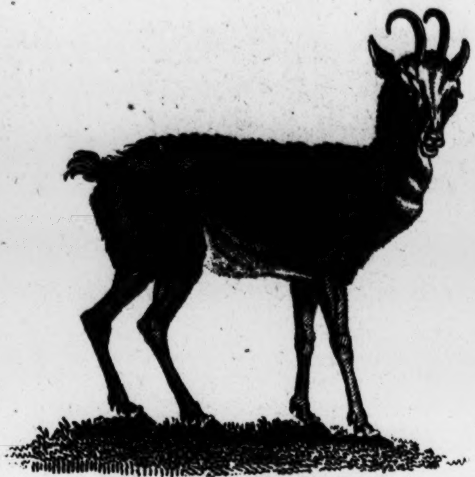
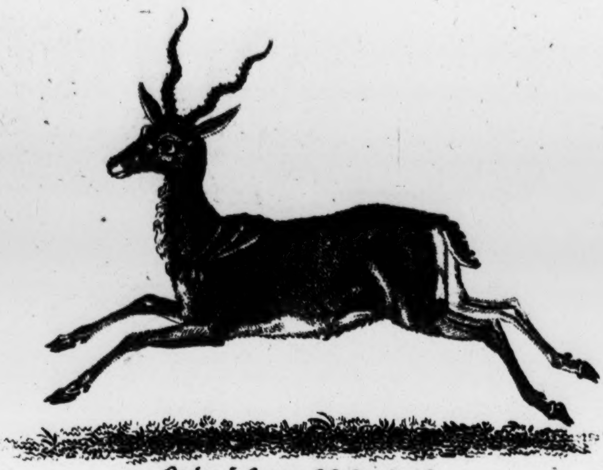
Class 1. Mammalia, Order 5. Pecora, Genus 30. Capra, Genus 31. Ovis, Genus 32. Bos. See System of Mammalia.



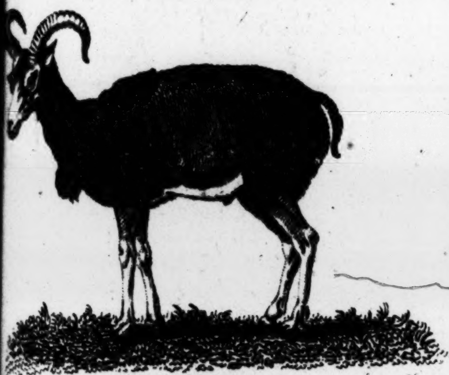
Order 5. Genus 30. Species 3.
Mambrina or Syrian Goat.



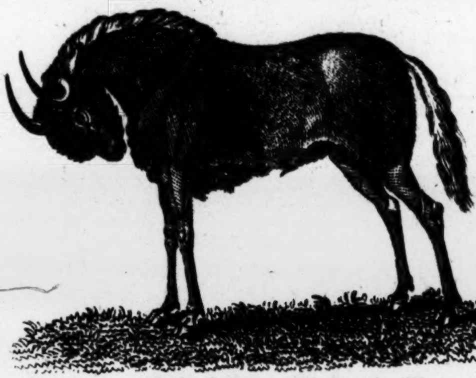
Order 5. Genus 30. Species 4.
Rupicapra or Chamois Goat.



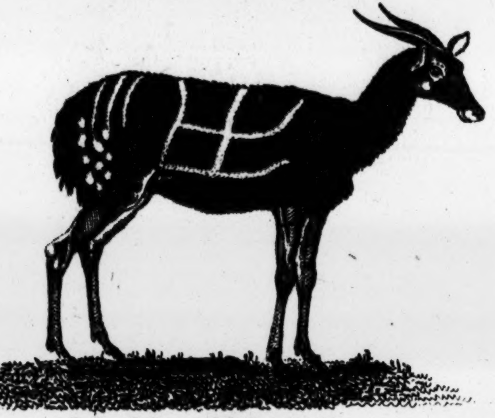
Order 5. Genus 30. Species 8.
Cerviacapra or Common Antelope.



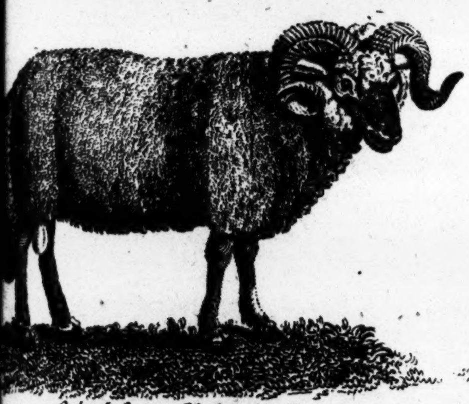
Order 5. Genus 30. Species 12.
Capra, Ammon or Musmon.



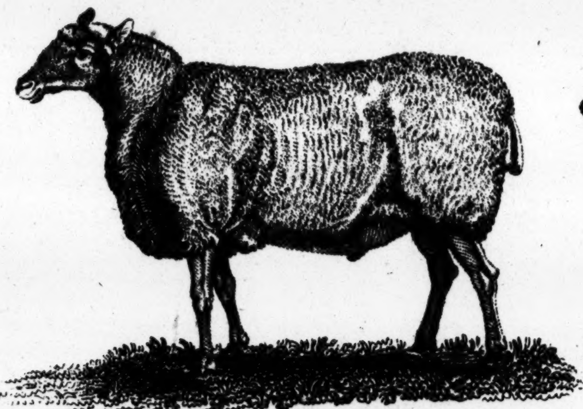
Order 5. Genus 30. Species 13.
Capra, Africanus or Gnu.



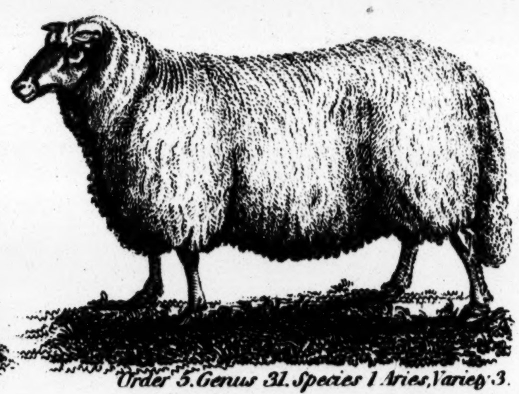
Order 5. Genus 30. Species 18.
Capra, Phaleratus or Pied Goat.



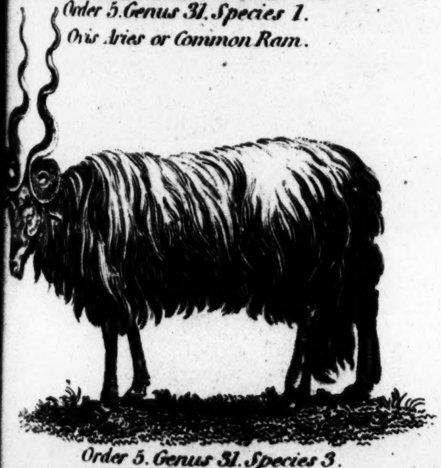
Order 5. Genus 31. Species 1.
Ovis Aries or Common Ram.



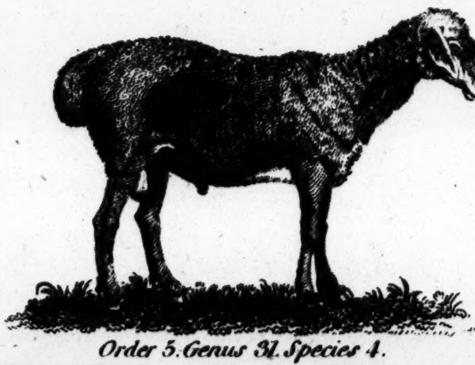
Order 5. Genus 31. Species 1. Aries, Variety 2.
Lincolniensis or Lincolnshire Ram.



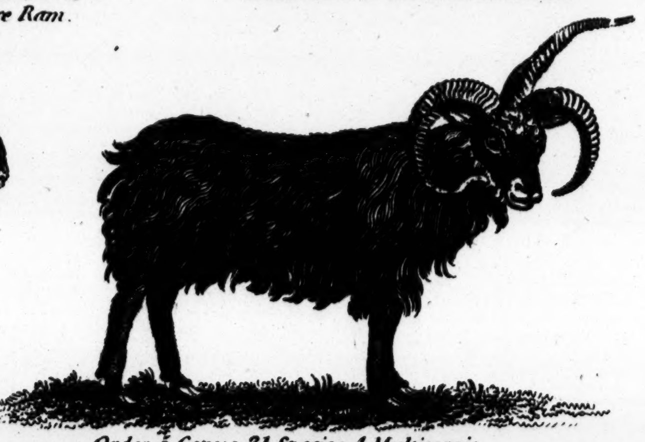
Order 5. Genus 31. Species 1 Aries, Variety 3.
Lesteriensis or Leicestershire Ram.



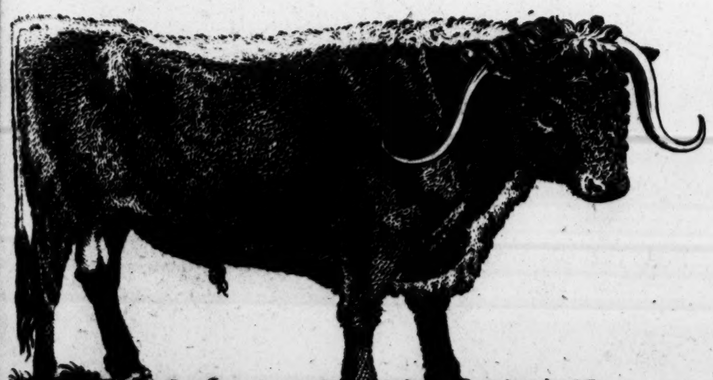
Order 5. Genus 31. Species 3.
Strepsiceros or Cretan Sheep.



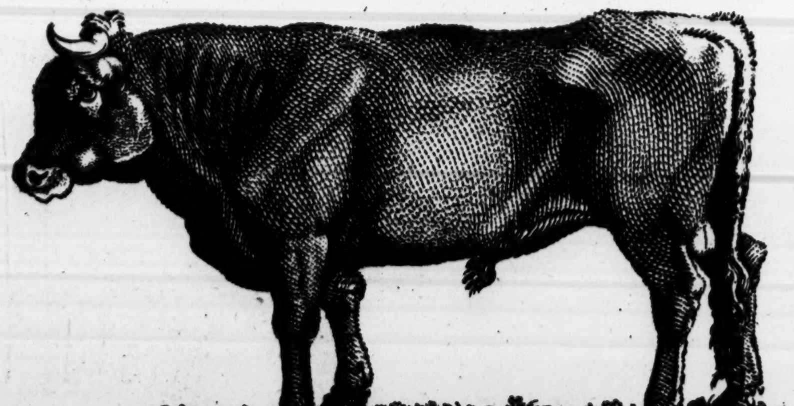
Order 5. Genus 31. Species 4.
Tartaricus or Tartarian Sheep.



Order 5. Genus 31. Species 4. Multicornis
or Many-horned Sheep.



Order 5. Genus 32. Species 1.
Bos, Taurus or Common Bull.



Order 5. Genus 32. Species 1. Taurus, Variety 2.
Lancastriensis or Lancashire Bull.

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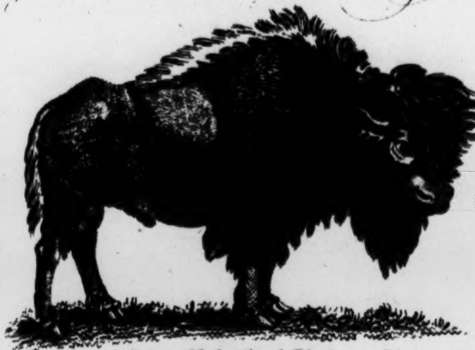
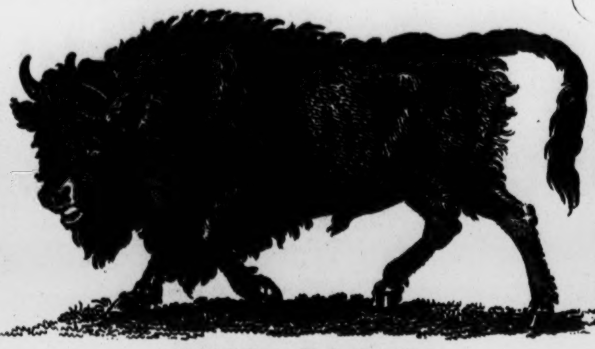
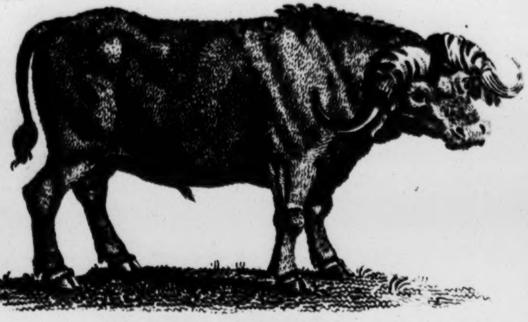
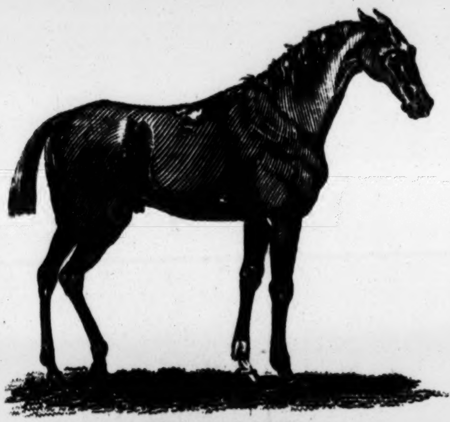
Plate 10.

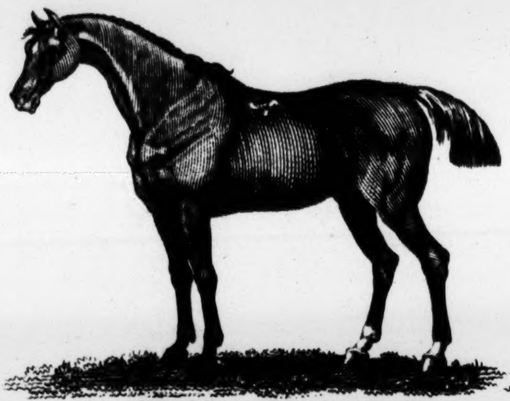
Claſs 1. Mammalia, Order 5. Pecora, Order 6. Belluæ, Genus 32. Bos, Genus 33. Equus, Genus 34. Hippopotamus, Genus 35. Sus, Genus 36. Rhinoceros. See System of Mammalia.

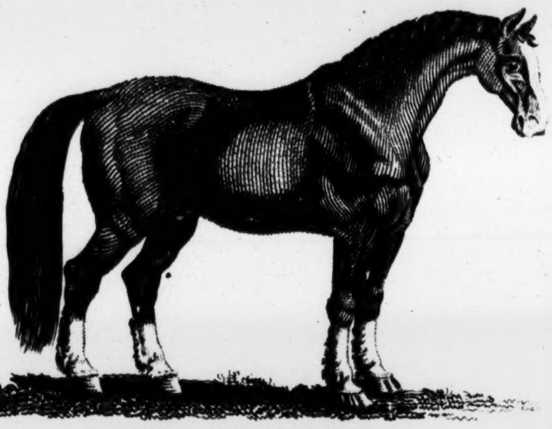

Order 5. Genus 32. Species 3. Bison
Asiaticus, or Wild Bull of Asia.

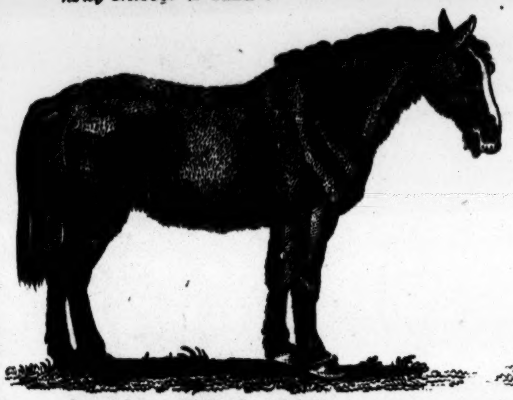

Order 5. Genus 32. Species 4. Urus
Europæus, or European Wild Bull.

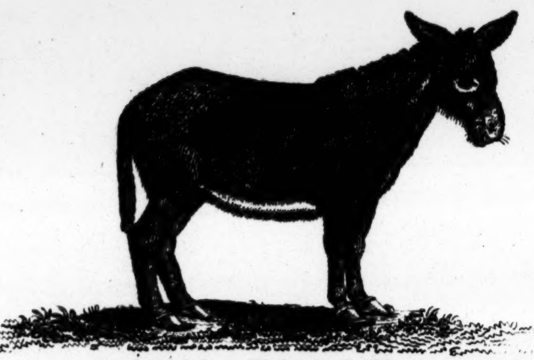

Order 5. Genus 32. Species 5.
Bubalis or Buffalo.

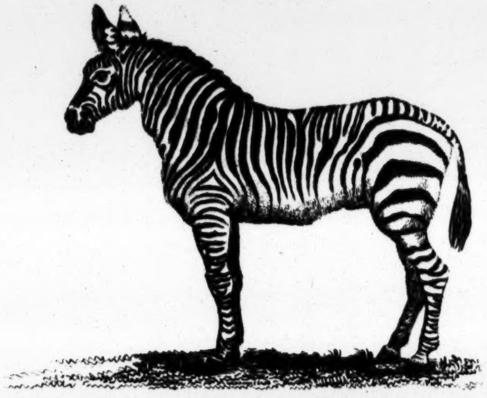

Order 6. Genus 33. Species 1. Caballus,
Variety 1. Cursor or Racer.

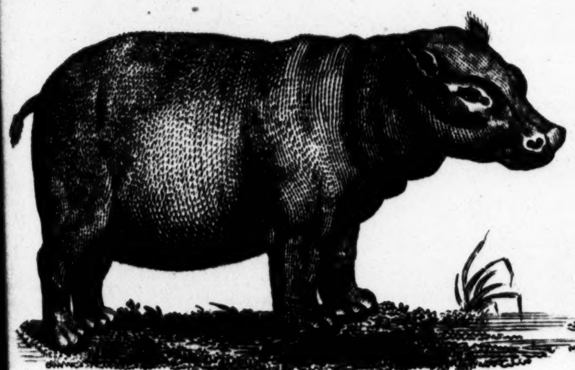

Order 6. Genus 33. Species 1 Caballus,
Variety 2. Venator or Hunter.

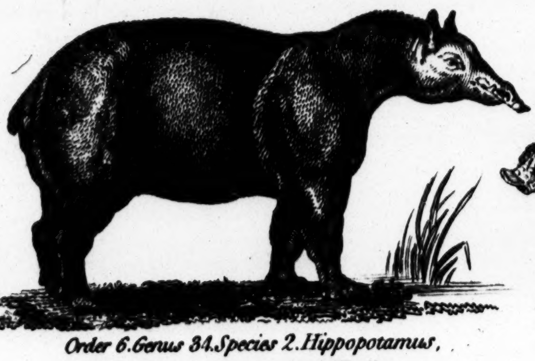

Order 6. Genus 33. Species 1. Caballus,
Variety 3. Jugalis or Draught Horse.

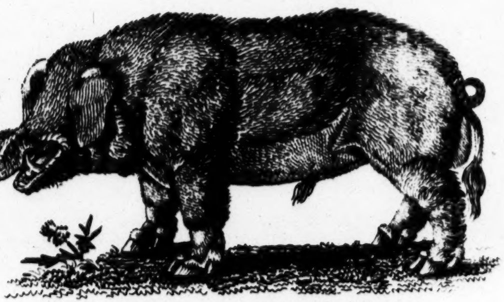

Order 6. Genus 33. Species 1. Caballus,
Variety 4. Jumentum or Cart Horse.

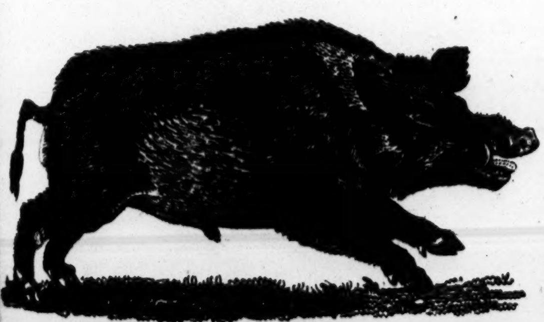

Order 6. Genus 33. Species 2. Asinus
Britannicus or British Aſs.

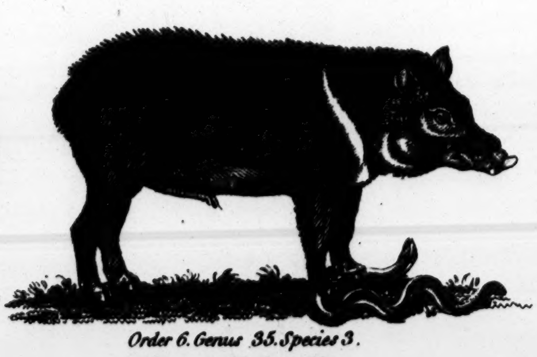

Order 6. Genus 33. Species 3
Zebra or African Aſs.

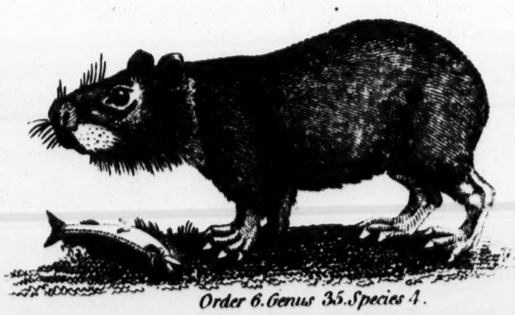

Order 6. Genus 34. Species 1. Hippopotamus,
Amphibius or Sea Horse.

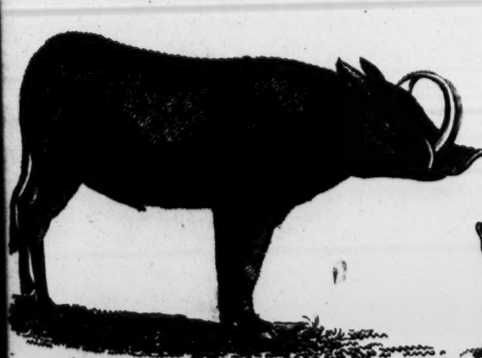

Order 6. Genus 34. Species 2. Hippopotamus,
Nasutus or Long-nosed Tapiir.

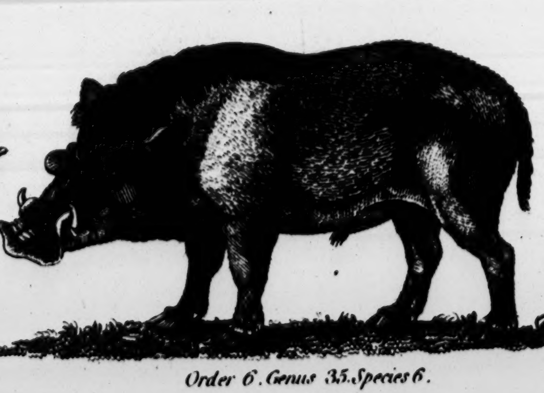

Order 6. Genus 35. Species 1. Scrofa,
Variety 1. Mansuetus or common Boar.

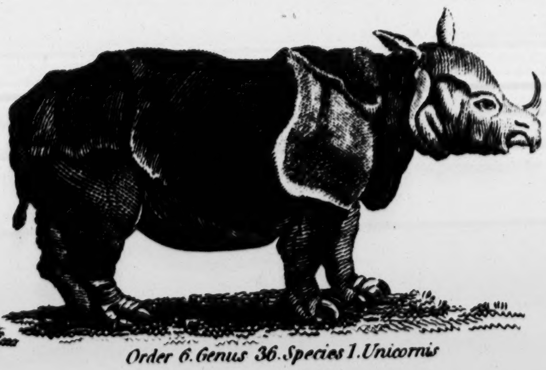

Order 6. Genus 35. Species 1. Scrofa,
Variety 2. Sylvestris or Wild Boar.


Order 6. Genus 35. Species 3.
Tajacu or Mexican Hog.


Order 6. Genus 35. Species 4.
Hydrochœris or River Hog.


Order 6. Genus 35. Species 5.
Babyruſsa or Babirouſsa.


Order 6. Genus 35. Species 6.
Ethiopicus or Ethiopian Boar.


Order 6. Genus 36. Species 1. Unicornis
or single horned Rhinoceros.

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BRITISH 18 MR 63 MUSEUM

variety of the Veſpertilio, or common Bat; at the ſame time we think it incumbent on us, to retain it in the order of claſſification, as well to avoid confuſion, as to preſerve an uniform adherence to the ſyſtem, as laid down by the immortal Linnæus. Had we omitted it, *Camelus* would have been the 26th, inſtead of the 27th genus, and *Moſchus* the 27th inſtead of the 28th, and ſo on to the cloſe of the Syſtem, by which means the whole order from genus 26, would have been perverted, and the Syſtem of courſe greatly deranged.

ORDER V. PECORA.

GENUS 27. CAMELUS. *Camel.* No horns; fore-teeth in the lower jaw 6. Canine 3 in the upper, 2 in the lower jaw. Upper lip cloven. Hoofs not divided through. This genus comprehends four ſpecies, viz. Dromedarius, Bactrianus, Glama, Pacos.

GENUS 28. MOSCHUS. *Muſk.* No horns; one canine tooth on each ſide in the upper jaw, ſtanding out of the mouth. There are three ſpecies of this genus, viz. Moſchiferus, Grimia, Pygmæus.

GENUS 29. CERVUS. *Deer.* Horns ſolid, branched, deciduous; no canine teeth. This genus comprehends ſeven ſpecies, viz. Camelopardalis, Alces, Elaphus, Tarandus, Dama, Capreolus, Guineenſis.

GENUS 30. CAPRA. *Goat.* Horns hollow, erect, bending back; no canine teeth. This genus comprehends twelve ſpecies, viz. Hircus, Ibex, Mambrica, Rupicapra, Depreſſa, Reverſa, Grazella, Cervicapra, Bezoartica, Dorcas, Tatarica, Ammon.

GENUS 31. OVIS. *Sheep.* Horns hollow, wrinkled, ſpiral; no canine teeth. This genus comprehends three ſpecies, viz. Aries, Guineenſis, Strepſiceros.

GENUS 32. BOS. *Ox.* Horns hollow, extending outwards, ſmooth; no canine teeth; a dewlap. This genus comprehends ſix ſpecies, viz. Taurus, Bonaſus, Biſon, Grunniens, Bubalis, Indicus.

ORDER VI. BELLUÆ.

GENUS 33. EQUUS. *Horſe.* Fore teeth 6 and 6. Canine ſingle, remote; hoofs undivided. There are three ſpecies of this genus, viz. Caballus, Aſinus, Zebra.

GENUS 34. HIPPOPOTAMUS. *River Horſe.* Fore teeth 6 above, and 4 below; canine ſingle and truncated. Profeſſor Martin and Mr. Pennant deſcribe this animal as having only four cutting teeth above and below. There is but one ſpecies of this genus, viz. Amphibius.

GENUS 35. SUS. *Hog.* Fore teeth, 4 above 6 below; canine teeth 2 above and 1 below; the inferior ones ſtanding out of the mouth are called tuſks; ſnout long, truncated. This genus comprehends five ſpecies, viz. Scrofa, Porcus, Tajacu, Hydrochæris, Barbyruſſa.

GENUS 36. RHYNOCEROS. Fore teeth, two in each jaw on both ſides; horn ſolid, conical on the noſe. There is but one ſpecies of this genus, viz. Unicornis.

ORDER VII. CETE.

GENUS 37. MONODON. *Narwal.* Two long, ſtrait, ſpiral teeth, perforating the upper lip. There is but one ſpecies of this genus, viz. Monoceros.

GENUS 38. BALÆNA. *Whale.* Horny laminæ, inſtead of teeth in the upper jaw. This genus comprehends four ſpecies, viz. Myſticetus, Phyſalus, Boops, Muſculus.

GENUS 39. PHYSETER. *Cachalot.* Teeth in the lower jaw only. This genus comprehends four ſpecies, viz. Catodon, Macrocephalus, Microps, Turſio.

GENUS 40. DELPHINUS. *Dolphin.* Teeth in both jaws. There are three ſpecies of this genus, viz. Phocæna, Delphis, Orca.

Remarks on Natural Hiſtory in general.

In order more clearly to give the Reader a knowledge of this Claſs of Animals, called *Mammalia*, we ſhall point out its relation to the other parts of Natural Hiſtory, as by ſhewing the chain of connection, it will afford the Reader a better idea of the preceding ſubject.

Naturaliſts have in general agreed in dividing the works of the creation into three principal diviſions called kingdoms, viz. the *animal*, the *vegetable*, and the *mineral* kingdoms; and theſe again have by many other authors been each divided into claſſes, orders, genera and ſpecies. Linnæus, whoſe Syſtem we mean to adopt, has divided the animal kingdom into ſix claſſes as follow:

The firſt claſs called *Mammalia*, or animals which give ſuck, have the heart furniſhed with two ventricles, and two auricles, and their blood is warm and red; they are viviparous.

The ſecond claſs called *aves*, or birds, have the heart alſo furniſhed with two ventricles and two auricles; blood warm and red: theſe are oviparous.

The third claſs called *amphibia*, or amphibious animals, have the heart furniſhed with one ventricle and one auricle; their blood is cold and red, and they *reſpire voluntarily*.

The fourth claſs called *piſces*, or fiſhes, have one ventricle, and one auricle; their blood is cold and red, and they *breathe by gills*.

The fifth claſs called *inſecta*, or inſects, have one ventricle without an auricle, and are *antennated*.

The ſixth claſs called *vermes*, or worms, have one ventricle without an auricle, and are *tentaculated*.

Naturaliſts who write on plants call their works a Treatiſe on Botany, which comprehends the ſecond kingdom in Natural Hiſtory: thoſe who write on Minerals call their works a Treatiſe on Mineralogy, which comprehends the third kingdom: but in Zoology, which is the firſt kingdom, and comprehends all living animals, as quadrupeds, birds, fiſhes, amphibious animals, inſects, and worms, writers have, in conſequence of this kingdom being ſo extenſive, conſidered them as diſtinct ſtudies, and treated the ſeveral ſubjects ſeparately: as for inſtance, the Hiſtory of Quadrupeds, under the title of Tetrapodology, and ſome, particularly Linnæus, adopt that of Mammalia, to expreſs the ſame ſubject. The Hiſtory of Aves, or Birds, under that of Ornithology; the Hiſtory of Piſces, or Fiſhes, under Ichthyology; that of Amphibia, or Amphibious Animals, under the title of Amphibiology; that of Inſecta, or Inſects, under Entomology; and that of Vermes, or Worms, under Vermeology.

Review of Authors on the Subject.

The authors who have written on quadrupeds are numerous, and many of them very ancient; their accounts alſo are proved to be in many caſes imaginary or fabulous. Later authors have much improved the ſcience; and many valuable works are publiſhed in various languages on this ſubject. But as it would be impoſſible to do juſtice to the merits of each, we ſhall content ourſelves with mentioning principally thoſe of our own countrymen, which are chiefly in Engliſh, to which we ſhall ſubjoin a liſt of the ſcientific works that are moſt in uſe. Our valuable and much reſpected naturaliſt Ray's Synopſis of Quadrupeds, printed in London in 1693, is an excellent work. Edwards's Natural Hiſtory of Birds, publiſhed in 1750, and his Gleanings of Natural Hiſtory, 1758, 1760, and 1764, contain ſome excellent figures of quadrupeds. The Hiſtory of Animals by Dr. Hill, in folio, 1752, is not deſtitute of merit. The Natural Hiſtory of Carolina, by Mr. Cateſby, contains ſome few animals; but we are more particularly indebted to Mr. Pennant for his Britiſh Zoology, in folio, 1766; in 8vo. 1768; Pennant's Indian Zoology, 4to 1769. Synopſis of Quadrupeds, October 1771. To theſe we may add the outlines of Natural Hiſtory of Great Britain and Ireland, by Dr. Berkenhout, and the Hiſtory of the Earth, and animated Nature, by Dr. Goldſmith; and above all, a general Hiſtory of Quadrupeds with wooden figures, engraved by T. Bewick, publiſhed lately at Newcaſtle upon Tyne; a work that muſt immortalize the name of the engraver, and give an excellent outline to the reader of this branch of knowledge. The Syſtema Naturæ, and Fauna Suecica of Linnæus, are moſt excellent ſyſtematic books; and much uſeful information may be acquired from the Elements of Natural Hiſtory, by our Botanic Profeſſor at Cambridge, Mr. Thomas Martyn, B. D. The elaborate work of Buffon and Daubenton, in 15 quarto volumes, has great merit, and proves the indefatigable induſtry and patient perſeverance of thoſe celebrated men.

The ſyſtem of Mr. Ray obtained very generally among naturaliſts, till, in the year 1735, Linnæus firſt publiſhed his Syſtem. This was followed by ſeveral others, varying in the arrangement of the animal kingdom, even to the laſt edition of 1767. Under the claſs, which he denominates MAMMALIA, he comprehends not only all the animals which we call *quadrupeds* (the lizard genus, or rather the reptiles pedati excepted) but alſo the cetaceous order, or whales, cachalots, and porpoiſes: juſtifying this arrangement of whales with *quadrupeds*, from their agreement of theſe animals in the ſtructure of the heart, in the reſpiration by means of lungs, in their having moveable eye-lids and ears, in being viviparous, furniſhed with teeth, and other particulars, by which they differ ſo materially from fiſhes, as more than to counterbalance their living with them in the ſame element.

Mr. Pennant, in his Synopſis of *Quadrupeds*, and profeſſor Martin, in his Elements of Natural Hiſtory, by including ſome animals that were unknown to Linnæus, and giving the rank of ſpecies to ſeveral that were conſidered by him as varieties, have extended the number of mammalia to two hundred and eighty-nine ſpecies. Mr. Klein, in 1751, publiſhed a new ſyſtem of *quadrupeds*, intitled *Quadrup.* Diſpoſitio breviſque Hiſt. Natur. in which he diſtributes them into two orders, the firſt comprehending thoſe whoſe feet are terminated by one or more hoofs, and the ſecond thoſe which are digitated; and each of theſe orders is ſubdivided into five families or claſſes. In his firſt order he follows the general arrangement of Mr. Ray, which he has conſiderably improved: but in the ſecond, by a ſervile regard to a method founded on the number of toes, he has combined very oppoſite animals; the camel and the ſloth, the mole and the bat, the glutton and the ape.

Mr. Pennant has introduced ſome uſeful alterations in his Hiſtory of *Quadrupeds:* this ingenious naturaliſt has followed Mr. Ray in his greater diviſion of animals into *hoofed* and *digitated*; but, after the manner of Mr. Klein, he has formed ſeparate genera of the rhinoceros, hippopotamus, tapiir and muſk. The apes are continued in the rank in which Mr. Ray placed them, and are followed by the maucaucos. The carnivorous animals are arranged according to the ſyſtem of Linnæus, omitting the ſeal, mole, ſhrew, and hedge-hog. The herbivorous or frugivorous *quadrupeds* occupy the claſs aſſigned them by Mr. Ray, to which he has alloted likewiſe the ſhrew, the mole, and the hedge-hog. The fourth ſection of digitated *quadrupeds* conſiſts of thoſe which are abſolutely deſtitute of cutting teeth, ſuch as the ſloth and armadillo. The fifth ſection is formed of thoſe which are deſtitute of teeth of every kind, ſuch as the manis and ant-eater. The third and fourth orders or diviſions which Mr. Pennant has added, are the *pinnated* and the *winged quadrupeds*; the firſt comprehends the walrus, the ſeals, and (in conformity to preceding writers) the manati. But theſe, he obſerves, ſeem as the links between the *quadrupeds* and the cetaceous animals. The bats are *winged quadrupeds*, and form the next gradation from this to the claſs of birds. See Pennant's Hiſt. of *Quadrupeds*, ed. 8vo. 1781. Preface.

Some Naturaliſts object to the method adopted by Ray and others, of dividing animals into *ſanguineous*, or ſuch as have blood, and *exſanguineous*, or ſuch as have no blood, alleging that all animals are ſanguineous, ſince all have a vital fluid circulating through veins and arteries, though it be not of a red colour in all; the eſſential character of the blood is not in its crimſon colour, but in its office: in which view every fluid, by whoſe motion through veſſels the life of an animal is ſuſtained, may be denominated *blood.* But this is rather a diſpute about words than things.

M. Briſſon in 1756 publiſhed a ſyſtem, in which he has arranged animals by the number or defect of their teeth; beginning with thoſe that are toothleſs, ſuch as the ant-eater, and ending with thoſe that have the greateſt number, ſuch as the opoſſum. By this arrangement, ſome *quadrupeds*, very diſtant from each other in their manners, are too nearly connected. We ſhall ſay nothing of M. Buffon's Hiſtory of *Quadrupeds*, though it contains much valuable information; but he has diſregarded ſyſtematic arrangement.

Concluſive Remarks.

All theſe treaſures of nature, ſo artfully contrived, ſo wonderfully propagated, ſo providentially ſupported throughout her three kingdoms, ſeem intended by the Creator for the ſake of man. Every thing may be made ſubſervient to his uſe, if not immediately, yet mediately; not ſo to that of other animals. By the help of reaſon man tames the fierceſt animals; purſues and catches the ſwifteſt; nay, he is able to reach even thoſe which lie hid in the bottom of the ſea.

By the help of reaſon, he increaſes the number of vegetables immenſely; and does that by art, which nature, left to herſelf, could ſcarcely effect. By ingenuity he obtains from vegetables whatever is convenient or neceſſary for food, drink, cloathing, medicine, navigation, and a thouſand other purpoſes.

He has found the means of going down into the abyſs of the earth, and almoſt ſearching its very bowels. With what artifice has he learned to get fragments from the moſt rocky mountains, to make the hardeſt ſtones fluid like water, to ſeparate the uſeful metal from the uſeleſs droſs, and to turn the fineſt ſand to ſome uſe!

When we follow the ſeries of created things, and conſider how providentially one is made for the ſake of another, the matter comes to this, that all things are made for the ſake of man; and for this end more eſpecially, that he, by admiring the works of the Creator, ſhould extol his glory; and at once enjoy all thoſe things of which he ſtands in need, in order to paſs his life conveniently and pleaſantly.

This ſubject concerning the works of nature, a very ſmall part of which we have been able to touch upon, is of ſuch importance and dignity, that if it were to be properly treated in all its parts, men would find wherewithal to employ almoſt all the powers of the mind. Nay, time itſelf would fail before even the moſt acute human ſagacity would be able to diſcover the moſt amazing œconomy, laws, and exquiſite ſtructure, of the leaſt inſect; ſince, as Pliny obſerves, nature no where appears more herſelf than in her moſt minute works.

Summary as it is, however, the preceding view, as it were in a map of one of the parts of nature, its connections and dependencies may, among other uſes, convey an uſeful leſſon, and ſuch an one as the beſt of us often need to have inculcated.

From a partial conſideration of things, we are very apt to criticiſe what we ought to admire; to look upon as uſeleſs what perhaps we ſhould own to be of infinite advantage to us, did we ſee a little farther; to be peeviſh where we ought to give thanks; and at the ſame time to ridicule thoſe who employ their time and thoughts in examining what we were (i. e. ſome of us moſt aſſuredly were) created and appointed to ſtudy. In ſhort, we are too apt to treat the Almighty worſe than a rational man would treat a good mechanic, whoſe works he would either thoroughly examine, or be aſhamed to find any fault with them. This is the effect of a partial conſideration of nature; but he who has the candour of mind and leiſure to look farther, will be inclined to cry out,

> How wond'rous is this ſcene! where all is form'd
> With number, weight, and meaſure! all deſign'd
> For ſome great end! where not alone the plant
> Of ſtately growth; the herb of glorious hue,
> Or food-full ſubſtance; not the labouring ſteed;
> The herd, and flock, that feed us; not the mine
> That yields us ſtores for elegance, and uſe;
> The ſea that loads our table, and conveys
> The wanderer man from clime to clime; with all
> Thoſe rolling ſpheres, that from on high ſhed down
> Their kindly influence: not theſe alone,
> Which ſtrike ev'n eyes incurious; but each moſs,
> Each ſhell, each crawling inſect, holds a rank
> Important in the plan of Him who fram'd
> This ſcale of beings; holds a rank, which loſt
> Would break the chain, and leave behind a gap
> Which nature's ſelf would rue. Almighty Being,
> Cauſe and ſupport of all things, can I view
> Theſe objects of my wonder, can I feel
> Theſe fine ſenſations, and not think of Thee?
> Thou who doſt thro' th' eternal round of time,
> Doſt thro' th' immenſity of ſpace exiſt
> Alone, ſhalt thou alone excluded be
> From this thy univerſe? Shall feeble man
> Think it beneath his proud philoſophy
> To call for thy aſſiſtance, and pretend
> To frame a world, who cannot frame a clod?—
> Not to know thee, is not to know ourſelves——

There are an immenſe number of animals upon the face of the globe, whoſe uſes are at preſent unknown to us; ſuch is the rhinoceros, hippopotamus, camelopardalis, the whole race of apes, monkeys, baboons, and many others; but to preſume that theſe animals are uſeleſs, would be a kind of blaſphemy, little ſhort of leſſening the works of the infinite Creator, and bringing them to a level with our finite ideas. Let us therefore earneſtly purſue the ſubject; the volume of nature is open to us; let us ſtudy it attentively; let us reaſon on what we have to learn by comparing it with what we know; and we ſhall inevitably find a regular ſeries of perfect order, diſpoſed by an unerring hand, acted upon by ſuperlative wiſdom, and renewed and perfected by divine love.

In this Syſtem we have not entered into a general deſcription of all the Animals which compoſe this part of Natural Hiſtory; *but have confined ourſelves to a curſory view of their reſpective uſes, &c. Had we entered here into their mode of propagation, living, form, colour, diſpoſition, &c. it would in a great meaſure have perverted the intention of our plan, which was principally deſigned to give the Claſſification abſtractedly, and thereby to convey to our Readers a clearer knowledge of the ſyſtematical arrangement. It was therefore deemed more eligible to give their peculiarities under their reſpective Generic names. Should any of our readers wiſh to have a knowledge of the particulars above alluded to, they are referred to the various Genera of the ſeveral Orders, as they are inſerted in the courſe of the Alphabet, in which is included an enumeration of the ſeveral Species of each reſpective Genus.*

For particular information concerning the Claſſification of the other branches of Zoology, ſee the other Claſſes which compoſe the animal kingdom, under the titles of Ornithology, Ichthyology, Entomology, Vermeology, &c.

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T. L'LOYD.

MAMMON, the god of riches, according to ſome authors; though others deny that the word ſtands for ſuch a deity, and underſtand by it only *riches* themſelves. Our Saviour ſays, We *cannot ſerve God and mammon*; that is, be religious and worldly minded at the ſame time. Our poet Milton makes mammon to be one of the fallen angels, and gives us his character in the following lines:

> Mammon, the leaſt erected ſpirit that fell
> From heav'n: for ev'n in heaven his looks and thoughts
> Were always downward bent; admiring more
> The riches of heav'n's pavement, trodden gold,
> Than ought divine, or holy elſe enjoy'd,
> In beatific viſion: by him firſt
> Man alſo, and by his ſuggeſtion taught,
> Ranſack'd the centre, and with impious hands
> Rifled the bowels of their mother earth,
> For treaſures better hid. Soon had his crew
> Open'd into the hills a ſpacious wound,
> And digg'd out ribs of gold. Let none admire,
> That riches grow in hell; that ſoil may beſt
> Deſerve the precious bane.

MAN, HOMO, in zoology, is juſtly reckoned at the head of the animal part of the creation; making a diſtinct genus of that order of quadrupeds, which Linnæus calls *anthropomorpha*, from their reſemblance to the human form. The ſame author diſtinguiſhes the race of mankind, according to their different colours, into the Europeans, or white men; the Americans, or ruddy-coloured men; the Aſiatics, or tawney-coloured men; and thoſe of Africa, or blacks.

Noſce teipſum, "Know thyſelf," is a precept worthy of the law giver of Athens, the ancient ſeat of polite literature; an important branch of knowledge, which may be reduced to the following heads: 1. In a religious view, *theologicè*, that you was created with an immortal ſoul, after the image of God. 2. In a moral ſenſe, *moraliter*, that you alone was bleſſed with a rational ſoul, to be employed to the praiſe of the Creator. 3. With reſpect to the other works of the creation, *naturaliter*, that you are conſtituted their lord, for whoſe uſe they are made. 4. In a phyſiological ſenſe, *phyſiologicè*, the moſt perfect and amazing fabric of your body. 5. With regard to diet, *diæteticè*, what things are uſeful, and what hurtful, in this reſpect. 6. In a pathological ſenſe, *pathologicè*, how frail you are, and how ſubject to a thouſand calamities. Theſe are the heads which, according to Linnæus, comprehend the knowledge of man, conſidered as an individual; a branch of knowledge ſo eſſential to the human race, that, without it, he ſeems to doubt whether any other characters be ſufficient to entitle one to be ranked among mankind: for he adds, *Hæc ſi noveris*, HOMO *es, et à reliquis animalibus diſtinctiſſimum genus*. The whole of this work may, in ſome reſpect, be accounted an analyſis of MAN; as comprehending his knowledge of God, of himſelf, and of natural and artificial objects. See HOMO.

MANATI, or ſea cow, in zoology, a ſpecies of the genus Trichecus. For deſcription, ſee TRICHECUS. For claſſification, ſee Syſtem of MAMMALIA. For repreſentation, ſee the Plates Genus 6.

MANDAMUS, in law, a writ that iſſues out of the court of king's-bench, ſent to the corporation, commanding them to admit or reſtore a perſon to his office. This writ alſo lies where juſtices of the peace refuſe to admit a perſon to take the oaths in order to qualify himſelf for enjoying any poſt or office; or where a biſhop or archdeacon refuſes to grant a probate of a will, to admit an executor to prove it, or to ſwear a church-warden, &c.

MANDARIN, a name given to the nobility and magiſtracy of the eaſtern countries, eſpecialy to thoſe of China. The word *mandarin* is unknown in this ſenſe among the Chineſe, who in lieu thereof, call their grandees and magiſtrates *quan*, or *quan fa*, q. d. ſervant or miniſter of a prince. There are in China nine orders of *mandarins*, or nine degrees of nobility; which have as many different animals for their characteriſtics. The firſt is diſtinguiſhed by a crane, the ſecond by a lion, the third by an eagle, the fourth by a peacock, &c. There are in all thirty-two or thirty-three thouſand *mandarins* in China. There are *mandarins* of letters, and *mandarins* of arms; both the one and the other of which paſs ſeveral examinations: beſides civil *mandarins*, or thoſe of juſtice. Since the time that the Tartars have rendered themſelves maſters of China, moſt of the tribunals, or courts of juſtice, &c. inſtead of one *mandarin* for a preſident, have two, the one a Tartar, and the other a Chineſe. The *mandarinate* is not hereditary, nor are any raiſed to it but men of letters.

MANDARIN is alſo a name which the Chineſe give to the learned language of the country. Beſides the proper and peculiar language of each nation and province, they have one common to all the learned men in the empire. This they call the *mandarine* tongue, or the language of the court. Their public officers, as notaries, lawyers, judges, and chief magiſtrates, write and ſpeak the *mandarin*.

MANIA, *madneſs*, in medicine, the moſt violent and acute ſpecies of delirium, ariſing from a perturbation of the imagination and judgment. See the Syſtem.

MANIFESTO; a public declaration made by a prince in writing, ſhowing his intentions to begin a war or other enterpriſe, with the motives that induce him to it, and the reaſons on which he founds his rights and pretenſions.

MANIS, the *Scaly Lizard*, in zoology, a genus of quadrupeds belonging to the order of bruta. There are two ſpecies: the firſt of which is the pentadactyla, or ſcaly lizard, with five toes on each foot. The head is ſmaller than the neck; the eyes are very ſmall; the length of the body including the tail, is from ſix to eight feet. The whole body is covered with hard ſcales, excepting the under part of the head and neck, the breaſt, the belly, and the internal ſide of each leg. Betwixt the ſcales of this animal there are ſome hairs like the briſtles of a hog, browniſh at the points. The ſcales are of a reddiſh colour, very hard, convex above, and concave below. The ſcales are unconnected; and the animal can raiſe or lower them at pleaſure, like the quills of the porcupine. When irritated, he erects his ſcales, and rolls himſelf up like a hedge-hog. In this ſituation, neither the lion, tiger, nor any other animal can hurt him. It is a mild inoffenſive creature, is ſlow of motion, and has no other method of eſcaping the purſuit of man, but by concealing himſelf in crannies of rocks, and in holes which they dig in the ground, and where they likewiſe bring forth their young. It is a native of the Eaſt Indies, and is very rare. It lives in woods and marſhy places; feeds on ants, which it takes by laying its long tongue acroſs their paths, which is covered with a viſcous ſaliva, ſo that the inſects which attempt to paſs over it cannot extricate themſelves.

The ſecond is the tetradactyla, or ſcaly lizard, with four toes on each foot. This ſpecies is very ſimilar to the former; only the tail of it is much longer in proportion to the body; and ſuch parts as want ſcales, inſtead of being naked, are covered with a ſoft hair. It is alſo found in the Eaſt Indies. For claſſification, ſee Syſtem of MAMMALIA. For repreſentation, ſee the Plates, Genus 9.

MANNA, in the materia medica, the juice of certain trees of the aſh kind, either naturally concreted on the plants, or exſiccated and purified by art. There are ſeveral ſorts of manna in the ſhops. The larger pieces, called *flake manna*, are uſually preferred; though the ſmaller grains are equally good, provided they are white, or of a pale yellow colour; very light, of a ſweet, not unpleaſant taſte. Manna is a mild, agreeable laxative; and may be given with ſafety to children and pregnant women: nevertheleſs, in ſome particular conſtitutions, it acts very unkindly, producing flatulencies and diſtenſions of the viſcera: theſe inconveniencies may be prevented by the addition of any grateful warm aromatic. It operates ſo weakly, that it does not produce the full effect of a cathartic, unleſs taken in large doſes; and hence it is rarely given in this intention by itſelf. It may be commodiouſly diſſolved in the purging mineral waters, or joined to the cathartic ſalts, ſenna, rhubarb, or the like. Geoffroy recommends acuating it with a few grains of emetic tartar: by this management, he ſays, bilious ſerum will be plentifully evacuated, without any nauſea, gripes, or other inconvenience.

MANNER, in painting, a habitude that a man acquires in the three principal parts of painting, the management of colours, lights and ſhadows; which is either good or bad according as the painter has practiſed more or leſs after the truth, with judgment and ſtudy. But the beſt painter is he who has no manner at all. The good or bad choice he makes is called *goute*, or taſte.

MANNERS, the plural noun, has various ſignifications; as, The general was of life, the morals, or habits, of any perſon or people; alſo, Ceremonious behaviour, or ſtudied civility. See the next article.

Good MANNERS, according to Swift, is the art of making thoſe people eaſy, with whom we converſe. Whoever makes the feweſt perſons uneaſy, is the beſt bred in the company. As the beſt law is founded upon reaſon, ſo are the beſt manners. And as ſome lawyers have introduced unreaſonable things into common law; ſo likewiſe many teachers have introduced abſurd things into common good manners. One principal point of this art is to ſuit our behaviour to the three ſeveral degrees of men; our ſurperiors, our equals, and thoſe below us. For inſtance, to preſs either of the two former to eat or drink, is a breach of manners; but a tradeſman or a farmer muſt be thus treated, or elſe it will be difficult to perſuade them that they are welcome. Pride, ill-nature, and want of ſenſe, are the three great ſources of ill-manners: without ſome one of theſe defects, no man will behave himſelf ill for want of experience; or of what, in the language of fools, is called *knowing the World*.

"I defy (proceeds our author) any one to aſſign an incident wherein reaſon will not direct us what we are to ſay or to do in company, if we are not miſled by pride or ill-nature. Therefore, I inſiſt that good ſenſe is the principal foundation of good manners; but becauſe the former is a gift which very few among mankind are poſſeſſed of, therefore all the civilized nations of the world have agreed upon fixing ſome rules for common behaviour, beſt ſuited to their general cuſtoms, or fancies, as a kind of artificial good-ſenſe to ſupply the defects of reaſon. Without which, the gentlemanly part of dunces would be perpetually at cuffs, as they ſeldom fail when they happen to be drunk, or engaged in ſquabbles about women or play. And, God be thanked, there hardly happeneth a duel in a year, which may not be imputed to one of thoſe three motives. Upon which account, I ſhall be exceedingly ſorry to find the legiſlature make any new laws againſt the practice of duelling; becauſe the methods are eaſy, and many, for a wiſe man to avoid a quarrel with honour, or engage in it with innocence. And I can diſcover no political evil in ſuffering bullies, ſharpers, and rakes, to rid the world of each other by a method of their own, where the law hath not been able to find an expedient.

"As the common forms of good-manners were intended for regulating the conduct of thoſe who have weak underſtandings; ſo they have been corrupted by the perſons for whoſe uſe they were contrived. For theſe people have fallen into a needleſs and endleſs way of multiplying ceremonies, which have been extremely troubleſome to thoſe who practiſe them, and inſupportable to every body elſe; inſomuch that wiſe men are often more uneaſy at the over-civility of theſe refiners, than they could poſſibly be in the converſations of peaſants or mechanics.

"The impertinencies of this ceremonial behaviour are no where better ſeen than at thoſe tables where ladies preſide, who value themſelves upon account of their good-breeding; where a man muſt reckon upon paſſing an hour without doing any one thing he hath a mind to, unleſs he will be ſo hardy as to break through all the ſettled decorum of the family. She determineth what he loveth beſt, and how much he ſhall eat; and if the maſter of the houſe happeneth to be of the ſame diſpoſition, he proceedeth in the ſame tyrannical manner to preſcribe in the drinking part: at the ſame time you are under the neceſſity of anſwering a thouſand apologies for your entertainment. And although a good deal of this humour is pretty well worn off among many people of the beſt faſhion, yet too much of it ſtill remaineth, eſpecially in the country; where an honeſt gentleman aſſured me, that having been kept four days againſt his will at a friend's houſe, with all the circumſtances of hiding his boots, locking up the ſtable, and other contrivances of the like nature, he could not remember, from the moment he came into the houſe, to the moment he left it, any one thing wherein his inclination was not directly contradicted; as if the whole family had entered into a combination to torment him. But, beſides all this, it would be endleſs to recount the many fooliſh and ridiculous accidents I have obſerved among theſe unfortunate proſelytes to ceremony. I have ſeen a ducheſs fairly knocked down by the precipitancy of an officious coxcomb running to ſave her the trouble of opening a door. Monſieur Buys, the Dutch envoy, whoſe politics and manners were much of a ſize, brought a ſon with him about 13 years old, to a great table at court. The boy and his father, whatever they put on their plates, they firſt offered round in order, to every perſon in the company; ſo that we could not get a minute's quiet during the whole dinner. At laſt their two plates happened to encounter, and with ſo much violence, that, being china, they broke in twenty pieces, and ſtained half the company with wet ſweetmeats and cream.

"There is a pedantry in manners as in all arts and ſciences, and ſometimes in trades. Pedantry is properly the over-rating any kind of knowledge we pretend to, and if that kind of knowledge be a trifle in itſelf, the pedantry is the greater. For which reaſon I look upon fiddlers, dancing maſters, heralds, maſters of the ceremony &c. to be greater pedants than Lipſius, or the elder Scaliger. With theſe kinds of pedants, the court, while I knew it, was always plentifully ſtocked: I mean from the gentleman uſher (at leaſt) incluſive, downward to the gentleman-porter; who are, generally ſpeaking, the moſt inſignificant race of people that this iſland can afford, and with the ſmalleſt tincture of good-manners, which is the only trade they profeſs. For being wholly illiterate, converſing chiefly with each other, they reduce the whole ſyſtem of breeding within the forms and circles of their ſeveral offices: and as they are below the notice of miniſters, they live and die in court under all revolutions, with great obſequiouſneſs to thoſe who are in any degree of credit or favour, and with rudeneſs and inſolence to every body elſe. From whence I have long concluded, that good-manners are not a plant of the court-growth: for if they were, thoſe people who have underſtandings directly of a level for ſuch acquirements, and who have ſerved ſuch long apprenticeſhips to nothing elſe, would certainly have picked them up. For as to the great officers who attend the prince's perſon or councils, or preſide in his family, they are a tranſient body, who have no better a title to good-manners than their neighbours, nor will probably have recourſe to gentlemen-uſhers for inſtruction. So that I know little to be learned at court on this head, except in the material circumſtance of dreſs; wherein the authority of the maids of honour muſt indeed be allowed to be almoſt equal to that of a favourite actreſs.

"I remember a paſſage my lord Bolingbroke told me: that going to receive prince Eugene of Savoy at his landing, in order to conduct him immediately to the queen, the prince ſaid he was much concerned that he could not ſee her majeſty that night: for Monſieur Hoffman (who was then by) had aſſured his highneſs, that he could not be admitted into her preſence with a tied-up periwig; that his equipage was not arrived; and that he had endeavoured in vain to borrow a long one among all his valets and pages. My lord turned the matter to a jeſt, and brought the prince to her majeſty: for which he was highly cenſured by the whole tribe of gentlemen-uſhers; among whom Monſieur Hoffman, an old dull reſident of the emperor's, had picked up this material point of ceremony; and which, I believe, was the beſt leſſon he had learned in five and twenty years reſidence.

"I make a difference between *good-manners* and *good-breeding*; although, in order to vary my expreſſion, I am ſometimes forced to confound them. By the firſt, I only underſtand the art of remembering, and applying, certain ſettled forms of general behaviour. But *good-breeding* is of a much larger extent: for beſides an uncommon degree of literature ſufficient to qualify a gentleman for reading a play, or a political pamphlet, it taketh in a great compaſs of knowledge; no leſs than that of dancing, fighting, gaming, making the circle of Italy, riding the great horſe, and ſpeaking French; not to mention ſome other ſecondary or ſubaltern accompliſhments, which are more eaſily acquired. So that the difference between good-breeding and good-manners lieth in this, That the former cannot be attained to by the beſt underſtandings without ſtudy and labour; whereas a tolerable degree of reaſon will inſtruct us in every part of good-manners without other aſſiſtance.

MANOEUVRE, in a military ſenſe, conſiſts ſolely in diſtributing equal motion to every part of a body of troops, to enable the whole to form, or change their poſition, in the moſt expeditious and beſt method, to anſwer the purpoſes required of a battalion, brigade, or line, of cavalry, artillery, or infantry. It has always been lamented, that men have been brought on ſervice without being informed of the uſes of the different manœuvres they have been practiſing; and, having no ideas of any thing but the uniformity of the parade, inſtantly fall into diſorder and confuſion when they looſe the ſtep, or ſee a deviation from the ſtraight lines they have been accuſtomed to at exerciſe. It is a pity to ſee ſo much attention given to ſhew, and ſo little to inſtruct the troops in what may be of uſe to them in real ſervice. No manœuvre ſhould be executed in preſence of the enemy, unleſs protected by ſome diviſion of the troops.

MANOR, or **MANNOR**, an ancient lordſhip, or royalty; conſiſting of demeſnes and ſervices, and of a court-baron, as incident thereto. *Manor* is the ſame with what was formerly called *baronia, barony*. A *manor* is a kind of noble fee, granted out partly to tenants, for certain ſervices to be performed, and partly reſerved to the uſe of the lord's family; with juriſdiction over his tenant, for the lands, or eſtates, held of him. For the original of *manors*, we are told there was anciently a certain compaſs of ground, granted by the king to ſome men of worth, for him and his heirs to dwell upon, and to exerciſe ſome juriſdiction, more or leſs, within that circuit, ſuch as he thought good to grant; but performing ſuch ſervices and paying ſuch yearly rent, as by this grant was required. Now the lord afterwards parcelling the ſame to other meaner men, received rent and ſervices from them, and by that means, as he became tenant to the king, the inferiors became tenants to him. But at this time a *manor* rather ſignifies a juriſdiction, and royalty incorporeal, than the land and ſuit: for a man may now have a *manor* in groſs, i. e. the right and intereſt of a court baron, with the perquiſites, and another enjoy every foot of land belonging to it.

MANSLAUGHTER, is a ſpecies of felonious homicide, and denotes the unlawful killing of a man, without any malice, either expreſs or implied; which may be either voluntarily, upon a ſudden heat; or involuntarily, but in the commiſſion of ſome unlawful act. As when two perſons, who before meant no harm to one another, falling out on ſome ſudden occaſion, the one kills the other; this is voluntarily *manſlaughter*. But in this and every other caſe of homicide upon provocation, if there be a ſufficient time for paſſion to ſubſide, and reaſon to interpoſe, and the perſon provoked afterwards kills the other, this is deliberate revenge, and amounts to *murder*. When a workman flings down a ſtone or piece of timber into a ſtreet, and kills a man; this may be either miſadventure, *manſlaughter*, or murder, according to the circumſtances attending it: if it were in a country village, and he calls out to all people to have a care, it is miſadventure only; but if it were in London, or other populous towns, where people are continually paſſing by, it is *manſlaughter*, though he gives loud warning; and murder, if he knows of their paſſing, and gives no warning at all.

MANTIS, in entomology, a genus belonging to the order of Hemiptera. For the claſſification, ſee the Syſtem.

MANTLE, or **MANTLING**, in heraldry, that appearance of folding of cloth, flouriſhing, or drapery, that is in any atchievement drawn about the coat of arms. See the Syſtem, Sect. VI. Article V.

MANUAL, *manualis*, ſignifies what is employed, or uſed by the hand, and whereof a preſent profit may be made. Thus ſuch a thing is ſaid to be in the *manual* occupation of one, where it is actually uſed or employed by him.

MANUAL *Exerciſe*. See MILITARY *Affairs*.

MANURING *of Ground*, the application of a matter proper for meliorating the ſoil, and rendering it more fertile. For an account of the ſeveral manures and the ſoils to which they are reſpectively adopted, ſee Syſtem of AGRICULTURE, Sect. II.

MANUSCRIPT, a book, or paper, written with the hand. By which it ſtands oppoſed to a printed book, or paper. A *manuſcript* is uſually denoted by the two letters MS. and, in the plural, by MSS, or MMSS. What makes public libraries valuable, is the number of ancient *manuſcripts* repoſited in them.

MAP, a plain figure, repreſenting the ſurface of the earth; or a part thereof, according to the laws of perſpective. A *map* is a projection of the ſurface of the globe, or a part thereof, on a plain ſurface, repreſenting the forms and dimenſions of the ſeveral countries and rivers; with the ſituation of cities, mountains, and other places. *Maps* are either univerſal, or particular. Univerſal *maps*, are thoſe which exhibit the whole ſurface of the earth, or the two hemiſpheres. Particular *maps*, are thoſe which exhibit ſome particular region, or part thereof. Each kind are frequently called *geographical*, or *land-maps*, in contradiſtinction to *hydrographical*, or *ſea-maps*, repreſenting only the ſeas and ſea-coaſts; and properly called *charts*.

The Uſe of MAPS is obvious from their conſtruction. The degrees of the meridians and parallels ſhew the longitudes and latitudes of places, and the ſcale of miles annexed, their diſtances; the ſituation of places, with regard to each other, as well as to the cardinal points, appears by inſpection, the top of the *map* being always the north, the bottom the ſouth, the right hand the eaſt, and the left the weſt; unleſs the compaſs uſually annexed ſhew the contrary.

MARBLE, in natural hiſtory, a genus of foſſils; being bright and beautiful ſtones, compoſed of ſmall ſeparate concretions, moderately hard, not giving fire with ſteel, fermenting with and ſoluble in acid menſtrua, and calcining in a ſlight fire. Marble, when chymically examined, appears to conſiſt of calcareous earth united with much fixed air; and is, like limeſtone or chalk, capable of being converted into a ſtrong quicklime. Dr. Black derives the origin of marbles, as well as limeſtone and marle, from the ſame ſource, viz. from the calcareous matter of ſhells and lithophyta. In one kind of limeſtone known by the name of *Portland ſtone*, and conſiſting of round grains united together, it was ſuppoſed to be compoſed of the ſpawn of fiſh; but compariſons of other phenomena have explained it. It is plain that it has been produced from a calcareous ſand, which is found on the ſhore of ſome of the iſlands in the ſouthern climates. By the conſtant agitation the ſofter parts are worn off, and the harder parts remain in the form of particles that are highly poliſhed, and which are afterwards gradually made to concrete together by cauſes of which we have yet no knowledge. There are indeed ſome few of the limeſtones and marbles in which we cannot diſcover any of the relics of the ſhells; but there are many ſigns of their having been in a diſſolved or liquified ſtate; ſo we cannot expect to ſee the remains of the form of the ſhells: but even in many of the marbles that have the greateſt appearance of a complete mixture, we ſtill find often the confuſed remains of the ſhells of which they have been originally compoſed. We ſhould ſtill find it difficult to conceive how ſuch maſſes ſhould have derived their origin from ſhells; but, conſidering the many collections that we have an opportunity of ſeeing in their ſteps towards this proceſs, and a little concreted together, ſo that by their going a ſtep further they might form limeſtone and marbles, we ſhall ſoon ſee the poſſibility of their being all produced in the ſame manner. Thus vaſt quantities of ſhells have been found in the province of Turin in France; and indeed there is no place where they have not been found. The lithophyta likewiſe ſeem to be a very fruitful ſource of this kind of earth. In the cold climates, where the moderate degree of heat is not ſo productive of animal-life, we have not ſuch an opportunity of obſerving this: but in the hot climates, the ſea, as well as the ſand, ſwarms with innumerable animals; and, at the bottom, with thoſe that produce the corals and madripores. We learn from the hiſtory of a ſhip that was ſunk in a ſtorm in the Gulf of Mexico, the vaſt growth there is of theſe bodies. About 30 years after, they attempted to dive into it to get out a quantity of ſilver; but they found great difficulty in getting it, from the ſhip being overgrown with coral. Sir Hans Sloan, in the Philoſophical Tranſactions, and in his hiſtory of Jamaica, obſerves, that the ſhip's timber, the iron, and money, were all concreted by the growth of the calcareous matter. So in a tract of many thouſands of years the quantity of it ſhould be very great; and as this is going on through a very great extent of the bottom of the ſea, it will produce very extenſive as well as maſſy collections of calcareous matter.

MARINE, a general name for the navy of a kingdom or ſtate; as alſo the whole œconomy of naval affairs; or whatever reſpects the building, rigging, arming, equiping, navigating, and fighting ſhips. It comprehends alſo the government of naval armaments, and the ſtate of all the perſons employed therein, whether civil or military. The hiſtory of the marine affairs of any one ſtate is a very comprehenſive ſubject, much more that of all nations. Thoſe who would be informed of the maritime affairs of Great Britain, and the figure it has made at ſea in all ages, may find abundance of curious matter in Selden's *Mare Clauſum*; and from his time to ours, we may trace a ſeries of facts in Lediard's and Burchet's Naval Hiſtory, but above all in the lives of the Admirals, by the accurate and judicious Dr. Campbell. See NAVAL *Affairs*.

MARINES, or MARINE *Forces*, a body of ſoldiers raiſed for the ſea-ſervice, and trained to fight either in a naval engagement, or in an action aſhore. In a ſea-fight their ſmall arms are of very great advantage in ſcouring the decks of the enemy; and when they have been long enough at ſea to ſtand firm when the ſhip rocks, they muſt be infinitely preferable to ſeamen if the enemy attempts to board, by fraiſing a battalion with their fixed bayonets to oppoſe him.

MARINER's *Compaſs*. See COMPASS.

St. MARK's *Goſpel*, a canonical book of the New Teſtament, being one of the four Goſpels. *St. Mark* wrote his Goſpel at Rome, where he accompanied St. Peter, in the year of Chriſt 64, or 65. Many of the moſt ancient writers aſſert that *St. Mark* was no more than an amanuenſis or interpreter to St. Peter, who dictated this Goſpel to him; others affirm that he wrote it after St. Peter's death. The learned have been alſo divided as to the language this Goſpel was wrote in, ſome affirming it was compoſed in Greek, which is the more general and probable opinion, others in Latin. Several of the ancient heretics received only the Goſpel of *St. Mark*: others, among the Catholics, rejected the twelve laſt verſes of this Goſpel. The goſpel of *St. Mark* is properly an abridgment of that of St. Matthew.

MARLE, a kind of calcareous earth, very much uſed in agriculture as a manure. For a copious account aſcertaining its quality and directing its uſes, ſee Syſtem of AGRICULTURE, Sect. II.

MARMALADE, a confection made of the juice or pulp of ſome fruit, as plums, apricots, quinces, boiled with ſugar to a conſiſtence. The *marmalade* of quinces is the moſt frequent: it is ſub-aſtringent, and grateful to the ſtomach. For the methods of preparing this and other confects, ſee *Abbots's Houſe-keepers valuable Preſent*.

MARMOR, *marble*, in natural hiſtory. See MARBLE.

MARMOTTA, a ſpecies of the 24th genus *mus*, in the Linnæan ſyſtem. For deſcription, ſee MUS. For repreſentation, ſee the plates to the Syſtem of MAMMALIA. For the claſſification, ſee the Syſtem.

MARQUE, or *Letters of* MARQUE, in military affairs, are letters of repriſal, granting the ſubjects of one prince or ſtate liberty to make repriſals on thoſe of another. They are ſo called from the German *marcke*, "limit, frontier;" as being *jus conceſſum in alterius principis, marckas ſeu limites tranſeundi, ſibique ejus faciendi*; as being a right of paſſing the limits or frontiers of another prince, and doing one's ſelf juſtice. Letters of marque among us are extraordinary commiſſions granted by authority for reparation to merchants taken and deſpoiled by ſtrangers at ſea; and repriſals are only the retaking, or taking of one thing for another. The form in theſe caſes is, the ſufferer muſt firſt apply to the lord privy ſeal, and he ſhall make out letters of requeſt under the privy ſeal; and if, after ſuch requeſt of ſatisfaction made, the party required do not, within convenient time, make due ſatisfaction or reſtitution to the party grieved, the lord chancellor ſhall make him out letters of marque under the great ſeal; and by virtue of theſe he may attack and ſeize the property of the aggreſſor nation, without hazard of being condemned as a robber or pirate.

MARQUIS, a title of honour, next in dignity to that of duke. A marquis is created by patent; his mantle his double ermine, three doublings and a half; his title is *moſt noble*; and his coronet has pearls and ſtrawberry-leaves intermixed round, of equal height. See the Syſtem of HERALDRY, Sect. VI. and Plate V.

MARRIAGE, a contract, both civil and religious, between a man and a woman, by which they engage to live together in mutual love and friendſhip for the ends of procreation. The firſt inhabitants of Greece lived together without marriage. Cecrops, king of Athens, was the firſt author of this honourable inſtitution among that people. After the commonwealths of Greece were ſettled, marriage was very much encouraged by their laws; and the abſtaining from it was diſcountenanced, and in many places puniſhed. The Lacedæmonians were particularly remarkable for their ſeverity towards thoſe who deferred marrying, as well as to thoſe who wholly abſtained from it. The Athenians had an expreſs law, that all commanders, orators, and perſons entruſted with any public affair, ſhould be married men. Polygamy, or the having more than one wife at a time, was not commonly tolerated in Greece. See POLYGAMY.

We find but few laws in the books of Moſes concerning the inſtitution of marriage: he reſtrained the Iſraelites from marrying within certain degrees of conſanguinity, but we find that polygamy, though not expreſly allowed, is however tacitly implied in the laws of Moſes: there is a particular law that obliged a man, whoſe brother died without iſſue, to marry his widow, and raiſe up children to his brother. The Hebrews purchaſed their wives, by paying down a competent dowry for them; and a man was at liberty to marry, not only in any of the 12 tribes, but even out of them, provided it was with ſuch nations as uſed circumciſion. The Romiſh church requires of the clergy perpetual abſtinence from marriage; and has advanced this inſtitution to the dignity of a ſacrament. The church of England, though ſhe does not conſider marriage as a ſacrament, yet looks upon it as an inſtitution ſo ſacred, as that it ought always to be celebrated by an eccleſiaſtical perſon; but marriages, without this ſanction, are not therefore null and void. There is no canon of this church, which forbids marriages to be ſolemnized at any time. The canonical hours for celebrating of matrimony, are from eight to twelve in the forenoon. The impediments to marriage are ſpecified in canon 102 of the Engliſh church, and are theſe: 1. A preceding marriage or contract, or any controverſy or ſuit depending on the ſame. 2. Conſanguinity or affinity. 3. Want of conſent of parents, or guardians, &c.

Marriage, according to our law, cannot be diſſolved but by death, breach of faith, or other notorious miſbehaviour. A marriage in reputation, as among the quakers, is allowed to be ſufficient to give title to a perſonal eſtate; though in the caſe of a perſon married by a diſſenting miniſter, who was not in orders, it has been held, that where a huſband demands a right due to him as ſuch by the eccleſiaſtical law, he ought to prove himſelf a huſband, thereby to be intitled to it; and yet this marriage is not altogether a nullity, becauſe, by the laws of nature, the contract is binding. On a promiſe of marriage, if it be mutual on both ſides, damages may be recovered in caſe either party refuſes to marry: and though no time for the marriage be agreed on, if the plaintiff aver that he offered to marry the defendant, who refuſed it, an action is maintainable for the damages; but no action ſhall be brought upon any agreement, except it is in writing, and ſigned by the party to be charged.

For the better preventing clandeſtine marriages, and the inconveniences ariſing therefrom, an act of parliament was paſſed, wherein the following regulations were made, viz. That from and after March 25, 1754, banns of matrimony ſhall be publiſhed in the pariſh church, or ſome public chapel belonging to the pariſh wherein the parties dwell, upon three Sundays before the marriage, during the time of ſervice, immediately after the ſecond leſſon; and where the parties dwell in different pariſhes, the banns ſhall be publiſhed in both; and the marriage ſhall be ſolemnized in the church or chapel wherein the banns were publiſhed, and no where elſe: and it is alſo required, that both or either of the parties to be married do reſide four weeks at leaſt in the pariſh where the banns are publiſhed. Nothing in this act deprives the archbiſhop of Canterbury of his uſual right of granting ſpecial licenſes to marry at any convenient time or place. All marriages ſolemnized contrary to the foreſaid regulations, ſhall be void; and the perſon ſolemnizing the ſame, ſhall be adjudged guilty of felony, and be tranſported for 14 years to his majeſty's colonies. Marriages ſolemnized by licenſe, where either of the parties (not being a widow or widower,) ſhall be under age, without the conſent of the father firſt had (if living,) or of the guardians or one of them, and, where there ſhall be no guardians, (if living and unmarried), or of the guardian appointed by chancery, ſhall be void to all intents and purpoſes. Where any ſuch guardian ſhall be *non compus mentis*, or in parts beyond the ſea, or ſhall refuſe their conſent to a proper match, the party may apply by petition to the lord chancellor, lord keeper, or lords commiſſioners of the great ſeal, who ſhall proceed on ſuch a petition in a ſummary way; and where the marriage propoſed ſhall appear to be proper, they ſhall judicially declare the ſame to be ſo by an order of court, which ſhall be deemed effectual. All marriages ſhall be ſolemnized in the preſence of two or more creditable witneſſes beſides the miniſter; and an entry thereof ſhall be immediately made in a regiſter kept for that purpoſe. This act ſhall not extend to the marriages of any of the royal family, nor to Scotland, nor to thoſe perſons called quakers, nor to thoſe profeſſing the Jewiſh religion.

Policy of Encouraging MARRIAGE. Dr. Halley obſerves, that the growth and increaſe of mankind is not ſo much ſtinted by any thing in the nature of the ſpecies, as it is from the cautious difficulty moſt people make to adventure on the ſtate of marriage, from the proſpect of the trouble and charge of providing for a family: nor are the poorer ſort of people herein to be blamed, who, beſides themſelves and families, are obliged to work for the proprietors of the lands that feed them; and of ſuch does the greater part of mankind conſiſt. Were it not for the backwardneſs to marriage, there might be four times as many births as we find; for by computation, there are 15,000 perſons above 16 and under 45, of which at leaſt 7000 are women capable of bearing children; yet there are only 1238, or a little more than a ſixth part of theſe, that breed yearly: whereas were they all married, it is highly probable that four of ſix ſhould bring forth a child every year, the political conſequences of which are evident. Therefore as the ſtrength and glory of a kingdom or ſtate conſiſts in the multitude of ſubjects, celibacy above all things ought to be diſcouraged, as by extraordinary taxing, or military ſervice: and on the contrary, thoſe who have numerous families ſhould be allowed certain privileges and immunities, like the *jus trium liberorum* among the Romans; and eſpecially, by effectually providing for the ſubſiſtence of the poor.

MARRIAGE *Settlement*, is a legal act, previous to marriage, whereby a jointure is ſecured to the wife after the death of the huſband. Theſe ſettlements ſeem to have been in uſe among the ancient Germans, and their kindred nation the Gauls. See an excellent marriage ſettlement by Blackſtone, in the appendix to the ſecond volume of his Commentaries.

Duty of MARRIAGE, is a term uſed in ſome ancient cuſtoms, ſignifying an obligation on women to marry.

MARROW, a ſoft oleaginous ſubſtance contained in the cavities of the bones. For a deſcription, ſee Syſtem of ANATOMY, Part I. Sect. XV.

MARS, in Pagan worſhip and mythology, the god of war. He was, according to ſome, the ſon of Jupiter and Juno. The amours of Mars and Venus, and the manner in which Vulcan caught and expoſed them to the laughter of the other gods, have been deſcribed by ſeveral of the ancient poets. He is repreſented as having ſeveral wives and miſtreſſes, and a conſiderable number of children. He was held in the higheſt veneration by the Romans, both from his being the father of Romulus their founder, and from their inclination to conqueſt; and had magnificent temples erected to him at Rome. Mars is uſually repreſented in a chariot, drawn by furious horſes. He is completely armed; and extends his ſpear with the one hand, and graſps a ſword, imbrued in blood, with the other. He has a fierce and ſavage aſpect. Diſcord is repreſented preceding his car; and Clamour, Fear, and Terror, appear in his train. The victims ſacrificed to him were the wolf, the horſe, the wood-pecker, the vulture, and the cock.

MARS, in aſtronomy, one of the five planets, and of the three ſuperior ones; its place being between the earth and Jupiter. See the Syſtem, Sect. VIII.

MARSHALLING *a Coat*, in heraldry, ſignifies the due and proper joining of ſeveral coats of arms belonging to diſtinct families in one and the ſame ſhield, or eſcutcheon; together with their ornaments, parts, and appurtenances. See the Syſtem of HERALDRY. For deſcription, Sect. IX. For repreſentation, Plate I.

MARSHALSEA. See COURT *of Marſhalſea*.

MARSHY, or MARSH *Lands*, a name given by our farmers to a ſort of paſture land, or grazing ground, which lies near the ſea, rivers or fence. For the method of draining marſhy lands, ſee the Syſtem of AGRICULTURE, Sect. XIX.

MARSUPIALIS, a ſpecies of the 17th genus Diadelphis, in the Linnæan Syſtem. See DIADELPHIS. For repreſentation, ſee the Plates to the Syſtem of MAMMALIA.

MARTES, or MARTIN, a ſpecies of the 15th genus Muſtela, in the Linnæan Syſtem. See MUSTELA. For repreſentation, ſee the plates to the Syſtem of MAMMALIA.

MARTIAL *Law*, is the law of war, depending upon the arbitrary, but juſt power and pleaſure of the king, or his lieutenants. The king, though in times of peace he makes no laws but by the conſent of his parliament; yet, in war, uſes abſolute power over the ſoldiery: though even this power hath been veſted, of late years, in the king, or his generals of the army, by act of parliament, and under particular reſtrictions too. Martial law, ſays Sir Matthew Hale, is in reality no law, but ſomething indulged rather than allowed as law. The neceſſity of order and diſcipline in an army is the only thing that can give it countenance; and therefore it ought not to be permittted in time of peace, when the king's courts are open for all perſons to receive juſtice according to the laws of the land. The petition of right enacts that no ſoldier ſhall be quartered on the ſubject without his own conſent; and that no commiſſion ſhall iſſue to proceed within this land according to martial law.

MARTIN, in ornithology, the Engliſh name of the genus *hirundo*. See HIRUNDO.

MARTYR, a perſon who ſuffers torments, and even death, in defence of the truth of the goſpel and their religion. Anciently thoſe who were baniſhed for the faith, were called *martyrs*, and alſo thoſe who periſhed in the holy wars. St. Stephen is called the *proto martyr*, or firſt *martyr*. Nineteen thouſand ſeven hundred are computed to have ſuffered *martyrdom* with St. Irenæus at Lyons, under the empire of Severus: ſix thouſand ſix hundred and ſixty-ſix ſoldiers of the Theban legion are ſaid to have been *martyred* in Gaul: Father Papebroch reckons ſixteen thouſand Abyſſinian *martyrs*, and one hundred and fifty thouſand others under Diocleſian alone.

There is ſcarce any faith or religion that does not pretend to its *martyrs*: Mahometans, heathens, idolaters, &c. all have their *martyrs*. In the ancient church, the acts, ſayings, ſufferings, and deaths, of the *martyrs*, were preſerved with great care, in order to be read on certain days, and thus propoſed as models to future ages: and yet, notwithſtanding all this diligence, we have but very little left of them: the greateſt part of them having been deſtroyed, during that dreadful perſecution, which Diocleſian carried on for ten years, with freſh fury, againſt the Chriſtians: for a moſt diligent ſearch was then made after all their books and papers; and all of them that were found were committed to the flames. Euſebius, indeed, compoſed a *martyrology*, but it never reached down to us; and thoſe ſince compiled are extremely ſuſpected. From the eighth century downwards, ſeveral Greek and Latin writers endeavoured to make up the loſs, by compiling, with vaſt labour, accounts of the lives and actions of the ancient *martyrs*: but moſt of them have given us little elſe than a ſeries of fables, adorned with profuſion of rhetorical flowers, and ſtriking images, as the wiſer, even among the Romiſh doctors, frankly acknowledge. Nor are thoſe records, that paſs under the name of Martyrology, worthy of ſuperior credit, ſince they bear the moſt evident marks both of ignorance and falſhood.

MARTYROLOGY, in the church of Rome, is a catalogue or liſt of martyrs, including the hiſtory of their lives and ſufferings for the ſake of religion. The term comes from μαρτυρ, "witneſs," and λεγω, "dico," or λεγω, "colligo."

The martyrologies draw their materials from the kalendars of particular churches, in which the ſeveral feſtivals dedicated to them are marked; and which ſeem to be derived from the practice of the ancient Romans, who inſerted the names of heroes and great men in their faſti, or public regiſters. The martyrologies are very numerous, and contain many ridiculous and even contradictory narratives; which is eaſily accounted for, if we conſider how many forged and ſpurious accounts of the lives of ſaints and martyrs appeared in the firſt ages of the church, which the legendary writers afterwards adopted without examining into the truth of them. However, ſome good critics, of late years, have gone a great way towards clearing the lives of the ſaints and martyrs from the monſtrous heap of fiction they labour under. We have alſo ſeveral proteſtant martyrologies, containing the ſufferings of the reformed under the papiſts; viz. an Engliſh martyrology, by J. Fox; with others by Clark, Bray, Southwell, &c. Thoſe who are inclined to be farther informed on this ſubject are referred to Dr. *Southwell*'s edition of Fox's Martyrology.

MASCULINE, the ſtronger of the two ſexes. See MALE.

MASCULINE, is more ordinarily uſed in grammar to ſignify the firſt and worthieſt of the genders of nouns. See GENDER. The maſculine gender is that which belongs to the male kind, or ſomething analogous to it. Moſt ſubſtantives are ranged under the heads of maſculine or feminine. This, in ſome caſes, is done with a ſhow of reaſon; but in others is merely arbitrary, and for that reaſon is found to vary according to the languages, and even according to the words introduced from one language into another. Thus the names of trees are generally feminine in Latin, and maſculine in the French. Farther, the genders of the ſame word are ſometimes varied in the ſame language. Thus *alvus*, according to Priſcian, was anciently maſculine, but is now become feminine. And *navire*, a ſhip, in French, was anciently feminine, but is now maſculine. See Syſtem of GRAMMAR, Part I. Chap. I. Sect. I.

MASCULINE *Rhyme*, in the French poetry, is that made with a word which has a ſtrong, open, and accented pronunciation; as all words have, excepting thoſe which have an *e* feminine in their laſt ſyllable.

MASCULUS FLOS, a male flower; a flower which contains the ſtamina, reckoned by the ſexualiſts the male organ of generation, but not the ſtigma or female organ. All the plants of the claſs diœcia of Linnæus have male and female flowers upon different roots: thoſe of the claſs monœcia, bear flowers of different ſexes on the ſame root. The plants, therefore, of the former are only male or female: thoſe of the latter are androgynous; that is, contain a mixture of both male and female flowers. See Syſtem of BOTANY, Sect. VI.

MASONS, *Free* or *Accepted*, a very ancient ſociety, or body of men, ſo called, either from ſome extraordinary knowledge of maſonry or building, which they are ſuppoſed to be maſters of, or becauſe the firſt founders of the ſociety were perſons of that profeſſion. They are now very conſiderable both for numbers and character; being found in every country in Europe, and conſiſting principally of perſons of merit and conſideration. As to antiquity, they lay claim to a ſtanding of ſome thouſand years; and it is ſaid, can trace up their original as early as the building of Solomon's temple. It is very doubtful when they were firſt introduced into this country: ſome have traced the origin of maſonry in general to the year 674: and it is certain that, after that time, many of our public buildings, in the Gothic ſtyle, were erected by men in companies, who, as ſome ſay, called themſelves *free*, becauſe they were at liberty to work in any part of the kingdom. Others have derived the inſtitution of *free maſons* from a combination among the *maſons* not to work without an advance of wages, when they were ſummoned from ſeveral counties, by writs of Edward III. directed to the ſheriffs, to aſſiſt in rebuilding and enlarging the caſtle, together with the church and chapel of St. George, at Windſor: accordingly it is ſaid, that the *maſons* agreed on tokens, &c. by which they might know one another, and to aſſiſt one another againſt being impreſſed, and not to work unleſs *free*, and on their own terms. What the end of their inſtitution is, ſeems ſtill, in ſome meaſure, a ſecret; though ſo much of it as is known appears laudable enough, as it tends to promote friendſhip, ſociety, mutual aſſiſtance, and good fellowſhip. The brothers of this fraternity are ſaid to be poſſeſſed of a great number of ſecrets, which have been religiouſly obſerved from age to age.

MASS, or MESSE, *Miſſa*, in a religious ſenſe, denotes the office, or public prayers made in the Romiſh church, at the celebration of the euchariſt. Romiſh divines define the maſs, an oblation made to God, wherein, by the change of a ſenſible object by virtue of a divine inſtitution, the ſovereign dominion of God over all things is acknowledged. This they eſteem the greateſt and moſt auguſt ceremony in uſe in the church; as being the ſacrifice of the new law, wherein the body and blood of Jeſus Chriſt are offered up to God. There is a great variety of maſſes in the Romiſh church; the thing acquiring new titles, and appellations, according to the different rites, intentions, and manners, in which it is performed, as well as other circumſtances.

MASSETER, in anatomy, a triangular two-headed muſcle, which ſurrounds the lower jaw, and helps to pull it upwards in eating. See the Syſtem, Part III. Sect. II.

MASTER *of Arts*, the firſt degree taken up in foreign univerſities, but the ſecond in ours; candidates not being admitted to it till they have ſtudied in the univerſity ſeven years.

MASTERS *of Chancery* are uſually choſen out of the barriſters of the common law; and ſit in chancery, or at the rolls, as aſſiſtants to the lord chancellor, and maſter of the rolls. See *Court* of CHANCERY.

MASTER *of the Robes*. See ROBES.

MASTER *of the Rolls*, a patent officer for life, who has the cuſtody of the rolls and patents which paſs the great ſeal; and of the records of the chancery. See *Court* of CHANCERY.

MASTICATION, MASTICATIO, in medicine, the action of chewing, or of agitating the ſolid parts of our food between the teeth, by means of the motion of the jaws, the tongue, and the lips, whereby it is broken into ſmall pieces, impregnated with ſaliva, and ſo fitted for deglutition, aud a more eaſy digeſtion in the ſtomach. The mixture of ſaliva with the food is of abſolute neceſſity; for the ſaliva, imbibed within the parts of it diſſolves the ſalts hid in them; and by ſo doing, prepares the food for fermentation in the ſtomach. The food, therefore, has the beginning of its digeſtion from the ſaliva, and its concluſion from the ferment in the ſtomach.

MATERIA MEDICA, a general name for every ſubſtance, uſed in medicine, and by ſome extended even to every article, uſed as food or drink.

MATHEMATICAL *Sect*, in the hiſtory of learning, is one of the two leading philoſophical ſects, which appeared towards the beginning of the ſeventeenth century: this ſect directed its reſearches by the principles of Gaſſendi, and ſought after truth by obſervation and experience. The diſciples of this ſect denied the poſſibility of erecting on the baſis of metaphyſical and abſtract truths, a regular and ſolid ſyſtem of philoſophy, without the aid of aſſiduous obſervation and repeated experiments, which are the moſt natural and effectual means of philoſophical progreſs and improvement. The advancement and reputation of this ſect, and of natural knowledge in general, were much owing to the plan of philoſophizing, propoſed by lord Bacon, to the eſtabliſhment of the Royal Society in London, to the genius and induſtry of Mr. Boyle, and to the unparalleled reſearches and diſcoveries of Sir Iſaac Newton. Barrow, Wallis, Locke, and many others, were of this ſect. See CORPUSCULAR, EXPERIMENTAL, and NEWTONIAN *Philoſophy*. The other ſect of philoſophers was the Metaphyſical.

MATHEMATICS, the ſcience of quantity; or a ſcience that conſiders magnitudes either as computable, or meaſurable. The word in its original, μαθησις, ſignifies *diſcipline*, or *ſcience*, in the general, and ſeems to have been applied to the doctrine of quantity, either by way of eminence, or becauſe, as this had the ſtart of all other ſciences, the reſt took their common name from it. For the origin of the *mathematics*, Joſephus dates it before the flood, and makes the ſons of Seth obſervers of the courſe and order of the heavenly bodies: he adds, that to perpetuate their diſcoveries, and ſecure them from the injuries either of a deluge, or conflagration, they had them engraven on two pillars, the one of ſtone the other of brick; the former of which, he ſays, was ſtanding in Syria in his days. The firſt who cultivated *mathematics* after the flood, were the Aſſyrians and Chaldeans; from whom the ſame Joſephus adds, they were carried by Abraham to the Egyptians; who proved ſuch notable proficients, that Ariſtotle makes no ſcruple to fix the firſt riſe of *mathematics* among them. From Egypt, five hundred eighty-four years before Chriſt, they paſſed into Greece through the hands of Thales, who, having learned geometry of the Egyptian prieſts, taught it in his own country. After Thales, comes Pythagoras: who among other mathematical arts, paid a peculiar regard to arithmetic; fetching the greateſt part of his philoſophy from numbers: he was the firſt, as Laertius tells us, who abſtracted geometry from matter; and to him we owe the doctrine of incommenſurable magnitude, and the five regular bodies, beſides the firſt principles of muſic and and aſtronomy. Pythagoras was ſucceeded by Anaxagoras, Oenopides, Briſo, Antipho, and Hippocrates of Chios; who all applied themſelves particularly to the quadrature of the circle, the duplicature of the cube, &c. but the laſt with moſt ſucceſs: this laſt is alſo mentioned by Proclus, as the firſt who compiled elements of *mathematics*.

Democritus excelled in *mathematics* as well as phyſics; though none of his works, in either kind, are extant: the deſtruction of which ſome authors aſcribe to Ariſtotle. The next in order is Plato, who not only improved geometry, but introduced it into phyſics, and ſo laid the foundation of a ſolid philoſophy. Out of his ſchool proceeded a crowd of *mathematicians*. Eudoxus was the firſt founder of a ſyſtem of aſtronomy. Menechmus invented the conic ſections, and Theudius and Hermotimus improved the elements. As for Ariſtotle, his works are ſo ſtored with *mathematics* that Blancanus compiled a whole book of them: out of his ſchool came Eudemus and Theophraſtus; the firſt of whom wrote of numbers, geometry, and inviſible lines; the latter a mathematical hiſtory. To Ariſteus, Iſidorus, and Hypſicles, we owe the books of ſolids; which, with the other books of elements were improved, collected, and methodized by Euclid, who died two hundred and eighty four years before Chriſt. A hundred years after Euclid, came Eratoſthenes and Archimedes. Cotemporary with the latter was Conon, a geometrician and aſtronomer. Soon after came Apollonius Pergæus, whoſe conics are ſtill extant. To him are likewiſe aſcribed the fourteenth and fifteenth books of Euclid, which are ſaid to have been contracted from Hypſicles. Hipparchus and Menelaus wrote on the ſubtenſes in a circle, the latter alſo on ſpherical triangles; Theodoſius's three books of ſpherics are ſtill extant. All theſe, Menelaus excepted, lived before Chriſt.

A. D. 70, Ptolemy of Alexandria was born; the prince of aſtronomers, and no mean geometrician: he was ſucceeded by the philoſopher Plutarch, of whom we have ſtill extant ſome mathemathematical problems. After him came Eutocius, who commented on Archimedes, and occaſionally mentions the inventions of Philo, Diocles, Nicodemus, Sporus, and Heron, on the duplicature of the cube. To Cteſebes of Alexandria we owe our pumps; and Geminus, who came ſoon after, is preferred by Proclus to Euclid himſelf. Diophantus of Alexandria was a great maſter of numbers, and the firſt inventor of algebra: and among others of the ancients, Nicomachus is celebrated for his arithmetical, geometrical, and muſical works; Serenus, for books on the ſection of the cylinder; Proclus, for his comments on Euclid; and Theon has the credit, among ſome, of being author of the books of Elements aſcribed to Euclid. The laſt to be named among the ancients is Pappus of Alexandria, who flouriſhed A. D. 400, and is celebrated for his books of *mathematical* collections ſtill extant.

Mathematics are commonly diſtinguiſhed into pure and ſpeculative, which conſider quantity abſtractedly; and mixed, which treat of magnitude as ſubſiſting in material bodies, and conſequently are interwoven every where with phyſical conſiderations. Mixed *mathematics* are very comprehenſive; ſince to them may be referred *Hydroſtatics*, which conſider the laws of fluids, or of bodies gravitating in fluids. *Pneumatics*, the air, with regard to the laws and menſuration thereof. *Hydraulics*, the motion of fluids. *Optics*, direct light or viſion. *Catoptrics*, reflected viſion. *Dioptrics*, refracted viſion. *Perſpective*, the images of objects, in order to delineate or repreſent them. *Aſtronomy*, the univerſe, and the phenomena of the heavens. *Geography*, the earth, both as in itſelf, and in its affections. *Hydrography*, the ſea, principally as navigable. *Gnomonics*, or *Dialling*, ſhadows, in order for determining the hour of the day. *Military Architecture*, the ſtrength of places, with regard to their defence againſt an enemy. *Civil Architecture*, (now become a branch of mathematics) or buildings. *Muſic*, ſounds, and their effects on the ear. For the elements of each of theſe, ſee the reſpective Syſtems.

Pure mathematics have one peculiar advantage, that they occaſion no diſputes among wrangling diſputants, as in other branches of knowledge; and the reaſon is, becauſe the definitions of the terms are premiſed, and every body that reads a propoſition has the ſame idea of every part of it. Hence it is eaſy to put an end to all mathematical controverſies, by ſhowing, either that our adverſary has not ſtuck to his definitions, or has not laid down true premiſes, or elſe that he has drawn falſe concluſions from true principles; and in caſe we are able to do neither of theſe, we muſt acknowledge the truth of what he has proved. It is true, that in mixed mathematics, where we reaſon mathematically upon phyſical ſubjects, we cannot give ſuch juſt definitions as the geometricians: we muſt therefore reſt content with deſcriptions; and they will be of the ſame uſe as definitions, provided we are conſiſtent with ourſelves, and always mean the ſame thing by thoſe terms we have once explained. Dr. Barrow gives a moſt elegant deſcription of the excellence and uſefulneſs of mathematical knowledge, in his inaugural oration, upon being appointed profeſſor of mathematics at Cambridge.

The mathematics, he obſerves, effectually exerciſe, not vainly delude, nor vexatiouſly torment, ſtudious minds with obſcure ſubtilties; but plainly demonſtrate every thing within their reach, draw certain concluſions, inſtruct by profitable rules, and unfold pleaſant queſtions. Theſe diſciplines likewiſe inure and corroborate the mind to a conſtant diligence in ſtudy; they wholly deliver us from a credulous ſimplicity, moſt ſtrongly fortify us againſt the vanity of ſcepticiſm, effectually reſtrain us from a raſh preſumption, moſt eaſily incline us to a due aſſent, and perfectly ſubject us to the government of right reaſon. While the mind is abſtracted and elevated from ſenſible matter, diſtinctly views pure forms, conceives the beauty of ideas, and inveſtigates the harmony of proportions; the manners themſelves are ſenſibly corrected and improved, the affections compoſed and rectified, the fancy calmed and ſettled, and the underſtanding raiſed and excited to more divine contemplations.

MATRIX, or UTERUS, in anatomy, the womb, or that part of the female of any kind, wherein the fœtus is conceived, and nouriſhed till the time of its delivery. See the Syſtem, Part V. Sect. XII.

MATRON, *matrona*, among the Romans, ſignified a married woman, and ſometimes alſo the mother of a family.

Jury of MATRONS, is a jury of twelve diſcreet women, directed by the judge to enquire into the fact, when a woman is capitally convicted, and pleads her pregnancy. This plea, though it cannot be made in ſtay of judgment, may be urged in reſpite of execution. If the Jury bring in their verdict quick with child, execution ſhall be ſtaid generally till the next ſeſſion; and ſo from ſeſſion to ſeſſion, till either the woman is delivered, or proves, by courſe of nature, not to have been with child at all. But if ſhe once hath had the benefit of this reprieve, and been delivered, and afterwards becomes pregnant again, ſhe ſhall not be entitled to the benefit of farther reſpite for that cauſe; for ſhe may now be executed before the child is quick in the womb, and ſhall not, by her own incontinence, evade the ſentence of juſtice. If a widow feigns herſelf with child, in order to exclude the next heir, and a ſuppoſititious birth is ſuſpected to be intended, then upon the writ *de ventre inſpiciendo*, a jury of women is to be impanelled to try the queſtion, whether with child or no?

MATTER, *materia*, *body*, or an extended, ſolid, diviſible, moveable, and paſſive ſubſtance, the firſt principle of all natural things, from the various arrangements and combinations whereof all bodies are formed. See Syſtem of MECHANICS.

MATTHEW, or *Goſpel of St.* MATTHEW, wrote his goſpel in Judæa, at the requeſt of thoſe he had converted; and it is thought he began in the year 41, eight years after Chriſt's reſurrection. It was written, according to the teſtimony of all the ancients, in the Hebrew or Syriac language; but the Greek verſion, which now paſſes for the original, is as old as the apoſtolical times.

MAXILLÆ, in anatomy, the jaws or thoſe parts of an animal, wherein the teeth are ſet, and which ſerve for maſticating the food. The *maxillæ* are two in number, and are denominated, from their ſituation, *ſuperior* and *inferior*. For a copious deſcription, ſee the Syſtem, Part II. Sect. XIV. For a repreſentation, ſee Plate I. *fig.* 1. letters *e f*.

MAXIM, denotes an eſtabliſhed propoſition or principle. In which ſenſe it amounts to much the ſame with AXIOM. *Maxims* are a kind of propoſitions, which have paſſed for principles of ſcience; and which, being ſelf-evident, have been by ſome ſuppoſed innate.

MAXIMUM, in mathematics, denotes the greateſt quantity attainable in any given caſe. If a quantity conceived to be generated by motion increaſes or decreaſes till it arrives at a certain magnitude or poſition, and then, on the contrary, grows greater or leſſer, and it be required to determine the ſaid magnitude or poſition, the queſtion is called a *problem de maximis et minimis*.

MAYOR, or MAIOR, the chief magiſtrate or governor in the cities, and moſt corporation towns of England; choſen annually by his peers out of the number of the aldermen. See ALDERMAN.

The *mayor* of any place is the king's lieutenant, and with the aldermen and common-council, can make laws, called *bye-laws*, for the government of the place. He has alſo the authority of a kind of judge, to determine matters, and to mitigate the rigour of the law. King Richard I. A. D. 1189, firſt changed the bailiffs of London into *mayors*; by whoſe example others were afterwards appointed. *Mayors* of corporations are juſtices of peace, *pro tempore*, and they are mentioned in ſeveral ſtatutes; but no perſon ſhall bear any office of magiſtracy concerning the government of any town, corporation, &c. that hath not received the ſacrament, according to the church of England, within one year before his election; and who ſhall not take the oaths of ſupremacy, &c. Stat. 13. Car. II. cap. 1.

MAYOR'S *Court*. See COURT.

MEADOW, in huſbandry, in its general ſignification, means paſture, or graſs land, annually mown for hay; but is more particularly applied to lands that are ſo low as to be too moiſt for cattle to graze upon them, in winter, without ſpoiling the ſward. For the method of overflowing and draining meadow-grounds, ſee Syſtem of AGRICULTURE, Sect. XIX.

MEASURE, in geometry, denotes any quantity aſſumed as one, or unity, to which the ratio of the other homogeneous or ſimilar quantities is expreſſed.

MEASURE, in a legal and commercial ſenſe, denotes a certain quantity of any thing bought, ſold, valued, or the like. Meaſures are then various, according to the various kinds and dimenſions of the things meaſured. Hence ariſe lineal, or longitudinal meaſures for lines or lengths; ſquare meaſures for areas or ſuperficies; and ſolid or cubic meaſures for bodies and their capacities: all which again are very different in different countries and in different ages, and even many of them for different commodities. Whence ariſe other diviſions of ancient and modern meaſures, domeſtic and foreign ones, dry meaſures, liquid meaſures, &c.

Long MEASURES or MEASURES *of Application*. The Engliſh ſtandard long meaſure for commerce, or that whereby the quantities of things are ordinarily eſtimated in the way of trade, is the yard, containing three Engliſh feet. Its diviſions are the foot, ſpan, palm, inch, and barley-corn; its multiples the pace, fathom, pole, furlong, and miles.

MECHANICAL, an epithet applied to whatever relates to mechanics: thus we ſay, mechanical powers, cauſes, &c. See the articles POWER, CAUSE, &c. The mechanical philoſophy is the ſame with what is otherwiſe called *corpuſcular philoſophy*. See CORPUSCULAR.

SYSTEM OF MECHANICS.

INTRODUCTION.

MECHANICS, *Mechanica*, Μηχανικη, a mixed mathematical ſcience, which conſiders motion, and moving powers, their nature and laws, with the effects thereof, in machines, &c. It is diſtinguiſhed by Sir Iſaac Newton into practical and rational *mechanics*: the former treats of the *mechanical* powers and of their various combinations: rational *mechanics* comprehends the whole theory of motion, and ſhews, when the powers or forces are given, how to determine the motions that are produced by them; and *vice verſa*. That part of *mechanics*, which conſiders the motion of bodies ariſing from gravity, is by ſome called *ſtatics*; in diſtinction from that part which conſiders the *mechanical* powers, and their application, and which is properly called *mechanics*. See MECHANICAL *Powers*.

The term *mechanics* has of old been, and ſtill is, uſed in a double ſenſe in very different ſciences, both with reſpect to their objects and principles. For the name *mechanics* is applied equally to that ſcience which treats of the equilibrium and compariſon of powers; and to that ſcience in which the nature, generation, and alteration of motion are explained. To avoid ambiguity, therefore, it would be proper to give the name *ſtatics* to the ſcience of the equilibrium and compariſon of powers, and to reſtrain the term *mechanics* to the ſcience of motion.

Theſe two ſciences not only differ as to their objects and principles, but alſo with reſpect to the times in which they have been cultivated. Some of the principles of *ſtatics* were eſtabliſhed by Archimedes; but Galileo laid the firſt foundation of *mechanics*, when he inveſtigated the deſcent of heavy bodies: and ſince his time, by the aſſiſtance of the new methods of computation, a great progreſs has been made, particularly by Sir Iſaac Newton, in his Principia. This admirable work is now rendered more acceſſible to beginners by the learned comment of the fathers le Seur and Jacquier, printed, with the text, at Geneva, 1739, 4to. 1742, 4 vols. 4to.

The doctrine of machines or engines is a principal branch of *mechanics*; but has not as yet been treated as it deſerves. We ſhall here inſert a few obſervations on this uſeful ſubject, from a late eminent author. In treating of machines, we ſhould conſider the weight that is to be raiſed, the power by which it is to be raiſed, and the inſtrument or engine by which this effect is to be produced. There are two principal problems that ought to be reſolved in treating of each of them. The firſt is, to determine the proportion, which the power and weight ought to have to each other, that they may juſt ſuſtain one another, or be in equilibrio. The ſecond is, to determine what ought to be the proportion of the power and weight to each other in a given machine, that it may produce the greateſt effect poſſible, in a given time.

All the writers on *mechanics* treat of the firſt of theſe problems, but few have conſidered the ſecond, though equally uſeful with the other. As to the firſt problem, this general rule holds in all powers: ſuppoſe the engine to move, and reduce the velocities of the power and weight to the reſpective directions in which they act; find the proportions of thoſe velocities; then if the power be to the weight as the velocity of the weight is to the velocity of the power; or, which amounts to the ſame thing, if the power multiplied by its velocity, gives the ſame product as the weight multiplied by its velocity; this is the caſe wherein the power and weight ſuſtain each other, and are in equilibrio; ſo that in this caſe, the one would not prevail over the other, if the engine was at reſt; and if it is in motion, it would continue to proceed uniformly, if it were not for the friction of its parts, and other reſiſtances.

The ſecond general problem in *mechanics*, is, to determine the proportion which the power and weight ought to bear to each other; that when the power prevails, and the machine is in motion, the greateſt effect poſſible may be produced by it in a given time. It is manifeſt, that this is an enquiry of the greateſt importance, though few have treated of it. When the power is only a little greater than that which is ſufficient to ſuſtain the weight, the motion is too ſlow; and though a greater weight is raiſed in this caſe, it is not ſufficient to compenſate the loſs of time. When the weight is much leſs than that which the power is able to ſuſtain, it is raiſed in leſs time; and this may happen not to be ſufficient to compenſate the loſs ariſing from the ſmallneſs of the load. It ought, therefore, to be determined when the product of the weight, multiplied by its velocity, is the greateſt poſſible; for this product meaſures the effect of the engine in a given time, which is always the greater in proportion as the weight which is raiſed is greater, and as the velocity with which it is raiſed is greater. We ſhall therefore ſubjoin ſome inſtances of this kind, that may be demonſtrated from the common elementary geometry; wiſhing that farther improvements may be made in this moſt uſeful part of *mechanics*.

When the power prevails, and the engine begins to move, the motion of the weight is at firſt gradually accelerated. The action of the power being ſuppoſed invariable, its influence in accelerating the motion of the weight decreaſes, while the velocity of the weight increaſes. Thus the action of a ſtream of water, or air, upon a wheel, is to be eſtimated only from the exceſs of the velocity of the fluid above the velocity already acquired by the part of the engine which it ſtrikes, or from their relative velocity. On the other hand; the weight of the load that is to be raiſed, and the friction, tend to retard the motion of the engine; and when theſe forces, viz. thoſe that tend to accelerate it, and thoſe that tend to retard it, become equal, the engine then proceeds with the uniform motion it has acquired.

In mechanics we have to conſider matter, forces exerted thereon, the motions and velocities produced, &c. We ſhall, therefore, in the firſt place take notice of the properties of matter.

SECT. I. MATTER AND ITS PROPERTIES.

By the word *matter* is here meant every thing that has length, breadth, and thickneſs, and reſiſts the touch.

The inherent properties of matter are ſolidity, inactivity, mobility, and diviſibility.

The *ſolidity* of matter ariſes from its having length, breadth, thickneſs; and hence it is, that all bodies are comprehended under ſome ſhape or other, and that every particular body hinders all others from occupying the ſame part of ſpace which it poſſeſſeth. Thus, if a piece of wood or metal be ſqueezed ever ſo hard between two plates, they cannot be brought into contact. And even water or air has this property; for if a ſmall quantity of it be fixed between any other bodies, they cannot be brought to touch one another. Dr. Prieſtley and ſome others have indeed denied this property to matter; and ſuppoſed, that, if a ſufficient degree of force was applied to two bodies, they might actually exiſt in the ſame place at the ſame moment: but ſuch abſtruſe ſpeculations cannot be of any ſervice in mechanics, the very foundation of which is built on the oppoſite principle, and neceſſarily implies the impenetrability or ſolidity of matter.

Inactivity or Paſſiveneſs of Matter. Since matter always endeavours to continue in the ſtate that it is in, whether of reſt or motion, therefore, if one body contains twice or thrice as much matter as another body does, it will have twice or thrice as much inactivity; that is, it will require twice or thrice as much force to give it an equal degree of motion, or to ſtop it after it hath been put into ſuch a motion. A great deal of this inactivity, however, we are aſſured, ariſes from gravity; for in thoſe caſes wherein gravity is not oppoſed, a ſmall body will ſet a very large one in motion.

Mobility of Matter. We find that all matter is capable of being moved, if a ſufficient degree of force be applied to overcome its inactivity or reſiſtance, or the force of gravity which acts upon all terreſtrial bodies.

Diviſibility of Matter. Since matter can never be annihilated by cutting or breaking, we can never imagine it to be cut into ſuch ſmall particles, but that if one of them is laid on a table, the uppermoſt ſide of it will be further from the table than the undermoſt ſide. Moreover, it would be abſurd to ſay that the greateſt mountain on earth has more halves, quarters, or tenth parts, than the ſmalleſt particle of matter has; wherefore the diviſibility of matter has no end.

We have many ſurpriſing inſtances of the ſmallneſs to which matter can be divided by art: of which the two following are very remarkable.

1. If a pound of ſilver be fuſed with a ſingle grain of gold, the gold will be equally diffuſed through the whole ſilver; ſo that taking one grain from any part of the maſs (in which there can be no more than the 5760th part of a grain of gold) and diſſolving it in *aqua fortis*, the gold will fall to the bottom. 2. The gold-beaters can extend a grain of gold into a leaf containing 50 ſquare inches; and this leaf may be divided into 500000 parts. For an inch in length can be divided into 100 parts, every one of which will be viſible to the bare eye: conſequently a ſquare inch can be divided into 10000 parts, and 50 ſquare inches into 500000. And if one of theſe parts be viewed with a microſcope that magnifies the diameter of an object only 10 times, it will magnify the area 100 times; and then the 100th part of a 500000th part of a grain (that is, the 50 millionth part) will be viſible. Such leaves are commonly uſed in gilding; and they are ſo very thin, that if 124500 of them were laid upon one another, and preſſed together, they would not exceed one inch in thickneſs.

Yet all this is nothing in compariſon of lengths that nature goes in the diviſion of matter. For Mr. Leewenhoek tells us, that there are more animals in the milt of a ſingle cod fiſh, than there are men upon the whole earth: and that, by comparing theſe animals in a microſcope with grains of common ſand, it appeared that one ſingle grain is bigger than four millions of them. Now each animal muſt have a heart, arteries, veins, muſcles, and nerves, otherwiſe they could neither live nor move. How inconceivably ſmall then muſt the particles of their blood be, to circulate through the ſmalleſt ramifications and joinings of their arteries and veins! It has been found by calculation, that a particle of their blood muſt be as much ſmaller than a globe of the tenth part of an inch in diameter, as that globe is ſmaller than the whole earth; and yet, if theſe particles be compared with the particles of light, they will be found to exceed them as much in bulk as mountains do ſingle grains of ſand. For, the force of any body ſtriking againſt an obſtacle is directly in proportion to its quantity of matter multiplied into its velocity: and ſince the velocity of the particles of light is demonſtrated to be at leaſt a million times greater than the velocity of a cannon-ball, it is plain, that if a million of theſe particles were as big as a ſingle grain of ſand, we durſt no more open our eyes to the light, than we durſt expoſe them to ſand ſhot point-blank from a cannon.

Another property of (or it may be an attendant on) matter, is *attraction*. This ſeems rather to be infuſed, or preſent with, than inherent in matter. Of this there are four kinds, viz. *coheſion*, *gravitation*, *magnetiſm*, and *electricity*.

The Attraction of Coheſion is that by which the ſmall parts of matter are made to ſtick and cohere together. Of this we have ſeveral inſtances, ſome of which follow: 1. If two drops of quickſilver are placed near each other, they will run together and become one large drop. 2. If two poliſhed plates of marble or braſs be put together, with a little oil between them to fill up the pores in their ſurfaces, and prevent the lodgment of any air, they will cohere ſo ſtrongly, even if ſuſpended in an exhauſted receiver, that the weight of the lower plate will not be able to ſeparate it from the upper one. In putting theſe plates together, the one ſhould be rubbed upon the other, as a joiner does two pieces of wood when he glues them. 3. If two pieces of cork, equal in weight, are put near each other in a baſon of water, they will move equally faſt toward each other with an accelerated motion, until they meet: and then, if either of them is moved, it will draw the other after it. If two corks of unequal weights are placed near each other, they will approach with accelerated velocities inverſely proportionate to their weights: that is, the lighter cork will move as much faſter than the heavier, as the heavier exceeds the lighter in weight. This ſhews, that the attraction of each cork is in direct proportion to its weight or quantity of matter. This kind of attraction reaches but to a very ſmall diſtance; for if two drops of quickſilver are rolled in duſt, they will not run together, becauſe the particles of duſt keep them out of the ſphere of each others attraction. When the ſphere of attraction ends, a *repulſive force* begins: thus, water repels moſt bodies till they are wet; and hence it is that a ſmall needle, if dry, ſwims great, that we find it almoſt impoſſible to mix them in ſuch a manner as not to ſeparate again. If a ball of light wood is dipt in oil, and then put into water, the water will recede ſo as to form a channel of ſome depth all around the ball.

Attraction of Gravitation is that power by which diſtant bodies tend towards one another. Of this we have daily inſtances in the falling of bodies to the earth. By this power in the earth it is, that bodies, on whatever ſide, fall in lines perpendicular to its ſurface; and conſequently, on oppoſite ſides, they fall in oppoſite directions, towards the centre: and by this power it is, that bodies on the earth's ſurface are kept to it on all ſides, ſo that they cannot fall from it. And as it acts upon all bodies in proportion to their reſpective quantities of matter, without any regard to their bulks or figures, it accordingly conſtitutes their weight.

As the attraction of any large body, this earth, for inſtance, conſiſts of the united attractions of all its parts; it thence follows, that if a body deſcends from the ſurface towards the centre of the earth, it would continually become lighter and lighter, the parts above attracting it, as well as thoſe below; in which caſe it is demonſtrated by mathematicians, that the gravity would decreaſe in the ſame proportion with the diſtance from the centre.

The force or power of gravity, is as the quantity of matter; for, as every particle of matter has its proper gravity, the effect of the whole muſt be in proportion to the number of the attracting particles; that is, as the quantity of matter in the whole body. Gravity, like all other emanations which proceed or iſſue from a centre, decreaſes as the ſquare of the diſtance increaſes, that is, a body at twice the diſtance of another, attracts with only a fourth part of the force; at thrice the diſtance, with a ninth part; at four times the diſtance, with a ſixteenth part; and ſo on.

Beſides the univerſal properties above-mentioned, there are bodies which have properties peculiar to themſelves; ſuch as the loadſtone, in which the moſt remarkable are theſe: 1. It attracts iron and ſteel only. 2. It conſequently turns one of its ſides to the north and another to the ſouth, when ſuſpended by a thread that does not twiſt. 3. It communicates all its properties to a piece of ſteel when rubbed upon it, without loſing any itſelf. See MAGNETISM.

Several bodies, particularly amber, glaſs, jet, ſealing wax, agate, and almoſt all precious ſtones, have a peculiar property of attracting and repelling light bodies when heated by rubbing. This is called *electrical attraction*. See ELECTRICITY.

SECT. II.

GENERAL LAWS OF MOTION.

DEFINITION I. *Body*, in mechanics, is the maſs or quantity of matter in motion, or to be put in motion or acted on. A body that yields to a ſtroke, and recovers its figure again, is called an elaſtic body; and one that will not do ſo, is named a non elaſtic body.

II. *Denſity*, is the proportion of the quantity of matter in any body to the quantity of matter in another body of the ſame ſize or bigneſs.

III. *Force*, is a power exerted on a body to move it. If it acts inſtantaneouſly, it is called *percuſſion* or *impulſe*. If conſtantly, it is an accellerated force.

IV. *Velocity* is a property of motion, by which it paſſes over a certain ſpace in a certain time, and is greater or leſs, according as it paſſes over a greater or leſs ſpace in a given time.

V. *Motion* is the continual or ſucceſſive change of place. If a body moves *equally*, it is called *equable* or *uniform motion*. If it *increaſes* or *decreaſes* it is called *accelerated* or *retarded motion*. When it is compared with ſome body at reſt, it is called *abſolute motion*. But when compared with other bodies in motion, it is called *relative motion*.

VI. *Direction of Motion*, is the courſe or way to which the body extends, or the line it moves in.

VII. *Quantity of Motion*, is the motion which a body has, conſidered both in regard to its velocity and quantity of matter. This is alſo called the momentum of a body.

VII. *Vis inertiæ* is the innate force of matter by which it reſiſts any change, ſtriving to preſerve its preſent ſtate of reſt or motion.

IX. *Gravity* is their force wherewith a body endeavours to fall downwards. It is called *abſolute gravity* in empty ſpace, and *relative gravity* when immerſed in a fluid.

X. *Specific Gravity* is a greater or leſſer weight of bodies of the ſame magnitude; or it is the proportion between their weights. This proceeds from the natural denſity of bodies. See a Table of the Specific Gravities of Bodies, with the methods of determining the ſame, in our Syſtem of HYDROSTATICS.

XI. *Centre of Gravity* is that point within a body, from which if it be ſuſpended, it will remain at reſt in any given poſition.

XII. *Centre of Motion* is a fixed point about which a body moves, and the axis of motion is a fixed line which it moves about.

XIII. *Power* and *Weight*, when oppoſed to one another, ſignify the body that moves another, and the moved body reſpectively, viz. the body which communicates motion is the Power, and that which receives it is the Weight.

XIV. *Equilibrium* is the ballance of two or more forces, ſo as to remain at reſt.

XV. *Streſs* is the effect which any force has to break a beam or other body; and *ſtrength* is the reſiſtance which a body is capable of making againſt any ſtraining force.

XVI. *Friction* is the reſiſtance which a machine ſuffers by the parts rubbing againſt one another.

POSTULATA.

1ſt. It muſt granted that a ſmall part of the ſurface of the earth may be looked upon as a plane. For ſuch a ſmall part of it as we have here occaſion to conſider does not ſenſibly differ therefrom.

2d. That heavy bodies deſcend in lines parallel to one another. For though in ſtrictneſs they tend to a point, viz. the earth's centre, yet it is at ſuch a diſtance, that at the earth's ſurface, thoſe lines do not ſenſibly differ from parallel lines.

3d. The ſame body is of the ſame weight in all places on or near the earth's ſurface. For the difference is not ſenſible.

4th. For the eaſe of calculation it is ſuppoſed that all bodies are perfectly ſmooth; all planes perfectly even; all bodies or machines to move without friction; all lines ſtreight and inflexible, without weight or thickneſs; cords extremely pliable, and ſo on. Allowances for friction muſt be made more from experiments, than any actual theory.

FUNDAMENTAL AXIOMS, OR LAWS OF MOTION.

1ſt. Every body endeavours to remain in its preſent ſtate, whether it be at reſt, or moving uniformly in a right line. Hence if a body moved forward in vacuo, or empty ſpace, ſo that it meets with no reſiſtance, it would move on uniformly for ever without change of velocity.

2d. The alteration of motion by any external force, is always proportional to that force, and is made in the direction of the right line, in which the force acts.

3d. To every action, there is always oppoſed an equal re-action, or the mutual actions of two bodies upon each other, are always equal and directed to contrary parts. For whatever draws or preſſes another, is as much drawn or preſſed by that other. If you preſs a ſtone with your finger, the finger is alſo preſſed by the ſtone. If a body impinge upon another, and by its force change the motion of the other, that body alſo, becauſe of the equality of mutual preſſure, will undergo an equal change in its own motion, towards the contrary part. The changes made by thoſe actions are equal, not in the velocities, but in the motions of bodies; and therefore ſince the motions are equally changed, the changes of the velocities made towards contrary parts, are reciprocally proportional to the bodies.

But though this Law of Motion of Sir Iſaac Newton, is ſufficiently evident to an intelligent mind, it has been cavilled at by many; and many through an unaccountable ignorance in the comprehenſion of this one Maxim, have attempted to ſubvert even his whole Syſtem of Philoſophy, and have gained proſelytes among the lower claſs of readers. But ſince, as it has been repeatedly ſhewn by the learned, that the objectors have never advanced any thing but empty motion, reſulting from a dull comprehenſion, the truth of this Axiom will remain, and continue to the honour of its renowned author, as long as things and time endure.

To theſe three grand Axioms, may be added the following:

4th. The motion of any body is made up of the ſum of the motions of all the parts.

5th. The weights of all bodies in the ſame place, are proportional to the quantities of matter they contain.

6th. The vis inertiæ of any body is proportional to the quantity of matter.

7th. Every body will deſcend to the loweſt place it can get to.

8th. Two equal forces acting againſt one another in contrary directions, deſtroy one another's effects. And unequal forces act only with the difference of them.

9th. When a body is kept in equilibrio, the contrary forces in any line of direction are equal.

10th. If a certain force generate any motion, an equal force acting in a contrary direction, will deſtroy as much motion in the ſame time.

11th. If a body is drawn by a rope, all the parts of the rope are equally ſtretched: and the force in any part acts in direction of that part; and it is the ſame thing whether the rope is drawn out at length, or paſſes over ſeveral pullies. See the Articles MOTION, PENDULUMS, and Section IV. of this Syſtem.

SECT. III. MECHANICAL POWERS.

The Foundation of all Mechanics. If we conſider bodies in motion, and compare them together, we may do this either with reſpect to the quantities of matter they contain, or the velocities with which they are moved. The heavier any body is, the greater is the power required either to move it or to ſtop its motion; and again, the ſwifter its moves, the greater is its force. So that the whole momentum or quantity of force of a moving body is the reſult of its quantity of matter multiplied by the velocity with which it is moved. And when the products ariſing from the multiplication of the particular quantities of matter in any two bodies by their reſpective velocities are equal, the momenta or entire forces are ſo too. Thus, ſuppoſe a body, which we ſhall call *A*, to weigh 40 pounds, and to move at the rate of two miles in a minute; and another body, which we ſhall call *B*, to weigh only four pounds, and to move twenty miles in a minute; the entire forces with which theſe two bodies would ſtrike againſt any obſtacle would be equal to each other, and therefore it would require equal powers to ſtop them. For 40 multiplied by 2 gives 80, the force of the body A; and 20 multiplied by 4 gives 80, the force of the body B.

Upon this eaſy principle depends the whole of mechanics: and it holds univerſally true, that when two bodies are ſuſpended by any machine, ſo as to act contrary to each other, if the machine be put into motion, and the perpendicular aſcent of one body multiplied into its weight be equal to the perpendicular deſcent of the other body multiplied into its weight, theſe bodies, how unequal ſoever in their weights, will balance one another in all ſituations: for, as the whole aſcent of one is performed in the ſame time with the whole deſcent of the other, their reſpective velocities muſt be directly as the ſpaces they move through: and the exceſs of weight in one body is compenſated by the exceſs of velocity in the other.

Upon this principle it is eaſy to compute the power of any mechanical engine whether ſimple or compound; for it is but only inquiring how much ſwifter the power moves than the weight does (*i. e.* how much farther in the ſame time), and juſt ſo much is the power increaſed by the help of the engine.

The Mechanic Powers. The ſimple machines, uſually called *mechanical powers*, are ſix in number, viz. the *lever*, the *wheel and axle*, the *pulley*, the *inclined plane*, the *wedge*, and the *ſcrew*. They are called *mechanical powers*, becauſe they help us to raiſe weights, move heavy bodies, and overcome reſiſtances, which we could not effect without them.

1. A *lever* is a bar of iron or wood, one part of which being ſupported by a prop, all the other parts turn upon that prop as their centre of motion: and the velocity of every part or point is directly as its diſtance from the prop. Therefore, when the weight to be raiſed at one end is to the power applied at the other to raiſe it, as the diſtance of the power from the prop is to the diſtance of the weight from the prop, the power and weight will exactly balance or counterpoiſe each other: and as a common lever has but very little friction on its prop, a very little additional power will be ſufficient to raiſe the weight.

There are four kinds of levers. 1. The common ſort, where the prop is placed between the weight and the power; but much nearer to the weight than the power. 2. When the prop is at one end of the lever, the power at the other, and the weight between them. 3. When the prop is at one end, the weight at the other, and the power applied between them. 4. The bended lever, which differs only in form from the firſt ſort, but not in property. Thoſe of the firſt and ſecond kind are often uſed in mechanical engines; but there are few inſtances in which the third ſort is uſed.

A *common balance* is a lever of the firſt kind; but as both its ends are at equal diſtances from its centre of motion, they move with equal velocities; and therefore, as it gives no mechanical advantage, it cannot properly be reckoned among the mechanical powers.

A lever of the firſt kind is repreſented by the bar ABC, *fig.* 13, Plate II. ſupported by the prop under B. Its principal uſe is to looſen large ſtones in the ground, or raiſe great weights to ſmall heights, in order to have ropes put under them for raiſing them higher by other machines. The parts AB, and BC, on different ends of the prop, are called the arms of the lever: the end A of the ſhorter arm AB being applied to the weight intended to be raiſed, or to the reſiſtance to be overcome; and the power applied to the end C of the longer arm BC.

In making experiments with this machine, the ſhorter arm AB muſt be as much thicker than the longer arm C, as will be ſufficient to balance it on the prop. This ſuppoſed, let P repreſent a power whoſe intenſity is equal to 1 ounce, and W a weight whoſe intenſity is equal to 12 ounces. Then, if the power be 12 times as far from the prop as the weight is, they will exactly counterpoiſe; and a ſmall addition to the power P will cauſe it to deſcend, and raiſe the weight W; and the velocity with which the power deſcends will be to the velocity with which the weight riſes, as 12 to 1: that is, directly as their diſtances from the prop; and conſequently, as the ſpaces through which they move. Hence, it is plain, that a man who by his natural ſtrength, without the help of any machine, could ſupport 100 weight, will by the help of this lever be enabled to ſupport 1200. If the weight be leſs, or the power greater, the prop may be placed ſo much farther from the weight; and then it can be raiſed to a proportionably greater height. For univerſally, if the intenſity of the weight multiplied into its diſtance from the prop be equal to the intenſity of the power multiplied into its diſtance from the prop, the power and weight will exactly balance each other; and a little addition to the power will raiſe the weight. Thus, in the preſent inſtance, the weight W is 12 ounces, and its diſtance from the prop is 1 inch; and 12 multiplied by 1 is 12; the power P is equal to 1 ounce, and its diſtance from the prop is 12 inches, which multiplied by 1 is 12 again; and therefore there is an equilibrium between them. So, if a power equal to 2 ounces be applied at the diſtance of 6 inches from the prop, it will juſt balance the weight W; for 6 multiplied by 2 is 12, as before. And a power equal to 3 ounces placed at 4 inches diſtance from the prop would be the ſame; for 3 times 4 is 12; and ſo on, in proportion.

The *ſtatera* or Roman *ſteelyard* is a lever of this kind, contrived for finding the weights of different bodies by one ſingle weight placed at different diſtances from the prop or centre of motion D, *Fig.* I. Plate III. For, if a ſcale hangs at A, the extremity of the ſhorter arm AB, and is of ſuch a weight as will exactly counterpoiſe the longer arm BC; if this arm be divided into as many equal parts as it will contain, each equal to AB, the ſingle weight I (which we may ſuppoſe to be 1 pound) will ſerve for weighing any thing as heavy as itſelf, or as many times heavier as there are diviſions in the arm BC, or any quantity between its own weight and that quantity. As for example, if I be 1 pound, and placed at the firſt diviſion 1 in the arm BC, it will balance 1 pound in the ſcale at A: if it be removed to the ſecond diviſion at 2, it will balance 2 pounds in the ſcale: if to the third, 3 pounds; and ſo on to the end of the arm BC. If each of theſe integral diviſions be ſubdivided into as many equal parts as a pound contains ounces, and the weight I placed at any of theſe ſubdiviſions, ſo as to counterpoiſe what is in the ſcale, the pounds and odd ounces therein are by that means aſcertained.

To this kind of lever may be reduced ſeveral ſorts of inſtruments, ſuch as ſciſſars, pinchers, ſnuffers; which are made of levers acting contrary to one another: their prop or centre of motion being the pin which keeps them together.

In common practice, the longer arm of this lever greatly exceeds the weight of the ſhorter; which gains great advantage, becauſe it adds ſo much to the power.

A lever of the ſecond kind has the weight between the prop and the power. In this, as well as the former, the advantage gained is as the diſtance of the power from the prop to the diſtance of the weight from the prop: for the reſpective velocities of the power and weight are in that proportion; and they will balance each other when the intenſity of the power, multiplied by its diſtance from the prop, is equal to the intenſity of the weight multiplied by its diſtance from the prop. Thus, if AB, *Fig.* 12, Plate II. be a lever on which the weight W of 6 ounces hangs at the diſtance of 1 inch from the prop G, and a power P equal to the weight of 1 ounce hangs at the end B, 6 inches from the prop, by the cord CD going over the fixed pulley E, the power will juſt ſupport the weight: and a ſmall addition to the power will raiſe the weight 1 inch for every 6 inches that the power deſcends.

This lever ſhews the reaſon why two men carrying a burden upon a ſtick between them, bear unequal ſhares of the burden in the inverſe proportion of their diſtances from it. For it is well known, that the nearer any of them is to the burden, the greater ſhare he bears of it: and if he goes directly under it, he bears the whole. So, if one man be at G, and the other at P, having the pole or ſtick AB reſting on their ſhoulders; if the burden or weight W be placed five times as near the man at G, as it is to the man at P, the former will bear five times as much weight as the latter.

This is likewiſe applicable to the caſe of two horſes of unequal ſtrength, to be ſo yoked, as that each horſe may draw a part proportionable to his ſtrength; which is done by dividing the beam ſo, that the point of traction may be as much nearer to the ſtronger horſe than to the weaker, as the ſtrength of the former exceeds that of the latter.

To this kind of lever may be reduced oars, rudders of ſhips, doors turning upon hinges, cutting-knives which are fixed at the point of the blade, and the like.

If in this lever we ſuppoſe the power and weight to change places, ſo that the power may be between the weight and the prop, it will become a lever of the third kind: in which, that there may be a balance between the power and the weight, the intenſity of the power muſt exceed the intenſity of the weight juſt as much as the diſtance of the weight from the prop exceeds the diſtance of the power from it. Thus, let E, *Fig.* 11, Plate II. be the prop of the lever AB, and W a weight of 1 pound, placed three times as far from the prop, as the power P acts at F, by the cord C going over the fixed pulley D; in this caſe, the power muſt be equal to three pounds, in order to ſupport the weight.

To this ſort of lever are generally referred the bones of a man's arm: for when we lift a weight by the hand, the muſcle that exerts its force to raiſe that weight, is fixed to the bone about one tenth part as far below the elbow as the hand is. And the elbow being the centre, round which the lower part of the arm turns, the muſcle muſt therefore exert a force ten times as great as the weight that is raiſed.

As this kind of lever is a diſadvantage to the moving power, it is never uſed but in caſes of neceſſity; ſuch as that of a ladder, which, being fixed at one end, is by the ſtrength of a man's arms reared againſt a wall. And in clock-work, where all the wheels may be reckoned levers of this kind, becauſe the power that moves every wheel, except the firſt, acts upon it near the centre of motion by means of a ſmall pinion, and the reſiſtance it has to overcome acts againſt the teeth round its circumference.

The fourth kind of lever differs nothing from the firſt, but in being bended for the ſake of convenience. B, *Fig.* 9, Plate II. is a lever of this ſort, bended at the part above W, which is its prop, or centre of motion. P is a power acting upon the longer arm B by means of the cord going over the pulley; and W is a weight of reſiſtance acting upon the end of the ſhorter arm. If the power P be to the weight W as the bar above W is to B, they are in *equilibrio*. Thus, ſuppoſe W to be 5 pounds acting at the diſtance of one foot from the centre of motion above the pedeſtal, and P to be 1 pound acting at B five feet from the centre above the pedeſtal, the power and weight will juſt balance each other. A hammer drawing a nail is a lever of this ſort.

2. The ſecond mechanical power is the *wheel* and *axle*, in which the power is applied to the circumference of the wheel, and the weight is raiſed by a rope which coils about the axle as the wheel is turned round. Here it is plain that the velocity of the power muſt be to the velocity of the weight, as the circumference of the wheel is to the circumference of the axle: and conſequently, the power and weight will balance each other, when the intenſity of the power is to the intenſity of the weight as the circumference of the axle is to the circumference of the wheel. Let AB, *Fig.* 2, Plate III. repreſent a wheel, CD its axle, and ſuppoſe the circumference of the wheel to be 8 times as great as the circumference of the axle; then, a power P equal to 1 pound hanging by the cord I, which goes round the wheel, will balance a weight W of 8 pounds hanging by the rope K, which goes round the axle. And as the friction on the pivots or gudgeons of the axle is but ſmall, a ſmall addition to the power will cauſe it to deſcend, and raiſe the weight: but the weight will riſe with only an eighth part of the velocity wherewith the power deſcends, and conſequently through no more than an eighth part of an equal ſpace, in the ſame time. If the wheel be pulled round by the handles S, S, the power will be increaſed in proportion to their length. And by this means, any weight may be raiſed as high as the operator pleaſes.

To this ſort of engine belong all cranes for raiſing great weights; and in this caſe, the wheel may have cogs all round it inſtead of handles, and a ſmall lantern or trundle may be made to work in the cogs, and be turned by a winch; which will make the power of the engine to exceed the power of the man who works it, as much as the number of revolutions of the winch exceed thoſe of the axle D, when multiplied by the exceſs of the length of the winch above the length of the ſemidiameter of the axle, added to the ſemidiameter or half thickneſs of the rope K, by which the weight is drawn up. Thus, ſuppoſe the diameter of the rope and axle taken together to be 12 inches, and conſequently half their diameters to be 6 inches; ſo that the weight W will hang at 6 inches perpendicular diſtance from below the centre of the axle; and let us ſuppoſe the wheel AB, which is fixed on the axle, to have 80 cogs, and to be turned by means of a winch 6 inches long, fixed on the axis of a trundle of 8 ſtaves or rounds, working in the cogs of the wheel. It is plain, that the winch and trundle would make 10 revolutions for one of the wheel AB, and its axis D, on which the rope K winds in raiſing the weight W; and the winch being no longer than the ſum of the ſemidiameters of the great axle and rope, the trundle could have no more power on the wheel than a man could have by pulling it round by the edge, becauſe the winch would have no greater velocity than the edge of the wheel has, which we here ſuppoſe to be ten times as great as the velocity of the riſing weight: ſo that in this caſe the power gained would be as 10 to 1. But if the length of the winch be 12 inches, the power gained will be as 20 to 1: if 18 inches (which is long enough for any man to work by), the power gained would be as 30 to 1; that is, a man could raiſe 30 times as much by ſuch an engine, as he could by his natural ſtrength without it, becauſe the velocity of the handle of the winch would be 30 times as great as the velocity of the riſing weight; the abſolute force of any engine being in proportion of the velocity of the power to the velocity of the weight raiſed by it. But then, juſt as much power or advantage is gained by the engine, ſo much time is loſt in working it. In this ſort of machines it is requiſite to have a racket-wheel G on one end of the axle, with a catch H to fall into its teeth; which will at any time ſupport the weight, and keep it from deſcending, if the workman ſhould, through inadvertency or careleſſneſs, quit his hold whilſt the weight is raiſing. And by this means, the danger is prevented which might otherwiſe happen by the running down of the weight when left at liberty.

3. *The Pulley.* The third mechanical power or engine conſiſts either of one *moveable pulley*, or a *ſyſtem of pullies*; ſome in a block or caſe which is fixed, and others in a block which is moveable and riſes with the weight. For though a ſingle pulley that only turns on its axis, and riſes not without the weight, may ſerve to change the direction of the power, yet it can give no mechanical advantage thereto; but is only as a beam of a balance, whoſe arms are of equal length and weight. Thus, if the equal weights W and P hang by the cords upon the pullies whoſe block is fixed to a beam they will counterpoiſe each other, juſt in the ſame manner as if the cord were cut in the middle, and its two ends hung upon the hooks fixed in the pulley at equal diſtances from its centre.

But if a weight W hangs at the lower end of the moveable block of the pulley above the weight W, *Fig.* 3. Plate II. and the cord goes under the pulley to the wheel above, it is plain that the half of the cord bears one half the weight, and the other half the other; for they bear the whole between them. Therefore, whatever holds the upper end of either rope, ſuſtains one half of the weight: and if the cord which adheres to the weight P be drawn up ſo as to raiſe the pulley to the wheel, the cord will then be extended to its whole length, all but that part which goes under the pulley: and conſequently, the power that draws the cord will have moved twice as far as the pulley with its weight W; on which account, a power whoſe intenſity is equal to one half of the weight will be able to ſupport it, becauſe if the power moves (by means of a ſmall addition) its velocity will be double the velocity of the weight; as may be ſeen by putting the cord over the wheel (which only changes the direction of the power, without giving any advantage to it), and hanging on the weight P, which is equal only to one half of the weight W; in which caſe there will be an equilibrium, and a little addition to P will cauſe it to deſcend, and raiſe W through a ſpace equal to one half of that through which P deſcends. Hence the advantage gained will be always equal to twice the number of pullies in the moveable or undermoſt block. So that, when the upper or fixed block, *Fig.* 4. Plate III. contains two pullies, which only turn on their axes, and the lower or moveable block U contains two pullies, which not only turn upon their axes, but alſo riſe with the block and weight; the advantage gained by this is as 4 to the working power. Thus, if one end of the rope KMOQ be fixed to a hook at I, and the rope paſſes over the pullies N and R, and under the pullies L and P, and has a weight T, of one pound, hung to its other end at T, this weight will balance and ſupport a weight W of four pounds hanging by a hook at the moveable block U, allowing the ſaid block as a part of the weight. And if as much more power be added, as is ſufficient to overcome the friction of the pullies, the power will deſcend with four times as much velocity as the weight riſes, and conſequently through four times as much ſpace.

Fig. 7, Plate II. The two pullies in the fixed block above, and the moveable block below, are in the ſame caſe with thoſe laſt mentioned; and thoſe in the lower block give the ſame advantage to the power.

As a ſyſtem of pullies has no great weight, and lies in a ſmall compaſs, it is eaſily carried about; and can be applied, in a great many caſes, for raiſing weights, where other engines cannot. But they have a great deal of friction on three accounts: 1. Becauſe the diameters of their axes bear a very conſiderable proportion to their own diameters: 2. Becauſe in working they are apt to rub againſt one another, or againſt the ſides of the block: 3. Becauſe of the ſtiffneſs of the rope that goes over and under them.

The common method of arranging pullies in their blocks, may be reduced to two. The firſt conſiſts in placing them one by the ſide of another, upon the ſame pin; the other, in placing them directly under one another, upon ſeparate pins. Each of theſe methods is liable to inconvenience. Mr. Smeaton, in order to avoid the impediments to which theſe combinations are ſubject, propoſes to combine theſe two methods in one. Accordingly, the pullies, as in *Fig.* 2, Plate II. are placed in each block in two tiers; ſeveral being upon the ſame pin as in the firſt method, and

every

Atwood's Apparatus for Experiments on Accelared Motion. Plate 1.

See System of Mechanics.

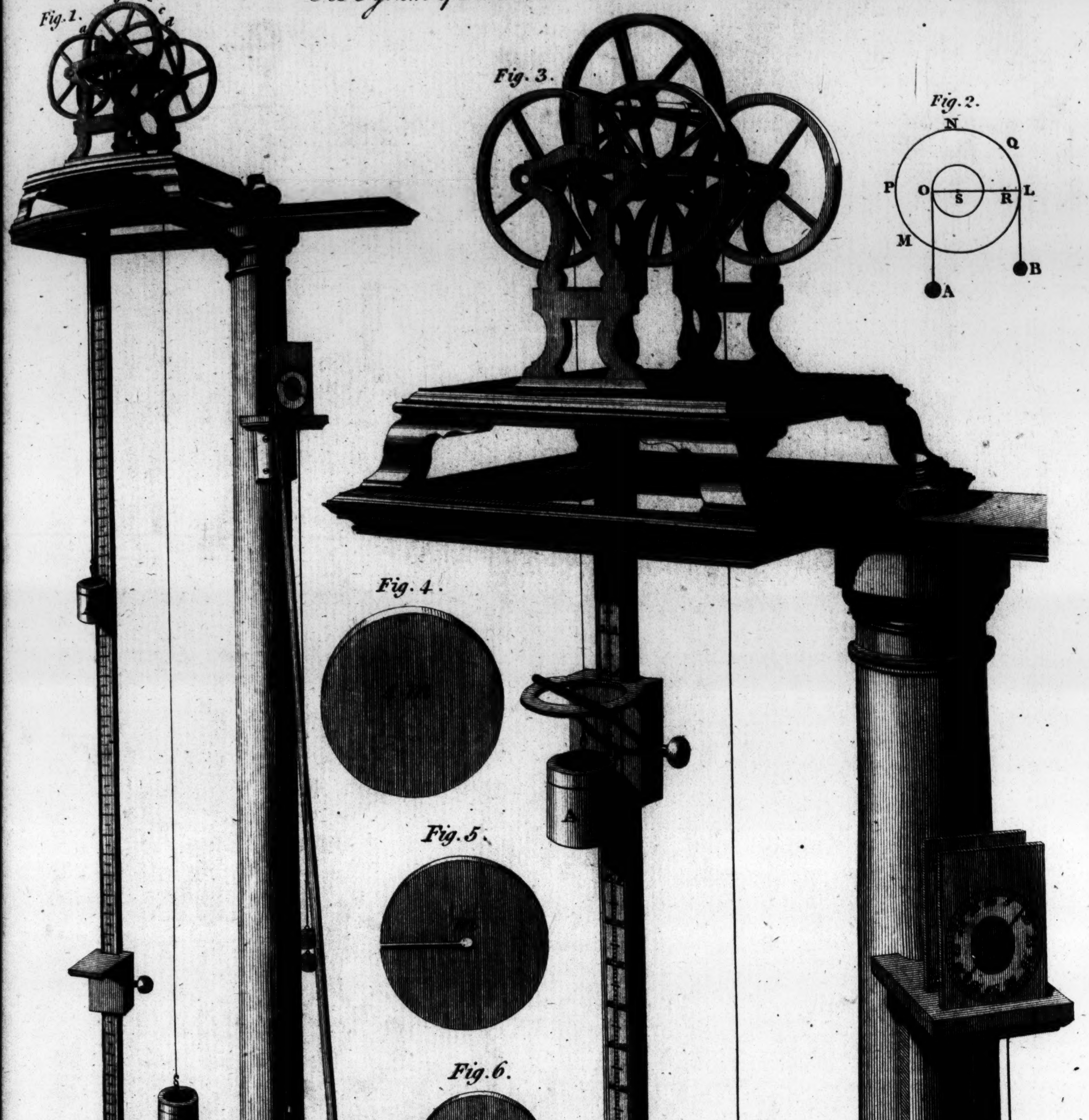
Fig. 1.
a
b
c
d
Fig. 3.
Fig. 2.
N
Q
P
O
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R
L
M
A
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Fig. 4.
Fig. 5.
Fig. 6.
A
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Fig. 7.
V
A
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Fig. 8.
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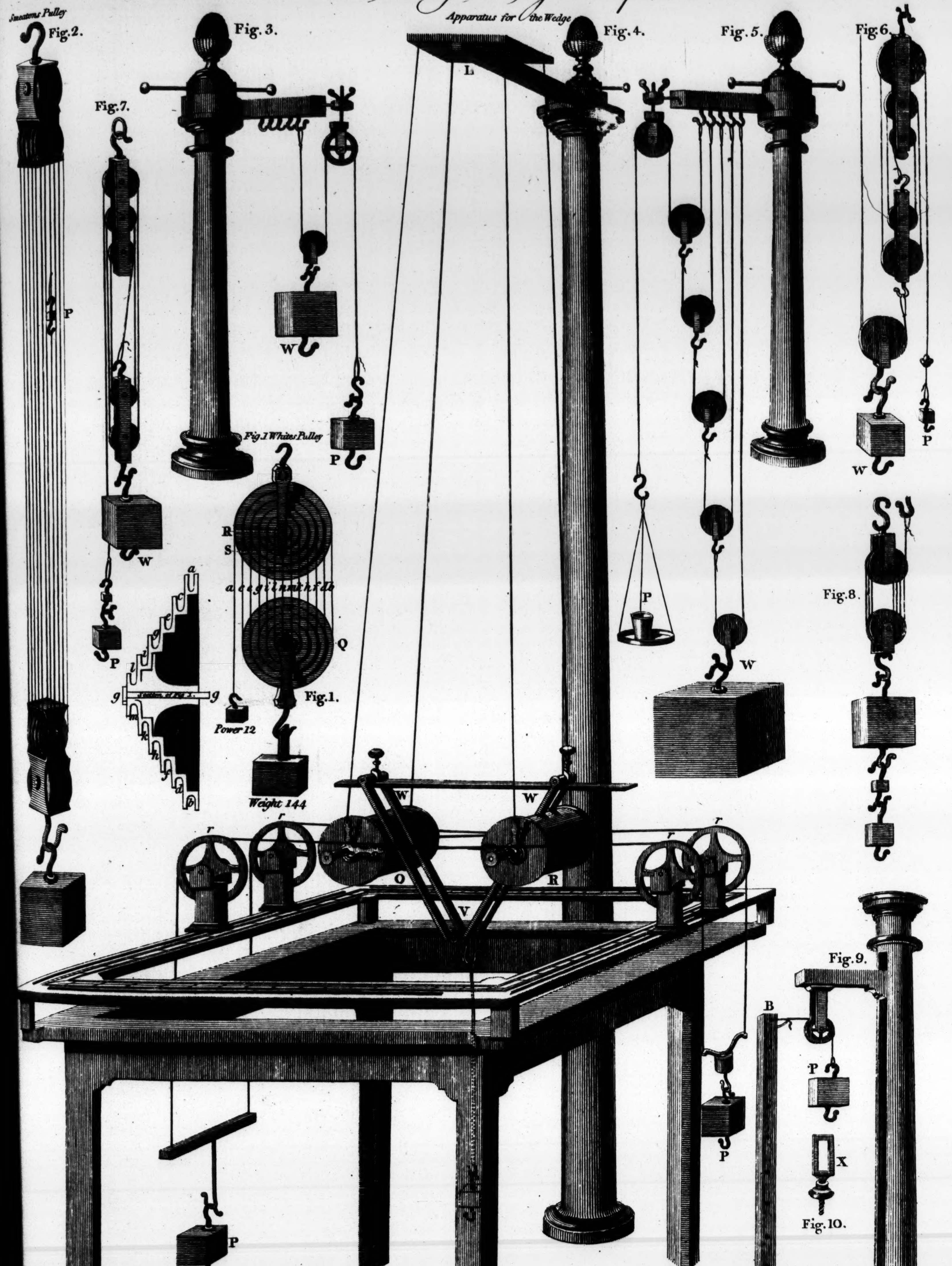
Mechanical Powers according to the latest Improvements, (including Whites Patent Concentric Pulley, See System of Mechanics.


Smeatons Pulley
Fig. 2.
P
Fig. 3.
W
P
Fig. 7.
W
P
Fig. 1 Whites Pulley
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S
a c e g i l n m k h f d b
Q
Fig. 1.
a
c
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Section of Fig. 1.
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h
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d
b
Power 12
Weight 144
Apparatus for the Wedge
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Fig. 9.
B
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Fig. 10.
W
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Fig. 11.
C
F
A
W
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3
E
D
C
B
6
5
4
3
2
1
0
A
P
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Fig. 12.
G
W
6
C
12
11
10
9
8
7
6
5
4
3
2
1
2
1
B
A
Fig. 13.
P
1
W
12

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Plate. 4.

Mechanic Powers, with their Application in Cranes, Mills & other Compound Engines. See System of Mechanics.

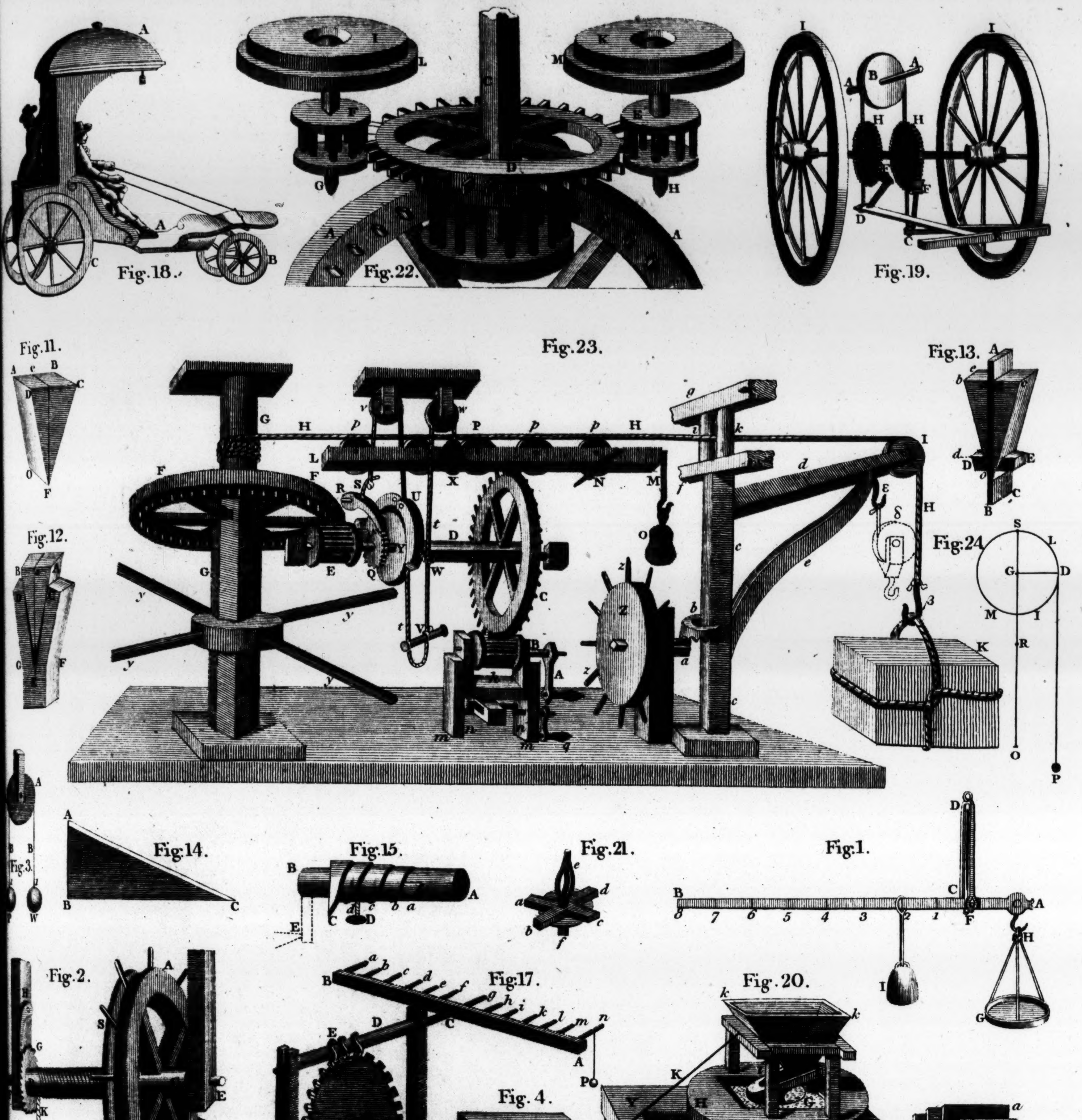

Fig. 18.
Fig. 22.
Fig. 19.
Fig. 11.
Fig. 23.
Fig. 13.
Fig. 12.
Fig. 24
Fig. 3.
Fig. 14.
Fig. 15.
Fig. 21.
Fig. 1.
Fig. 2.
Fig. 17.
Fig. 20.
Fig. 4.
Fig. 16.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
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Lodge sculp.

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every one having another under it as in the ſecond; and ſo that, when the tackle is in uſe, the two tiers that are the remoteſt from one another, are ſo much larger in diameter than thoſe that are neareſt, as to allow the lines of the former to go over the lines of the latter without rubbing. From this conſtruction ariſes a new method of reeving the line upon the ſhieves; for here, whatever be the number of ſhieves, the fall of the tackle will be always upon the middle ſhieve, or on that next to the middle, according as the number of pullies in each pin is odd or even. To do this, the line is fixed to ſome convenient part of the upper block, and brought round the middle ſhieve of the larger tier of the under block; from thence round one of the ſame ſort next the centre one of the other block; and ſo on, till the line comes to the outſide ſhieve, where the laſt line of the larger tier falls upon the firſt ſhieve of the ſmaller; and being reeved round thoſe, till it comes at the oppoſite ſide, the line from the laſt ſhieve of the ſmaller tier again riſes to the firſt of the larger, whence it is conducted round, till it ends on the middle ſhieve of the upper block on the larger tier.

Multiplying Pullies, or Pullies that act one upon another, are exceedingly advantageous in mechanics. In Plate II. *Fig.* 5, we have a repreſentation of pullies of this kind; that pulley over which the rope paſſes to the power or weight P, is a fixed pulley, the other five are moveable, but each having one end of that rope which paſſes under them, fixed to the beam. In this conſtruction, if the weight, W, be fixed to the loweſt pulley, it will only require half the power at P, to raiſe or ſuſtain it, that it would do if fixed to the pulley next above it; and when fixed at that next pulley, it will only require half the power or weight at P, to ſuſtain it, that it would do if fixed at the next higher pulley, and ſo on. Thus, if a weight of 32 lb. be fixed to the hook of the firſt or uppermoſt moving pulley, then a power or weight equal to 16 lb. at P, will ſuſtain it, or keep the whole in equilibrio. If the weight be fixed to the next lower pulley, a power at P of 8 lb. will counterballance it; if fixed to the next below that, a power at P, equal to 4 lb. will be ſufficient; if the weight be fixed to the 4th moving pulley, then the requiſite weight at P will be only 2 lb; and if the weight W, of 32 lb. be fixed at the loweſt pulley, then 1 lb. at P will ſuſtain it, and the leaſt imaginable increaſe of power or weight at P, will actually raiſe the weight W. Hence by increaſing the number of ſuch pullies, the greateſt weights at W, may be raiſed by the ſmalleſt power at P, each additional pulley increaſing the power in a duplicate ratio.

The next ſubject that claims our attention, is the Patent Concentric Pulley, invented by Mr. James White, and applied with great ſucceſs to the raiſing heavy weights by the application of a ſmall power, as well as to thoſe purpoſes that may be termed *negative*; where a conſiderable weight with a ſlow motion is employed to produce a quicker and leſs intenſe one; as in the caſe of roaſting jacks or other machines, of which *weight* is the motive principle. We are favoured with the following deſcription of it from the inventor.

" *Fig.* I. is a front view of the concentric pulley, accompanied with a Section for its better explanation. The letters O, P, indicate two frames, containing each a ſingle pulley, revolving on a pin pointed out by the dotted lines Q and R in the figure. Each of theſe pullies has ſix grooves in it of diameters proportionate to the quantity of line they involve from their relative ſituations in the Syſtem. For, ſuppoſing each of the grooves a diſtinct pulley, and their diameters all equal; it is evident that, if the weight 144 were to be raiſed, by pulling at S, till the pullies touched each other; the firſt pulley, or R, muſt receive that length of line as many times told as there are parts of the line hanging between it and the lower pulley. Now, in this caſe, there are twelve parts of the ſame line, formed by its revolving about ſix upper and ſix lower pullies or grooves. Therefore, as much line muſt paſs over the firſt pulley R, as is equal to twelve times the diſtance of the two pullies: but, from a mere view of the figure, the ſecond pulley (which is the firſt in the lower frame and marked Q,) cannot receive, or conduct, ſo much line as the former, by what is equal to the diſtance between them. In like manner the third pulley (which is the ſecond in the upper frame) involves leſs than the laſt mentioned; and ſo on, in a retrograde progreſſion, to the laſt pulley; which only receives one twelfth part of the whole. For this takes its ſhare of line *n*, from a fixed point in the upper frame that gives it nothing: whereas all the others, in the ſame frame, receive their line, as it were, partly by going to fetch it, and partly by the line coming to meet the pulley: both which motions will be eaſily noticed, though in different degrees, at all the other pullies, if attended to by a diligent obſerver.

" Now, on the ſuppoſition that theſe pullies are equal in ſize, and free to move as determined by the line paſſing about them, it appears evident from the nature of the Syſtem (and is daily proved in the uſe of the common pulley) that the number of their revolutions, and conſequently their velocities, muſt be in proportion to the number of ſuſpending parts that are between the fixed point abovementioned, and each pulley reſpectively. Thus R would go 12 times round, while the pulley under which the part *n* of the line paſſed, if equal to it, would revolve once only: and the intermediate time and velocities would be members of the ſame ſeries of arithmetical progreſſionals; of which, if the firſt number were 1, the laſt term would be always equal to the whole number of terms.

" Since then the revolutions of equal and diſtinct pullies are meaſured by their velocities, and that it is poſſible to find any proportion of velocity on a ſingle body, running on a center; viz. by ſearching proportionate diſtances from ſuch center, it follows, that if the diameters of certain grooves in the ſame ſubſtance, be exactly adapted to the above ſeries, (ſuppoſing the line inelaſtic and of no magnitude) the neceſſity of uſing ſeveral pullies in each frame will vaniſh, and with it ſome of thoſe difficulties to which, it muſt be owned, this uſeful machine is ſtill liable.

" Theſe were the ideas that ſuggeſted this improvement, and produced the pulley repreſented in *Fig.* I. Plate II. where, again, O, P, are the frames; Q, R, the pullies, and *a*, *b*, *c*, up to *n*, the coils of line by which the weight is ſupported; *q* is the line of fraction, common called the fall, which paſſes over and under the proper grooves, in the order the letters indicate, till it is faſtened to the upper frame juſt above *n*. The grooves however in practice are not nor can be arithmetical progreſſionals; for the diameter of the line or rope employed, muſt in all caſes be deducted from each term; without which the ſmaller grooves, to which the ſaid diameter bears a greater proportion than to the larger ones, will tend to riſe and fall faſter than the larger, and thus introduce confuſion and worſe defects than thoſe the invention is intended to obviate.

" The Section annexed to the former figure ſhews the method of turning the groove and hollowing the back of the pulley, in order to obtain lightneſs and ſave materials. It is needleſs here to inſiſt on the advantages attending theſe pullies, or to attempt a further deſcription of the principle which I ſuppoſe is now well underſtood. Suffice it to ſay, that lateral friction, and a ſhaking motion, which ſo much affect the common pulley, are quite done away in this caſe by the length of bearing. And leſt this circumſtance ſhould offer an idea of weakneſs, I would obſerve that to have pins for the pullies to run on, is not the only nor perhaps the beſt method; but that I ſometimes uſe centers fixed to the pullies, and revolving on a very ſhort bearing in the ſide of the frame, by which ſtrength is increaſed, and friction very much diminiſhed; for, to the laſt moment the motion of the pulley is perfectly circular; and this very circumſtance is the cauſe of its not wearing out the center as ſoon as it would, aſſiſted by the ever increaſing irregularities of a gullied bearing.

" I ſhall only add that theſe pullies, when well executed, apply to roaſting jacks and other machines of that nature, with peculiar advantage both as to the time of going, and their own durability; and that it is poſſible to produce a ſyſtem of ſuch pullies, of ſix or eight parts only, and adapted to the pockets, that ſhall raiſe upwards of an hundred weight by means of a ſkain of ſewing ſilk, or a clue of common thread."

[*We cannot but conſider this Pulley as a great improvement in Mechanics, and of the higheſt utility*; *at the ſame we cordially embrace this opportunity of informing the public, that the very ingenious Inventor and Patentee, applies in the moſt unexpenſive and ſimple methods, the principles of Mechanics to many uſeful purpoſes in the arts and commerce*; *by which conſiderable ſavings and convenience will accrue to the purchaſers*; *having long devoted to a knowledge of theſe ſubjects, the utmoſt efforts of a mind evidently formed for the ſucceſsful purſuit of ſuch ſtudies.*]

4. *The Inclined Plane.* The fourth mechanical power is the *inclined plane*; and the advantage gained by it is as great as its length exceeds its perpendicular height. Let AB, *Fig.* 5, Plate III. be a plane parallel to the horizon, and CD a plane inclined to it; and ſuppoſe the whole length CD to be three times as great as the perpendicular height G*f*F: in this caſe, the cylinder E will be ſupported upon the plane CD, and kept from rolling down upon it, by a power equal to a third part of the weight of the cylinder. Therefore, a weight may be rolled up this inclined plane with a third part of the power which would be ſufficient to draw it up by the ſide of an upright wall. If the plane was four times as long as high, a fourth part of the power would be ſufficient; and ſo on in proportion. Or, if a pillar was to be raiſed from a floor to the height GF, by means of the engine ABDC, (which would then act as a half wedge, where the reſiſtance gives way only on one ſide) the engine and pillar would be *in æquilibrio* when the power applied at GF was to the weight of the pillar as GF to GD; and if the power be increaſed, ſo as to overcome the friction of the engine againſt the floor and pillar, the engine will be driven, and the pillar raiſed: and when the engine has moved its whole length upon the floor, the pillar will be raiſed the whole height of the engine from G to F.

The force wherewith a rolling body deſcends upon an inclined plane, is to the force of its abſolute gravity, by which it would deſcend perpendicularly in a free ſpace, as the height of its plane is to its length. For, ſuppoſe the plane AB, *Fig.* 6, Plate III. to be parallel to the horizon, the cylinder C will keep at reſt upon any part of the plane where it is laid. If the plane be ſo elevated, that its perpendicular height D is equal to half its length AB, in *Fig.* 7, Plate III. the cylinder will roll down upon the plane with a force equal to half its weight; for it would require a power (acting in the direction of AB) equal to half its weight, to keep it from rolling. If the plane AB, *Fig.* 8, Plate III. be elevated, ſo as to be perpendicular to the horizon, the cylinder C will deſcend with its whole force of gravity, becauſe the plane contributes nothing to its ſupport or hindrance; and therefore, it would require a power equal to its whole weight to keep it from deſcending.

Let the cylinder C, *Fig.* 9, Plate III. be made to turn upon ſlender pivots in the frame D, in which there is a hook *e*, with a line G tied to it: let this line go over the fixed pulley H, and have its other end tied to the hook in the weight I. If the weight of the body I, be to the weight of the cylinder C, added to that of its frame D, as the perpendicular height of the plane LM is to its length AB, the weight will juſt ſupport the cylinder upon the plane, and a ſmall touch of a finger will either cauſe it to aſcend or deſcend with equal eaſe: then, if a little addition be made to the weight I, it will deſcend, and draw the cylinder up the plane. In the time that the cylinder moves from A to B, it will riſe through the whole height of the plane ML; and the weight will deſcend from H to K, through a ſpace equal to the whole length of the plane AB.

If the plane be made to move upon rollers or friction-wheels, and the cylinder be ſupported upon it; the ſame power will draw the plane under the cylinder, which before drew the cylinder up the plane, provided the pivots of the axes of the friction-wheels be ſmall, and the wheels themſelves be pretty large. For, let the machine ABC, *Fig.* 10, Plate III. (equal in length and height to ABM, *Fig.* 9,) be provided with four wheels, whereof two appear at D and E, and the third under C, whilſt the fourth is hid from ſight by the horizontal board *a*. Let the cylinder F be laid upon the lower end of the inclined plane CB, and the line G be extended from the frame of the cylinder, about 6 feet parallel to the plane CB; and, in that direction, fixed to a hook in the wall; which will ſupport the cylinder, and keep it from rolling off the plane. Let one end of the line H be tied to a hook at C in the machine, and the other end to a weight K, the ſame as drew the cylinder up the plane before. If this line be put over the fixed pulley I, the weight K will draw the machine along the horizontal plane L, and under the cylinder F: and when the machine has been drawn the whole length CB, the cylinder will be raiſed to *d*, equal to the perpendicular height AB above the horizontal part at A. To the inclined plane may be reduced all hatchets, chiſſels, and other edge-tools which are chamfered only on one ſide.

5. *The Wedge.* The fifth mechanical power or engine is the *wedge*; which may be conſidered as two equally inclined planes DEF and CEF, *Fig.* 11, Plate III. joined together at their baſes *e*EF: then, DC is the whole thickneſs of the wedge at its back ABCD, where the power is applied; EF is the depth or height of the wedge; DF the length of one of its ſides, equal to CF the length of the other ſide; and OF is its ſharp edge, which is entered into the wood intended to be ſplit by the force of a hammer or mallet ſtriking perpendicularly on its back.

Thus, AB*b*, *Fig.* 12, Plate III. is a wedge driven into the cleſt CDE of the wood FG. When the wood does not cleave at any diſtance between the wedge, there will be an equilibrium between the power impelling the wedge downward, and the reſiſtance of the wood acting againſt the two ſides of the wedge; if the power be to the reſiſtance, as half the thickneſs of the wedge as its back is to the length of either of its ſides; that is, as A*a*, to A*b*, or B*a* to B*b*. And if the power be increaſed, ſo as to overcome the friction of the wedge and the reſiſtance ariſing from the coheſion or ſtickage of the wood, the wedge will be drove in, and the wood ſplit aſunder.

But when the wood cleaves at any diſtance before the wedge (as it generally does), the power impelling the wedge will not be to the reſiſtance of the wood, as half the thickneſs of the wedge is to the length of one of its ſides, but as half its thickneſs is to the length of either ſide of the cleft, eſtimated from the top or acting part of the wedge. For if we ſuppoſe the wedge to be lengthened down from *b* to the bottom of the cleft, at E, the ſame proportion will hold; namely, that the power will be to the reſiſtance, as half the thickneſs of the wedge is to the length of either of its ſides; or, which amounts to the ſame thing, as the whole thickneſs of the wedge is to the length of both its ſides.

Some writers have advanced, that the power of the wedge is to the reſiſtance to be overcome, as the thickneſs of the back of the wedge is to the length only of one of its ſides; which ſeems very ſtrange: for, if we ſuppoſe AB, *Fig.* 14, Plate III. to be a ſtrong inflexible bar of wood or iron fixed into the ground at CB, and D and E to be two blocks of marble lying on the ground on oppoſite ſides of the bar; it is evident that the block D may be ſeparated from the bar to the diſtance *d*, equal to *ab*, by driving the inclined plane or half wedge *abo* down between them; and the block E may be ſeparated to an equal diſtance on the other ſide, in like manner, by the half wedge *cdo*. But the power impelling each half wedge will be to the reſiſtance of the block againſt its ſide, as the thickneſs of that half wedge is to the length of its acting ſide. Therefore the power to drive both the half wedges is to both the reſiſtances, as both the half backs is to the length of both the acting ſides, or as half the thickneſs of the whole back is to the length of either ſide. And if the bar be taken away, the blocks put cloſe together, and the two half wedges joined to make one, it will require as much force to drive it down between the blocks, as is equal to the ſum of the ſeparate powers acting upon the half wedges when the bar was between them.

To confirm this by an experiment, let two cylinders, as O and R, *Fig.* 4, Plate II. be drawn towards one another by lines running over fixed pullies, and a weight of 40 ounces hanging at the lines belonging to each cylinder: and let a wedge of 40 ounces weight, having its back juſt as thick as either of its ſides is long, be put between the cylinders, which will then act againſt each ſide with a reſiſtance equal to 40 ounces, whilſt its own weight endeavours to bring it down and ſeparate them: and here, the power of the wedge's gravity impelling it downward, will be to the reſiſtance of both the cylinders againſt the wedge, as the thickneſs of the wedge is to the length of both its ſides; for there will then be an equilibrium between the weight of the wedge and the reſiſtance of the cylinders againſt it, and it will remain at any height between them; requiring juſt as much power to puſh it upward as to pull it downward. If another wedge of equal weight and depth with this, and only half as thick, be put between the cylinders, it will require twice as much weight to be hung at the ends of the lines which draw them together, to keep the wedge from going down between them. That is, a wedge of 40 ounces, whoſe back is only equal to half the length of one of its ſides, will require 80 ounces to each cylinder, to keep it in an equilibrium between them: and twice 80 is 160, equal to 4 times 40. So that the power will be always to the reſiſtance, as the thickneſs of the back of the wedge is to the length, not of its own ſide, but of both its ſides.

The beſt way for making a wedge with its apparatus for trying experiments, is as follows:

Let WWV be two flat ſurfaces, each about 15 inches long and three or four in breadth, joined together by a hinge at V; and let a bar go acroſs WW, on which the ſaid ſurfaces WWV may be opened to any angle not more than 60 degrees, and then fixed at the given angle by means of two ſcrews above WW. It will then repreſent the wedge with its end *x*, which enters the wood, and it will alſo repreſent the two ſides of the wedge againſt which the wood acts in cleaving. By means of the bar which goes acroſs above WW, the wedge may be opened ſo as to adjuſt the thickneſs of its back in any proportion to the length of either of its ſides; but not to exceed that length: and any weight may be hung to the wedge upon the hook *x*, which weight, together with the weight of the wedge itſelf, may be conſidered as the impelling power, which is all the ſame in experiment whether it be laid upon the back of the wedge to puſh it down, or hung to its edge to pull it down. Let O, R, be two wooden cylinders, each about two inches thick, where they touch the outſides of the wedge WWV; and let their ends be made like two round flat plates, to keep the wedge from ſlipping off endwiſe between them. Let a ſmall cord with a loop on one end of it go over a pivot in the end of the cylinders O and R, and the cords on the right hand of the figure, which adhere to the weight P, belonging to the cylinder O, go over the fixed pullies *r*, *r*, on the right hand ſide, and be faſtened at their other ends to the bar above the weight on the right hand on which any weight may be hung at pleaſure. In the like manner let the cords on the left hand of the figure belonging to the cylinder R, go over the fixed pullies *r*, *r*, on the ſame ſide, to the bar above the weight P, on which a weight may be hung equal to that on the other ſide. Theſe weights, by drawing the cylinders towards one another, may be conſidered as the reſiſtances of the wood acting equally againſt oppoſite ſides of the wedge; the cylinders themſelves being ſuſpended near and parallel to each other, by their pivots in the loops on the lines which lead up to I, at the top of the figure, which lines may be fixed to hooks in the cieling of the room. The longer theſe lines are, the better; and they ſhould never be leſs than four feet each. The farther alſo the pullies *r*, *r*, both on the right and left, are from the cylinders O and R, the truer will the experiments be; and they may turn upon pins fixed into the wall.

In this machine, the weights P, P, on both ſides, and the weights in centre which hangs to *x*, may be varied at pleaſure, ſo as to be adjuſted in proportion of the length of the wedge's ſides to the thickneſs of its back; and when they are ſo adjuſted, the wedge will be *in æquilibrio* with the reſiſtance of the cylinders.

The wedge is a very great mechanical power, ſince not only wood, but even rocks can be ſplit by it; which would be impoſſible to effect by the lever, wheel and axle, or pulley: for the force of the blow, or ſtroke, ſhakes the cohering parts, and thereby makes them ſeparate the more eaſily.

6. *The Screw.* The ſixth and laſt mechanical power is the *ſcrew*: which cannot properly be called a *ſimple machine*, becauſe it is never uſed without the application of a lever or winch to aſſiſt in turning it: and then it becomes a compound engine of a very great force either in preſſing the parts of bodies cloſe together, or in raiſing great weights. It may be conceived to be made by cutting a piece of paper ABC (*Fig.* 14. Plate III.) into the form of an inclined plane or half wedge, and then coiling it round a cylinder AB (*Fig.* 15. Plate III.) And here it is evident, that the winch E muſt turn the cylinder once round before the weight of reſiſtance D can be moved from one ſpiral winding to another, as from *d* to *c*; therefore, as much as the circumference of a circle deſcribed by

the handle of the winch is greater than the interval or diſtance between the ſpirals, ſo much is the force of the ſcrew. Thus, ſuppoſing the diſtance between the ſpirals to be half an inch, and the length of the winch to be 12 inches; the circle deſcribed by the handle of the winch where the power acts will be 76 inches nearly, or about 152 half-inches, and conſequently 152 times as great as the diſtance between the ſpirals: and therefore a power at the handle, whoſe intenſity is equal to no more than a ſingle pound will balance 152 pounds acting againſt the ſcrew; and as much additional force, as is ſufficient to overcome the friction, will raiſe the 152 pounds; and the velocity of the power will be to the velocity of the weight as 152 to 1. Hence it appears, that the longer the winch be made, and the nearer the ſpirals are to one another, ſo much the greater is the force of the ſcrew.

A machine for ſhewing the force or power of the ſcrew may be contrived in the following manner. Let the wheel C, *Fig.* 16. Plate III. have a ſcrew *a b* on its axis, working in the teeth of the wheel D, which ſuppoſe to be 48 in number. It is plain, that for every time the wheel C and ſcrew *a b* are turned round by the winch A, the wheel D will be moved one tooth by the ſcrew; and therefore, in 48 revolutions of the winch, the wheel D will be turned once round. Then, if the circumference of a circle deſcribed by the handle of the winch be equal to the circumference of a groove *e* round the wheel D, the velocity of the handle will be 48 times as great as the velocity of any given point in the groove. Conſequently, if a line G (above number 48) goes round the groove *e*, and has a weight of 48 pounds hung to it below the pedeſtal EF, a power equal to one pound at the handle will balance and ſupport the weight. To prove this by experiment, let the circumferences of the grooves of the wheels C and D be equal to one another; and then if a weight H of one pound be ſuſpended by a line going round the groove of the wheel C, it will balance a weight of 48 pounds hanging by the line G; and a ſmall addition to the weight H will cauſe it to deſcend, and ſo raiſe up the other weight.

If the line G, inſtead of going round the groove *e* of the wheel D, goes round its axle I; the power of the machine will be as much increaſed, as the circumference of the groove *e* exceeds the circumference of the axle: which, ſuppoſing it to be 6 times, then one pound at H will balance 6 times 48, or 288 pounds hung to the line on the axle: and hence the power or advantage of this machine will be as 288 to 1. That is to ſay, a man, who by his natural ſtrength could lift an hundred weight, will be able to raiſe 288 hundred, or $14\frac{8}{20}$ ton weight, by this engine.

But the following engine is ſtill more powerful, on account of its having the addition of four pullies: and in it we may look upon all the mechanical powers as combined together, even if we take in the balance. For as the axis D of the bar AB, *Fig.* 17. Plate III. is in its middle at C, it is plain, that, if equal weights are ſuſpended upon any two pins equidiſtant from the axis C, they will counterpoiſe each other. It becomes a lever by hanging a ſmall weight P upon the pin *n*, and a weight as much heavier upon either of the pins *b*, *c*, *d*, *e*, or *f*, as in proportion to the pins being ſo much nearer the axis. The wheel and axle FG is evident: ſo is the ſcrew E; which takes in the inclined plane, and with it the half wedge. Part of a cord goes round the axle, the reſt under the lower pullies K, *m*, over the upper pullies L, *n*, and then it is tied to a hook at *m* in the lower or moveable block, on which hangs the weight W.

In this machine, if the wheel F has 30 teeth, it will be turned once round in 30 revolutions of the bar AB, which is fixed on the axis D of the ſcrew E: if the length of the bar is equal to twice the diameter of the wheel, the pins *a* and *n* at the ends of the bar will move 60 times as faſt as the teeth of the wheel do: and conſequently, one ounce at P will balance 60 ounces hung upon a tooth at *q* in the horizontal diameter of the wheel. Then, if the diameter of the wheel F is 10 times as great as the diameter of the axle G, the wheel will have 10 times the velocity of the axle; and therefore one ounce P at the end of the lever AC will balance 10 times 60, or 600 ounces hung to the rope H which goes round the axle. Laſtly, if four pullies be added, they will make the velocity of the lower block K, and weight W, four times leſs than the velocity of the axle: and this being the laſt power in the machine, which is four times as great as that gained by the axle, it makes the whole power of the machine 4 times 600, or 2400. So that a man who could lift 100 weight in his arms by his natural ſtrength, would be able to raiſe 2400 hundred weight by this engine.

By one or more of theſe ſimple powers, all great weights are raiſed to conſiderable heights; but in them all, the more they diminiſh the weight, the more ſlow they are in their operations, and conſequently the more do they retard the workman's diſpatch; and univerſally the more ſimple they are, the more expeditious. Beſides this, their friction or rubbing againſt each other greatly diminiſhes their power. The friction in the balance is leaſt, it is more in the lever, increaſed in the axle and wheel, yet more in the pulley, but moſt of all in the ſcrew. In general, in combined engines, upon account of this friction, they will require a third part more of power to move them, than the theory allows. For this reaſon, therefore, it will for ever be impoſſible to fulfil the boaſt of Wilkins, who vaunted that he could pull up an oak by the roots with a ſingle horſe-hair; for the force requiſite to work the machine in pulling it up, would nearly amount to a third part of the force which the machine exerts. The large capſtan and pulley, uſed in launching a man of war, would in theory do it moſt effectually. A ſimple lever, drawn a proper length by the imagination, would do it as well; it would even fulfil the great boaſt of Archimedes, it would remove the earth itſelf. The learned often amuſe themſelves with fancies like theſe; and it was for this that Cicero called *Archimedes* a trifler.

COMPOUND ENGINES.

A Carriage to go without any other Force than what it receives from the Paſſengers. By means of wheels, ſome people have contrived carriages to go without horſes, or any other moving power than what was given by the paſſengers, by the wind, &c. One of theſe is repreſented by *Fig.* 18, Plate III. It is moved by the footman behind it; and the fore-wheels, which act as a rudder, are guided by the perſon who ſits in the carriage.

Between the hind-wheels is placed a box, in which is concealed the machinery that moves the carriage. AA, (*Fig.* 19, Plate III.) is a ſmall axis fixed into the box. B is a pulley, over which runs a rope, whoſe two ends are faſtened to the ends of the two levers or treddles CD, whoſe other ends are fixed in ſuch manner in the piece E, which is joined to the box, that they can eaſily move up and down. F, F, are two flat pieces of iron that are joined to the treddles, and take the teeth of the two wheels H, H, which are fixed on the ſame axis with the hind wheels of the carriage I, I.

It is evident, that when the footman behind preſſes down one of the treddles, ſuppoſe C, with his foot, he muſt bring down one of the pieces of iron F, and conſequently turn the wheel H that is next to it, and at the ſame time, by means of the rope that goes over the pulley, he muſt raiſe the other treddle D, together with its piece F, which being thruſt down will turn the other wheel H; and ſo alternately: and as the great wheels are fixed on the ſame axis, they muſt neceſſarily move at the ſame time.

It is eaſy to conceive, that if the end of the treddles next E, inſtead of being placed behind the carriage, were turned the oppoſite way, ſo as to come under the feet of the perſon who ſits in it, he might move it with equal, or even with greater facility, than the footman, as it would then be charged with the weight of one perſon only.

A machine of this kind will afford a ſalutary recreation in a garden or park, or on any plain ground; but in a rough or deep road muſt be attended with more pain than pleaſure.

OF MILLS AND CRANES.

A common Mill. In a common breaſt-mill, *Fig.* 20, Plate III. where the fall of water may be about ten feet, AA is the great wheel, which is generally about 17 or 18 feet in diameter, reckoned from the outermoſt edge of any float board at *a* to that of its oppoſite float at *b*. To this wheel the water is conveyed through a channel; and by falling upon the wheel, turns it round.

On the axis BB of this wheel, and within the mill-houſe, is a wheel D, about 8 or 9 feet diameter, having 61 cogs, which turn a trundle E, containing ten upright ſtaves or rounds; and when theſe are the number of cogs and rounds, the trundle will make $6\frac{1}{10}$ revolutions for one revolution of the wheel.

The trundle is fixed upon a ſtrong iron axis called the ſpindle, the lower end of which turns in a braſs foot, fixed at F, in the horizontal beam ST, called the *bridge tree*; and the upper part of the ſpindle turns in a wooden buſh fixed into the nether-millſtone which lies upon beams in the floor YY. The top part of the ſpindle above the buſh is ſquare, and goes into a ſquare hole in a ſtrong iron croſs *a b c d*, (ſee *Fig.* 21, Plate III.) called the *rynd*; under which, and cloſe to the buſh, is a round piece of thick leather upon the ſpindle, which it turns round at the ſame time that it does the rynd.

The rynd is let into grooves in the under ſurface of the running millſtone G (*Fig.* 20.); and ſo turns it round in the ſame time that the trundle E is turned round by the cog-wheel D. This millſtone has a large hole quite through its middle, called the *eye of the ſtone*, through which the middle part of the rynd and upper end of the ſpindle may be ſeen; whilſt the four ends of the rynd lie hid below the ſtone in their grooves

The end T of the bridge-tree TS (which ſupports the upper millſtone G upon the ſpindle) is fixed into a hole in the wall; and the end S is let into a beam QR, called the *brayer*, whoſe end R remains fixed in a mortiſe; and its other end Q hangs by a ſtrong iron rod P, which goes through the floor YY, and as a ſcrew-nut on its top at O; by the turning of which nut, the end Q of the brayer is raiſed or depreſſed at pleaſure, and conſequently the bridge-tree TS and upper millſtone. By this means, the upper millſtone may be ſet as cloſe to the under one, or raiſed as high from it, as the miller pleaſes. The nearer the millſtones are to one another, the finer they grind the corn; and the more remote from one another, the coarſer.

The upper millſtone G is incloſed in a round box H, which does not touch it any where; and is about an inch diſtant from its edge all around. On the top of this box ſtands a frame for holding the hopper, *k k*, to which is hung the ſhoe, I, by two lines faſtened to the hind part of it, fixed upon hooks in the hopper, and by one end of the crook-ſtring K faſtened to the fore-part of it at *i*, the other end being twiſted round the pin L. As the pin is turned one way, the ſtring draws up the ſhoe cloſer to the hopper, and ſo leſſens the aperture between them; and as the pin is turned the other way, it lets down the ſhoe, and enlarges the aperture.

There is a ſquare hole in the top of the ſpindle, in which is put the feeder *e*, *Fig.* 21. This feeder (as the ſpindle turns round) jogs the ſhoe I, three times in each revolution, and ſo cauſes the corn to run conſtantly down from the hopper K, through the ſhoe, into the eye of the mill-ſtone, where it falls upon the top of the rynd, and is, by the motion of the rynd and the leather under it, thrown below the upper ſtone, and ground between it and the lower one. The violent motion of the ſtone creates a centrifugal force in the corn going round with it, by which means it gets farther and farther from the centre, as in a ſpiral, in every revolution until it be thrown quite out; and, being then ground, it falls through a ſpout M, called the *mill-eye*, into the trough N.

In order to cut and grind the corn, both the upper and under millſtones have channels or furrows cut into them, proceeding obliquely from the centre towards the circumference. And theſe furrows are each cut perpendicularly on one ſide and obliquely on the other into the ſtone, which gives each furrow a ſharp edge, and in the two ſtones they come as it were againſt one another like the edges of a pair of ſciſſars; and ſo cut the corn, to make it grind the eaſier when it falls upon the places between the furrows. Theſe are cut the ſame way in both ſtones when they lie upon their backs, which makes them run croſs-ways to each other when the upper ſtone is inverted by turning its furrowed ſurface towards that of the lower. For, if the furrows of both ſtones lay the ſame way, a great deal of the corn would be driven onward in the lower furrows: and ſo come out from between the ſtones without ever being cut.

A leſs quantity of water will turn an overſhot-mill, where the wheel has buckets inſtead of float-boards, than a breaſt-mill, where the fall of the water ſeldom exceeds half the height A *b* of the wheel. So that, where there is but a ſmall quantity of water, and a fall great enough for the wheel to lie under it, the bucket, or overſhot wheel is always uſed. But where there is a large body of water, with a little fall, the breaſt or float-boat wheel muſt take place.

Thoſe who recollect what has been ſaid concerning the acceleration of bodies falling freely by the power of gravity acting conſtantly and uniformly upon them, may perhaps aſk, Why ſhould the motion of the wheel be equable, and not accelerated, ſince the water acts conſtantly and uniformly upon it? The plain anſwer is, that the velocity of the wheel can never be ſo great as the velocity of the water that turns it; for if it ſhould become ſo great, the power of the water would be quite loſt upon the wheel, and then there would be no proper force to overcome the friction of the geers and attrition of the ſtones. Therefore, the velocity with which the wheel begins to move, will increaſe no longer than till its momentum or force is balanced by the reſiſtance of the machine; and then the wheel will go on with an equable motion.

A Hand-mill. If the cog-wheel D *fig.* 20, Plate III. be made about 18 inches diameter, with 30 cogs, the trundle as ſmall in proportion, with 10 ſtaves, and the millſtones be each about two feet in diameter, and the whole work be put into a ſtrong frame of wood, as repreſented in the figure, the engine will be a hand-mill for grinding corn or malt in private families. And then, it may be turned by a winch inſtead of the wheel AA; the millſtone making three revolutions for every one of the winch. If a heavy fly be put upon the axle B, near the winch, it will help to regulate the motion.

If the cogs of the wheel and rounds of the trundle could be put in as exactly as the teeth are cut in the wheels and pinions of a clock, then the trundle might divide the wheel exactly: that is to ſay, the trundle might make a given number of revolutions for one of the wheel, without a fraction. But as any exact number is not neceſſary in mill-work, and the cogs and rounds cannot be ſet in ſo truly as to make all the intervals between them equal; a ſkillful mill-wright will always give the wheel what he calls *a hunting cog*; that is, one more than what will anſwer to an exact diviſion of the wheel by the trundle. And then, as every cog comes to the trundle, it will take the next ſtaff or round behind the one which it took in the former revolution: and by that means will wear all the parts of the cogs and rounds which work upon one another equally, and to equal diſtances from one another, in a little time; and ſo make a true uniform motion throughout the whole work. Thus, in the above water-mill, the truddle has 10 ſtaves, and the wheel 61 cogs.

Sometimes, where there is a ſufficient quantity of water, the cog-wheel AA, *Fig.* 22, Plate III. turns a large trundle BB, on whoſe axis C is fixed the horizontal wheel D, with cogs all round its edge, turning two trundles E and F at the ſame time; whoſe axes or ſpindles G and H turn two millſtones I and K, upon the fixed ſtones L and M. And when there is not work for them both, either may be made to lie quiet, by taking out one of the ſtaves of its trundle, and turning the vacant place towards the cog-wheel D. And there may be a wheel fixed on the upper end of the great upright axle C for turning a couple of boulting mills; and other work for drawing up the ſacks, fanning and cleaning the corn, ſharpening of tools, &c.

A Horſe-mill. If, inſtead of the cog-wheel AA and trundle BB, horizontal levers be fixed into the axle C below the wheel D, then horſes may be put to theſe levers for turning the mill: which is often done where water cannot be had for that purpoſe.

A Wind-mill. The working parts of a wind-mill differ very little from thoſe of a water-mill: only the former is turned by the action of the wind upon four ſails, every one of which ought (as is generally believed) to make an angle of $54\frac{2}{3}$ degrees with a plane perpendicular to the axis on which the arms are fixed for carrying them; it being demonſtrable, that when the ſails are ſet to ſuch an angle, and the axis turned end-ways toward the wind, the wind has the greateſt power upon the ſails. But this angle anſwers only to the caſe of a vane or ſail juſt beginning to move: for, when the vane has a certain degree of motion, it yields to the wind; and then that angle muſt be increaſed to give the wind its full effect.

A crane is an engine by which great weights are raiſed to certain heights, or let down to certain depths. It conſiſts of wheels, axles, pullies, ropes, and a gib or gibbet. When the rope H, *Fig.* 23, Plate III. is hooked to the weight K, a man turns the winch A, on the axis whereof is the trundle B, which turns the wheel C, on whoſe axis D is the trundle E which turns the wheel F with its upright axis G, on which the great rope HH winds as the wheel turns; and going over a pulley I, at the end of the arm *d* of the gib *ccde*, it draws up the heavy burden K; which being raiſed to a proper height, as from a ſhip to the quay, is then brought over the quay by pulling the wheel Z round by the handles z, z, which turns the gib by means of the half wheel *b* fixed on the gib-poſt *cc*, and the ſtrong pinion *a* fixed on the axis of the wheel Z. This wheel gives the man that turns it an abſolute command over the gib, ſo as to prevent it from taking any unlucky ſwing, ſuch as often happens when it is only guided by a rope tied to its arm *d*; and people are frequently hurt, ſometimes killed, by ſuch accident.

The great rope goes between two upright rollers *i* and *k*, which turn upon gudgeons in the fixed beams *f* and *g*; and as the gib is turned towards either ſide, the rope bends upon the roller next that ſide. Were it not for theſe rollers, the gib would be quite unmanageable; for the moment it were turned ever ſo little towards any ſide, the weight K would begin to deſcend, becauſe the rope would be ſhortened between the pulley I and axis G; and ſo the gib would be pulled violently to that ſide, and either be broken to pieces, or break every thing that came in its way. Theſe rollers muſt be placed ſo that the ſides of them round which the rope bends may keep up the middle of the bended part directly even with the centre of the hole in which the upper gudgeon of the gib turns in the beam *f*. The truer theſe rollers are placed, the eaſier the gib is managed, and the leſs apt to ſwing either way by the force of the weight K.

A ratchet-wheel Q is fixed upon the axis D, near the trundle E; and into this wheel falls the catch or click R. This hinders the machine from running back by the weight of the burden K, if a man who raiſes it ſhould happen to be careleſs, and ſo leave off working at the winch A ſooner than he ought to do.

When the burden K is raiſed to its proper height from the ſhip, and brought over the quay by turning the gib about, it is let down gently upon the quay, or into a cart ſtanding thereon, in the following manner: A man takes hold of the rope *tt* (which goes over the pulley *v*, and is tied to a hook at S in the catch R) and ſo diſengages the catch from the ratchet-wheel Q; and then, the man at the winch A turns it backward, and lets down the weight K. But if the weight pulls too hard againſt this man, another lays hold of the handle V, and by pulling it downward draws the gripe U cloſe to the wheel Y, which by rubbing hard againſt the gripe hinders the too quick deſcent of the weight; and not only ſo, but even ſtops it at any time if required. By this means, heavy goods may be either raiſed or let down at pleaſure, without any danger of hurting the men who work the engine.

When part of the goods are craned up, and the rope is to be let down for more, the catch R is firſt diſengaged from the ratchet-wheel Q, by pulling the cord *t*; then the handle *q* is turned half round backward, which, by the crank *nn* in the piece *o*, pulls down the frame *b* between the guides *m* and *m* (in which it ſlides in a groove) and ſo diſengages the trundle B from the wheel C: and then, the heavy hook β, at the end of the rope H, deſcends by its own weight, and turns back the great wheel F with its trundle E and the wheel C; and this laſt wheel acts like a fly againſt the wheel F and hook β, and ſo hinders it from going down too quick; whilſt the weight X keeps up the gripe U from rubbing againſt the wheel Y, by means of a cord going from the weight, over the pulley *w*, to the hook W in the gripe; ſo that the gripe never touches the wheel, unleſs it be pulled down by the handle V.

When the crane is to be ſet at work again for drawing up another burden, the handle *q* is turned half round forwards; which, by the crank *nn*, raiſes up the frame *b*, and cauſes the trundle B to lay hold of the wheel C; and then, by turning the winch A, the burden of goods K is drawn up as before.

The crank *nn* turns pretty ſtiff in the mortiſe near *o*, and ſtops againſt the farther end of it when it has got juſt a little beyond the perpendicular; ſo that it can never come back of itſelf: and therefore, the trundle B can never come away from the wheel C, until the handle *q* be turned half round.

The great rope runs upon rollers in the lever LM, which keep it from bending between the axle at G and the pulley I. This lever turns upon the axis N by means of the weight O, which is juſt ſufficient to keep its end L up to the rope; ſo that, as the great axle turns, and the rope coils round it, the lever riſes with the rope, and prevents the coilings from going over one another.

The power of this crane may be eſtimated thus: Suppoſe the trundle B to have 13 ſtaves or rounds, and the wheel C to have 78 ſpur-cogs; the trundle E to have 14 ſtaves, and the wheel F 56 cogs. Then, by multiplying the ſtaves of the trundles, 13 and 14, into one another, their product will be 182; and by multiplying the cogs of the wheels, 78 and 56, into one another, their product will be 4368; and dividing 4368 by 182, the quotient will be 24: which ſhews, that the winch A makes 24 turns for one turn of the wheel F and its axle G on which the great rope or chain HIH winds. So that, if the length or radius of the winch A were only equal to half the diameter of the great axle G, added to half the thickneſs of the rope H, the power of the crane would be as 24 to 1; but the radius of the winch being double the above length, it doubles the ſaid power, and ſo makes it as 48 to 1; in which caſe, a man may raiſe 48 times as much weight by this engine as he could do by his natural ſtrength without it, making proper allowance for the friction of the working parts. Two men may work at once, by having another winch on the oppoſite end of the axis of the trundle under B; and ſo make the power ſtill double.

If this power be thought greater than what may be generally wanted, the wheels may be made with fewer cogs in proportion to the ſtaves in the trundles; and ſo the power may be of whatever degree is judged to be requiſite. But if the weight be ſo great as will require yet more power to raiſe it (ſuppoſe a double quantity), then the rope H may be put under a moveable pulley, as δ, and the end of it tied to a hook in the gib at ε; which will give a double power to the machine, and ſo raiſe a double weight hooked to the block of the moveable pulley.

When only ſmall burdens are ſo raiſed, this may be quickly done by men puſhing the axle G round by the handſpokes *y, y, y, y*; having firſt diſengaged the trundle B from the wheel C: and then, this wheel will only act as a fly upon the wheel F; and the catch R will prevent its running back, if the men ſhould inadvertently leave off puſhing before the burden be unhooked from β.

Laſtly, when very heavy burdens are to be raiſed, which might endanger the breaking of the cogs in the wheel F; their force againſt theſe cogs may be much abated by men puſhing round the handſpokes *y, y, y, y,* whilſt the man at A turns the winch.

We have only ſhewn the working parts of this crane, without the whole of the beams which ſupport them; knowing that theſe are eaſily ſuppoſed, and that if they had been drawn, they would have hid a great deal of the working parts from ſight, and alſo confuſed the figure.

SECT. IV. ATWOOD's EXPERIMENTS ON MOTION ACCELERATED.

Among the experiments of different artiſts for aſcertaining the qunatities of accelerated motion; there are none that we have met with ſo well adapted to the purpoſe, as the apparatus of Mr. Atwood, F.R.S. which, as he obſerves, at once diſcovers to the underſtanding, the quantity of matter moved, the conſtant force which moves it, the ſpace deſcribed from reſt, the time of deſcription, and the velocity acquired.

1. *Of the Maſs moved.* In order to obſerve the effects of the moving force, which is the object of any experiment, the interference of all other forces ſhould be prevented: the quantity of matter moved therefore, conſidering it before any impelling force has been applied, ſhould be without weight: for although it be impoſſible to abſtract the natural gravity or weight from any ſubſtance whatever, yet the weight may be ſo counteracted as to be of no ſenſible effect in experiments. Thus in the inſtrument conſtructed to illuſtrate this ſubject experimentally, A, B, Plate I. *Fig.* 1. repreſent two equal weights affixed to the extremities of a very fine and flexible ſilk line: this line is ſtretched over a wheel or fixed pulley *a b c d*, moveable round an horizontal axis: the two weights A, B being preciſely equal and acting againſt each other, remain in equilibrio; and when the leaſt weight is ſuperadded to either (ſetting aſide the effects of friction) it will preponderate. When A, B, are ſet in motion, by the action of any weight *m*, the ſum A + B + *m* would conſtitute the whole maſs moved, but for the inertia of the materials which muſt neceſſarily be uſed in the communication of motion: theſe materials conſiſt of 1. The wheel *abcd* over which the line ſuſtaining A and B paſſes. 2. The four friction wheels on which the axle of the wheel *abcd* reſts: the uſe of theſe wheels is to prevent the loſs of motion, which would be occaſioned by the friction of the axle if it revolved on an immoveable ſurface. 3. The line by which the bodies A and B are connected ſo as when ſet in motion to move with equal velocities. The weight and inertia of the line are too ſmall to have ſenſible effect on the experiments, but the inertia of the other materials juſt mentioned conſtitute a conſiderable proportion of the maſs moved, and muſt be taken into account. Since when A and B are put in motion, they muſt neceſſarily move with a velocity equal to that of the circumference of the wheel *abcd* to which the line is applied; it follows, that if the whole maſs of the wheels were accumulated in this circumference, its inertia would be truly eſtimated by the quantity of matter moved; but ſince the parts of the wheels move with different velocities, their effects in reſiſting the communication of motion to A and B by their inertia will be different; thoſe parts which are furtheſt from the axis reſiſting more than thoſe which revolve nearer, in a duplicate proportion of thoſe diſtances. If the figures of the wheels were regular, from knowing their weights and figures, the diſtances of their centres of gyration from their axes of motion would become known, and conſequently an equivalent weight, which being accumulated uniformly in the circumference *a b c d*, would exert an inertia equal to that of the wheels in their conſtructed form. But as the figures are wholly irregular, recourſe muſt be had to experiment, to aſſign what equivalent quantity of matter, which being accumulated uniformly in the circumference of the wheel *abcd*, would reſiſt the communication of motion to A in the ſame manner as the wheels.

In order to aſcertain the inertia of the wheel *a b c d*, with that of the friction wheels, the weights A, B, being removed, the following experiment was made.

A weight of thirty grains was affixed to a ſilk line (the weight of which was not ſo much as $\frac{1}{4}$ of a grain, and conſequently too inconſiderable to have ſenſible effect in the experiment) this line being wound round the wheel *a b c d*, the weight 30 grains by deſcending from reſt communicated motion to the wheel, and by many trials was obſerved to deſcribe a ſpace of about $38\frac{1}{2}$ inches in 3 ſeconds. From theſe deta the equivalent maſs or inertia of the wheels will be known from this rule:

Let a weight P, be applied to communicate motion to a ſyſtem of bodies (*Fig.* 24, Plate III.) by means of a very ſlender and flexible line going round the wheel SDM, through the centre of which the axis paſſes (G being the common centre of gravity, *g* the centre of gravity of the matter contained in this line, and *o* the centre of oſcillation) Let this weight deſcend from reſt through any convenient ſpace *s* inches, and let the obſerved time of its deſcent be *t* ſeconds, then if *l* be the ſpace through which bodies deſcend freely by gravity in one ſecond, the equivalent weight ſought $= \frac{W \times Sg \times So}{SD^2} = \frac{P \times t^2 l}{s} - P.$

Here we have $p = 30$ grains, $t = 3$ ſeconds, $l = 193$ inches, $s = 38.5$ inches; and $\frac{P \times t^2 l}{s} - P = \frac{30 \times 9 \times 193}{385} - 30 =$ 1323 grains, or $2\frac{3}{4}$ ounces.

This is the inertia equivalent to that of the wheel *abcd*, (*Fig.* I. Plate I.) and the friction wheels together: for the rule extends to the eſtimation of the inertia of the maſs contained in all the wheels.

The reſiſtance to motion therefore ariſing from the wheel's inertia, will be the ſame as if they were abſolutely removed, and a maſs of $2\frac{3}{4}$ ounces were uniformly accumulated in the circumference of the wheel *a b c d*. This being premiſed, let the boxes A and B be replaced, being ſuſpended by the ſilk line over the wheel or pully *a b c d*, and balancing each other: ſuppoſe that any weight *m* be added to A ſo that it ſhall deſcend; the exact quantity of matter moved, during the deſcent of the weight A, will be aſcertained, for the whole maſs will be $A + B + m + 2\frac{3}{4}$ oz.

In order to avoid troubleſome computations in adjuſting the quantities of matter moved and the moving forces, ſome determinate weight of convenient magnitude may be aſſumed as a ſtandard, to which all the others are referred. This ſtandard weight in the ſubſequent experiments is $\frac{1}{4}$ of an ounce, and is repreſented by the letter *m*. The inertia of the wheels being therefore $= 2\frac{3}{4}$ ounces, will be denoted by 11 *m*. A and B are two boxes conſtructed ſo as to contain different quantities of matter, according as the experiment may require them to be varied: the weight of each box, including the hook to which it is ſuſpended, $= 1\frac{1}{2}$ oz. or according to the preceding eſtimation, the weight of each box will be denoted by 6 *m*; theſe boxes contain ſuch weights as are repreſented by *Fig.* 4. Plate I. each of which weighs an ounce, ſo as to be equivalent to 4 *m*; other weights of $\frac{1}{2}$ an oz. $= 2m$, $\frac{1}{4} = m$, and aliquot parts of *m*, ſuch as $\frac{1}{2}m$, $\frac{1}{4}m$, may be alſo included in the boxes, according to the conditions of the different experiments hereafter deſcribed.

If $4\frac{3}{4}$ oz. or 19 *m*, be included in either box, this with the weight of the box itſelf will be 25 *m*; ſo that when the weights A and B, each being 25 *m*, are balanced in the manner above repreſented, their whole maſs will be 50 *m*, which being added to the inertia of the wheels 11 *m*, the ſum will be 61 *m*. Moreover, three circular weights, ſuch as that which is repreſented at *Fig.* 5, are conſtructed; each of which $= \frac{1}{4}$ oz. or *m*; if one of theſe be added to A and one to B, the whole maſs will now become 63 *m*, perfectly in equilibrio, and moveable by the leaſt weight added to either (ſetting aſide the effects of friction) in the ſame manner preciſely as if the ſame weight or force were applied to communicate motion to the maſs 63 *m*, exiſting in free ſpace and without gravity.

2. *The moving Force.* Since the natural weight or gravity of any given ſubſtance is conſtant, and the exact quantity of it eaſily eſtimated, it will be convenient here to apply a weight to the maſs A, as a moving force: thus, when the ſyſtem conſiſts of a maſs $=$ 63 *m*, according to the preceding deſcription, the whole being per-

fectly balanced, let a weight $\frac{1}{4}$ oz. or m, ſuch as is repreſented in *Fig.* 5, be applied on the maſs A; this will communicate motion to the whole ſyſtem: by adding a quantity of matter m to the former maſs 63 m, the whole quantity of matter moved will now become 64 m, and the moving force being $= m$, this will give the force which accelerates the deſcent of A $= \frac{m}{64m}$, or $\frac{1}{64}$ part of the accelerating force by which the bodies deſcend freely towards the earth's ſurface.

By the preceding conſtruction, the moving force may be altered without altering the maſs moved; for ſuppoſe the three weights m, two of which are placed on A, and one on B to be removed, then will A balance B. If the weights 3 m be all placed on A, the moving force will now become 3 m, and the maſs moved 64 m as before, and the force which accelerates the deſcent of A $= \frac{3m}{64m} = \frac{3}{64}$ part of the force by which gravity accelerates bodies in their free deſcent to the ſurface.

Suppoſe it were required to make the moving force 2 m, the maſs moved continuing the ſame. In order to effect this, let the three weights, each of which $= m$, be removed; A and B will balance each other; and the whole maſs will be 61 m: let $\frac{1}{2}$ m, *Fig.* 6. be added to A, and $\frac{1}{2}$ m to B, the equilibrium will ſtill be preſerved, and the maſs moved will be 62 m; now let 2 m be added to A, the moving force will be 2 m, and the maſs moved 64 m, as before; wherefore the force of acceleration $= \frac{1}{32}$ part of the acceleration of gravity. Theſe alterations in the moving force may be made with great eaſe and convenience in the more obvious and elementary experiments, there being no neceſſity for altering the contents of the boxes A and B: but the proportion and abſolute quantities of the moving force and maſs moved may be of any aſſigned magnitude, according to the conditions of the propoſition to be illuſtrated.

3. *Of the Space deſcribed.* The body A, *Fig* 1. deſcends in a vertical line; and a ſcale about 64 inches in length graduated into inches and tenths of an inch is adjuſted vertical, and ſo placed that the deſcending weight A may fall in the middle of a ſquare ſtage, fixed to receive it at the end of the deſcent: the beginning of the deſcent is eſtimated from *o* on the ſcale, when the bottom of the box A is on a level with *o*. The deſcent of A is terminated when the bottom of the box ſtrikes the ſtage, which may be fixed at different diſtances from the point o, ſo that by altering the potion of the ſtage, the ſpace deſcribed from quieſcence may be of any given magnitude leſs than 64 inches.

4. *The Time of Motion* is obſerved by the beats of a pendulum, which vibrates ſeconds: and the experiments, intended to illuſtrate the elementary propoſitions, may be eaſily ſo conſtructed that the time of motion ſhall be a whole number of ſeconds; the eſtimation of the time therefore admits of conſiderable exactneſs, provided the obſerver takes care to let the bottom of the box A begin its deſcent preciſely at any beat of the pendulum; then the coincidence of the ſtroke of the box againſt the ſtage, and the beat of the pendulum at the end of the time of motion, will ſhew how nearly the experiment and the theory agree together. There might be various mechanical devices thought of for letting the weight A begin its deſcent at the inſtant of a beat of the pendulum; let the bottom of the box A, when at o on the ſcale, reſt on a flat rod, held in the hand horizontally, its extremity being coincident with o; by attending to the beats of the pendulum, and with a little practice the rod which ſupports the box A may be removed at the diſtance the pendulum beats, ſo that the deſcent of A ſhall commence at the ſame inſtant.

5. *Of the Velocity acquired.* It remains only to deſcribe in what manner the velocity acquired by the deſcending weight A, at any given point of the ſpace through which it has deſcended, is made evident to the ſenſes. The velocity of A's deſcent being continually accelerated will be the ſame in no two points of the ſpace deſcribed: this is occaſioned by the conſtant action of the moving force; and ſince the velocity of A at any inſtant, is meaſured by the ſpace which would be deſcribed by it, moving uniformly for a given time with the velocity it had acquired at that inſtant, this meaſure cannot be experimentally obtained, except by removing the force by which the deſcending bodies' acceleration was cauſed.

In order to ſhew in what manner this is effected particularly, let us again ſuppoſe the boxes A and B $= 25$ m each, ſo as together to be $= 50$ m; this with the wheel's inertia 11 m will make 61 m; now let m, *Fig.* 5. be added to A, and an equal weight m to B, theſe bodies will balance each other, and the whole maſs will be 63 m. If a weight m be added to A, motion will be communicated, the moving force being m, and the maſs moved 64 m. In eſtimating the moving force, the circular weight $= m$ was made uſe of as a moving force; but for the preſent purpoſe of ſhewing the velocity acquired, it will be convenient to uſe a flat rod, the weight of which is alſo $= m$, *Fig.* 8. Plate 1. Let the bottom of the box A be placed on a level with o on the ſcale, the whole maſs being as deſcribed above $= 63$ m, perfectly balanced in equilibrio. Now let the rod, the weight of which $= m$, be placed on the upper ſurface of A; this body will deſcend along the ſcale preciſely in the ſame manner as when the moving force was applied in the form of a circular weight. Suppoſe the maſs A, *Fig.* 3. Plate I. to have deſcended by conſtant acceleration of force of m, for any given time or through a given ſpace: let a circular frame be ſo affixed to the ſcale, contiguous to which the weight deſcends, that A may paſs centrally through it, and that this circular frame may intercept the rod m by which the body A has been accelerated from quieſcence. After the moving force m has been intercepted at the end of the given ſpace or time, there will be no force operating on any part of the ſyſtem, which can accelerate or retard its motion; this being the caſe, the weight A, the inſtant after m has been removed, muſt proceed uniformly with the velocity which it had acquired that inſtant: in the ſubſequent part of its deſcent, the velocity being uniform will be meaſured by ſpace deſcribed in any convenient number of ſeconds.

Other Uſes of the Inſtrument. It is needleſs to deſcribe particularly, but it may not be improper juſt to mention the further uſes of this inſtrument; ſuch as the experimental eſtimation of the velocities communicated by the impact of bodies elaſtic and nonelaſtic; the quantity of reſiſtance oppoſed by fluids, as well as for various other purpoſes; theſe uſes we ſhall not inſiſt on, but the properties of retarded motion being a part of the preſent ſubject, it may be neceſſary to ſhew in what manner the motion of bodies reſiſted by conſtant forces are reduced to experiment by means of the inſtrument above deſcribed, with as great eaſe and preciſion as the properties of bodies uniformly accelerated. A ſingle inſtance will be ſufficient: thus, ſuppoſe the maſs contained in the weights A and B *fig.* 3. Plate I. and the wheels to be 61 m, when perfectly in equilibrio, let a circular weight m be applied to B, and let two long weights or rods, each $= m$, be applied to A, then will A deſcend by the action of the moving force m, the maſs moved being 64 m: ſuppoſe that when it has deſcribed any given ſpace by conſtant acceleration, the two rods m are intercepted by the circular frame above deſcribed, while A is deſcending through it; the velocity acquired by that deſcent is known, and when the two rods are intercepted, the weight A will begin to move on with the velocity acquired, being now retarded by the conſtant force m; and ſince the maſs moved is 62 m, it follows, that the force of retardation will be $\frac{1}{62}$ part of that force whereby gravity retards bodies thrown perpendicularly upwards. The weight A will therefore proceed along the graduated ſcale in its deſcent with an uniformly retarded motion, and the ſpaces deſcribed, times of motion, and velocities deſtroyed by the reſiſting force, will be ſubject to the ſame meaſures as in the examples of accelerated motion above deſcribed.

In the foregoing deſcriptions, two ſuppoſitions have been aſſumed, neither of which are mathematically true: but it may be eaſily ſhewn that they are ſo in a phyſical ſenſe; the errors occaſioned by them in practice being inſenſible:

1. The force which communicates motion to the ſyſtem has been aſſumed conſtant, which will be true only on a ſuppoſition that the line, at the extremities of which the weights A and B *fig.* 1. are affixed, is without weight. In order to make it evident, that the line's weight and inertia are of no ſenſible effect, let a caſe be referred to, wherein the body A deſcends through 48 inches from reſt by the action of the moving force m, when the maſs moved is 64 m; the time wherein A deſcribes 48 inches is increaſed by the effects of the line's weight by no more than $\frac{312}{10000}$ part of a ſecond; the time of deſcent being 3.9896 ſeconds, when the ſtring's weight is not conſidered, and the time when the ſtring's weight is taken into account $= 4.0208$ ſeconds; the difference between which is wholly inſenſible by obſervation.

2. The bodies have alſo been ſuppoſed to move in vacuo, whereas the air's reſiſtance will have ſome effect in retarding their motion: but as the greateſt velocity communicated in theſe experiments, cannot much exceed that of about 26 inches in a ſecond, (ſuppoſe the limit 26.2845) and the cylindrical boxes being about 1 $\frac{3}{4}$ inches in diameter, the air's reſiſtance can never increaſe the time of deſcent in ſo great a proportion as that of 240 : 241; its effects therefore will be inſenſible in experiment.

The effects of friction are almoſt wholly removed by the friction wheels; for when the ſurfaces are well poliſhed and free from duſt, &c. if the weights A and B be balanced in perfect equilibrio, and the whole maſs conſiſts of 63 m, according to the example already deſcribed, a weight of 1$\frac{1}{2}$ grains, or at moſt 2 grains, being added either to A or B, will communicate motion to the whole, which ſhews that the effects of friction will not be ſo great as a weight of 1$\frac{1}{2}$ or 2 grains. In ſome caſes, however, eſpecially in experiments relating to retarded motion, the effects of friction become ſenſible; but may be very readily and exactly removed by adding a ſmall weight 1.5 or 2 grains to the deſcending body, taking care that the weight added is ſuch as is in the leaſt degree ſmaller than that which is juſt ſufficient to ſet the whole in motion, when A and B are equal and balance each other, before the moving force is applied.

We have rather been copious in the deſcription of this apparatus, as it is a New Improvement, and very curiouſly illuſtrates thoſe principles of motion, which had hitherto been only eſtabliſhed by Theory: at leaſt, we do not recollect any invention before this that could afford ſuch a ſtriking proof of the Principles of Gravitation and Motion Accelerated.

SYSTEM OF MEDICINE.

HISTORY.

THE art of Medicine is in itſelf ſo noble and ſo generally uſeful to mankind, that many have thought it came originally from God by expreſs revelation; and, accordingly, we find the heathens with one voice aſcribing the origin of the medicinal art to their gods. But it is evidently of human invention; and mankind were naturally led to it from caſual obſervations on the diſeaſes to which they found themſelves ſubject. At what time medicine was firſt reduced to rules, and began to be practiſed as an art, is not known. The moſt ancient phyſicians we read of were thoſe who embalmed the patriarch Jacob by order of his ſon Joſeph. The ſacred writer ſtyles theſe phyſicians *ſervants* to Joſeph: from whence we may be aſſured that they were not *prieſts*, as the firſt phyſicians are generally ſuppoſed to have been; for in that age we know the Egyptian prieſts were in ſuch high favour, that they retained their liberty, when, through a public calamity, all the reſt of the people were made ſlaves to the prince.

What ſeems moſt probable on this ſubject is, that religion and medicine came to be mixed together only in conſequence of that degeneracy into ignorance and ſuperſtition, which ſome time or other hath taken place among all nations. The Egyptians, we know, came at laſt to be ſunk in the moſt ridiculous and abſurd ſuperſtition; and then, indeed, it is no wonder to find their prieſts commencing phyſicians, and mingling charms, incantations, &c. with their remedies. That this was the caſe, though long after the days of Joſeph, we are very certain; and indeed it ſeems as natural for ignorance and barbariſm to combine religion with phyſic, as it is for a civilized and enlightened people to keep them ſeparate. Hence we ſee, that among all modern barbarians their prieſts or conjurors are their only phyſicians.

The Greeks too had ſeveral perſons to whom they attributed the invention of phyſic, particularly Prometheus, Apollo or Pæan, and Æſculapius; which laſt was the moſt celebrated of any. But here we muſt obſerve, that as the Greeks were a very warlike people, their phyſic ſeems to have been little elſe than what is now called ſurgery, or the cure of wounds, fractures, &c. Hence, Æſculapius, and his pupils Chiron, Machaon, and Podalirius, are celebrated by Homer only for their ſkill in curing theſe, without the leaſt mention of their attempting the cures of internal diſeaſes. We are not, however, to ſuppoſe, that they confined themſelves entirely to ſurgery. They no doubt would occaſionally preſcribe for internal diſorders; but as they were moſt frequently converſant with wounds, we may naturally ſuppoſe the greateſt part of their ſkill to have conſiſted in knowing how to cure theſe.

The practice of theſe ancient Greek phyſicians, notwithſtanding the praiſes beſtowed on them by their poets, ſeems to have been very limited, and in ſome caſes even pernicious. All the external remedies applied to Homer's wounded heroes were fomentations, while inwardly their phyſicians gave them wine, ſometimes mingled with cheeſe ſcraped down. This laſt we know muſt have been pernicious in many caſes by increaſing the inflammation: and it is very probable, that ſuch an improper exhibition was merely a conſequence of their ignorance; as we ſee old women in this country will give ardent ſpirits to thoſe who are ſeized with inflammatory fevers, in order to prevent their patients from fainting. A great deal of their phyſic alſo conſiſted in charms, incantations, amulets, &c. of which, as they are common to all ſuperſtitious and ignorant nations, it is ſuperfluous to take any farther notice. Among the Greeks, however, Æſculapius, as he was reckoned the moſt eminent practitioner of his time, ſo his name continued to be revered after his death; he was ranked amongſt the gods; and the principal knowledge of the medicinal art remained with his family to the time of Hippocrates, who reckoned himſelf the ſeventeenth in a linneal deſcent from Æſculapius, and who was truly the firſt who treated of medicine in a regular and rational manner.

At laſt, the Grecian philoſophers attempted to introduce particular theories into the medicinal art. Pythagoras, who lived about the 60th Olympiad, and founded the Italic ſchool, is the firſt we read of who began to take theſe things into conſideration.

This may be a ſufficient ſpecimen of the ancient philoſophic medicine, of which we ſhall now take no farther notice, but proceed to give a brief account of the ſtate in which the art was left by Hippocrates, whoſe name has been celebrated through ſo many ages. According to Soranus, Hippocrates was born in the iſland of Cos, in the firſt year of the 88th Olympiad; but others make him older, ſo that the exact time in which he lived cannot be aſcertained.

The works attributed to him are very voluminous, but evidently done by different perſons, as many of them are contradictory to each other, ſo that it is difficult to determine thoſe which are really his writings, and thoſe which are not. Some indeed are ſo ſceptical on this head, as to deny that we have proper evidence that any of thoſe works really belong to Hippocrates: in moſt of the writings of Hippocrates, we find a general principle acknowledged which is called *nature*. To this principle he aſcribes a mighty power. "Nature (ſays he) is of itſelf ſufficient to every animal. She performs every thing that is neceſſary to them, without needing the leaſt inſtruction from any one how to do it." Upon this footing, as if nature had been a principle endowed with knowledge, he gives her the title of *juſt*; and aſcribes virtues or powers to her, which are her ſervants, and by means of which ſhe performs all her operations in the bodies of animals; they diſtribute the blood, ſpirits, and heat, through all parts of the body, which by this means receive life and ſenſation. And in other places he tells us, that it is this faculty which gives nouriſhment, preſervation, and growth, to all things.

The health or ſickneſs of the body he reckoned to conſiſt in the ſtate of the four humours. Theſe are the blood, phlegm, the yellow bile, and the melancholy or black bile. The blood, he ſays, is naturally hot and moiſt, of colour red, and ſweet to the taſte: the phlegm is cold and moiſt, white, viſcid, and ſaltiſh; the bile yellow, dry, viſcid, bitter, and drawn from the fat part of the blood or aliments; the melancholy, black bile, he ſaid, was cold and dry, very viſcid, windy, and fermentative. On theſe four humours, according to him depend health and ſickneſs.

Of all the cauſes of diſeaſes, mentioned by Hippocrates, the moſt general are diet and air. On the ſubject of diet he has compoſed ſeveral books, and in the choice of this he was exactly careful; and the more ſo, as his practice turned almoſt wholly upon it. He alſo conſidered the air very much; he examined what winds blue ordinarily or extraordinarily; he conſidered the irregularity of the ſeaſons, the riſing and ſetting of ſtars, or the time of certain conſtellations; alſo the time of the ſolſtices, and of the equinoxes; thoſe days, in his opinion, producing great alterations in certain diſtempers. But what hath chiefly contributed to procure the vaſt reſpect generally paid to Hippocrates, is his induſtry in obſerving the moſt minute circumſtances of diſeaſes, and his exactneſs in nicely deſcribing every thing that happened before, and every accident that appeared at the ſame time with them; as alſo what appeared to give eaſe, and what to increaſe the malady, which is what we call *writing the hiſtory of a diſeaſe*.

Hippocrates alſo inquired into the ſtate of the pulſe, or the beating of the arteries. According to Galen, he was the firſt phyſician that made uſe of the word *pulſe* in the ſenſe in which it is now commonly taken; that is to ſay, for the natural and ordinary beating of the arteries. For the moſt ancient phyſicians, and even Hippocrates himſelf, for a long time, by this word, underſtood the violent pulſation that is felt in an inflamed part, without putting the fingers to it. It is obſerved, however, by Galen, and other phyſicians, that Hippocrates touches on the ſubject of the pulſe more ſlightly than any other on which he treats. But that our celebrated phyſician underſtood ſomething even on this ſubject, is eaſily gathered from ſeveral paſſages in his writings; as when he obſerves, that in acute fevers the pulſe is very quick and very great; and when he makes mention, in the ſame place, of trembling pulſes, and thoſe that beat ſlowly; when he obſerves, that in ſome diſeaſes incident to women, when the pulſe ſtrikes the finger faintly, and in a languiſhing manner, it is a ſign of approaching death.

From this account of Hippocrates, it will appear, that he was not ſo much taken up with reaſoning on the phænomena of diſeaſes, as of reporting them. He was content to obſerve theſe phænomena exactly, to diſtinguiſh diſeaſes by them, and judged of the event by comparing them exactly together. For his ſkill in prognoſtics he was indeed very remarkable, as we have already mentioned, inſomuch that he and his pupils were looked upon by the vulgar as prophets. What adds very much to his reputation is, that he lived in an age when phyſic was altogether buried in ſuperſtition, and yet he did not ſuffer himſelf to be carried away by it; on the contrary, on many occaſions, he expreſſes his abhorrence of it. One of his principal maxims was this, That, to preſerve health, we ought not to overcharge ourſelves with too much eating, nor neglect the uſe of exerciſe and labour.

Here we cannot help taking notice of the prodigious diſparity between the delicacy of the people in our days, and in thoſe of Hippocrates: for he takes great pains to tell the difference between the fleſh of a dog, a fox, a horſe, and an aſs; which he would not have done if at that time they had not been uſed for victuals, at leaſt by the common people. With regard to drink, he takes pains to diſtinguiſh the good waters from the bad. He adviſes to mix wine with an equal quantity of water: and this he ſays, is the juſt proportion; by uſing which the wine will expel what is hurtful to the body, and the water will ſerve to temper the acrimony of the humours. Venery, in his opinion, is wholeſome, provided people conſult their ſtrength, and do not purſue it to exceſs; which he finds fault with on all occaſions, and would have it avoided alſo in relation to ſleep and watching. In his writings are likewiſe to be found ſeveral remarks concerning good and bad air; and he makes it appear that the good or bad diſpoſition of this element does not depend ſolely on the difference of the climate, but on the ſituation of every place in particular. He ſpeaks alſo of the good and bad effects of the paſſions, and would have us uſe a great deal of moderation in regard to them. Hippocrates gives alſo the following inſtruction: "We ought (ſays he) to mind with a great deal of attention what gives eaſe, and what creates pain; what is eaſily ſupported, and what cannot be endured." We ought not to do any thing raſhly; but ought to pauſe, or wait, without doing any thing: by this way, if you do the patient no good, you will at leaſt do him no hurt. Theſe are the principal and moſt general maxims of the practice of Hippocrates, and which proceed upon the ſuppoſition laid down at the beginning, viz. that nature cures diſeaſes. We next proceed to conſider particularly the remedies employed by him, which will ſerve to give us further inſtructions concerning his practice.

Diet was the firſt, the principal, and oftentimes the only remedy made uſe of by this great phyſician to anſwer the greateſt part of the intentions above-mentioned. That he ſpoke the truth in this reſpect is plain from what we have already obſerved concerning the treatment of the wounded heroes by the pupils of Æſculapius.

There were many diſeaſes for which he judged the bath was a proper remedy; and he takes notice of all the circumſtances that are neceſſary in order to cauſe the patient to receive benefit from it.

In chronical diſtempers Hippocrates approved very much of exerciſe, though he did not allow it in acute ones: but even in theſe he did not think that a patient ought always to lie a-bed; but tells us, that "we muſt ſometimes puſh the timorous out of bed, and rouſe up the lazy."

When our phyſician found that diet and exerciſe were not ſufficient to eaſe nature of a burden of corrupted humours, he was obliged to make uſe of other means, of which *purgation* was the principal one.

Blood-letting was another method of evacuation pretty much uſed by Hippocrates. Another aim he had in this, beſides the mere evacuation, was to divert or recal the courſe of the blood when he imagined it was going where it ought not. A third end of bleeding was to procure a free motion of the blood and ſpirits. In a pleuriſy he directs to take blood from the arm of the ſide affected; and for the ſame reaſon, in pains of the head, he directs the veins of the noſe and forehead to be opened. Theſe directions, however, we now know to be almoſt entirely ſuperfluous, and to have proceeded from Hippocrates's ignorance of the blood's circulation.

When bleeding and purging, which were the principal and moſt general means uſed by Hippocrates for taking off a plethora, proved inſufficient for that purpoſe, he had recourſe to diuretics and ſudorifics.

Of the external remedies preſcribed by Hippocrates, fomentations were the chief. Theſe were of two kinds. The one was a ſort of bath, in which the patient ſat in a veſſel full of a decoction of ſimples appropriated to his malady; ſo that the part affected was ſoaked in the decoction. This was chiefly uſed in diſtempers of the womb, of the arms, the bladder, the reins, and generally all the parts below the diaphragm. The ſecond way of fomenting was, to take warm water and put it into a ſkin or bladder, or even into a copper or earthen veſſel, and to apply it to the part affected. From preſcribing the bath it is evident that Hippocrates minutely obſerved the effects of the ſeveral remedies he preſcribed; and particularly in this inſtance of infuſing the virtues of his medicines through the abſorbent ſyſtem. Though he had not a knowledge of this ſet of veſſels, which are but of late diſcovery, it more evidently points out the merit of this great man, as he diſcovered the effect without knowing the cauſe.

Gargles, a kind of fomentations for the mouth, were alſo known to Hippocrates. In the quinſey he uſed a gargle made of marjoram, ſavory, celery, mint, and nitre, boiled with water and a little vinegar. When this was ſtrained, they added honey to it, and waſhed their mouths frequently with it. Oils and ointments were likewiſe much uſed by Hippocrates, with a view to mollify and abate pain, to ripen boils, reſolve tumours, refreſh after wearineſs, make the body ſupple, &c. It is worth our obſervation, that the compound medicines of Hippocrates were but very few, and compoſed only of four or five ingredients at moſt; and that he not only underſtood pharmacy, or the art of compounding medicines, but preparing ſuch as he uſed himſelf, or cauſed his ſervants to prepare them in his houſe by his directions.

The firſt phyſician of eminence who differed conſiderably in his practice from Hippocrates was Praxagoras. From ſome authors we learn that he accounted for diſeaſes from the qualities of the humours, of which he reckoned ten ſorts, whereas Hippocrates ſuppoſed only four.

About the 131ſt year after Chriſt, in the reign of the emperor Adrian, lived the celebrated Galen, a native of Pergamus, whoſe name makes ſuch a conſpicuous figure in the hiſtory of phyſic. At this time the dogmatic, empiric, methodic, and other ſects, had each their abettors. The methodics were held in great eſteem, and looked upon to be ſuperior to the dogmatics, who were ſtrangely divided among themſelves, ſome of them following Hippocrates, others Eraſiſtratus, and others Aſclepiades. Galen undertook the reformation of medicine, and ſeems to have been of that ſect which was called *eclectic*, from their chooſing out of different authors what they eſteemed good in them, without being particularly attached to any one more than the reſt. This declaration he indeed ſets out with; but, notwithſtanding this, he follows Hippocrates much more than any of the reſt. Though before his time ſeveral phyſicians had commented on the works of Hippocrates, yet Galen pretends that none of them had underſtood his meaning beſides himſelf. His firſt attempt therefore was to explain the works of Hippocrates; with which view he wrote a great deal, and after this ſet about compoſing a ſyſtem of his own. In one of his books entitled, "Of the eſtabliſhment of medicine," he defines the art to be one which teaches to preſerve health and cure diſeaſes. In another book, however, he propoſes the following definition: "Medicine (ſays he) is a ſcience which teaches what is ſound, and what is not ſo; and what is of an indifferent nature, or holds a medium between what is ſound and what is the reverſe."

His method of cure differed little from that of Hippocrates: but from the ſpecimen of Galen's method of teaching the medicinal art, it is evident that his ſyſtem was little elſe than a heap of ſpeculations, diſtinctions, and reaſonings; whereas that of Hippocrates was founded immediately upon facts, which he had either obſerved himſelf, or had from the obſervations of others. In conſequence of the eſtabliſhment of ſuch a ſyſtem, the medicinal art, as well as others during the dark ages of popery, came to be reduced to a heap of quibbling diſtinctions and metaphyſical nonſenſe. After the days of Galen, however, the knowledge of medicine did not immediately decline. Dr. Freind is of opinion that it continued to advance till the year 600. He cenſures Mr. Le Clerc for placing the phyſicians Oribaſius, Aëtius, Alexander, and Paulus Ægineta, all without any diſtinction, in the fourth century; and ſtill more for placing Diocles Caryſtius 500 years after Chriſt, when he ſhould, according to him, have been placed 300 years before him.

Oribaſius flouriſhed about the year 360, and was phyſician to the emperor Julian. He ſpeaks very fully of the effects of bleeding by way of ſcarification, a thing little taken notice of by former writers.

Aëtius lived very near the end of the fifth, or in the beginning of the ſixth century. Many paſſages in his writings ſerve to ſhew us how much the actual and potential cautery were uſed by the phyſicians of that age. He alſo takes notice of the worms bred in different parts of the body called *dracunculi*, which were unknown to Galen. He ſeems alſo to be the firſt Greek writer among the Chriſtians who gives us any ſpecimen of medicinal ſpells and charms; ſuch as that of a finger of St. Blaſius for removing a bone which ſticks in the throat, and another in relation to a fiſtula. He gives a remedy for the gout, which he calls the *grand drier*: the patient is to uſe it for a whole year, and obſerve the following diet each month. "In September, he muſt eat and drink milk: in October, he muſt eat garlic: in November, abſtain from bathing: in December, he muſt eat no cabbage: in January, he is to take a glaſs of pure wine in the morning: in February, to eat no beet: in March, to mix ſweet things both in eatables and drinkables: in April, not to eat horſe-radiſh, nor in May the fiſh called *polypus*; in June to drink cold water in a morning; in July, to avoid venery: and laſtly, in Auguſt to eat no mallows." This may ſufficiently ſhew the quackery of thoſe times, and how ſuperſtition was beginning to mix itſelf with the art.

Alexander, who flouriſhed in the reign of Juſtinian, is a more original author than either of the two former. He confines himſelf directly to the deſcribing the ſigns of diſeaſes, and the methods of cure, without meddling with anatomy, the materia medica, or ſurgery, as all the reſt did.

Paulus was born in the iſland Ægina, and lived in the 7th century. He tranſcribes a great deal from Alexander and other phyſicians. His deſcriptions are ſhort and full. He treats particularly of womens diſorders; and ſeems to be the firſt inſtance upon record of a profeſſed *man-midwife*, for ſo he was called by the Arabians: and accordingly he begins his book with the diſorders incident to pregnant women. He treats alſo very fully of ſurgery; and gives ſome directions, according to Dr. Freind, not to be found in the moſt ancient writers.

With this phyſician cloſes the period of the Greek claſſical phyſicians. As for the weſtern parts of the world, every art and ſcience had been long loſt in them, by the inundation of Goths and other barbarous nations who over-ran the Roman empire. The Arabians, who about this time over-ran the eaſtern parts of the world, were at firſt as great enemies to learning of all kinds as the Goths; but at length they applied themſelves to the ſtudy of ſeveral ſciences, particularly medicine. They were for the moſt part, indeed, only copiers of the Greeks; we are, however, indebted to them for ſome improvements. They were the firſt who introduced chymical remedies, though of theſe they uſed but few, nor did they make any conſiderable progreſs in the chymical art. Anatomy was not in the leaſt improved by them, nor did ſurgery receive any advancement till the time of Albucaſis, who lived, probably, in the 12th century. They added a great deal to botany and the materia medica, by the introduction of new drugs, of the aromatic kind eſpecially, from the eaſt, many of which are of conſiderable uſe. They alſo found out the way of making ſugar; and by help of that, ſyrups; which two new materials are of great uſe in mixing up compound medicines.

With regard to their practice, in ſome few particulars they deviated from the Greeks. They deviated from Hippocrates, in particular, in one very trivial circumſtance, which produced a terrible controverſy. The queſtion was, Whether blood in a pleuriſy ought to be drawn from the arm of the affected ſide, or the oppoſite. Hippocrates had directed it to be drawn from the arm of the affected ſide; but the Arabians, following ſome other ancient phyſicians, ordered it to be drawn from the oppoſite one. Such was the ignorance of thoſe ages, that the univerſity of Salamanca in Spain made a decree, that no one ſhould dare to let blood but in the contrary arm; and endeavoured to procure an edict from the emperor Charles V. to ſecond it; alleging that the other method was of no leſs pernicious conſequence to medicine, than Luther's hereſy had been to religion.

By reaſon of the general decay of learning in the weſtern parts of the world, the Greek writers became totally forgot, becauſe nobody could read the language; and the Arabians, though moſtly copiers from them, enjoyed all the reputation that was due to the others. The Arabian phyſic was introduced into Europe very early, with the moſt extravagant applauſe: and not only this, but other branches of their learning came into repute in the weſt; inſomuch that in the 11th century, the ſtudies of natural philoſophy and the liberal arts were called *the ſtudies of the Saracens.* This was owing partly to the cruſades undertaken againſt them by the European princes; and partly to the ſettlement of the Moors in Spain, and the intercourſe they and other Arabians had with the Italians.

From this time to the end of the 15th and beginning of the 16th century, the hiſtory of phyſic furniſhes us with no intereſting particulars. This period, however, is famous for the introduction of chymiſtry into medicine, and the diſcovery of three new diſtempers, the ſweating ſickneſs, the venereal diſeaſe, and the ſcurvy. The ſweating ſickneſs began in 1483, in the army of Henry VII. upon his landing at Milfordhaven, and ſpread itſelf at London from the 21ſt of September to the end of October. It returned here five times, and always in ſummer; firſt in 1485, then in 1506, afterwards in 1517, when it was ſo violent that it killed many in the ſpace of three hours, ſo that numbers of the nobility died, and of the commonalty in ſeveral towns often the one-half periſhed. It appeared the fourth time in 1528, and then proved mortal in ſix hours; many of the courtiers died of it, and Henry VIII. himſelf was in danger. In 1529, and only then, it infeſted the Netherlands and Germany, in which laſt country it did much miſchief. The laſt return of it was in 1551.

In the beginning of the 16th century, the famous chymiſt Paracelſus introduced a new ſyſtem into medicine, founded on the principles of his art. The Galenical ſyſtem had prevailed till his time; but their practice had greatly degenerated, and was become quite trifling and frivolous. The phyſicians rejected the uſe of opium, mercury, and other efficacious remedies. Paracelſus, who made uſe of theſe, had therefore greatly the advantage over them; and now all things relating to medicine were explained on imaginary chymical principles. It will eaſily be conceived that a practice founded in this manner could be no other than the moſt dangerous quackery. At this time, however, it was neceſſary; for now a new diſeaſe over-ran the world, and threatened greater deſtruction than almoſt all the old ones put together, both by the violence of its ſymptoms, and its baffling the moſt powerful remedies at that time known. This was the venereal diſeaſe, which is ſaid to have been imported from the Weſt-Indies by the companions of Chriſtopher Columbus. Its firſt remarkable appearance was at the ſiege of Naples in 1494, from whence it was ſoon after propagated through Europe, Aſia, and Africa. The ſymptoms with which it made the attack at that time were exceedingly violent, much more ſo than they are at preſent; and conſequently were utterly unconquerable by the Galeniſts. The quacks and chymiſts, who boldly ventured on mercury, though they no doubt deſtroyed numbers by their exceſſive uſe of it, yet ſhewed that a remedy for this terrible diſtemper was at laſt found out, and that a proper method of treating it might ſoon be fallen upon. Shortly after, the Weſt-Indian ſpecific, guaiacum, was diſcovered: the materia medica was enriched with that and many other valuable medicines, both from the Eaſt and Weſt-Indies; which contributed conſiderably to the improvement of the practice of phyſic. The ſcurvy likewiſe began to ſpread during the courſe of this century. The mariners of Saxony called it *ſcharbock*, which, in their language, ſignifies *inflammation*; and this it ſeems was one way in which it at firſt appeared, and terminated often in a gangrene. It broke out among the Portugueſe ſailors in ſome of their voyages to the Eaſt Indies.

The revival of learning, which now took place throughout Europe, the appearance of theſe new diſtempers, and the natural fondneſs of mankind for novelty, contributed greatly to promote the advancement of medicine as well as other ſciences.

It was not, however, till the year 1628 that a foundation was laid for a ſolid and rational ſyſtem. This was done by Dr. Harvey, who diſcovered the circulation of the blood; which may juſtly be reckoned the moſt capital diſcovery that ever was made with regard to the practice of medicine.

Before this time every phyſician had ſome kind of theory of his own, yet, as all theſe were built upon principles in themſelves erroneous, and inconſiſtent with what has been ſince diſcovered concerning the ſtructure of the human body, they are now quite unworthy of notice. But, on the diſcovery of the circulation of the blood, matters took a different turn, and phyſicians began to aim at eſtabliſhing a theory of medicine upon more ſolid and conſiſtent principles. It was generally agreed, that the circulation was the capital and vital function of the body, and that upon it the life and health did immediately depend. The blood was conſidered as it were the *primum mobile* of the whole body; and to ſomething in the blood all the diſorders to which the human race are liable, were thought to be owing. About this time, alſo, the laws of mechanics began to be better and more generally underſtood; and various theories were formed with a deſign to account for all the phenomena of the human body upon mathematical or mechanical principles. Calculations were made concerning the diameters of the veſſels, their gradual diminution, the friction of the blood againſt their ſides, the force of the heart, &c. Thus were mathematics introduced into phyſic, and every thing relative to the human body was thought to be performed by the mere force of ſuch mechanical powers as we are acquainted with, and whoſe effects we obſerve in pumps, ſteam-engines, and other hydraulic machines.

The conſequences of this doctrine, however, ſoon deſtroyed the principles on which it was founded; and ſuch prodigious powers were attributed to the action of ſome parts of the body, as were much more than ſufficient to deſtroy the texture of the parts themſelves. Upon the whole, the immediate conſequence of Dr. Harvey's moſt important diſcovery, were, that all the vain and fanciful theories of the ancients were thrown aſide, and others more rational eſtabliſhed in their place. Such were the progreſs and the general principles and modes of practice which prevailed in former times. With reſpect to thoſe of more modern date, they are ſo various and numerous that as we cannot enter into a detail of them, conſiſtently with the limits of our work, we refer our readers to the theories of profeſſors, and proceed to point out the moſt approved methods of practice, according to modern uſe.

PRACTICE of MEDICINE;

Or the DESCRIPTION *and* CURE *of the principal Diſeaſes incident to Human Nature, arranged in Syſtematic Order.*

Sauvages was the firſt who attempted to arrange diſeaſes according to the plan ſuggeſted by Sydenham; and his work ſtill continues the only one that merits the title of *Methodical Noſology.* For though Linnæus, Vogel, Cullen, and Sagar, have ſucceſſively endeavoured to improve his method of claſſification, they have contented themſelves with an enumeration and arrangement of the different genera, without entering into their deſcription and cure: ſo that, though we have ſince had various *Schemes of Arrangement*, we have had, properly ſpeaking, no complete *Syſtem of Noſology*; that is, no complete Courſe of Medicine according to any of theſe arrangements. Preſuming, therefore, that a Practice formed upon the moſt approved Claſſification, in imitation of the work of Sauvages, might be eſteemed an acquiſition by our readers, we have endeavoured to execute that taſk in ſuch a manner ,as to exhibit the moſt approved methods of treatment, with the lateſt diſcoveries and improvements in the healing art.

CLASS I. PYREXIÆ;

OR FEBRILE DISEASES IN GENERAL.

ORDER I. FEBRES.

GENUS I. TERTIANA; the TERTIAN, or THIRD DAY FEVER.

Deſcription. This diſeaſe comes on in the morning, or from breakfaſt to dinner time. It begins with a remarkably ſhivering, increaſing frequently to a kind of convulſive ſhaking of the limbs. The extremities are always cold, ſometimes remarkably ſo. The cold for the moſt part is firſt perceived about the lumbar regions, and from thence aſcending along the ſpine, turns towards the pit of the ſtomach. Sometimes it begins in the firſt joint of the fingers and tip of the noſe. Sometimes attacks only a particular part of the body, as one of the arms, the ſide of the head, &c. This cold is preceded by a heavy and ſleepy torpor, languor and laſſitude, which we are partly to aſcribe to real weakneſs, and partly to mere lazineſs. To theſe ſymptoms ſucceed yawning and ſtretching; after which the cold comes on as above deſcribed, not unfrequently with a pain of the back, and a troubleſome ſenſation of tenſion in the precordia and hypochondria. To this ſucceed nauſea and vomiting; and the more genuine the diſeaſe, the more certainly does the vomiting come on, by which a great deal of tough mucous matter, and ſometimes bilious ſtuff or indigeſted food, is evacuated during the firſt paroxyſms. In ſome there is only a violent ſtraining to vomit, without bringing up any thing: ſometimes, inſtead of theſe ſymptoms, a diarrhœa occurs; and this chiefly in weak, phlegmatic, and aged people, or where an indigeſted mucous ſaburra has long remained in the primæ viæ.

When theſe ſymptoms have continued for an hour or two, the cold begins to go off, and is ſucceeded by a laſſitude, languor, and flaccidity of the whole body, but chiefly in the limbs, with an uneaſy ſoreneſs as if the parts had been bruiſed; excepting in thoſe caſes where the nauſea continues for a longer time. After this languor a heat comes on, the increaſe of which is generally ſlow, but ſometimes otherwiſe, with pain of the head, thirſt, and bitterneſs in the mouth. The pulſe is quick and unequal; ſometimes beating 130 ſtrokes in a minute. As ſoon as this heat hath abated, a little moiſture or ſweat is obſerved to break forth; not always indeed in the firſt, but always in the ſucceeding paroxyſms, and the urine lets fall a quantity of lateritious ſediment. The whole paroxyſm is ſcarce ever over in leſs than ſix hours, more frequently eight, and in violent caſes extends to twelve hours; but that which exceeds 12 hours is to be reckoned a ſpurious kind, and approaching to the nature of continued fevers. All theſe ſymptoms, however, are repeated every third day, in ſuch a manner that the patient is quite free from fever for at leaſt 24 hours. The paroxyſms return much about the ſame time, though ſometimes a little ſooner or later.

Cauſes of this Diſeaſe, and Perſons ſubject to it. The genuine tertian attacks men rather than women, young people rather than old; the latter being more ſubject to anomalous tertians. It likewiſe ſeizes the luſty and active, rather than the lazy and indolent. Thoſe, however, who are very ſenſible and apt to nauſeate their meat, fall eaſily into a tertian fever. The cauſe, according to Dr. Cullen, is the miaſma of marſhy places, and that only. Other phyſicians have taken in many more cauſes, almoſt every thing indeed which debilitates the body: but the Doctor denies that any of theſe, though they may diſpoſe the body for receiving the diſeaſe, or may augment it, can by any means produce it without the concurrence of the marſh miaſma.

Prognoſis. The genuine ſimple tertian, unleſs improper medicines are adminiſtered, is generally very eaſily cured; nay, the vulgar reckon it of ſuch a ſalutary nature, that after it they imagine a perſon becomes more ſtrong and healthy than before. Hippocrates hath juſtly obſerved, that theſe fevers terminate of their own accord after ſeven or nine paroxyſms. Juncker tells us, that it frequently terminates before the ſeventh paroxyſm, but rarely before the fourth. He alſo denies that any thing critical is to be obſerved in its going off; but in this he differs from Vogel, who tells us, that the urine, for ſome days after the fever is quite gone off, appears ſlimy, and lets fall much ſediment. The latter alſo informs us, that beſides the common criſis by ſweat and urine, the tertian hath one peculiar to itſelf, namely, dry ſcabby ulcers breaking out upon the lips. Theſe ſometimes appear about the third or fourth paroxyſm; and then we may venture to foretel that the diſeaſe will go off ſpontaneouſly after the ſeventh. But though the diſeaſe is never dangerous, in cold climates at leaſt, when properly treated; yet the improper uſe of hot and ſtimulating medicines may change it into a continued fever, more or leſs dangerous according to the quantity of medicines taken and the conſtitution of the patient; in which caſe the prognoſis muſt be regulated by the particular ſymptoms which occur.

The treatment of all genuine intermittents, whether *tertians*, quotidians, or quartans, being preciſely the ſame, the general method of cure applicable to them all may be here given, to which it will be eaſy to refer when we come to deſcribe the others.

In treating intermittent fevers, phyſicians have formed indications of cure according to their different theories. The followers of Boerhaave, Stahl, &c. who imagined that the diſeaſe proceeded from a lentor or other diſorder in the blood and juices, always thought it neceſſary to correct and evacuate theſe peccant humours by emetics and purgatives before they attempted to ſtop the diſeaſe by the bark or any other medicine. The bark indeed ſeems to be held in very little eſtimation by them; ſince Vogel affirms, that this medicine, inſtead of deſerving to have the preference of all other febrifuge medicines, ought rather to be ranked among the loweſt of the whole; and for this reaſon he aſcribes the cures hereafter mentioned, by the external application of the bark, entirely to nature.

The circumſtances which may eſpecially prevent the fulfilling of theſe two indications, and therefore give occaſion to the third, are, a phlogiſtic diatheſis prevailing in the ſyſtem, and congeſtions fixed in the abdominal viſcera. The firſt muſt be removed by blood-letting and the antiphlogiſtic regimen; the ſecond, by vomiting and purging.

It is not, however, very common for intermittents to be cured by medicines given during the time of the paroxyſm. The bark is the medicine to which we are chiefly to truſt. Our phyſicians are now generally agreed, that very little preparation of the body is requiſite previous to the adminiſtration of the bark, in intermitting fevers. It is ſufficient to cleanſe the ſtomach and alimentary canal by an emetic or cathartic. Where the diſeaſe is attended with ſickneſs or nauſea, ſix or eight grains of ipecacuanha may be given: but where there are no ſymptoms of this kind, it is better to give a ſtomachic purge, as an ounce or two of tinctura ſacra, or a few grains of pil. Rufi. Theſe are to be adminiſtered in the intermiſſion, immediately after the paroxyſm hath ceaſed, ſo that their operation may be over before its return; and after their operation is compleated, the bark may be given with perfect ſafety. If the paroxyſm be moderate, we need not have recourſe to the bark till another fit hath manifeſted the true nature of the diſeaſe: but if it proves ſevere, there is often an abſolute neceſſity for adminiſtering the bark on the firſt intermiſſion of the fever, and even with hardly any preparation of the patient.

The bark hath been often obſerved to fail in removing intermittents, from not continuing the uſe of it for a ſufficient length of time, from adminiſtering it in too ſmall a doſe, or from giving it in an improper form. It was a prevailing opinion, that an ounce, or an ounce and an half, of the bark, taken during one intermiſſion, is ſufficient to prevent the return of another paroxyſm. But this is not always the caſe; for a ſevere fit will often attack a patient who hath taken ſuch a quantity. When this happens, the patient ought to perſevere during the following intermiſſions, with an increaſe of the doſe, till five or ſix ounces at leaſt have been taken. The medicine alſo ought not to be omitted as ſoon as one fit is ſtopped, but ſhould be continued in a ſmaller doſe for at leaſt ten days or a fortnight. Even for ſeveral months after the diſeaſe is entirely removed, it would be adviſeable to take a little bark occaſionally in damp weather, or during an eaſterly wind, to prevent a relapſe. Where the intervals between the fits are ſhort, as in quotidians and double tertians, from one to two drachms of it ought to be taken every two or three hours.

GENUS II. QUARTANA; the QUARTAN or FOUR DAY FEVER.

Deſcription. The genuine quartan, according to Juncker, keeps its form more exactly than other intermittents; ſcarcely coming on at any other time than four or five in the afternoon. The cold is leſs violent than in the tertian; but is very perceptible, though it doth not proceed to ſuch a height as to make the limbs ſhake; and continues for about two hours. It is preceded and accompained by a languor both of body and mind. There is ſeldom any vomiting unleſs when the ſtomach is manifeſtly overloaded with aliment; neither is there any diarrhœa, but the belly in general is rather bound, not only on the days on which the paroxyſm takes place, but alſo on the intermediate ones. The heat which ſlowly ſucceeds the cold, is leſs troubleſome to the patient by its violence than by the uneaſy dryneſs of the ſkin, which is ſcarce ever moiſtened with ſweat. This heat rarely continues longer than four or ſix hours, unleſs perhaps at the firſt or ſecond paroxyſm. It is accompanied alſo with a giddineſs and dull pain of the head. On the termination of the paroxyſm, the patient returns to a middling ſtate of health, and continues in the ſame for the reſt of the intermediate days; only there remains ſomewhat of a loathing, and a deep-ſeated pain as if the perſon was all over bruiſed or broken, which kind of ſenſation the phyſicians are wont to call *oſteocopus*. The fit returns every fourth day, and that preciſely at the ſame hours, being rarely poſtponed.

Cauſes of, and Perſons ſubject to, this Diſorder. The ſame general cauſes concur in producing this as in other intermittents, namely marſhy miaſmata, and whatever can diſpoſe the body to be eaſily affected by them. Studious people, and thoſe of a melancholic turn, are ſaid to be particularly ſubject to quartans; but what are the immediate cauſes which produce a return of the fits ever fourth day, inſtead of every day, or every third day, muſt no doubt lie for ever concealed, as depending upon the ſecret and inexplicable mechaniſm of the human body.

Prognoſis. A ſimple quartan, where there is no reaſon to dread any induration of the viſcera, may very certainly admit of a cure; and the prognoſis can never be unfavourable, unleſs in caſes of extreme weakneſs, or where the diſtemper hath been unſkilfully treated.

Cure. This does not in the leaſt differ from that which hath been laid down for the ſimple tertian, and which it is therefore needleſs to repeat here.

To the tertian or quartan fevers alſo belong the *Erraticæ* of authors. As all thoſe abovementioned differ only in the ſlight circumſtance of the type from the intermitting and remitting tertians already deſcribed at length, it is unneceſſary here to take up time in deſcribing every minute circumſtance related by phyſicians concerning them, eſpecially as it could contribute nothing towards the laying down a better method of cure than what hath been already ſuggeſted.

GENUS III. QUOTIDIANA; the QUOTIDIAN or DAILY FEVER.

Deſcription. This kind of fever generally comes on about ſix or ſeven o'clock in the morning, beginning with a conſiderable degree of cold and ſhivering, which laſts for about an hour; and is often accompanied with vomiting, or ſpontaneous diarrhœa, or both. It is ſucceeded by a pretty ſtrong heat, accompanied with thirſt, reſtleſſneſs, and pain of the head. When the heat abates a little, a ſpontaneous ſweat commonly follows, and the whole paroxyſm rarely exceeds ſix hours. It returns, however, every day almoſt always at the ſame hour, unleſs it is evidently diſturbed.

Cauſes of, and Perſons ſubject to, the Diſeaſe. The ſame general cauſes are to be aſſigned for the quotidian as for other intermittents. This kind occurs but rarely: and is ſaid to attack people of a phlegmatic temperament rather than any other; alſo old people rather than young, and women rather than men. The prognoſis and method of cure are not different from thoſe of tertians and quartans.

CONTINUED FEVERS.

GENUS IV. SYNOCHA.

Deſcription. The ſynocha, or diary fever, begins without any ſenſation of cold or ſhivering, unleſs there is ſome internal inflammation, or the ſmall pox or meaſles happen to be preſent. A continual heat without any intermiſſion conſtitutes the eſſence of this diſeaſe. The heat, however, is more tolerable than in the ſynocha properly ſo called. In ſome the pains of the head are pungent and throbbing, anſwering to the pulſations of the arteries; but in others they are dull and heavy. The face is red and bloated; and there is a remarkable laſſitude of the limbs, with a great, full, and frequent pulſe. The urine is red, and depoſits a ſediment almoſt of the colour of orange-peel; and in the very firſt day of the diſeaſe, ſigns of concoction, (according to the Hippocratic phraſe), appear in it. The fever commonly goes off with a gentle ſweat, but more rarely with an hæmorrhage of the noſe. Its ſhorteſt period is 24 hours; but if it goes beyond the fourth day, it is then a ſynocha properly ſo called.

Cauſes of, and Perſons ſubject to, this Diſeaſe. As we have already remarked of intermittents, ſo muſt we alſo now remark of continued fevers, that it is impoſſible to diſcover thoſe minute cauſes, which occaſioned the difference of type betwixt one inflammatory fever and another, though moſt authors pretend to enumerate theſe with great certainty. Thus Juncker tells us, that the cauſe of the ſimple ephemera is plethora, together with any immoderate agitation and commotion of the fluids while in that ſtate. Vogel reckons among the cauſes of his *febris diaria*, paſſions of the mind, pain, want, expoſure to the ſun, &c.; a repulſion or abſorption of certain humours; wounds, fractures, luxations, &c.: ſo that in general we may reckon every thing tending to increaſe the action of the arterial ſyſtem to be in certain circumſtances a cauſe of inflammatory fever. Hence we find thoſe are moſt ſubject to the ſynocha whoſe conſtitution is either naturally robuſt, or who are expoſed to thoſe cauſes which tend to produce an increaſed action of the arterial ſyſtem; ſuch as hard labour, high living, &c.

Prognoſis. The moſt ſimple kind of ſynocha, that is, the ephemera or diary fever, is commonly cured without the aſſiſtance of medicine; and therefore the prognoſis is for the moſt part favourable: yet, if it is improperly treated by heating medicines, it may eaſily be converted into the other kind; or, if there is a putrid diſpoſition of the fluids, into a fever of a very dangerous nature. The ſame thing is to be underſtood even of the moſt violent kind; for ſimple inflammatory fevers are not dangerous unleſs complicated with an affection of ſome particular part, as the pleura, ſtomach, &c.

Cure. Here Dr. Cullen objects to the hypotheſis of thoſe who are for leaving the cure of continued fevers to the operations of nature; becauſe theſe operations are neither certain in themſelves, nor are they ſo well underſtood as to enable us to regulate them properly; and it is likewiſe poſſible to ſuperſede them by art. The plan therefore on which he proceeds is, to form his indications of cure upon the means of obviating the tendency to death in fevers; and theſe he reduces to three. 1. To moderate the violence of re-action. 2. To remove or obviate the cauſes of debility, as before mentioned; and, 3. To obviate or correct the tendency of the fluids to putrefaction, will be noticed under the following Genus.

GENUS V. TYPHUS; the *Typhus, or Slow Nervous* FEVER.

Deſcription. Of all the deſcriptions we have of the nervous fever, that of Dr. Huxham is the beſt. According to him, the patient at firſt grows ſomewhat liſtleſs, and feels ſlight chills and ſhudders, with uncertain fluſhes of heat, and a kind of wearineſs all over, like what is felt after great fatigue. This is always attended with a ſort of heavineſs and dejection of ſpirit, more or leſs of a load, pain, or giddineſs of the head; a nauſea and diſreliſh of every thing ſoon follows, without any conſiderable thirſt, but frequently with urging to vomit, though little but inſipid phlegm is brought up. Though a kind of lucid interval of ſeveral hours ſometimes intervenes, yet the ſymptoms return with aggravation, eſpecially towards night; the head grows more giddy or heavy; the heats greater; the pulſe quicker, but weak; with an oppreſſive kind of breathing. A great torpor, or obtuſe pain and coldneſs, affects the hinder-part of the head frequently, and oftentimes a heavy pain is felt on the top all along the *coronary ſuture*; this, and that of the back-part of the head, generally attend nervous fevers, and are commonly ſucceeded by ſome degree of a delirium. The pulſe during all this time is quick, weak, and unequal; ſometimes fluttering and ſometimes for a few moments ſlow; nay, even intermitting, and then with a ſudden fluſh in the face, immediately very quick, and perhaps ſoon after ſurpriſingly calm and equal; and thus alternately. The tongue at the beginning is ſeldom or never dry or diſcoloured, but ſometimes covered with a thin whitiſh mucus: at length, indeed, it often appears very dry, red, and chapped, or of the colour of pomegranate rind; but this moſtly at the *ſtate* or cloſe of the diſeaſe: yet however dry the tongue and lips ſeem, the patient ſcarce ever complains of thirſt, though ſometimes of a heat in the tongue. Frequently profuſe ſweats pour forth all at once about the ninth, tenth, or twelfth day, commonly coldiſh and clammy on the extremities; oftentimes very thin ſtools are diſcharged, and then nature ſinks apace; the extremities grow cold, the nails pail or livid. This delirium ſometimes ends in a profound coma, or unconquerable propenſity to ſleep, and that ſoon in eternal ſleep. The ſtools, urine, and tears, run off involuntarily, and denounce a ſpeedy diſſolution, as the vaſt tremblings and twitchings of the nerves and tendons are preludes to a general convulſion, which at once ſnaps off the thread of life. In one or other of theſe ways are the ſick carried off, after having languiſhed for fourteen, eighteen, or twenty days; nay, ſometimes much longer. All perſons grow deaf and ſtupid towards the end of this diſeaſe (ſome extremely deaf), though too quick and apprehenſive at the beginning; inſomuch that the leaſt noiſe or light greatly offended them. Many from their immoderate fears ſeem to hurry themſelves out of life, where little danger is apparent at the beginning: nay, ſome will not allow themſelves to ſleep, from a vain fear of dozing quite away; and others from the vaſt hurry, anxiety and confuſion they are ſenſible of in it, or at their awaking.

Cauſes of, and Perſons ſubject to, the Diſorder. The nervous fever is a conſequence of contagion received by means of ſome corrupted animal-ſubſtance. It moſt commonly attacks perſons of weak nerves, a lax habit of body, and a poor thin blood; thoſe who have ſuffered great evacuations, a long dejection of ſpirits, immoderate watchings, ſtudies, fatigue, &c. alſo thoſe who have uſed much crude unwholeſome food, vapid impure drinks, or who have been confined long in damp foul air; who have broken the vigour of their conſtitutions by ſalivations, too frequent purging, immoderate venery, &c. Hence we ſee that the diſeaſe conſiſts principally in an extreme debility of the nervous ſyſtem; for, when people are prepared for this fever by having their nerves already weakened, the contagious particles immediately attack the nervous ſyſtem, without ſo much affecting the ſtate of the blood or juices, though the latter are greatly affected in the putrid malignant fevers.

Prognoſis. In nervous fevers, the prognoſis is very much the ſame with that of the putrid malignant kind.

Cure. This fever is produced by a contagion affecting the nervous ſyſtem of a perſon already debilitated, and thus producing weakneſs in an extreme degree.

In contagious diſeaſes, of which this is one, we know, both from the effects which appear, and from diſſections, that the tone of the heart and arteries is conſiderably diminiſhed; and that tonic remedies are therefore properly indicated. We are to conſider theſe remedies as of two kinds; 1. The power of cold; 2. That of tonic medicines.

The power of cold as a tonic in fevers may be employed in two ways; either as thrown into the ſtomach, or as applied to the ſurface of the body. As the power of cold may be communicated from any one part to every other part of the ſyſtem, ſo it will be readily allowed that the ſtomach is a part as fit as any other for this communication, and that cold drink taken into the ſtomach may prove an uſeful tonic in fevers. This the experience of all ages has confirmed; but at the ſame time it has been frequently obſerved, that, in certain circumſtances, cold drink taken into the ſtomach has proved very hurtful; and therefore that its uſe in fevers requires ſome limitations. What theſe limitations ſhould be, and what are all the circumſtances which may forbid the uſe of cold drink, it is difficult to determine; but it ſeems clearly forbidden in all caſes where a phlogiſtic diatheſis prevails in the ſyſtem, and more eſpecially when there are topical affections of an inflammatory nature.

The other method of employing cold as a tonic, is by applying it to the ſurface of the body, as a refrigerant power fit to moderate the violence of reaction; but probably it may here alſo be conſidered properly as a tonic, and uſeful in caſes of debility. Not only cool air, but cold water alſo, may be applied to the ſurface of the body as a tonic. The ancients frequently applied it with advantage to particular parts as a tonic; but it is a diſcovery of modern times, that, in the caſe of putrid fevers attended with much debility, the body may be waſhed all over with cold water. This was firſt practiſed at Breſlaw in Sileſia, as appears from a diſſertation under the title of *Epidemia Verna, quæ Wratiſlaviam anno* 1737 *afflixit*, to be found in the *Acta Nat. Curioſ.* vol. x. And from other writers it appears, that the practice has paſſed into ſome of the neighbouring countries; but in this iſland it doth not appear that we have yet had any experience of it.

The medicines which have been employed in fevers as tonics are various. If the *ſaccharum ſaturni* hath been found uſeful, it is probably as a tonic rather than as a refrigerant; and the *ens veneris*, or other preparations of iron which have been employed, can act as tonics only. The preparations of copper, from their effects in epilepſy, are preſumed to poſſeſs a tonic power; but whether their uſe in fevers be founded on their tonic or emetic powers, is uncertain. And upon the whole there may no doubt occur ſome inſtances of fevers being cured by tonics taken from the foſſile kingdom; but the vegetable tonics are the moſt efficacious, and among theſe the Peruvian bark certainly holds the firſt place.

The bark has commonly been conſidered as a ſpecific, or a remedy of which the operation was not underſtood. We muſt obſerve, however, that, as in many caſes the effects of the bark are perceived ſoon after its being taken into the ſtomach, and before it can poſſibly be conveyed to the maſs of blood, we may conclude, that its effects do not ariſe from its operating on the fluids; and muſt therefore depend upon its operating on the nerves of the ſtomach, and being thereby communicated to the reſt of the nervous ſyſtem. This operation ſeems to be a tonic power, the bark being a remedy in many caſes of debility, particularly in gangrene: and if its operation may be explained from its poſſeſſing a tonic power, we may eaſily perceive why it is improper when a phlogiſtic diatheſis prevails; and from the ſame view we can aſcertain in what caſes of continued fever it may be admitted.

Of all the ſtimulants which may be properly employed, wine ſeems to be the moſt eligible. It has the advantage of being grateful to the palate and ſtomach, and of having its ſtimulant parts ſo much diluted, that it can be conveniently given in ſmall doſes; andd therefore it may be employed with ſufficient caution; but it is of little ſervice unleſs taken pretty largely. It may be ſuſpected that wine has an operation analogous to that of opium; and on good grounds. But we can diſtinctly remark its ſtimulant power only; which renders its effects in the phrenitic delirium manifeſtly hurtful; and in the mild delirium depending on debility, as remarkably uſeful.

The other method of cure is, to correct or obviate the tendency in *the fluids to putrefaction*. This may be done, 1. By avoiding any new application of putrid or putreſcent matter. 2. By evacuating the putrid or putreſcent matter already preſent in the body. 3. By correcting the putrid or putreſcent matter remaining in the body by diluents and antiſeptics. 4. By ſupporting the tone of the veſſels, and thereby reſiſting further putrefaction, or obviating its effects. 5. By moderating the violence of re-action, conſidered as a means of increaſing putrefaction.

The further application of putrid or putreſcent matter may be avoided, 1. By removing the patient from places filled with corrupted air. 2. By preventing the accumulation of the patient's own effluvia, by a conſtant ventilation, and by a frequent change of bed-clothes and body-linen. 3. By the careful and ſpeedy removal of all excremental matters from the patient's chamber. 4. By avoiding animal-food.

The putrid or putreſcent matter already preſent in the body, may be evacuated partly by frequent evacuations of the contents of the inteſtines; and more effectually ſtill by ſupporting the excretions of perſpiration and urine by the plentiful uſe of diluents. That which remains in the body may be rendered more mild and innocent by the uſe of diluents, or may be corrected by the uſe of antiſeptics. Theſe laſt are of many and various kinds: but which of them are conveniently applicable, or more particularly ſuited to the caſe of fevers, is not well aſcertained. Thoſe moſt certainly applicable and uſeful are aceſcent aliments, acids of all kinds, and neutral ſalts.

The progreſs of putrefaction may be conſiderably retarded, and its effects obviated, by ſupporting the tone of the veſſels; and this may be done by tonic medicines, of which the chief are cold, and the Peruvian bark, as already mentioned. The violence of re-action increaſing the tendency to putrefaction, may be moderated by the means already mentioned under *ſynocha*. Theſe are the proper indications to be obſerved in the cure of the ſlow nervous fever.

Towards the decline of the fever alſo, where the ſweats are abundant and weakening, ſmall doſes of the tincture of the bark, with ſaffron and ſnake-root, are given with the greateſt advantage, frequently interpoſing a doſe of rhubarb to carry off the putrid colluvies in the firſt paſſages; which withal makes the remiſſions or intermiſſions that often happen in the decline of nervous diſeaſes more diſtinct and manifeſt, and gives a fairer opportunity of throwing in the bark; for in the proper exhibition of this medicine we are to place our chief hope of curing both the nervous and putrid malignant fevers.

Genus VI. FEBRIS PESTILENS, MALIGNA; *Putrid, Peſtilential, or Malignant Fevers.*

Deſcription This is a diſeaſe of the moſt dangerous nature, as, beſides the extreme debility of the nervous ſyſtem, there is a rapid tendency of the fluids to putrefaction, which ſometimes cuts off the patient in a few days, nay, in the warm climates, in 12 or 14 hours; or if the patient recovers, he is for a long time, even in this country, in an exceedingly weak ſtate, and requires many weeks to recover his former health.

The putrid fevers, according to Huxham, make their attack with much more violence than the ſlow nervous ones; the rigors are ſometimes very great, though ſometimes ſcarce felt; the heats much ſharper and permanent; yet, at firſt, ſudden, tranſient, and remittent: the pulſe more tenſe and hard, but commonly quick and ſmall; though ſometimes ſlow, and ſeemingly regular for a time, and then fluttering and unequal. The head-ach, nauſea, and vomiting, are much more conſiderable even from the beginning. Sometimes a ſevere fixed pain is felt in one or both temples, or over one or both eye-brows; frequently in the bottom of the orbits of the eyes. The eyes always appear very dull, heavy, yellowiſh, and very often a little inflamed. The countenance ſeems bloated, and more dead-coloured than uſual. Commonly the temporal arteries throb much, and a tinnitus aurium is very troubleſome; a ſtrong vibration alſo of the carotid arteries frequently takes place in the advance of the fever, though the pulſe at the wriſt may be ſmall, nay even ſlow: this is a certain ſign of an impending delirium, and generally proceeds from ſome conſiderable obſtructions in the brain.

Few or none of theſe fevers are without a ſort of lumbago, or pain in the back and loins; always an univerſal wearineſs or ſoreneſs is felt, and often much pain in the limbs. Sometimes a great heat, load, and pain, affect the pit of the ſtomach, with perpetual vomiting of porraceous or black choler, and a moſt troubleſome ſingultus; the matter diſcharged is frequently of a very nauſeous ſmell. The tongue, though only white at the beginning, grows daily more dark and dry; ſometimes of a ſhining livid colour, with a kind of dark bubble at top; ſometimes exceeding black; and ſo continues for many days together; nor is the tinge to be got off many times for ſeveral days, even after a favourable criſis: at the height of the diſeaſe, it generally becomes vaſtly dry, ſtiff, and black, or of a dark pomegranate colour. Hence the ſpeech is very inarticulate, and ſcarce intelligible. The thirſt in the increaſe of the fever is commonly very great, ſometimes unquenchable; and yet no kind of drink pleaſes, but all ſeem bitter and mawkiſh; at other times, however, no thirſt is complained of, though the mouth and tongue are exceedingly foul and dry; this is always a dangerous ſymptom, and ends in a frenzy or coma. The lips and teeth, are furred up with a very black tenacious ſordes. At the onſet of the fever, the urine is often crude, pale, and vapid, but grows much higher coloured in the advance, and frequently reſembles a ſtrong lixivium, or citrine urine, tinged with a ſmall quantity of blood; it is without the leaſt ſediment or cloud, and ſo continues for many days together: by degrees it grows darker, like dead ſtrong high-coloured beer, and ſmells very rank and offenſive. In petechial fevers, the urine hath often been ſeen almoſt black and very *fetid*. The ſtools, eſpecially near the ſtate, or in the decline of the fever, are for the moſt part intolerably fetid, green, livid, or black, frequently with ſevere gripes and blood. When they are more yellow or brown, the leſs the danger; but the higheſt when they run off inſenſibly, whatever their colour may be. It is likewiſe a very bad ſymptom when the belly continues tenſe, ſwollen, and hard, after profuſe ſtools; for this is generally the conſequence of an inflammation or mortification of the inteſtines. A gentle diarrhœa is often very beneficial, and ſometimes ſeems to be the only way which nature takes to carry off the morbific matter.

Sometimes black, livid, dun, or greeniſh ſpots appear, which always indicate a high degree of malignity; however, the more florid the ſpots are, the leſs danger is to be feared. It is alſo a good ſign when the black or violet petechiæ become of a brighter colour. The large, black, or livid ſpots, are almoſt always attended with profuſe hæmorrhages; and the ſmall, duſky, brown ſpots, like freckles, are not much leſs dangerous than the livid or black; though they are ſeldom accompanied with fluxes of blood: exceſſively profuſe, cold, clammy ſweats are often concomitant, by which alſo they ſometimes vaniſh, though without any advantage to the patient. The eruption of the petechiæ is uncertain; ſometimes they appear on the fourth or fifth day, though ſometimes not till the eleventh, or even later. The *vibices*, or large, dark, greeniſh marks, ſeldom appear till very near the fatal period. Frequently alſo we meet with efflorence like the meaſles in malignant fevers, but of a much more dull and livid hue; in which the ſkin, eſpecially on the breaſt, appears as it were marbled or variegated. This in general is an ill ſymptom, and is often attended with fatal conſequences.

Sometimes about the 11th or 14th day, on the coming on of profuſe ſweats, the petechiæ diſappear, and vaſt quantities of white miliary puſtules break out. This is ſeldom found of any conſiderable advantage; but an itching, ſmarting, red raſh, commonly gives great relief; and ſo do the large, fretting, watery bladders, which many times riſe upon the back, breaſt, ſhoulders, &c. A ſcabby eruption likewiſe about the lips and noſe is certainly one of the ſalutary ſymptoms; and the more hot and angry it is, ſo much the better. But of much more uncertain and dangerous event are the brown coloured aphthæ; nor are thoſe that are exceeding white and thick like lard, of a very promiſing aſpect. They are ſoon ſucceeded by great difficulty of ſwallowing, pain and ulceration of the fauces, œſophagus, &c. and with an inceſſant ſingultus: the whole *primæ viæ* become at laſt affected; a bloody dyſentery comes on, followed by a ſphacelation of the inteſtines; as is evident from the black, ſanious, and bloody ſtools, extremely fetid and infectious. Vibices, or large, black, and bluiſh marks reſembling bruiſes, are frequently ſeen towards the cloſe of the fever; and, when attended with lividity and coldneſs of the extremities, are certain tokens of approaching death. In ſome caſes, the blackneſs hath been known to reach almoſt to the elbows, and the hands have been dead-cold for a day or two before the death of the patient.

Such are the general appearances of the putrid malignant fever in this country, among thoſe who enjoy a free air, and are not croweded together, or expoſed to the cauſes of infection: but in jails, hoſpitals, or other places where the ſick are crowded, and in ſome meaſure deprived of the benefit of the free air, the ſymptoms are, if poſſible, more terrible.

Cauſes of, and Perſons ſubject to, this Diſorder. The cauſe of this fever, as well as that of the ſlow nervous fever, is an infection or contagion from ſome diſeaſed animal body, or from corrupted vegetables; and therefore is very little, if at all, different from thoſe peſtilential diſorders which have ariſen after battles, when great numbers of dead bodies were allowed to lie above ground and infect the air with their effluvia. This is confirmed by an obſervation of Foreſtus, who was eyewitneſs to a diſtemper of this kind, (which indeed he calls a *plague*), owing to the ſame cauſe, attended with buboes and a high degree of contagion. The ſame author alſo gives an account of a malignant fever breaking out at Egmont in North-Holland, occaſioned by the rotting of a whale which had been left on the ſhore. We have a like obſervation of a fever affecting the crew of a French ſhip, by the putrefaction of ſome cattle which they had killed on the iſland of Nevis in the Weſt Indies. Theſe men were ſeized with a pain in their head and loins, great weakneſs, and a diſorder of the ſtomach, accompanied with fever. Some had carbuncles; and on others purple ſpots appeared after death.

Galen aſſigns two cauſes for peſtilential fevers: 1. The great heat of the weather, when the humours happen to be in a more putreſcent ſtate than uſual. 2. A putrid ſtate of the air, ariſing either from a multitude of dead bodies left unburnt, as after a battle, or from the evaporation of corrupted lakes and marſhes.

Prognoſis. In theſe fevers we cannot draw a prognoſtic from any ſymptom by itſelf; and perhaps all of them together are more fallible than in others. Generally the following are good; turbid urine in the decline of the diſeaſe; and at that time a gentle ſweat or moiſture diffuſed over the body, or even the ſkin ſoft and the tongue moiſt; or to have ſome looſe ſtools ſucceeded by a diaphoreſis: the pulſe to riſe by wine or cordials, with an abatement of the ſtupor, tremor, and other affections of the brain. Deafneſs is rather a good ſign. The bad ſigns are, a ſubſultus tendinum; the eyes much inflamed and ſtaring; the ſpeech quick, and the ſound of the voice altered; a high delirium; perpetual watchfulneſs; conſtant ſickneſs at the ſtomach, and vomitings; frequent ſtools, with a ſinking pulſe, and the diſorder of the head increaſed; coldneſs of the extremities, and a tremulous motion of the tongue. It is obſerved to be among the worſt ſigns when the patient complains of blindneſs; when he ſwallows with difficulty, or cannot put out his tongue when deſired to do it; when he can lie on his back only, and pulls up his knees; or when inſenſible he endeavours to uncover his breaſt, or makes frequent attempts to get out of bed without aſſigning any reaſon. If to any of theſe are added ichorous, cadaverous, and involuntary ſtools, it is a ſign of a mortification of the bowels and approaching death. It will not ſeem ſtrange to find moſt of theſe prognoſtics common to the advanced ſtate of other fevers, when we conſider, that from whatever cauſe fevers begin, by a long continuance the humours are corrupted, and the brain and nerves affected much in the ſame manner as in thoſe which ariſe from infection.

Prevention and Cure. As diſtempers of the putrid kind never ariſe without an infection received from ſome quarter or other, the methods of prevention muſt evidently be reduced to two general heads. 1. To avoid receiving the infection into the body; and, 2. To put the body in ſuch a ſituation as may enable it to reſiſt the infection when received.

Cure. It now remains to conſider the proper method of curing putrid fevers, on the ſuppoſition that the infection hath been allowed to operate till the blood becomes radically tainted, and of conſequence the nervous ſyſtem affected to ſuch a degree, that its power cannot be reſtored by any of the ſimple medicines before mentioned. Here all authors agree, that a change of air, when it can be effected, is abſolutely neceſſary, and often contributes more towards the removing of the diſeaſe than all the medicines that can be exhibited.

Vomits muſt be uſed with caution; for though they may be of uſe by way of prevention, yet in the advanced ſtate of the diſeaſe, when the patient has all along complained of a ſickneſs at ſtomach, they are evidently unſafe. Here the antiſeptic quality of fixed air is of much uſe, and the neutral draughts given in the act of efferveſcence are generally attended with happy effects. Nay, clyſters of fixed air itſelf have been found very ſerviceable. Even in very bad ſtages of the diſtemper, where a putrid and colliquative looſeneſs hath taken place, clyſters of fixed air have been known to alleviate the ſymptoms. We muſt not, however, put too much confidence in medicines of this kind. Mild aſtringent cordials, eſpecially the wine and Peruvian bark, are the only reſources in theſe diſorders. Concerning the former, Sir John Pringle obſerves, in the low ſtate of theſe fevers, and in great ſinkings, which either come after unſeaſonable bleedings, or long want of nouriſhment, it was a moſt grateful and efficacious cordial, to which nothing was comparable. Perhaps there is no rule more neceſſary in this ſtate, than not to let the patient when low remain long without taking ſomething cordial and nouriſhing; as many have been obſerved paſt recovery, by being ſuffered to paſs a whole night without any ſupport about the time of the criſis. In the advanced ſtate of this fever the ſick are remarkably low; and therefore Hoffman adviſes in ſuch caſes, that they ſhould be conſtantly kept in bed, and not permitted even to ſit up in it. In the laſt ſtage of this fever, as well as in that of the ſea-ſcurvy, it would ſeem that the force of the heart was too ſmall to convey the blood to the brain, except when the body is in an horizontal poſture.

But, however neceſſary wine and the bark may be in the low ſtage of this fever, we muſt remember, that theſe remedies are to be adminiſtered only as antiſeptics and ſupporters of the *vis vitæ*, without aiming at thoroughly raiſing the pulſe or relieving the head, or at forcing a ſweat by them before nature points that way. If the delirium increaſed upon uſing wine, if the eyes looked wild or the voice became quick, there was reaſon to apprehend a phrenitis; and accordingly it was obſerved, that at ſuch times all internal heating medicines aggravated the ſymptoms; and in theſe caſes bliſters were of the greateſt ſervice. Fomentations of vinegar and warm water for the feet, our author is of opinion, would anſwer better than either ſinapiſms or bliſters, provided they were long enough and often enough applied. In the inflammatory fevers, he has known theſe fomentations have little effect for the firſt hour, and yet ſucceed afterwards. For internal medicine, the bark was omitted for ſome time, but the patient was continued with an acidulated drink, viz. barley-water and vinegar; and treated alſo with camphire, *pulvis contrayerva compoſitus*, and nitre, as was uſual in the beginning of the fever. If the delirium was of the low kind, a decoction of the bark and wine were the only remedies; for in no inſtance was the delirium perfectly removed till the time of the criſis. It muſt alſo be obſerved, that a delirium may ariſe in putrid fevers from two oppoſite errors; one from large and repeated bleeding, and the other from wine and the cordial medicines being taken too early. It appears therefore how nice the principles are that regard the cure; as neither a hot nor a cool regimen will anſwer with every patient, or in every ſtate of the diſeaſe.

If a diarrhœa came on the decline of the fever, it was moderated, but not ſuppreſſed, by adding an opiate to the uſual medicines. For though the looſeneſs may be conſidered as critical; yet as the ſick were too low to bear evacuations, there was a neceſſity for reſtraining it in ſome meaſure; and it has often been obſerved, that when it has been treated in this manner, about the uſual time of the criſis, the patient has fallen into a gentle ſweat, which has carried off the diſeaſe. In proportion to the putrid nature of the ſtools, opiates and aſtringents were uſed with the greater caution.

Sometimes the patient falls into an irregular intermittent; which, if not of a hectic nature from an internal abſceſs, may proceed from neglecting to clear the *primæ viæ*. For it is eaſy to conceive, that after a long fever of ſuch a putrid nature, often attended with langour of the bowels, the fæces may be ſo much accumulated, and ſo corrupted, as to occaſion new diſorders. In ſuch caſes, after proper evacuation by purge, the bark was almoſt an infallible remedy.

GENUS VII. SYNOCHUS *or* HECTIC FEVER.

This is a contagious diſtemper, being a complication of a ſynocha and typhus; we ſhall therefore refer to what hath been already ſaid concerning theſe diſeaſes.

The hectic is reckoned by Dr. Cullen to be merely ſymptomatic; as indeed ſeems very probable, ſeeing it always accompanies abſorptions of pus into the blood from internal ſuppurations, or indeed from ſuch as are external, provided they are very large or of a bad kind.

Deſcription. The beſt deſcription of this diſorder we have, is that by Dr. Heberden. According to him, the appearance of the hectic fever is not unlike that of the genuine intermittent; from which, however, the diſeaſe is very different in its nature, as well as infinitely more dangerous. In the true intermittent, the three ſtages of cold, heat, and ſweat, are far more diſtinctly marked, the whole fit is much longer, the period which it obſerves is more conſtant and regular, and the intermiſſions are more perfect, than in the hectic fever. For in the latter, even in the cleareſt remiſſion, there is uſually a feveriſh quickneſs perceptible in the pulſe, which ſeldom fails to exceed the utmoſt limit of a healthy one, by at leaſt ten ſtrokes in a minute.

The chillneſs of the hectic fever is ſometimes ſucceeded by heat, and ſometimes immediately by a ſweat without any intermediate ſtate of heat. The heat will ſometimes come on without any remarkable chillneſs preceding; and the chillneſs has been obſerved to go off without being followed either by heat or ſweat. The duration of theſe ſtages is ſeldom the ſame for three fits together; and as it is not uncommon for one of them to be wanting, the length of the whole fit muſt vary much more than in the true intermittent; but in general it is much ſhorter.

The hectic fever will return with great exactneſs, like an intermittent, for two or perhaps three fits; but Dr. Heberden informs us, that he does not remember ever to have known it keep the ſame period for four fits ſucceſſively. The paroxyſm will now and then keep off for ten or twelve days; and at other times, eſpecially when the patient is very ill, it will return ſo frequently on the ſame day, that the chillneſs of a new fit, will follow immediately the ſweat of the former. It is not unuſual to have many threatenings of a ſhivering return in the ſame day; and ſome degree of drowzineſs is apt to attend the ceſſation of a fit.

The urine in a true intermittent is clear in the fits, and turbid in the intervals; but in the hectic fever it is liable to all kinds of irregularity. It will be equally clear or turbid in both ſtages; or turbid in the fits, and clear in the intervals; and ſometimes it will be, as in a true intermittent, clear during the fever, and thick at the going off.

Hectic patients often complain of pains like thoſe of the rheumatiſm, which either affect by turns almoſt every part of the body, or elſe return conſtantly to the ſame part; which is often at a great diſtance from the ſeat of the principal diſorder, and, as far as is known, without any peculiar connection with it. Thoſe pains are ſo violent in ſome patients, as to require a large quantity of opium. As far as Dr. Heberden has obſerved, they are common, where the hectic ariſes from ſome ulcer open to the external air, as in cancers of the face, breaſt, &c. Joined with this fever, and ariſing probably from one common cauſe, he has been ſurpriſed to ſee ſwellings of the limbs, neck, or trunk of the body, riſe up almoſt in an inſtant, as if the part was all at once grown fatter. Theſe ſwellings are not painful, hard, or diſcoloured, and they continue for ſeveral hours.

Dr. Heberden has ſeen this fever attack thoſe who ſeemed in tolerable health, in a ſudden and violent manner, like a common inflammatory one; and like that, alſo, in a very ſhort time bring them into imminent danger of their lives; after which it has begun to abate, and to afford hopes of a perfect recovery. But though the danger might be over for the preſent, and but little of a fever remain; yet that little has ſoon ſhewed, that it was kept up by ſome great miſchief within, and, proving unconquerable by any remedies, has gradually undermined the health of the patient, and never ceaſed except with his life. This manner of its beginning, however, is extraordinary. It much oftener diſſembles its ſtrength at firſt; and creeps on ſo ſlowly, that the ſubjects of it, though they be not perfectly well, yet for ſome months hardly think themſelves ill; complaining only of being ſooner tired with exerciſe than uſual, of want of appetite, and of falling away. But gentle as the ſymptoms may ſeem, if the pulſe be quicker than ordinary, ſo as to have the artery to beat 90 times and perhaps 120 times in a minute, there is the greateſt reaſon to be apprehenſive of the event. In no diſorder, perhaps, is the pulſe of more uſe to guide our judgment than in the hectic fever: yet even here we muſt be upon our guard, and not truſt entirely to this criterion; for one in about 20 patients, with all the worſt ſigns of decay from ſome incurable cauſe, which irreſiſtibly goes on to deſtroy his life, will ſhew not the ſmalleſt degree of quickneſs, or any other irregularity of the pulſe, to the day of his death.

Cauſes, &c. This fever will ſupervene whenever there is a great collection of matter formed in any part of the body; but it more particularly attends upon the inflammation of a ſcirrhous gland, and even upon one that is ſlight and only juſt beginning; the fever growing worſe in proportion as the gland becomes more inflamed, ulcered, or gangrenous. And ſuch is the lingering nature of thoſe glandular diſorders, that the firſt of thoſe ſtages will continue for many months, and the ſecond for many years.

Lying-in women, on account of the violence ſuſtained in delivery, generally die of this fever. Women of the age of near 50 and upwards are particularly liable to it. For, upon the ceſſation of their natural diſcharge, the glands of the breaſts, ovaries, or womb, too commonly begin to grow ſcirrhous, and proceed to be cancerous. Not only theſe, but the glandular parts of all the abdominal viſcera, are diſpoſed to be affected at this particular time, and to become the ſeats of incurable diſorders.

The injuries done to the ſtomach and liver by hard drinking, are attended with ſimilar ſymptoms, and terminate in the ſame manner.

Dr. Heberden obſerves, that the ſlighteſt wound by a fine pointed inſtrument is known upon ſome occaſions to bring on the greateſt diſturbances, and the moſt alarming ſymptoms, nay, even death itſelf. For not only the wounded part will ſwell and be painful, but by turns almoſt every part of the body; and very diſtant parts have been known to come even to ſuppuration. Theſe ſymptoms are conſtantly accompanied with this irregular intermittent, which laſts as long as any of them remain.

Prognoſis. This anomalous fever is never leſs dangerous than when it belongs to a kindly ſuppuration, into which all the diſeaſed parts are melted down, and for which there is a proper outlet.

The ſymptoms and danger from ſome ſmall punctures, with their concomitant fever, moſt frequently give way in a few days; though in ſome perſons they have continued for two or three months, and in others have proved fatal.

The inflammation of internal ſcirrhous glands, or of thoſe in the breaſts, ſometimes goes off, and the fever, which depended upon it, ceaſes; but it much oftener happens, that it proceeds to cancerous and gangrenous ulcers, and terminates in death.

Cure. The ſame medicines are not likely always to ſuit a fever, which, ariſing from very different cauſes, is attended with ſuch a variety of ſymptoms. A mixture of aſafetida and opium, has in ſome perſons ſeemed ſingularly ſerviceable in this fever, when brought on by a ſmall wound; but in moſt other caſes the principal if not the ſole attention of the phyſician muſt be employed in relieving the ſymptoms, by tempering the heat, by preventing both coſtiveneſs and purging, by procuring ſleep, and by checking the ſweats. If, at the ſame time, continues Dr. Heberden, he put the body into as good general health as may be, by air, exerciſe, and a proper courſe of mild diet, he can perhaps do nothing better than to leave all the reſt to nature. In ſome few fortunate patients, nature appears to have ſuch reſources, as may afford reaſon for entertaining hopes of cure, even in very bad caſes. For ſome have recovered from this fever attended with every ſymptom of an abdominal viſcus incurably diſeaſed, after all probable methods of relief from art had been tried in vain, and after the fleſh and ſtrength were ſo exhauſted as to leave ſcarce any hopes from nature. In thoſe deplorable circumſtances, there has ariſen a ſwelling not far from the probable ſeat of the diſorder, and yet without any diſcoverable communication with it. This ſwelling has come to an abſceſs; in conſequence of which the pulſe has ſoon returned to its natural ſtate, as have alſo the appetite, fleſh, and ſtrength. What nature has performed in thoſe rare caſes, Dr. Heberden acquaints us, he has often endeavoured to imitate, by making iſſues or applying bliſters near the ſeat of the diſeaſe; but he cannot ſay with the ſame exceſs.

It ſeems at preſent, Dr. Heberden obſerves, the opinion of many practitioners, that the gangrenes will be ſtopped, and ſuppuration become more kindly, by the uſe of bark; and therefore this remedy is always either adviſed, or permitted in the irregular fever joined with ſuppurations and gangrenes. But he affirms he does not remember ever to have ſeen any good effect from the bark in this fever unattended with an apparent ulcer; and even in gangrenes it ſo often fails, that in ſucceſsful caſes, where it has been adminiſterd, there muſt be room for ſuſpicion that the ſucceſs was owing to another cauſe. Dr. Heberden acknowledges at the ſame time, that he never ſaw any harm from the bark in theſe, or indeed in any other caſes, except a purging or ſickneſs of no conſequence, where it has happened to diſagree with the ſtomach, or where the latter has been loaded by taking the medicine too faſt, eſpecially in dry boluſes wrapped in wafer-paper.

In hectic illneſſes, where all other means have proved ineffectual, a journey to Bath is uſually propoſed by the friends, and wiſhed for by the ſick; but Dr. Heberden juſtly obſerves, that, beſides the fatigue and many inconveniences of a journey to a dying perſon, the Bath waters are peculiarly hurtful in this fever, which they never fail to increaſe, and thereby aggravate the ſufferings, and haſten the death of the patient.

ORDER II. PHLEGMASIÆ; OR INFLAMMATIONS.

GENUS VIII. PHLOGOSIS; *Heat and painful Tenſion of ſome External or Internal Part.*

This diſeaſe is a ſynocha fever, accompanied with an inflammation of ſome particular part either external or internal, and conſequently varies very much in its form and the degree of danger attending it, according to the ſituation and functions of the part affected with topical inflammation.

For the cure of inflammations, Dr. Cullen lays down the following indications. 1. To remove the remote cauſes when they are evident and continue to operate. 2. To take off the phlogiſtic diatheſis affecting the whole ſyſtem, or the particular part. 3. To take off the ſpaſm of the particular part by remedies applied to the whole ſyſtem or to the part itſelf.

This means of removing the remote cauſes will readily occur, from conſidering the particular nature and circumſtances of the different kinds. Acrid matters muſt be removed, or their action muſt be prevented, by the application of demulcents. Compreſſing and over-ſtretching powers muſt be taken away; and, from their ſeveral circumſtances, the means of doing ſo will be obvious.

The means of taking off the phlogiſtic diatheſis of the ſyſtem are the ſame with thoſe already mentioned under the cure for ſynocha. The means of taking off the ſpaſm alſo from the particular part, are much the ſame with thoſe already mentioned. Only it is to be remembered, that topical bleedings, ſuch as cupping with ſcarification, applying leeches, &c. are in this caſe much more indicated; and that ſome of the other remedies are to be directed more particularly to the part affected, as ſhall be more fully conſidered when we treat of thoſe diſeaſes attended with particular inflammations.

When a tendency to ſuppuration is perceived, the proper indication is to promote the production of perfect pus as much as poſſible. For this purpoſe various remedies, ſuppoſed to poſſeſs a ſpecific power, have been propoſed: but it does not appear that any of them are poſſeſſed of a virtue of this kind; and, in our author's opinion, all that can be done is to favour the ſuppuration by ſuch applications as may ſupport a moderate heat in the part, by ſome tenacity confine the perſpiration, and by an emollient quality may weaken the coheſion of the teguments, and favour their eroſion. As all abſceſſes are occaſioned by the effuſion of fluids, and as in the caſe of certain effuſions a ſuppuration becomes not only unavoidable but deſireable, it may be ſuppoſed that moſt of the means of procuring a reſolution by diminiſhing the force of circulation, &c. ought to be avoided. But as we obſerve on the one hand, that a certain degree of increaſed impetus, or of the original ſymptoms of inflammation, is neceſſary to produce a proper ſuppuration; ſo it is then eſpecially neceſſary to avoid thoſe means of reſolution which may diminiſh too much the force of circulation. And on the other hand, as the impetus of the blood, when violent, is found to prevent the proper ſuppuration; ſo, in ſuch caſes, though a tendency to ſuppuration may have begun, it may be proper to continue thoſe means of reſolution which moderate the force of the circulation. With reſpect to the opening of abſceſſes when completely formed, ſee SURGERY.

When an inflammation has taken a tendency to gangrene, that event is to be prevented by every poſſible means; and theſe muſt be different according to the nature of the ſeveral cauſes: but after a gangrene has in ſome degree taken place, it can be cured only by the ſeparation of the dead from the living parts. This in certain circumſtances can be performed, and moſt properly, by the knife.

In other caſes it can be done by exciting a ſuppuratory inflammation on the verge of the living part, whereby its coheſion with the dead part may be every where broken off, ſo that the latter may fall off by itſelf. While this is doing, it is proper to prevent the further putrefaction of the part, and its ſpreading wider. For this purpoſe various antiſeptic applications have been propoſed: but Dr. Cullen is of opinion, that while the teguments are entire, theſe applications can hardly have any effect; and therefore, that the fundamental procedure muſt be to ſcarify the part ſo as to reach the living ſubſtance, and, by the wounds made there, to excite the ſuppuration required. By the ſame inciſions alſo, we give acceſs to antiſeptics, which may both prevent the progreſs of the putrefaction in the dead, and excite the inflammation neceſſary on the verge of the living parts.

When the gangrene proceeds from the loſs of tone, and when this communicated to the neighbouring parts prevents that inflammation which is requiſite to the ſeparation of the dead parts from the living, it will be neceſſary to obviate this loſs of tone by tonic medicines given internally; and for this purpoſe the Peruvian bark has been found to be moſt effectual. But when the gangrene ariſes from the violence of inflammation, the bark may not only fail of proving a remedy, but may do harm: for its power as a tonic is eſpecially ſuited to thoſe caſes of gangrene which proceed from an original loſs of tone, as in the caſe of palſy and œdema; or in thoſe caſes where a loſs of tone takes place while the original inflammatory ſymptoms are removed.

On the other hand, Mr. Bell is of opinion, that inciſions made with a view to admit the operation of antiſeptic remedies in gangrenes, as well as the remedies themſelves, muſt be pernicious by reaſon of the irritation they occaſion, and by the danger of wounding blood-veſſels, nerves, tendons, &c. alſo by allowing free-paſſage for the putreſcent fluids into the parts not yet affected. And unleſs they are carried ſo deep as to reach the ſound parts, applications of the antiſeptic kind can never have any effect in anſwering the purpoſe for which they were intended. The ſame author alſo remarks, that all the advantages commonly obſerved from the great number of applications recommended for gangrene, are obtained with more eaſe, and generally too with more certainty from the uſe of ſome gentle ſtimulating embrocation; which, by exciting a ſlight irritation upon the ſurface, eſpecially when aſſiſted by a free uſe of the bark, produces, for the moſt part, ſuch a degree of inflammation as is wiſhed for. With this view he has frequently known a weak ſolution of ſal ammoniac, a drachm of the ſalt to two ounces of vinegar and ſix of water, for a mixture of a very proper ſtrength for every purpoſe of this kind. But the degree of ſtimulus can eaſily be either increaſed or diminiſhed according to circumſtances, by uſing a larger or ſmaller proportion of the ſalt.

Whenever, either by the means recommended, or by a natural exertion of the ſyſtem, a ſlight inflammation appears between the diſeaſed and ſound parts, we may in general, with tolerable certainty, expect, that in due time the parts will be ſeparated; and when a full ſuppuration is once fairly eſtabliſhed, there can be little doubt that the mortified parts will be ſoon and eaſily removed.

A complete ſeparation being effected, the remaining ſore is to be treated in the manner deſcribed under the article Surgery; with a proper attention, at the ſame time, to the ſupport of the general ſyſtem by the continuance of a nouriſhing diet, the bark, and ſuch quantities of wine as may ſeem neceſſary.

With regard to the bark, however, it is proper to take notice of another caſe of mortification in which it is likewiſe unſucceſsful, as well as in that attended with a high degree of inflammation; and that is, in thoſe mortifications of the toes and feet, common in old people, or which ariſe from any cauſe increaſing the rigidity of the veſſels to ſuch a degree as to prevent the motion of the fluids through them. In this caſe Mr. Pott has diſcovered, that all kinds of warm applications are unſucceſsful; but that by the free uſe of opium, together with ſedatives and relaxants externally applied, he has frequently ſeen the tumefaction of the feet and ancles ſubſide, the ſkin recover its natural colour, and all the mortified parts ſeparate in a very ſhort time, leaving a clean ſore. But as to ſcarifications, or any other attempt to ſeparate artificially the mortified from the ſound parts, he thinks them very prejudicial, by giving pain; which is generally of itſelf violent in this diſeaſe, and which ſeems to have a great ſhare in producing the other evils.

Genus IX. OPHTHALMIA, *or Inflammation of the* Eyes.

Cauſes. From the diſtinctions which authors have invented in the ophthalmia, it is evident, that by far the greateſt part of them are ſymptomatic, or merely the conſequences of other diſorders preſent in the habit; and therefore the remedies muſt be directed towards the removal of theſe primary diſorders; and when they are gone the ophthalmia will be removed of courſe. The inflammation of the eye may be conſidered as of two kinds; according as it is ſeated in the membranes of the ball of the eye, when it is named *ophthalmia membranarum*; or as it is ſeated in the ſebaceous glands placed in the tarſus, or edges of the eye-lids, in which caſe it may be termed *ophthalmia tarſi*. Theſe two kinds are very frequently connected together, as the one may excite the other; but they are ſtill to be diſtinguiſhed according as the one or the other may happen to be the primary affection.

The inflammation of the *membranes* of the eye affects eſpecially, and moſt frequently, the adnata, and appears in a turgeſcence of its veſſels; ſo that the red veſſels which are naturally there, become not only increaſed in ſize, but many more appear than in a natural ſtate.

The ophthalmia membranarum requires the remedies proper for inflammation in general; and when the deeper ſeated membranes are affected, and eſpecially when a pyrexia is preſent, large general bleedings may be neceſſary. But this laſt is ſeldom the caſe; and, for the moſt part, the ophthalmia is an affection purely local, accompanied with little or no pyrexia. General bleedings therefore have little effect upon it, and the cure is chiefly to be obtained by topical bleedings, that is, blood drawn from the veſſels near the inflamed part; and opening the jugular vein, or the temporal artery, may be conſidered as in ſome meaſure of this kind. It is commonly ſufficient to apply a number of leeches round the eye; and it is perhaps ſtill better to draw blood by cupping and ſcarifying upon the temples. In many caſes, the moſt effectual remedy is to ſcarify the internal ſurface of the inferior eye-lid, and to cut the turgid veſſels upon the adnata itſelf.

Beſides blood-letting, purging, as a remedy ſuited to inflammation in general, has been conſidered as peculiarly adapted to inflammation in any part of the head, and therefore to ophthalmia; and it is ſometimes uſeful: but, for the reaſons given before with reſpect to general bleeding, purging in the caſe of ophthalmia does not prove uſeful in any proportion to the evacuation excited. For relaxing the ſpaſm in the part, and taking off the determination of the fluids to it, bliſtering near the part has commonly been found uſeful.

Ophthalmia, as an external inflammation, admits of topical applications. All thoſe, however, which increaſe the heat and relax the veſſels of the part, prove hurtful; and the admiſſion of cool air to the eye, and the application of cooling and aſtringent medicines, which at the ſame time do not produce irritation, prove uſeful. In the cure of this diſtemper indeed, all irritation muſt carefully be avoided, particularly that of light; and the only certain means of doing this is by keeping the patient in a dark chamber.

In the *ophthalmia tarſi*, the ſame medicines may be neceſſary as are already recommended for the ophthalmia membranarum. However, as the ophthalmia tarſi may often depend upon an acrimony depoſited in the ſebaceous glands of the part, ſo it may require various internal remedies according to the variety of the acrimony in fault; for which we muſt refer to the conſideration of ſcrophula, ſyphilis, or other diſeaſes with which this ophthalmia may be connected; and where theſe ſhall not be evident, certain remedies more generally adapted to the evacuation of acrimony, ſuch as mercury, may be employed. In the ophthalmia tarſi, it almoſt conſtantly happens that ſome ulcerations are formed on the tarſus. Theſe require the application of mercury and copper, which alone may ſometimes cure the whole affection; and they may be uſeful even when the diſeaſe depends upon a fault of the whole ſyſtem.

Both in the ophthalmia membranarum, and in the ophthalmia tarſi, it is neceſſary to obviate that glueing together of the eye-lids which commonly happens in ſleep; and which may be done by inſinuating a little of any mild unctuous medicine between the eye-lids before the patient ſhall go to ſleep.

The ſlighter kinds of inflammations from the duſt or the ſun, may be removed by fomenting with warm milk and water, adding a ſmall portion of brandy; and by anointing the borders of the eye-lids with *unguentum tutiæ*, or the like, at night, eſpecially when thoſe parts are excoriated and ſore. But in bad caſes, after the inflammation has yielded a little to evacuations, the *coagulum aluminoſum* of the London diſpenſatory ſpread on lint, and applied at bed-time, has been found the beſt external remedy. Before the uſe of the latter, the ſolution of white vitriol is preſcribed with advantage; and in violent pains it is of ſervice to foment frequently with a decoction of white poppy-heads.

Genus X. PHRENTIS, Phrenzy, or *Inflammation of the Brain.*

The true phrenitis, or inflammation of the membranes or ſubſtance of the brain, is very rare as an original diſeaſe: but, as a ſymptom of others, much more frequent.

Deſcription. The ſigns of an impending phrenzy are, immoderate and continual watchings; or if any ſleep is obtained, it is diſturbed with dreams and gives no refreſhment; acute and laſting pains, eſpecially in the hind-part of the head and neck; little thirſt; a great and ſlow reſpiration, as if proceeding from the bottom of the breaſt; the pulſe ſometimes ſmall and ſlow, ſometimes quick and frequent; a ſuppreſſion of urine; and forgetfulneſs. The diſtemper when preſent may be known by the following ſigns: The veigns of the head ſwell, and the temporal arteries throb much; the eyes are fixed, ſparkle, and have a fierce aſpect; the ſpeech is incoherent, and the patient behaves very roughly to the bye-ſtanders, with furious attempts to get out of bed, not indeed continually, but returning as it were by paroxyſms; the tongue is dry, rough, yellow, or black; there is a coldneſs of the external parts; a proneneſs to anger; chattering of the teeth; a trembling of the hands, with which the ſick ſeem to be gathering themſelves, and actually do gather the naps off the bed-clothes.

Cauſes of, and Perſons ſubject to, this Diſorder. People of a hot and bilious habit of body, and ſuch as are of a paſſionate diſpoſition, are apt to fall into a phrenzy. The ſame danger are thoſe in who uſe much ſpices, or are given to hot and ſpirituous liquors; who have been expoſed more than uſual to the ſun, or obliged to undergo immoderate ſtudies or watchings; who are ſubject to head-achs, or in whom ſome cuſtomary hæmorrhages have been ſtopped; or the diſeaſe may ariſe from ſome injury offered to the head externally. Dr. Pringle obſerves, that the phrenitis, when conſidered as an original diſeaſe, is apt to attack ſoldiers in the ſummer-ſeaſon when they are expoſed to the heat of the ſun, and eſpecially when aſleep and in liquor. A ſymptomatic phrenzy is alſo more frequent in the army than elſewhere, on account of the violence done to all fevers when the ſick are carried in waggons from the camp to an hoſpital, where the very noiſe or light alone would be ſufficient, with more delicate natures, to raiſe a phrenzy.

Prognoſis. Every kind of phrenzy, whether idiopathic or ſymptomatic, is attended with a high degree of danger; and, unleſs removed before the fourth day, a gangrene or ſphacelus of the meninges readily takes place, and the patient dies delirious. The following are the moſt fatal ſymptoms: A continual and furious delirium, with watching; thin watery urine, white fæces, the urine and ſtools running off involuntary, or a total ſuppreſſion of theſe excretions; a ready diſpoſition to become ſtupid, or to faint; trembling, rigor, chattering of the teeth, convulſions, hickup, coldneſs of the extremities, trembling of the tongue, ſhrill voice, a ſudden ceſſation of pain, with apparent tranquility. The following are favourable: Sweats, apparently critical, breaking out; a ſeeming effort of nature to terminate the diſeaſe by a diarrhœa; a large hæmorrhage from the noſe; ſwellings of the glands behind the ears; hæmorrhoids.

Cure. This is not different from the cure of inflammation in general; but here the moſt powerful remedies are to be immediately employed. Large and repeated bleedings are eſpecially neceſſary; and theſe too taken from veſſels as near as poſſible to the part affected. The opening the temporal artery has been recommended, and with ſome reaſon; but as the practice is attended with ſome inconveniencies, perhaps the opening of the jugular veins may prove more effectual; with which, however, may be joined the drawing of blood from the temples by cupping and ſcarifying. It is alſo probable, that purging may be of more uſe in this than in ſome other inflammatory affections, as it may operate by revulſion. For the ſame purpoſe of revulſion, warm pediluvia are a remedy, but rather ambiguous. The taking off the force of the blood in the veſſels of the head by an erect poſture is generally uſeful. Bliſtering is alſo uſeful, but chiefly when applied near to the part affected. In ſhort, every part of the antiphlogiſtic regimen is here neceſſary, and particularly the admiſſion of cold air. Even cold ſubſtances applied to the head have been found uſeful; and the application of ſuch refrigerants as vinegar is certainly proper. Opiates are hurtful in every inflammatory ſtate of the brain. On the whole, however, it muſt be remarked, that practitioners are very uncertain with regard to the means proper to be uſed in this diſeaſe; and the more ſo, that the ſymptoms by which the diſeaſe is commonly judged to be preſent, appear ſometimes without any internal inflammation; and on the other hand, diſſections have ſhewn that the brain has been inflamed, where few of the peculiar ſymptoms of inflammation had appeared before.

GENUS XI. CYNANCHE *Tonſillaris*; *the Inflammatory* QUINSY.

Deſcription. This is an inflammation of the mucous membrane of the fauces, affecting principally that congeries of mucous follicles which forms the tonſils; and from thence ſpreading along the velum and uvula, ſo as frequently to affect every part of the mucous membrane. The diſeaſe appears by ſome tumour and redneſs of the parts; is attended with a painful and difficult deglutition; a troubleſome clammineſs of the mouth and throat; a frequent, but difficult, excretion of mucus; and the whole is accompanied with pyrexia. The inflammation and tumour are commonly at firſt moſt conſiderable in one tonſil; and afterwards, abating in that, increaſe in the other. This diſeaſe is not contagious.

Cauſes of, and Perſons ſubject to, the Diſorder. This diſeaſe is commonly occaſioned by cold externally applied, particularly about the neck. It affects eſpecially the young and ſanguine; and a diſpoſition to it is often acquired by habit. It occurs eſpecially in the ſpring and autumn, when viciſſitudes of heat and cold frequently take place.

Prognoſis. This ſpecies of quinſy terminates frequently by reſolution, ſometimes by ſuppuration, but hardly ever by gangrene; though in ſome caſes ſloughy ſpots appear on the fauces: the prognoſis therefore is generally favourable.

Cure. Here ſome bleeding may be neceſſary; but large and general evacuations are ſeldom beneficial. The opening of the ranular veins ſeems to be an inſignificant remedy, according to Dr. Cullen, but is recommended as efficacious by Sir John Pringle; and leeches ſet on the external fauces are ſerviceable. The inflammation may be often relieved by moderate aſtringents, and particularly by acids applied to the parts affected. In many caſes, nothing has been found to give more relief than the vapour of warm water received into the fauces.

Beſides theſe, bliſtering and rubefacient medicines are applied with ſucceſs, as well as antiphlogiſtic purgatives; and every part of the antiphlogiſtic regimen is to be obſerved, except the application of cold. Sir John Pringle recommends a thick piece of flannel moiſtened with two parts of common ſweet oil, and one of ſpirit-of-hartſhorn, (or in a larger proportion, if the ſkin will bear it), applied to the throat, and renewed once every four or five hours. By this means the neck, and ſometimes the whole body, is put into a ſweat, which, after bleeding, either carries off or leſſons the inflammation. When the diſeaſe takes a tendency to ſuppuration, nothing will be more uſeful than the taking into the fauces the ſteams of warm water. When the abſceſs is attended with much ſwelling, if it break not ſpontaneouſly, it ought to be opened by a lancet; and this does not require much caution, as even the inflammatory ſtate may be relieved by ſome ſcarification of the tonſils. Dr. Cullen has never ſeen any caſe requiring bronchotomy.

THE MALIGNANT, PUTRID, OR ULCEROUS SORE THROAT.

No account of this diſtemper was publiſhed in this country till the year 1748, when a very accurate one was drawn up by Dr. Fothergill, and in 1752 by Dr. Huxham. The latter obſerves, that this diſeaſe was preceded by long, cold, and wet ſeaſons; by which probably the bodies of people were debilitated, and more apt to receive contagion, which poſſibly alſo might be produced by the ſtagnant and putrid waters.

He obſerves that in a few hours after the ſeizure, and ſometimes cotemporary with it, a ſwelling and ſoreneſs of the throat was perceived, and the tonſils became very tumid and inflamed, and many times the parotid and maxillary glands ſwelled very much, and very ſuddenly, even at the very beginning; ſometimes ſo much as even to threaten ſtrangulation. The fauces alſo very ſoon appeared of a high florid red, or rather of a bright crimſon colour, very ſhining and gloſſy; and moſt commonly on the uvula, tonſils, velum palatinum, and back part of the pharynx, ſeveral whitiſh or aſh-coloured ſpots appeared ſcattered up and down, which oftentimes increaſed very faſt, and ſoon covered one or both the tonſils, uvula, &c. thoſe in the event proved ſloughs of ſuperficial ulcers, which ſometimes, however, eat very deep into the parts. The tongue at this time, though only white and moiſt at the top, was very foul at the root, and covered with a thick yellowiſh or brown coat. The breath alſo now began to be very nauſeous; which offenſive ſmell increaſed hourly, and in ſome became at length intolerable, and that too ſometimes even to the patients themſelves. The noſtrils likewiſe in many were greatly inflamed and excoriated, continually dripping down a moſt ſharp ichor, or ſanious matter, ſo exceſſively acrid, that it not only corroded the lips, cheeks, and hands of the children that laboured under the diſeaſe, but even the fingers and arms of the very nurſes that attended them: a ſudden ſtoppage of this rheum from the mouth and noſtrils actually choaked ſeveral children; and ſome ſwallowed ſuch quantities of it, as occaſioned excoriations of the inteſtines, violent gripings, dyſentery, &c. nay, even excoriations of the anus and buttocks. Not only the noſtrils, fauces, &c. were greatly affected by this extremely ſharp matter, but the wind-pipe itſelf was ſometimes much corroded by it, and pieces of its internal membrane were ſpit up, with much blood and corruption; and the patients lingered on for a conſiderable time, and at length died tabid; though there were more frequent inſtances of its falling ſuddenly and violently on the lungs, and killing in a peripneumonic manner.

An early and kindly eruption, however, was moſt commonly a very good omen; and, when ſucceeded by a very copious deſquamation of the cuticle, one of the moſt favourable ſymptoms that occurred; but when the eruption turned of a duſky or livid colour, or prematurely or ſuddenly receded, every ſymptom grew worſe, and the utmoſt danger impended, eſpecially if purple, or black, ſpots appeared up and down, as ſometimes happened; the urine grew limpid, and convulſions came on, or a fatal ſuffocation ſoon cloſed the tragedy.

The diſeaſe was generally at the height about the fifth or ſixth day in young perſons, in the elder not ſo ſoon; and the criſis many times was not till the eleventh and twelfth, and then very imperfect: ſome adults, however, were carried off in two or three days; the diſtemper either falling on the lungs, and killing in a peripneumonic manner, or on the brain; and the patient either died raving or comatoſe. In ſome, the diſeaſe brought on a very troubleſome cough, purulent expectoration, hæmoptoe, and hectic; in which they lingered on for ſeveral weeks, and then died tabid.

In ſome few patients our author obſerved, ſome time before the fatal period, not only the face bloated, ſallow, ſhining, and greaſy as it were, but the whole neck vaſtly ſwoln, and of a cadaverous look; and even the whole body became in ſome degree œdematous; and the impreſſion of a finger would remain fixed in a part, the ſkin not riſing again as uſual; an indication that the blood ſtagnated in the capillaries, and that the elaſticity of the fibres was quite loſt.

Prognoſis. This may be eaſily gathered from the above deſcription. The malignant and putrid tendency of the diſeaſe is evident, and an increaſe of the ſymptoms which ariſe from that putreſcent diſpotiſion of the body muſt give an unfavourable prognoſtic; as, on the contrary, a decreaſe of theſe, and an apparent increaſe of the *vis vitæ*, are favourable: in general, what is obſerved to be favourable in this, and *vice verſa*.

Cure. In this the ſeptic tendency of the diſeaſe is chiefly to be kept in view. The debility with which it is attended renders all evacuations by bleeding and purging improper, except in a few inſtances where the debility is leſs, and the inflammatory ſymptoms more conſiderable. The fauces are to be preſerved from the effects of the acrid matter poured out upon them, and are therefore to be frequently waſhed out by antiſeptic gargles or injections; and the putreſcent ſtate of the whole ſyſtem ſhould be guarded againſt and corrected by internal antiſeptics, eſpecially by the Peruvian bark given in the beginning and continued through the courſe of the diſeaſe. Emetics, both by vomiting and nauſeating, prove uſeful. When any conſiderable tumour occurs, bliſters applied externally will be of ſervice, and in any caſe may be proper to moderate the inflammation.

GENUS XII. PNEUMONIA. PNEUMONIC INFLAMMATION.

Under the general head of ***Pneumonia***, are comprehended all inflammations of the thoracic viſcera, or membrane lining the inſide of that cavity; as the ſymptoms do not ſufficiently diſtinguiſh the ſeat of the affection, nor does a difference in the ſituation of the affected place make any difference in the cure.

Deſcription. Pneumonic inflammation, however various in the ſeat, always diſcovers itſelf by pyrexia, difficult breathing, cough, and pain in ſome part of the thorax. It almoſt always comes on with a cold ſtage, and is accompanied with the other ſymptoms of pyrexia; though, in ſome few inſtances the pulſe may not be more frequent, nor the heat of the body increaſed beyond what is natural. Sometimes the pyrexia is from the beginning accompanied with the other ſymptoms; but frequently is formed ſome hours before them, and particularly before the pain is felt. The pain is alſo different in different caſes, and felt in different parts of the thorax, but moſt frequently in one ſide. It has been ſaid to affect the right ſide more frequently than the left; but this is uncertain, and we are ſure that the left ſide has been very often affected. Sometimes it is felt as if it was under the ſternum; ſometimes in the back between the ſhoulders; and when in the ſides, its place has been higher or lower, more forward or backward; but the place of all others moſt frequently affected is about the ſixth or ſeventh rib, near the middle of its length, or a little more forward.

But as the ſymptoms never clearly indicate where the ſeat of the diſeaſe is, there is but little foundation for the different names by which it hath been diſtinguiſhed. The term *pleuriſy* is improperly limited to that inflammation which begins in and chiefly affects the pleura coſtalis; but this is a rare occurrence; and that becauſe the pneumonia muchmore frequently begins in the pleura inveſting the lungs, producing all the ſymptoms which belong to what has been called the *pleuritis vera*. It ſeems probable, that every acute inflammation begins in membranous parts; and in every diſſection of perſons dead of peripneumony, the external membrane of the lungs, or ſome part of the pleura, has appeared to have been conſiderably affected. An inflammation of the pleura covering the upper ſurface of the diaphragm, has been diſtinguiſhed by the appellation of *paraphrenitis*, as ſuppoſed to be attended with the peculiar ſymptoms of delirium, *riſus ſardonicus*, and other convulſive motions: but it is certain, that an inflammation of that portion of the pleura, and affecting alſo even the muſcular ſubſtance of the diaphragm, has often taken place without any of the ſymptoms abovementioned; nor do any account of diſſections, ſupport the opinion than an inflammation of the pleura covering the diaphragm is attended with delirium more commonly than any other pneumonic inflammation. It is to be obſerved, however, that though the inflammation may begin in one particular part of the pleura, the morbid affection is commonly communicated to the whole extent of the membrane.

The pneumonic inflammation, like others, may terminate by reſolution, ſuppuration, or gangrene: but it has alſo a termination peculiar to itſelf; namely, when it is attended with an effuſion of blood into the cellular texture of the lungs, which, ſoon interrupting the circulation of the blood through the viſcus, produces a fatal ſuffocation. This indeed appears to be the moſt common termination of pneumonic inflammation when it ends fatally; for upon the diſſection of almoſt every perſon dead of this diſeaſe, it appears that ſuch an effuſion had happened. It ſeems likewiſe probable, that an effuſion of this kind is ſometimes made into the cavity of the bronchiæ; for, in ſome perſons who have died after labouring under a pneumonic inflammation for a few days only, the bronchiæ have been found filled with a conſiderable quantity of ſerous and thickiſh fluid, which muſt be conſidered rather as the effuſion abovementioned, having had its thinner parts taken off by reſpiration, than as a pus ſo ſuddenly formed in the inflamed part.

Dr. Cullen is of opinion, that the effuſion into the bronchiæ above-mentioned often concurs with the effuſion of red blood into the cellular ſubſtance of the lungs to occaſion the fatal ſuffocation which frequently terminates peripneumony: that the effuſion of ſerum alone may have this effect: and that the ſerum poured out in a certain quantity, rather than any debility in the powers of expectoration, is the cauſe of that ceſſation of ſpitting which precedes the fatal event; for in many caſes the expectoration has ceaſed, when no other ſymptoms of debility have appeared, and when, upon diſſection, the bronchiæ have been full of liquid matter. Nay, it is even probable, that in ſome caſes ſuch an effuſion may take place without any ſymptoms of violent inflammation which had appeared before, and thus account for thoſe unexpected fatal terminations which have ſometimes happened.

The evacuation moſt frequently attending, and ſeeming to have the greateſt effect in promoting reſolution, is an expectoration of a thick, white, or yellowiſh matter, a little ſtreaked with blood, copious, and brought up without much or violent coughing. Very frequently the reſolution of this diſeaſe is attended with, and perhaps produced by, a ſweat which is warm, fluid, copious, over the whole body, and attended with an abatement of the frequency of the pulſe, heat of the body, and other febrile ſymptoms.

Cauſes of, and Perſons ſubject to, the Diſorder. The remote cauſe of pneumonic inflammation is commonly cold applied to the body, obſtructing perſpiration, and determining to the lungs, while at the ſame time the lungs themſelves are expoſed to the action of cold. Theſe circumſtances operate chiefly when an inflammatory diatheſis prevails in the ſyſtem; and therefore upon perſons of the greateſt vigour, in cold climates, in the winter ſeaſon, and particularly in the ſpring, when viciſſitudes of heat and cold are frequent. This diſeaſe, however, may ariſe in any ſeaſon when ſuch varieties take place. Other remote cauſes alſo may have a ſhare in producing this diſtemper; ſuch as every means of obſtructing, ſtraining, or otherwiſe injuring, the pneumonic organs.

Prognoſis. In pneumonic inflammations, a violent pyrexia is always dangerous. The danger, however, is chiefly denoted by the difficulty of breathing. When the patient can lie on one ſide only; when he can lie on neither ſide, but only on his back; when he cannot breathe with tolerable eaſe, except when the trunk of his body is erect; when even in this poſture the breathing is very difficult, and attended with a turgeſcence and fluſhing of the face, with partial ſweats about the head and neck, and an irregular pulſe, theſe circumſtances mark the difficulty of breathing in different degrees; and conſequently, in proportion, the danger of the diſeaſe. A frequent violent cough, aggravating the pain, is always the ſymptom of an obſtinate diſeaſe; and as the diſeaſe is ſeldom or never reſolved without ſome expectoration, ſo a dry cough muſt always be an unfavourable ſymptom.

When the pains, which had at firſt affected one ſide only, ſhall afterwards ſpread into the other; or when, leaving the ſide firſt affected, they paſs entirely into the other; theſe are always marks of a dangerous diſeaſe. A delirium coming on during a pneumonic inflammation is always a ſymptom denoting much danger. If the diſeaſe continues beyond the 14th day, it will terminate in a ſuppuration, or phthiſis. The termination by gangrene is much more rare than has been imagined: and when it does occur, it is uſually joined with the termination by effuſion; the ſymptoms of the one being hardly diſtinguiſhable from thoſe of the other.

Cure. This muſt proceed upon the general plan mentioned under Synocha; but, on account of the importance of the part affected, the remedies muſt be employed early, and as fully as poſſible. Veneſection is chiefly to be depended on; and may be done in either arm, as the ſurgeon finds moſt convenient; and the quantity taken away ought in general to be as large as the patient's ſtrength will allow. The remiſſion of pain, and the relief of reſpiration, during the flowing of the blood, may limit the quantity to be then drawn; but if theſe ſymptoms of relief do not appear, the bleeding ſhould be continued till the ſymptoms of a beginning ſyncope come on. It is ſeldom that one bleeding, however large, will cure this diſeaſe; and though the pain and difficulty of breathing may be much relieved by the firſt bleeding, theſe ſymptoms commonly, and after no long interval recur, often with as much violence as before. In this caſe the bleeding is to be repeated even on the ſame day, and perhaps to the ſame quantity as before. Sometimes the ſecond bleeding may be larger than the firſt. There are perſons who, by their conſtitution, are ready to faint even upon a ſmall bleeding; and in ſuch perſons this may prevent the drawing ſo much blood at firſt as a pneumonic inflammation may require: but as the ſame perſons are found to bear after-bleedings better than the firſt, this allows the ſecond and ſubſequent bleedings to be larger, and to ſuch a quantity as the ſymptoms of the diſeaſe may ſeem to require.

Bleedings are to be repeated according to the ſtate of the ſymptoms, and they will be more effectual when practiſed in the courſe of the firſt three days than afterwards; but they are not to be omitted though four days of the diſeaſe may already have elapſed. If the phyſician has not been called in time, or the firſt bleedings have not been ſufficiently large, or even though they ſhould have procured ſome remiſſion, yet upon the return of the urgent ſymptoms, bleeding may be repeated at any time within the firſt fortnight, or even after that period, if a ſuppuration be not evident, or if after a ſeeming ſolution the diſeaſe ſhall have returned.

In a more advanced ſtate, and when the ſymptoms have ſuffered a conſiderable remiſſion, we may then truſt the cure to the expectoration alone. It is not obſerved that bleeding, during the firſt day of the diſeaſe, ſtops expectoration; on the contrary, it hath been often found to promote it; and it is only in a more advanced ſtate of the diſeaſe, when the patient has been already exhauſted by large evacuations and a continuance of his illneſs, that bleeding ſeems to put a ſtop to expectoration; and even then, this ſtoppage ſeems not to take place ſo much from the powers of expectoration being weakened by bleeding, as by its favouring the ſerous effuſion in the bronchiæ, already taken notice of.

Beſides bleeding, every part of the antiphlogiſtic regimen ought here to be carefully employed: the patient muſt keep out of bed as much as he can bear; muſt have plenty of warm diluting drinks, impregnated with vegetable acids, accompanied with nitre or ſome other cooling neutral ſalt; and the belly alſo ought to be kept open by emollient glyſters or cooling laxative medicines. Vomiting is dangerous; but it hath been found uſeful to exhibit emetics in nauſeating doſes, and in a ſomewhat advanced ſtate of the diſeaſe theſe doſes have been found the beſt means of promoting expectoration. Fomentations and poultices to the pained part have been found uſeful; but bliſtering is found to be much more effectual. A bliſter, however, ought not to be applied till at leaſt one bleeding hath been premiſed, as veneſection is leſs effectual when the irritation of a bliſter is preſent. If the diſeaſe is moderate, a bliſter may be applied immediately after the firſt bleeding; but in violent caſes, where it may be preſumed that a ſecond bleeding may ſoon be neceſſary after the firſt, it will be proper to delay the bliſter till after the ſecond bleeding, when it may be ſuppoſed that the irritation occaſioned by the bliſter will be over before another bleeding becomes neceſſary. It may frequently be of uſe in this diſeaſe to repeat the bliſtering; and in that caſe the plaſters ſhould always be applied ſomewhere on the thorax, for when applied to more diſtant parts they have little effect. The keeping the bliſtered parts open, and making what is called a perpetual bliſter, has much leſs effect than a freſh bliſtering.

Many methods have been propoſed for promoting expectoration, but none appear to be ſufficiently effectual; and ſome of them, being acrid ſtimulant ſubſtances, are not very ſafe. The gums uſually employed ſeem to be too heating: the ſquills leſs ſo; but they are not very powerful, and ſometimes inconvenient, by the conſtant nauſea they occaſion. The volatile alkali may be of ſervice as an expectorant, but it ought to be reſerved for an advanced ſtate of the diſeaſe. Mucilaginous and oily demulcents appear to be uſeful, by allaying that acrimony of the mucus which occaſions too frequent coughing; and which coughing prevents the ſtagnation and thickening of the mucus, and thereby its becoming mild. The receiving the ſteams of warm water into the lungs, impregnated with vinegar, has often proved uſeful in promoting expectoration; and, for this purpoſe, the machine called the *inhaler*, lately invented by Mr. Mudge, ſurgeon at Plymouth, promiſes to be of great ſervice. But of all others the antimonial emetics, given in nauſeating doſes, promiſe to be the moſt powerful for promoting expectoration. The kermes mineral hath been greatly recommended; but doth not ſeem to be more efficacious than emetic tartar or antimonial wine; and the doſe of the kermes is much more uncertain than that of the others.

Though this diſeaſe often terminates by a ſpontaneous ſweating, this evacuation ought not to be excited by art, unleſs with much caution. If, however, the ſweats be partial and clammy only, and a great difficulty of breathing ſtill remain, it will be very dangerous to encourage them.

Phyſicians have differed much with regard to the uſe of opiates in pneumonic affections. It appears, however, that, in the beginning of the diſeaſe, and before bleeding and bliſtering have produced ſome remiſſion of the pain and of the difficulty of breathing, opiates have a very bad tendency, by their increaſing the difficulty of breathing and other inflammatory ſymptoms. But in a more advanced ſtate of the diſeaſe, when the difficulty of breathing has abated, and when the urgent ſymptom is a cough, proving the chief cauſe of the continuance of pain and want of reſt, opiates may be employed with great advantage and ſafety.

Vomica, or *Abſceſs* of the *Lungs*.

This ſometimes follows pneumonia, though the caſe is not frequent. The ſymptoms of it ſo much reſemble the phthiſis, that it can moſt properly be treated of under that head.

Genus XIII. CARDITIS, or *Inflammation of the* Heart.

Deſcription. This diſeaſe is attended with all the ſymptoms of pneumonia, but in a higher degree; it is beſides ſaid to be accompanied with hydrophobic ſymptoms, fainting, palpitation of the heart, a ſeeming madneſs, ſunk and irregular pulſe, watery eyes, and a dejected countenance, with a dry and black tongue. On diſſection, the heart and pericardium are found very much inflamed, and even ulcerated, with many polypous concretions.

Cauſes, &c. The ſame as in the pneumonia.

Prognoſis. In the carditis the prognoſis is more unfavourable than in the pneumonia; and indeed, unleſs the diſeaſe very quickly terminates, it muſt prove fatal, on account of the conſtant and violent motion of the heart, which exaſperates the inflammation, and increaſes all the ſymptoms.

Cure. Here bleeding is neceſſary in as great a degree as the patient can poſſibly bear, together with bliſtering, and the antiphlogiſtic regimen likewiſe carried to a greater height than in the pneumonia; but the general method is the ſame as in other inflammatory diſeaſes.

Genus XIV. GASTRITIS, or *Inflammation of the* Stomach.

Deſcription. The inflammation of the ſtomach is attended with great heat and pain in the epigaſtric region, extreme anxiety, an almoſt continual and painful hickup, with a moſt painful vomiting of every thing taken into the ſtomach. Sometimes a temporary madneſs enſues; and there is an inſtance in the Edinburgh Medical Eſſays of the diſorder being attended with an hydrophobia. The pulſe is generally more ſunk than in other inflammations, and the fever inclines to the nature of a typhus. The diſorder is commonly of the remitting kind, and during the remiſſions the pulſe frequently intermits. During the height of the diſeaſe, a mortal phrenzy frequently ſupervenes. The diſeaſe terminates on the fourth, ſeventh, ninth day, or from the eleventh to the fifteenth; and is more apt to end in a gangrene than pneumonic inflammations, and more frequently in a ſcirrhus than in an abſceſs.

Cauſes, &c. The inflammation of the ſtomach may ariſe from any acrid ſubſtance taken into it; from a vehement paſſion; too large draughts of cold liquor, eſpecially when the perſon is very hot; from a ſurfeit; a ſtoppage of perſpiration; repulſion of the gout; opiates; inflammations of the neighbouring viſcera; or from external injuries, ſuch as wounds, contuſions, &c. It affects chiefly thoſe of a plethoric habit, and hot bilious conſtitution.

Prognoſis. This diſeaſe is always very dangerous, and the prognoſis doubtful, which alſo muſt always be in proportion to the ſeverity of the ſymptoms. A ceſſation of pain, coldneſs about the præcordia, great debility, with a languid and intermitting pulſe, with an abatement of the hickup, denote a gangrene and ſpeedy death. From the ſenſibility of the ſtomach alſo, and its great connection with the reſt of the ſyſtem, it muſt be obvious, that an inflammation of it, by whatever cauſes produced, may be attended with fatal conſequences. The tendency to ſuppuration may be known by the ſymptoms continuing but in a moderate degree for more than one or two weeks, and by a conſiderable remiſſion of the pain, while a ſenſe of weight and an anxiety ſtill remain. When an abſceſs has been formed, the frequency of the pulſe is at firſt abated: but ſoon after it increaſes with frequent cold ſhiverings, and an exacerbation in the afternoon and evening; followed by night-ſweats, and other ſymptoms of hectic fever. Theſe at length prove fatal, unleſs the abſceſs open into the cavity of the ſtomach, the pus be evacuated by vomiting, and the ulcer ſoon healed.

Cure. It appears from diſſections, that the ſtomach may very often be inflamed when the characteriſtic marks of it have not appeared; and therefore we cannot lay down any general rules for the cure of this diſeaſe. When the ſymptoms appear in the manner above deſcribed, the cure is to be attempted by large and repeated bleedings employed early in the diſeaſe; and from theſe we are not to be deterred by the weakneſs of the pulſe, for it has commonly become fuller and ſofter after the operation. A bliſter ought alſo to be applied to the region of the ſtomach; and the cure will be aſſiſted by fomentations of the whole abdomen, and by frequent emollient and laxative glyſters. The irritability of the ſtomach in this diſeaſe will admit of no medicines being thrown into it; and if any can be ſuppoſed neceſſary, they muſt be exhibited in glyſters. Diluting drinks may be tried; but they muſt be of the very mildeſt kind, and given in ſmall quantities at a time. Opiates, in whatever manner exhibited, are very hurtful during the firſt days of the diſeaſe; but when the violence of the diſeaſe ſhall have abated, and when the pain and vomiting recur at intervals only, opiates given in glyſters may frequently be employed with advantage. A tendency to gangrene in this diſeaſe is to be obviated only by the means juſt now mentioned; and when it does actually ſupervene, it admits of no remedy. A tendency to ſuppuration is to be obviated by the ſame means employed early in the diſeaſe. After a certain period it cannot be prevented by any means whatever; and, when actually begun, muſt be left to nature; the only thing that can be done by art to avoid all irritation.

Genus XV. ENTERITIS, *or Inflammation of the* Intestines.

Deſcription. This diſeaſe ſhews itſelf by a fixed pain in the abdomen, attended with fever, vomiting, and coſtiveneſs. The pain is often felt in different parts of the abdomen, but more frequently ſpreads over the whole, and is particularly violent about the navel.

Cauſes, &c. Inflammations of the inteſtines may ariſe from the ſame cauſes as thoſe of the ſtomach; though commonly the former will more readily occur from cold applied to the lower extremities, or to the belly itſelf. It is alſo found ſupervening on the ſpaſmodic colic, incarcerated hernia, and volvulus.

Prognoſis. Inflammations of the inteſtines have the ſame terminations with thoſe of the ſtomach, and the prognoſis in both caſes is much the ſame.

Cure. The cure of enteritis is in general the ſame with that of gaſtritis: but in the former there is commonly more acceſs to the introduction of liquids, of acid, aceſcent, and other cooling remedies, and even of laxatives; but as a vomiting frequently attends the enteritis, care muſt be taken not to excite that vomiting by the quantity or quality of any thing thrown into the ſtomach. With regard to the ſuppuration and gangrene of the inteſtines following the enteritis, the ſame thing is to be underſtood as is mentioned under the Gastritis.

Eryſipelatous Enteritis. Concerning this nothing farther can be ſaid, than what had been already delivered concerning the gaſtritis.

Genus XVI. HEPATITIS, *or Inflammation of the* Liver.

Deſcription. The inflammation of the liver is thought to be of two kinds, acute and chronic: but the latter very often does not diſcover itſelf except by an abſceſs found in the liver after death, and which is ſuppoſed to have been occaſioned by ſome degree of inflammation; for this reaſon the chronic inflammation cannot be deſcribed, and we ſhall here only treat of the acute hepatitis.

The acute hepatitis is attended with a conſiderable fever; a frequent, ſtrong, and hard pulſe; high coloured urine; an acute pain in the right hypochondrium, increaſed by preſſing upon the part. The pain is very often in ſuch a part of the ſide as to make it appear like a pleuriſy; and frequently, like that, is increaſed on inſpiration. The diſeaſe is alſo commonly attended with a cough, which is generally dry, but ſometimes moiſt; and when the pain thus reſembles a pleuriſy, the patient cannot lie eaſily except upon the ſide affected. The pain is frequently extended to the clavicle, and to the top of the ſhoulder; and is attended ſometimes with hickup, and ſometimes with vomiting. Some have added jaundice, or a yellowneſs in the eyes, to the ſymptoms of this diſtemper; but experience ſhews that it hath often occured without any ſuch ſymptom.

Cauſes, &c. The remote cauſes of hepatitis are not always to be diſcerned, and many have been aſſigned on a very uncertain foundation. It has been ſuppoſed that the diſeaſe may be an affection either of the extremities of the hepatic artery, or thoſe of the vena portarum; but of the laſt there is no proof, nor is the ſuppoſition at all probable. The inflammation on the concave ſurface of the liver, may be readily communicated to the gall-bladder and biliary ducts: and this, perhaps, is the only caſe of idiopathic hepatitis, attended with jaundice.

Prognoſis. The inflammation of the liver, like others, may end by reſolution, ſuppuration, or gangrene; and the tendency to the one or to the other of thoſe events may be known from what has been already mentioned concerning the prognoſis in gaſtritis. The reſolution of hepatitis is often the conſequence of, or is attended with evacuations of different kinds. An hæmorrhage, ſometimes from the noſe, and ſometimes from the hæmorrhoidal veſſels, gives a ſolution of the diſeaſe. Sometimes the ſame thing is accompliſhed by a bilious diarrhœa; and ſometimes the reſolution is attended with ſweating, and an evacuation of urine depoſiting a copious ſediment. Sometimes it may be cured by an eryſipelas appearing in ſome external part. When the diſeaſe hath ended in ſuppuration, the pus collected may be diſcharged by the biliary ducts; or, if the ſuppurated part does not adhere any where cloſely to the neighbouring parts, into the cavity of the abdomen: but if, during the firſt ſtate of inflammation, the affected part of the liver ſhall have formed a cloſe adheſion to ſome of the neighbouring parts, the diſcharge after ſuppuration may be various, according to the different ſeat of the abſceſs.

Cure. For the cure of hepatitis, we muſt have recourſe to the general means of removing other inflammatory diſorders. Bleeding is to be uſed according to the degree of fever and pain. Bliſters are to be applied: fomentations of the external parts, emollient glyſters, gentle laxatives, diluents and refrigerants, are alſo uſeful. But when a ſuppuration has been formed, and the abſceſs points outwardly, the part muſt be opened, the pus evacuated, and the ulcer healed according to the ordinary methods in uſe for healing abſceſſes and ulcers in other parts.

Genus XVII. SPLENITIS, or *Inflammation of the* Spleen.

Deſcription. This diſeaſe, according to *Junker*, comes on with a remarkable ſhivering, ſucceeded by a moſt intenſe heat and very great thirſt; a pain and tumour are perceived in the left hypochondrium, and the paroxyſms for the moſt part aſſume a quartan form. When the patients expoſe themſelves for a little to the free air, their extremities immediately grow very cold. If an hæmorrhage happens, the blood flows out of the left noſtril. The other ſymptoms are the ſame with thoſe of the hepatitis. Like the liver, it is alſo ſubject to a chronic inflammation, which often happens after agues, and is commonly called the *ague cake*.

Cauſes, &c. The cauſes of this diſtemper are in general the ſame with thoſe of other inflammatory diſorders; but thoſe which determine the inflammation to that particular part more than another, are very much unknown. It attacks perſons of a very plethoric and ſanguine habit of body rather than others.

Prognoſis. What hath been ſaid of the inflammation of the liver applies alſo to that of the ſpleen, though the latter is leſs dangerous than the former. Here alſo a vomiting of black matter, which in other acute diſeaſes is ſuch a fatal omen, ſometimes proves critical, according to the teſtimony of Junker. Sometimes the hæmorrhoids prove critical; but very often the inflammation terminates by ſcirrhus.

Cure. This is not at all different from what hath been already laid down concerning the hepatitis.

Genus XVIII. NEPHRITIS, or *Inflammation of the* Kidneys.

Deſcription. The nephritis has the ſame ſymptoms in common with other inflammations; but its diſtinguiſhing mark is the pain in the region of the kidney, which is ſometimes obtuſe, and ſometimes pungent. The pain is not increaſed by the motion of the trunk of the body ſo much as a pain of the rheumatic kind affecting the ſame region. It may alſo frequently be diſtinguiſhed by its ſhooting along the courſe of the ureter, and is frequently attended with a drawing up of the teſticle, and a numbneſs of the limb on the ſide affected; though indeed theſe ſymptoms moſt commonly attend the inflammation ariſing from a calculus in the kidney or ureter. The diſeaſe is alſo attended with frequent vomiting, and often with coſtiveneſs and colic pains. The urine is moſt commonly of a deep red colour, and is voided frequently and in a ſmall quantity at a time. In more violent caſes the urine is commonly colourleſs.

Cauſes, &c. The remote cauſes of this diſeaſe may be various; as external contuſion, violent or long continued riding; ſtrains of the muſcles of the back incumbent on the kidneys; various acrids in the courſe of circulation conveyed to the kidney; and perhaps ſome other internal cauſes not yet well known: the moſt frequent is that of calculous matter obſtructing the *tubuli uriniferi*, or calculi formed in the pelvis of the kidneys, and either ſticking there or fallen into the ureter.

Prognoſis. This is not different from that of other inflammatory diſeaſes.

Cure. This is to be attempted by bleeding, external fomentation, frequent emollient glyſters, antiphlogiſtic purgatives, and by the free uſe of mild and demulcent liquids. The uſe of bliſters is ſcarce admiſſible, or at leaſt will require great care to avoid any conſiderable abſorption of the cantharides.

Genus XIX. CYSTITIS, or *Inflammation of the* Bladder.

The inflammation of the bladder from internal cauſes is a very rare diſtemper; and when it does at any time occur, is to be cured in the ſame manner with other inflammations, avoiding only the uſe of cantharides. When the diſeaſe ariſes from the internal uſe of theſe flies, camphire is recommended, beſides other cooling medicines, and particularly cooling and emollient glyſters.

Genus XX. HYSTERITIS, or *Inflammation of the* Uterus.

Deſcription. The diſeaſe is often confounded with that called the *puerperal* or *child-bed fever*; but is very eſſentially diſtinct from it, as will be ſhewn in its proper place. The inflammation of the uterus is often apt to terminate by gangrene: there is a pain in the head, with delirium; and the uterine region is ſo exceedingly tender, that it cannot bear the moſt gentle preſſure without intolerable pain. When the *fundus uteri* is inflamed, there is great heat, throbbing, and pain, above the pubes; if its poſterior part, the pain is more confined to the loins and rectum, with a teneſmus; if its anterior part, it ſhoots from thence towards the neck of the bladder, and is attended with a frequent irritation to make water, which is voided with difficulty; and if its ſides or the ovaria are affected, the pains will then dart into the inſide of the thighs.

Cauſes, &c. Inflammations of the uterus, and indeed of the reſt of the abdominal viſcera, are very apt to take place in lying-in women; the reaſon of which ſeems to be the ſudden change produced in the habit, and an alteration in the courſe of the circulating blood by the contraction of the uterus after delivery. The preſſure of the gravid uterus being ſuddenly taken off from the *aorta deſcendens* after delivery, the reſiſtance to the impulſe of the blood paſſing through all the veſſels derived from it, and diſtributed to the contiguous viſcera, will be conſiderably leſſened: it will therefore ruſh into thoſe veſſels with a force ſuperior to their reſiſtance; and, by putting them violently on the ſtretch, may occaſion pain, inflammation, and fever. This contraction of the uterus alſo renders its veſſels impervious to the blood which had freely paſſed through them for the ſervice of the child during pregnancy; and conſequently a much larger quantity will be thrown upon the contiguous parts, which will ſtill add to their diſtenſion, and increaſe their tendency to inflammation.

Prognoſis. An inflammation of the uterus generally may be expected to produce an obſtruction of the lochia; but the fever produced ſeldom proves mortal, unleſs the inflammation is violent and ends in a gangrene.

Cure. This is to be attempted by the ſame general means already recommended, and the management of this diſorder entirely coincides with that of the puerperal fever.

Genus XXI. RHEUMATISMUS; *the* Rheumatism.

THE ACUTE RHEUMATISM.

Deſcription. The rheumatiſm is particularly diſtinguiſhed by pains affecting the joints, and for the moſt part the joints alone; but ſometimes alſo the muſcular parts. Very often they ſhoot along the courſe of the muſcles from one joint to another, and are always much increaſed by the action of the muſcles belonging to the joint or joints affected. The larger joints are thoſe moſt frequently affected, ſuch as the hip joint and knees of the lower extremities. and the ſhoulders and elbows of the upper ones. The ancles and wriſts are alſo frequently affected; but the ſmaller joints, ſuch as thoſe of the toes or fingers, ſeldom ſuffer. The pains do not commonly remain long in the ſame joint, but frequently ſhift from one to another, and ſometimes return to joints formerly affected; and in this manner the diſeaſe often continues for a long time. The pyrexia hath an exacerbation every evening, and is moſt conſiderable during the night, when the pains alſo become more violent; and it is at the ſame time that the pains ſhiſt their place from one joint to another. Theſe ſeem to be alſo increaſed during the night by the body being covered more cloſely, and kept warmer.

A joint, after having been for ſome time affected with pain, commonly becomes alſo affected with ſome ſwelling and redneſs, which is painful to the touch. It ſeldom happens that a ſwelling coming on does not take off the pain entirely, or ſecure the joint againſt a return of it. The blood is always ſizy. The acute rheumatiſm differs from all other inflammatory diſeaſes in not being liable to terminate in ſuppuration: this rarely happens; but the diſeaſe ſometimes produces effuſions of a tranſparent gelatinous fluid into the ſheaths of the tendons.

Sometimes the rheumatiſm will continue for ſeveral weeks; however, it ſeldom proves fatal, and it is rare that the pyrexia continues to be conſiderable for more than two or three weeks. While the pyrexia abates in its violence, if the pains of the joints continue, they are leſs violent; more limited in their place, being confined commonly to one or a few joints only; and are leſs ready to change their place.

Cauſes, &c. This diſeaſe is frequent in cold, and more uncommon in warm climates. It appears moſt frequently in autumn and ſpring; leſs frequently in winter, while the froſt is conſtant; and very ſeldom during the heat of ſummer. It may, however, occur at any ſeaſon, if viciſſitudes of heat and cold be for the time frequent. For the moſt part, the acute rheumatiſm ariſes from the application of cold to the body when unuſually warm; or when the cold is applied to one part of the body, whilſt the other parts are kept warm; or laſtly, when the application of the cold is long continued, as when moiſt or whet clothes are applied to any part of the body. Theſe cauſes may affect perſons of all ages; but the rheumatiſm ſeldom appears either in very young or in elderly perſons, and moſt commonly occurs from the age of puberty to that of 35. Theſe cauſes may alſo affect perſons of any conſtitution, but they moſt commonly affect thoſe of a ſanguine temperament.

The proximate cauſe of rheumatiſm hath by many been ſuppoſed to be a lentor in the fluids obſtructing the veſſels of the part. While we cannot find either evidence or reaſon for ſuppoſing that the rheumatiſm depends on any change in the ſtate of the fluids, we muſt conclude that the proximate cauſe of it is the ſame with that of other inflammations not depending upon a direct ſtimulus.

In the caſe of rheumatiſm, it is ſuppoſed that the moſt common remote cauſe of it, that is, cold applied, operates eſpecially on the veſſels of the joints, theſe being leſs covered by a cellular texture than thoſe of the intermediate parts of the limbs. It is farther ſuppoſed, that the application of cold produces a conſtriction of the extreme veſſels, and at the ſame time an increaſe of tone or phlogiſtic diatheſis in the courſe of them, from which ariſes an increaſed impetus of the blood, and at the ſame time a reſiſtance to the free paſſage of it, and conſequently inflammation and pain. It is alſo ſuppoſed, that the reſiſtance formed excites the *vis medicatrix*, to a further increaſe of the impetus of the blood; and to ſupport this, a cold ſtage ariſes, a ſpaſm is formed, and a pyrexia and phlogiſtic diatheſis are produced in the whole ſyſtem.

Hence the cauſe of rheumatiſm appears to be exactly analogous to that of inflammations depending on an increaſed afflux of blood to a part while it is expoſed to the action of cold. But there ſeems to be further in this diſeaſe ſome peculiar affection of the muſcular fibres. Theſe ſeem to be under ſome degree of rigidity; and therefore leſs eaſily admit of motion, and are pained upon the exertions of it. This alſo ſeems to be the affection which gives opportunity to the propagation of pains from one joint to another, and which are moſt ſeverely felt in the extremities terminating in the joints, becauſe beyond theſe the oſcillations are not propagated. This affection of the muſcular fibres explains the manner in which ſtrains and ſpaſms produce rheumatic affections; and, on the whole, ſhews, that with an inflammatory affection of the ſanguiferous ſyſtem, there is alſo in rheumatiſm a peculiar affection of the muſcular fibres, which has a conſiderable ſhare in producing the phænomena of the diſeaſe.

Cure. Here we muſt remember, that in the acute rheumatiſm there is an inflammatory affection of the parts, and a phlogiſtic diatheſis of the whole ſyſtem. The cure therefore requires, in the firſt place, an antiphlogiſtic regimen, and particularly a total abſtinence from animal-food, and from all fermented or ſpirituous liquors; ſubſtituting a mild vegetable or milk diet, and the plentiful uſe of ſoft diluting liquors. On this principle, blood-letting is the chief remedy of acute rheumatiſm. The blood is to be drawn in large quantity; and the bleeding is to be repeated in proportion to the frequency, fulneſs, and hardneſs of the pulſe, and the violence of the pain. For the moſt part, large and repeated bleedings during the firſt days of the diſeaſe ſeem to be neceſſary, and accordingly have been very much employed: but to this ſome bounds are to be ſet; for very profuſe bleedings occaſion a ſlow recovery, and, if not abſolutely effectual, are ready to produce a chronic rheumatiſm.

To avoid that debility of the ſyſtem which general bleedings are apt to occaſion, the urgent ſymptom of pain may be often relieved by topical bleedings; and when any ſwelling or redneſs have come upon a joint, the pain may very certainly be relieved by topical bleedings; but as the pain and continuance of the diſeaſe ſeem to depend more upon the phlogiſtic diatheſis of the whole ſyſtem than upon the affection of particular parts, ſo topical bleedings will not ſupply the place of the general bleedings propoſed above.

To take off the phlogiſtic diatheſis prevailing in this diſeaſe, purging may be uſeful, if procured by medicines which do not ſtimulate the whole ſyſtem, as neutral ſalts, and other medicines which have a refrigerant power. Purging, however, is not ſo uſeful as bleeding in removing phlogiſtic diatheſis; and when the diſeaſe has become general and violent, frequent ſtools are inconvenient, and even hurtful, by the motion and pain which they occaſion.

In this diſeaſe, external applications are of little ſervice. Fomentations in the beginning of the diſeaſe rather aggravate than relieve the pains. The rubefacients and camphire are more effectual, but they generally only ſhift them from one part to another, and do not prove any cure of the general affection. Bliſtering may alſo be very effectual in removing the pain from a particular part; but will be of little uſe, except where the pains are much confined to a particular place.

The ſeveral remedies above-mentioned moderate the violence of the diſeaſe, and ſometimes remove it entirely; but they ſometimes fail, and leave the cure imperfect. The attempting a cure by large and repeated bleedings is attended with many conveniencies; and the moſt effectual and ſafe method of cure is, after ſome general bleedings for taking off, or at leaſt diminiſhing, the phlogiſtic diatheſis, to employ ſweating conducted by the rules laid down when ſpeaking of the cure of ſynocha. Opiates, except where they are directed to procure ſweat, always prove hurtful in every ſtage of this diſeaſe. The Peruvian bark has been ſuppoſed a remedy in ſome caſes; but it is ſeldem found uſeful, and is frequently hurtful. It ſeems only fit for thoſe caſes in which the phlogiſtic diatheſis is much abated, and at the ſame time the exacerbations of the diſeaſe are manifeſtly periodical, with conſiderable remiſſions interpoſed. Calomel, and other preparations of mercury, have been recommended in ſome caſes of the acute rheumatiſm; they are only uſeful in caſes approaching to the nature of the chronic kind.

GENUS XXII. CHRONIC RHEUMATISM.

Deſcription. When the pyrexia attending the acute rheumatiſm hath ceaſed; when the ſwelling and redneſs of the joints are entirely gone, but pains ſtill continue to affect certain joints, which remain ſtiff, feel uneaſy upon motion, changes of weather, or in the night-time only; the diſeaſe is then called the *chronic rheumatiſm*, as it often continues for a very long time.

The limits betwen the acute and chronic rheumatiſms are not always exactly marked. When the pains are ſtill ready to ſhift their place; when they are eſpecially ſevere in the night-time; when, at the ſame time, they are attended with ſome degree of pyrexia, and with ſome ſwelling, and eſpecially ſome redneſs, of the joints; the diſeaſe is to be conſidered as partaking of the nature of the acute rheumatiſm. But when there is no longer any degree of pyrexia remaining; when the pained joints are without redneſs; when they are cold and ſtiff; when they cannot eaſily be made to ſweat; or when, while a free and warm ſweat is brought out on the reſt of the body, it is only clammy and cold on the pained joints; and when further, the pains of theſe are increaſed by cold, and relieved by heat, applied to them; the caſe is to be conſidered as that of a purely chronic rheumatiſm.

The chronic rheumatiſm may affect different joints; but is eſpecially apt to affect thoſe which are ſurrounded with many muſcles, and thoſe of which the muſcles are employed in the moſt conſtant and vigorous exertions. Such is the caſe of the vertebræ of the loins, the affection of which is named *lumbago*; or of the hip-joint, when the diſeaſe is named *iſchias*, or *ſciatica*.

The diſtinction of the rheumatic pains from thoſe reſembling them which occur in the ſiphylis and ſcurvy muſt be obvious, either from the ſeat of the pains, or from the concomitant ſymptoms peculiar to thoſe diſeaſes. The diſtinction of the rheumatiſm from the gout will be more fully underſtood from what is laid down in the following genus.

Cauſes, &c. The phenomena of the purely chronic rheumatiſm lead us to conclude, that its proximate cauſe is an atony both of the blood-veſſels and of the muſcular fibres of the part affected, together with ſuch a degree of rigidity and contraction in the latter as frequently attend them in a ſtate of atony.

Cure. From the view juſt now given of the proximate cauſe of chronic rheumatiſm, the indication of cure muſt be, to reſtore the activity and vigour of the vital principal in the part. The remedies are either external or internal.

The external are, the ſupporting the heat of the part, by keeping it conſtantly covered with flannel; the increaſing the heat of the part by external heat, applied either in a dry or humid form; the diligent uſe of the fleſh bruſh, or other means of friction; the application of electricity in ſparks or ſhocks; the application of cold water by affuſion or immerſion; the application of eſſential oils of the moſt warm and penetrating kind; the application of ſalt brine; and laſtly, the employment either of exercife, of the part itſelf as far as it can eaſily bear, or by riding or other mode of geſtation.

The internal remedies are, 1. Large doſes of eſſential oils drawn from reſinous ſubſtances, ſuch as turpentine. 2. Subſtances containing ſuch oils, as guaiac. 3. Volatile alkaline ſalts. 4. Theſe or other medicines directed to procure ſweat; and, 5. Calomel, or ſome other preparation of mercury, in ſmall doſes, continued for ſome time. Beſides theſe, there are ſeveral others recommended; as bleeding, general and topical; burning, bliſtering, and iſſues: but theſe are only uſeful when the diſeaſe ſtill partakes of the nature of the acute rheumatiſm.

Genus XXIII. ODONTALGIA, *the* Tooth-ach.

Deſcription. This well-known diſeaſe makes its attack by a moſt violent pain in the teeth, moſt frequently in the *molares*, but more rarely in the *inciſorii*, reaching ſometimes up to the eyes, and ſometimes backward into the cavity of the ear. At the ſame time there is a manifeſt determination to the head, and a remarkable tenſion and inflation of the veſſels takes place, not only in the parts next to that where the pain is ſeated, but over the whole head.

Cauſes, &c. The tooth-ach is ſometimes merely a rheumatic affection ariſing from cold, but more frequently from a carious tooth. It is alſo a ſymptom of pregnancy, and takes place in ſome nervous diſorders; it may attack perſons at any time of life, though it is moſt frequent in the young and plethoric.

Cure. Many empirical remedies have been propoſed for the cure of the tooth-ach, but none have in any degree anſwered the purpoſe. When the affection is purely rheumatic, bliſtering behind the ear will almoſt always remove it; but when it proceeds from a carious tooth, the pain is much more obſtinate. In this caſe it hath been recommended to touch the pained part with a hot iron, or with oil of vitriol, in order to deſtroy the aching nerve; to hold ſtrong ſpirits in the mouth; to put a drop of oil of cloves into the hollow of the tooth, or a pill of equal parts of opium and camphire. The Peruvian bark hath alſo been recommended, and perhaps with more juſtice, on account of its tonic and antiſeptic powers; but very often all theſe remedies will fail, and the only infallible cure is to draw the tooth. See Surgery.

Genus XXIV. PODAGRA, *the* Gout.

The Regular Gout.

Deſcription. What we call a *paroxyſm of the gout* is principally conſtituted by an inflammatory affection of ſome of the joints. This ſometimes comes on ſuddenly, without any warning, but is generally preceded by ſeveral ſymptoms; ſuch as the ceaſing of a ſweating which the feet had been commonly affected with before; an unuſual coldneſs of the feet and legs; a frequent numbneſs, alternating with a ſenſe of prickling along the whole of the lower extremities; frequent cramps of the muſcles of the legs; and an unuſual turgeſcence of the veins. Theſe ſymptoms take place for ſeveral days, ſometimes for a week or two, before a paroxyſm comes on; but commonly, upon the day immediately preceding it, the appetite becomes greater than uſual.

The circumſtances of paroxyſms are the following. They come on moſt commonly in the ſpring; and ſooner or later, according as the vernal heat ſucceeds ſooner or later to the winter's cold; and, perhaps, ſooner or later alſo, according as the body may happen to be more or leſs expoſed to viciſſitudes of heat and cold. The attacks are ſometimes felt firſt in the evening, but more commonly about two or three o'clock of the morning. The paroxyſm begins with a pain affecting one foot, moſt commonly in the ball or firſt joint of the great toe, but ſometimes in other parts of the foot. With the coming on of this pain, there is commonly more or leſs of a cold ſhivering; which, as the pain increaſes, gradually ceaſes; and is ſucceeded by a hot ſtage of pyrexia, which continues for the ſame time with the pain itſelf. From the firſt attack, the pain becomes, by degrees, more violent, and continues in this ſtate with great reſtleſſneſs of the whole body till next midnight, after which it gradually remits; and, after it has continued for 24 hours from the commencement of the firſt attack, it commonly ceaſes entirely; and, with the coming on of a gentle ſweat, allows the patient to fall aſleep. The patient, upon coming out of this ſleep in the morning, finds the pained part affected with ſome redneſs and ſwelling, which, after having continued for ſome days, gradually abate.

When the diſeaſe, after having thus remained for ſome time in a joint, ceaſes entirely, it generally leaves the perſon in very perfect health, enjoying greater eaſe and alacrity in the functions of both body and mind than he had for a long time before experienced. At the beginning of the diſeaſe, the returns of it are ſometimes only once in three or four years: but as it advances, the intervals become ſhorter, and at length the attacks are annual; afterwards they come twice each year; and at length recur ſeveral times during the whole courſe of autumn, winter, and ſpring; and as, when the fits are frequent, the paroxyſms become alſo longer, ſo, in the advanced ſtate of the diſeaſe, the patient is hardly ever tolerably free from it, except perhaps for two or three months in ſummer.

The progreſs of the diſeaſe is alſo marked by the parts which it affects. At firſt, it commonly affects one foot only; afterwards every paroxyſm affects both feet, the one after the other; and as the diſeaſe proceeds, it not only affects both feet at once, but, after having ceaſed in the foot which was ſecondly attacked, returns again into the firſt, and perhaps a ſecond time alſo into the other. Its changes of place are not only from one foot to another, but from the feet into other joints, eſpecially thoſe of the upper and lower extremities; ſo that there is hardly a joint of the body that, on one occaſion or other, is not affected. It ſometimes affects two different joints at the ſame time; but more commonly is at any one time ſevere in a ſingle joint only, and paſſes ſucceſſively from one joint to another; ſo that the patient's affliction is often protracted for a long time.

When the diſeaſe has often returned, and the paroxyſms have become very frequent, the pains are commonly leſs violent than they were at firſt; but the patient is more affected with ſickneſs, and the other ſymptoms of the atonic gout, which ſhall be hereafter mentioned.

After the firſt paroxyſm of the diſeaſe, the joints which have been affected are entirely reſtored to their former ſuppleneſs and ſtrength: but, after the diſeaſe has recurred very often, the joints affected do neither ſo ſuddenly nor entirely recover their former ſtate, but continue weak and ſtiff; and theſe effects at length proceed to ſuch a degree, that the joints loſe their motion entirely.

In many perſons, but not in all, after the diſeaſe has frequently recurred, concretions of a chalky nature are formed upon the outſide of the joints, and for the moſt part immediately under the ſkin. The matter ſeems to be depoſited at firſt in a fluid form, afterwards becoming dry and firm. In their firm ſtate, theſe concretions are a friable earthy ſubſtance, entirely ſoluble in acids. After they have been formed, they contribute, with other circumſtances, to deſtroy the motion of the joint. In moſt perſons who have laboured under the gout for many years, a nephritic affection comes on, and diſcovers itſelf by all the ſymptoms which uſually attend calculous concretions in the kidneys, and which we ſhall have occaſion to deſcribe in another place. All that is neceſſary to be obſerved here is, that the nephritic affection alternates with paroxyſms of the gout; and that the two affections, the nephritic and the gouty, are hardly ever preſent at the ſame time. This alſo may be obſerved, that children of gouty or nephritic parents commonly inherit one or other of theſe diſeaſes; but whichever may have been the principal diſeaſe of the parent, ſome of the children have the one, and ſome the other. In ſome of them, the nephritic affection occurs alone, without any gout ſupervening; and this happens to be frequently the caſe of the female children of gouty parents. In the whole of the hiſtory already given, we have deſcribed the moſt common form of the diſeaſe.

The principal circumſtance, in what we term the *regular gout*, is the inflammatory affection of the joints; and whatever ſymptoms we can perceive to be connected with, or to depend upon, the diſpoſition which produces that inflammatory affection, but without its taking place or being preſent at the ſame time, we name the *irregular gout*. Of ſuch irregular gout there are three different ſtates, which we name the Atonic, the Retrocedent, and the Misplaced *Gout*.

The *firſt* is, when the gouty diatheſis prevails in the ſyſtem; but, from certain cauſes, does not produce the inflammatory affection of the joints. In this caſe, the morbid ſymptoms which appear, are chiefly affections of the ſtomach, ſuch as loſs of appetite, indigeſtion, and its various circumſtances of ſickneſs, nauſea, vomiting, flatulency, acid eructations, and pains in the region of the ſtomach. Theſe ſymptoms are frequently accompanied with pains and cramps in ſeveral parts of the trunk, and the upper extremities of the body, which are relieved by the diſcharge of wind from the ſtomach. Together with theſe affections of the ſtomach, there commonly occurs a coſtiveneſs; but ſometimes a looſeneſs, with cholic pains. Theſe affections of the alimentary canal are often attended with all the ſymptoms of hypochondriaſis, as dejection of mind, a conſtant and anxious attention to the ſlighteſt feelings, an imaginary aggravation of theſe, and an apprehenſion of danger from them. In the ſame atonic gout, the viſcera of the thorax alſo are ſometimes affected; and palpitations, faintings, and aſthma, occur. In the head alſo, occur head-achs, giddineſs, apoplectic and paralytic affections. When the ſeveral ſymptoms now mentioned occur in habits having the marks of a gouty diſpoſition, this may be ſuſpected to have laid the foundation of them; and eſpecially when either, in ſuch habits, a manifeſt tendency to the inflammatory affection has formerly appeared, or when the ſymptoms mentioned are intermixed with and are relieved by ſome degree of the inflammatory gout. In ſuch caſes there can be no doubt of conſidering the whole as a ſtate of the gout.

Another ſtate of the diſeaſe we name the *retrocedent* gout. This occurs when an inflammatory ſtate of the joints has, in the uſual manner, come on, but without ariſing to the ordinary degree of pain and inflammation; or at leaſt without theſe continuing for the uſual time, or without their receding gradually in the uſual manner; theſe affections of the joints ſuddenly and entirely ceaſe, while ſome internal part becomes affected. The internal part moſt commonly affected is the ſtomach; which then is affected with anxiety, ſickneſs, vomiting, or violent pain: but ſometimes the internal part is the heart, which gives occaſion to a ſyncope; ſometimes it is the lungs, which are affected with aſthma; and ſometimes it is the head, giving occaſion to apoplexy or palſy. In all theſe caſes there can be no doubt of the ſymptoms being all a part of the ſame diſeaſe, however different the affection may ſeem to be in the parts which it attacks.

The third ſtate of irregular gout, which we name the *miſplaced*, is when the gouty diatheſis, inſtead of producing the inflammatory affection of the joints, produces an inflammatory affection of ſome internal part, and which appears from the ſame ſymptoms that attend the inflammations of thoſe parts ariſing from other cauſes. Whether the gouty diatheſis does ever produce ſuch inflammation of the internal parts without having firſt produced it in the joints, or if the inflammation of the internal part be always a tranſlation from the joints previouſly affected, we dare not determine; but, even ſuppoſing the latter to be always the caſe, we think the difference of the affection of the internal part muſt ſtill diſtinguiſh the *miſplaced* from what we have named the *retrocedent gout*.

With regard to the miſplaced gout, Dr. Cullen, whom we here follow, tells us, that he never met with any caſes of it in his practice, nor does he find any diſtinctly marked by practical writers, except that of a pneumonic inflammation.

It is commonly ſuppoſed, that there are ſome caſes of rheumatiſm which are ſcarcely to be diſtinguiſhed from the gout; but theſe, our author thinks, are but few; and that the two diſeaſes may be for the moſt part diſtinguiſhed with great certainty, by obſerving the prediſpoſition, the antecedents, the parts affected, the recurrences of the diſeaſe, and its connection with the ſyſtem; which circumſtances, for the moſt part, appear very differently in the two diſeaſes.

Cauſes, &c. The gout is generally an hereditary diſeaſe: but ſome perſons, without any hereditary diſpoſition, ſeem to acquire it: and in ſome an hereditary diſpoſition may be counteracted from various cauſes. It attacks the male ſex eſpecially; but it ſometimes, though more rarely, attacks alſo the female. The females liable to it are thoſe of the more robuſt and full habits; and it very often happens to thoſe before the menſtrual evacuation hath ceaſed. Dr. Cullen hath alſo found it occurring in ſeveral females whoſe menſtrual evacuations were more abundant than uſual.

The gout ſeldom attacks eunuchs; and when it does, ſeems to fall upon thoſe who happen to be of a robuſt habit, to lead an indolent life, and to live very full. It attacks eſpecially men of robuſt and large bodies, who have large heads, are of full and corpulent habits, and whoſe ſkins are covered with a thicker *rete mucoſum*, which gives a coarſer ſurface. To ſpeak in the ſtyle of the ancient phyſicians, the gout will ſeldom be found to attack theſe of a ſanguine, or ſuch as are of a purely melancholic temperament: but very readily thoſe of a *cholerico-ſanguine* temperament. It is, however, very difficult to treat this matter with preciſion. The gout ſeldom attacks perſons employed in conſtant bodily labour, or thoſe who live much upon vegetable aliment. It does not commonly attack men till after the age of 35; and generally not till a ſtill later period. There are indeed inſtances of the gout appearing more early; but theſe are few in compariſon of the others. When the diſeaſe does appear early in life, it ſeems to be in thoſe who have the hereditary diſpoſition very ſtrong, and to whom the remote cauſes hereafter mentioned have been applied in a very conſiderable degree.

The occaſional cauſes of the diſeaſe ſeem to be of two kinds. Firſt, thoſe which induce a plethoric ſtate of the body. Secondly, thoſe which, in plethoric habits, induce a ſtate of debility. Of the firſt kind are a ſedentary, indolent manner of life, and a full diet of animal food. Of the ſecond kind of occaſional cauſes which induce debility are exceſs in venery; intemperance in the uſe of intoxicating liquors; indigeſtion, produced either by the quantity or quality of the aliments; exceſſive evacuations; the ceaſing of uſual labour; a ſudden change from a very full to a very ſpare diet; the large uſe of acids and aceſcents; and laſtly, cold applied to the lower extremities. The former ſeem to act by increaſing the prediſpoſition; the latter are commonly the exciting cauſes, both of the firſt attacks, and of the repetitions of the diſeaſe.

With reſpect to the *proximate* cauſe of the gout, it hath generally been thought that it depends on a certain morbific matter always preſent in the body; and that this matter, by certain cauſes, thrown upon the joints or other parts, produces the ſeveral phenomena of the diſeaſe.

Cure. In entering upon this, we muſt obſerve, in the firſt place, that a cure has been commonly thought impoſſible; and we acknowledge it to be very probable, that the gout, as a diſeaſe of the whole habit, and very often depending upon original confirmation, cannot be cured by medicines, the effects of which are always very tranſitory, and ſeldom extend to the producing any conſiderable change of the whole habit. It would perhaps have been happy for gouty perſons if this opinion had been implicitly received by them; as it would have prevented their having been ſo often the dupes of ſelf-intereſted pretenders, who have either amuſed them with inert medicines, or have raſhly employed thoſe of the moſt pernicious tendency. We are much diſpoſed to believe the impoſſibility of a cure of the gout by medicines; and more certainly ſtill inclined to think, that, whatever may be the poſſible power of medicines, yet no medicine for curing the gout has hitherto been found. Athough almoſt every age has preſented a new remedy, all hitherto offered have, very ſoon after, been either neglected as uſeleſs, or condemned as pernicious.

Dr. Cullen contends, that a great deal can be done towards the cure of the gout by a regimen: and is firmly perſuaded, that any man who, early in life, will enter upon the conſtant practice of bodily labour, and of abſtinence from animal-food, will be preſerved entirely from the diſeaſe.

Whether there be any other means of radically curing the gout, the Doctor is not ready to determine. There are hiſtories of caſes of the gout, in which it is ſaid, that by great emotions of mind, by wounds, and by other accidents, the ſymptoms have been ſuddenly relieved, and never again returned; but how far theſe accidental cures might be imitated by art, or would ſucceed in other caſes, is at leaſt extremely uncertain.

The practices proper and neceſſary in the treatment of the gout, are to be conſidered under two heads: *Firſt*, As they are to be employed in the intervals of paroxyſms; or, *ſecondly*, As during the time of theſe. In the intervals of paroxyſms, the indications are, to prevent altogether the return of paroxyſms; or at leaſt to render them leſs frequent, and more moderate. During the time of paroxyſms, the indications are, to moderate the violence and ſhorten the duration of them as much as can be done with ſafety.

1. It has been already obſerved, that the gout may be entirely prevented by conſtant bodily exerciſe, and by a low diet; and Dr. Cullen is of opinion, that this prevention may take place even in perſons who have hereditary diſpoſition to the diſeaſe. Even when the diſpoſition has diſcovered itſelf by ſeveral paroxyſms of inflammatory gout, he is perſuaded that labour and abſtinence will abſolutely prevent any returns of it for the reſt of life. Theſe, therefore, are the means of anſwering the firſt indication to be purſued in the intervals of paroxyſms.

Exerciſe in perſons diſpoſed to the gout, is directed to two purpoſes. One of theſe is the ſtrengthening of the tone of the extreme veſſels; and the other, the guarding againſt a plethoric ſtate. For the former, if exerciſe be employed early in life, and before intemperance has weakened the body, a very moderate degree of it will anſwer the purpoſe; and, for the latter, if abſtinence be at the ſame time obſerved, little exerciſe will be neceſſary. With reſpect to exerciſe, this in general is to be obſerved, that it ſhould never be violent; for, if violent, it cannot be long continued, and muſt always endanger the bringing on an atony in proportion to the violence of the preceding exerciſe. In more advanced ſtates of the diſeaſe, however, when there is ſome diſpoſition to a paroxyſm, much walking will bring it on; either as it weakens the tone of the lower extremities, or as it excites an inflammatory diſpoſition in them; and thus it ſeems to be, that ſtrains or contuſions often bring on a paroxyſm of the gout.

Abſtinence, the other part of our regimen for preventing the gout, is of more difficult application. If an abſtinence from animal food be entered upon early in life, while the vigour of the ſyſtem is yet entire, there is no doubt of its being both ſafe and effectual; but, if the motive of this diet ſhall not have occurred till the conſtitution hath been broken by intemperance, or by the decline of life, a low diet may then endanger the bringing on an atonic ſtate. The ſafety of an abſtemious courſe may be greater or leſs according to the management of it. It is animal food which eſpecially diſpoſes to the plethoric and inflammatory ſtate, and that food is to be therefore eſpecially avoided; but, on the other hand, it is vegetable aliment of the loweſt quality that is in danger of weakening the ſyſtem too much by not affording ſufficient nouriſhment, and more particularly of weakening the tone of the ſtomach by its aceſcency. It is therefore a diet of a middle nature that is to be choſen; and milk is preciſely of this kind, as containing both animal and vegetable matter. The farinaceous ſeeds are next to be choſen; and are the food moſt proper to be joined with milk.

With reſpect to drink, fermented liquors are uſeful only when they are joined with animal food, and that by their aceſcency; and their ſtimulus is only neceſſary from cuſtom. When, therefore, animal food is to be avoided, fermented liquors are unneceſſary; and by increaſing the aceſcency of vegetables, the liquors may be hurtful. The ſtimulus of fermented, or ſpirituous liquors, is not neceſſary to the young and vigorous, and, when much employed, impairs the tone of the ſyſtem. Theſe liquors, therefore, are to be avoided, except ſo far as cuſtom and the declining ſtate of the ſyſtem may have rendered them neceſſary. For preventing or moderating the regular gout, water is the only proper drink.

By obviating the prediſpoſition, and by avoiding the exciting cauſes, the gout may be entirely prevented; but, as the meaſures neceſſary for this purpoſe will, in moſt caſes, be purſued with difficulty, and even with reluctance; men have been very deſirous to find a medicine which might anſwer the purpoſe, without any reſtraint on their manner of living. To gratify this deſire, phyſicians have propoſed, and, to take advantage of it, empirics have feigned, many remedies, as we have already obſerved. Of what nature ſeveral of theſe remedies have been, it is difficult to ſay: but of thoſe which are unknown, we conclude, from their having been only of temporary fame, and from their having ſoon fallen into neglect, that they have been either inert or pernicious, and therefore ſhall make no enquiry after them; and ſhall now remark only upon one or two known remedies for the gout which have been lately in vogue.

One of theſe is what has been named in England the *Portland powder*. This is not a new medicine, but is mentioned by Galen, and with ſome little variation in its compoſition, has been mentioned by the writers of almoſt every age ſince that time. It appears to have been at times in faſhion, and to have again fallen into neglect; and our author thinks that this laſt has been owing to its having been found to be, in many inſtances, pernicious. In every inſtance we have known of its exhibition for the length of time preſcribed, the perſons who had taken it were indeed afterwards free from any inflammatory affection of the points; but they were affected with many ſymptoms of the atonic gout; and all, ſoon after finiſhing their courſe of the medicine, have been attacked with apoplexy, aſthma, or dropſy, which proved fatal.

Another remedy which has had the appearance of preventing the gout, is an alkeli in various forms; ſuch as the fixed alkali, both mild and cauſtic, lime-water, ſoap, and abſorbent earths. Since it became common to exhibit theſe medicines in nephritic and calculous caſes, it has often happened that they were given to thoſe who where at the ſame time ſubject to the gout; and it has been obſerved, that under the uſe of theſe medicines, gouty perſons have been longer free from the fits of their diſeaſe. That, however, the uſe of theſe medicines has entirely prevented the returns of gout, Dr. Cullen obſerves, that he never puſhed the uſe of thoſe medicines for a long time, being apprehenſive that the long-continued uſe of them might produce a hurtful change in the ſtate of the fluids.

As the preventing the gout depends very much on ſupporting the tone of the ſtomach, and avoiding indigeſtion; ſo coſtiveneſs, by occaſioning this, is very hurtful to gouty perſons. It is therefore neceſſary for ſuch perſons to prevent or remove coſtiveneſs, and by a laxative medicine, when needful; but it is at the ſame time proper, that the medicine employed ſhould be ſuch as may keep the belly regular, without much purging. Aloetics, rhubarb, magneſia alba, or flowers of ſulphur, may be employed, as the one or the other may happen to be beſt ſuited to particular perſons.

2. Theſe are the ſeveral meaſures to be purſued in the intervals of the paroxyſms; and we are next to mention the meaſures proper during the time of them.

As during the time of paroxyſms the body is in a feveriſh ſtate, no irritation ſhould then be added to it; and every part, therefore, of the antiphlogiſtic regimen, except the application of cold, ought to be ſtrictly obſerved. Another exception to the general rule may occur when the tone of the ſtomach is weak, and when the patient has been before much accuſtomed to the uſe of ſtrong drink; for then it may be allowable, and even neceſſary, to give ſome animal-food, and a little wine.

That no irritation is to be added to the ſyſtem during the paroxyſms of gout, except in the caſes mentioned, is entirely agreed upon among phyſicians: but it is a more difficult matter to determine whether, during the time of paroxyſms, any meaſures may be purſued to moderate the violence of reaction, and of inflammation. Dr. Sydenham has given it as his opinion, that the more violent the inflammation and pain, the paroxyſms will be the ſhorter, as well as the interval between the preſent and the next paroxyſm longer: and, if this opinion be admitted as juſt, it will forbid the uſe of any remedies which might moderate the inflammation; which is, to a certain degree, undoubtedly neceſſary for the health of the body. On the other hand, acute pain preſſes for relief; and, although a certain degree of inflammation may ſeem abſolutely neceſſary, it is not certain but that a moderate degree of it may anſwer the purpoſe: and it is even probable, that, in many caſes, the violence of inflammation may weaken the tone of the parts, and thereby invite a return of paroxyſms. It ſeems to be in this way, that, as the diſeaſe advances, the paroxyſms become more frequent.

From theſe laſt conſiderations, it ſeems probable, that, during the time of paroxyſms, ſome meaſures may be taken to moderate the violence of the inflammation and pain, and particularly, that in firſt paroxyſms, and in the young and vigorous, blood-letting at the arm may be practiſed with advantage: but this practice cannot be repeated often with ſafety; becauſe blood-letting not only weakens the tone of the ſyſtem, but may alſo contribute to produce plethora. However, bleeding by leeches on the foot, and upon the inflamed part, may be practiſed and repeated with greater ſafety; and inſtances have been known of its having been practiſed with ſafety to moderate and ſhorten paroxyſms; but how far it may be carried we have not had experience enough to determine.

Camphire, and ſome aromatic oils, have the power of allaying the pain, and of removing the inflammation from the part affected: but theſe remedies commonly make the inflammation only ſhift from one part to another, and therefore with the hazard of its falling upon a part where it may be more dangerous; and they have ſometimes rendered the gout retrocedent.

From theſe reflections it will appear, that ſome danger muſt attend every external application to the parts affected during a paroxyſm; and that therefore the common practice of commiting the perſon to patience and flannel alone, is eſtabliſhed upon the beſt foundation. Opiates give the moſt certain relief from pain; but, when given in the beginning of gouty paroxyſms, occaſion theſe to return with greater violence. When, however, the paroxyſms ſhall have abated in their violence, but ſtill continue to return, ſo as to occaſion painful and reſtleſs nights; opiates may then be given with ſafety and advantage; eſpecially in the caſe of perſons advanced in life, and who have been often affected with the diſeaſe. When, after paroxyſms have ceaſed, ſome ſwelling and ſtiffneſs ſhall remain in the joints, theſe ſymptoms are to be diſcuſſed by the diligent uſe of the fleſh-bruſh. Purging immediately after a paroxyſm, will be always employed with the hazard of bringing it on again.

Thus far of the REGULAR gout. We now proceed to conſider the management of the diſeaſe when it has become IRREGULAR.

1. In the *atonic* gout, the cure is to be accompliſhed by carefully avoiding all debilitating cauſes; and by employing, at the ſame time, the means of ſtrengthening the ſyſtem in general, and the ſtomach in particular.

For ſtrengthening the ſyſtem in general, we recommend frequent exerciſe on horſeback, and moderate walking. Cold bathing alſo may anſwer the purpoſe; and may be ſafely employed, if it appear to be powerful in ſtimulating the ſyſtem, and be not applied when the extremities are threatened with any pain. For ſupporting the tone of the ſyſtem in general, when threatened with atonic gout, ſome animal food ought to be employed, and the more aceſcent vegetables ought to be avoided. In the ſame caſe, ſome wine alſo may be neceſſary: but it ſhould be in moderate quantity, and of the leaſt aceſcent kinds; and if every kind of wine ſhall be found to increaſe the acidity of the ſtomach, ardent ſpirits and water muſt be employed.

For ſtrengthening the ſtomach, bitters and the Peruvian bark may be employed; but care muſt be taken that they be not conſtantly employed for any great length of time. The moſt effectual medicine for ſtrengthening the ſtomach is iron, which may be employed under various preparations; but the beſt appears to be the ruſt in fine powder, which may be given in very large doſes. For ſupporting the tone of the ſtomach, aromatics may be employed; but ſhould be uſed with caution, as the frequent and large uſe of them have an oppoſite effect; and they ſhould therefore be given only in compliance with former habits, or for palliating preſent ſymptoms. When the ſtomach happens to be liable to indigeſtion, gentle vomits may be frequently given, and proper laxatives ſhould be always employed to obviate or to remove coſtiveneſs.

In the atonic gout, or in perſons liable to it, to guard againſt cold is eſpecially neceſſary; and the moſt certain means of doing this, is by repairing to a warm climate during the winter-ſeaſon. In the more violent caſes, bliſtering the lower extremities may be uſeful; but that remedy ſhould be avoided when any pain threatens the extremities. In perſons liable to the atonic gout, iſſues may be eſtabliſhed in the extremities, as in ſome meaſure a ſupplement to the diſeaſe.

2. A ſecond caſe of the irregular gout, is the *retrocedent*. When this affects the ſtomach and inteſtines, relief is to be inſtantly attempted by the free uſe of ſtrong wines, joined with aromatics, and given warm; or, if theſe ſhall not prove powerful enough, ardent ſpirits muſt be employed, and are to be given in a large doſe. In moderate attacks, ardent ſpirits, impregnated with garlic or with aſa fœtida, may be employed; or, even without the ardent ſpirits, a ſolution of aſa fœtida, with the volatile alkali, may anſwer the purpoſe. Opiates are often an effectual remedy; and may be joined with aromatics, as in the electuarium thebaicum; or they may be uſefully joined with volatile alkali and camphire. Muſk has likewiſe proved uſeful in this diſeaſe. When the affection of the ſtomach is accompained with vomiting, this may be encouraged, by taking draughts of warm wine, at firſt with water, and afterwards without it; having at length recourſe, if neceſſary, to ſome of the remedies abovementioned, and particularly the opiates. In like manner, if the inteſtines be affected with diarrhœa, this is to be at firſt encouraged by taking plentifully of weak broth; and when this ſhall have been done ſufficiently, the tumult is to be quieted by opiates.

When the retrocedent gout ſhall affect the lungs, and produce aſthma, this is to be cured by opiates, by antiſpaſmodics, and perhaps by bliſtering on the back or breaſt. When the gout, leaving the extremities, ſhall affect the head, and produce pain, vertigo, apoplexy, or palſy, our reſources are very precarious. The moſt probable means of relief is, bliſtering the head; and, if the gout ſhall have receded very entirely from the extremities, bliſters may be applied to theſe alſo. Together with theſe bliſterings, aromatics, and the volatile alkali, may be thrown into the ſtomach.

3. The third caſe of the irregular gout is the *miſplaced*; that is, when the inflammatory affection of the gout, inſtead of falling upon the extremities, falls upon ſome internal part. In this caſe, the diſeaſe is to be treated by blood-letting, and by ſuch other remedies as would be proper in an idiopathic inflammation of the ſame parts.

Order III. EXANTHEMATA.

contagious diseases.

Genus XXV. PESTIS, *the* Plague.

Deſcription. The circumſtances peculiarly characteriſtic of this diſeaſe, eſpecially of its more violent and dangerous ſtates, are, 1. The great loſs of ſtrength in the animal functions, which often appears early in the diſeaſe. 2. The ſtupor, giddineſs, and conſequent ſtaggering, which reſembles drunkenneſs, or the head-ach and various delirium, all of them denote a great diſorder in the functions of the brain. 3. Anxiety, palpitation, ſyncope, and eſpecially the weakneſs and irregularity of the pulſe, denote a conſiderable diſturbance in the action of the heart. 4. Nauſea and vomiting, particularly the vomiting of bile, which ſhews an accumulation of vitiated bile in the gall-bladder and biliary ducts, and from thence derived into the inteſtines and ſtomach; which denote a conſiderable ſpaſm, and loſs of tone in the extreme veſſels on the ſurface of the body. 5. The buboes and carbuncles, which denote an acrimony prevailing in the fluids; and, laſtly, The petechiæ, hæmorrhages, and colliquative diarrhœa, which denote a putreſcent tendency prevailing in a great degree in the maſs of blood.

To theſe characteriſtics of the plague, we ſhall add one mentioned by Sir John Pringle, which, though perhaps leſs frequent than the others, yet ſeems worthy of notice. It is this, That in the plague there is an extraordinary enlargement of the heart and liver. In nine diſſections of bodies dead of the plague at Marſeilles, this extraordinary enlargement of the heart is taken notice of in them all, and of the liver in ſeven of them. The account was ſent to the Royal Society by M. Didier, one of the phyſicians to the king of France, and hath been publiſhed in the Philoſophical Tranſactions.

The author takes notice, that "the heart and liver were of double the natural ſize. The preternatural enlargement Dr. Pringle thinks is owing to the relaxation of the ſolid parts, by which means they become unable to reſiſt the impetus of blood, and therefore are eaſily extended; as in the caſe of infancy, where the growth is remarkably quick. And a ſimilar enlargement he takes notice of in the ſcurvy, and other putrid diſeaſes.

Cauſes, &c. From a conſideration of the ſymptoms above-mentioned may be concluded, that the plague is owing to a ſpecific contagion, often ſuddenly producing the moſt conſiderable debility in the nervous ſyſtem or moving powers, and of a general putreſcency in the fluids.

Prevention. Here we refer to all thoſe methods of preventing and removing the incipient contagion of putrid fevers, which have been ſo fully enumerated. The diſeaſe never ariſes in the northern parts of Europe, but in conſequence of being imported from ſome other country. The magiſtrate's firſt care therefore ought to be to prevent the importation; and this may generally be done by a due attention to bills of health, and to the proper performance of quarantines. The quarantines of perſons may with ſafety be much leſs than 40 days; and if this were allowed, the execution of the quarantine would be more exact and certain, as the temptation to break it would be in a great meaſure avoided. With reſpect to the quarantine of goods, it cannot be perfect unleſs the ſuſpected goods be unpacked, duly ventilated, and other means be employed for correcting the infection they may carry; and if all this be properly done, it is probable that the time commonly preſcribed for quarantine may be alſo ſhortened. A ſecond meaſure in the way of prevention is required, when an infection has reached and prevailed in any place, to prevent that infection from ſpreading into others. This can only be done by preventing the inhabitants or the goods of any infected place from going out of it, till they have undergone a proper quarantine. The third meaſure, and which ought to be employed with great care, is, to prevent the infection from ſpreading among the inhabitants of a place in which it has ariſen. And in this caſe, a great deal may be done by the magiſtrate. 1. By allowing as many of the inhabitants as are free from infection, and are not neceſſary to the ſervice of the place, to go out of it. 2. By diſcharging all aſſemblies, or unneceſſary intercourſe of the people. 3. By ordering ſome neceſſary communications to be performed without contact. 4. By making ſuch arrangements and proviſions as may render it eaſy for the families remaining to ſhut themſelves up in their own houſes. 5. By allowing perſons to quit houſes where an infection appears, upon condition that they go into lazarettoes. 6. By ventilating, and purifying, and deſtroying, at the public expence, all infected goods. 7. By avoiding hoſpitals, and providing ſeparate apartments for infected perſons. The fourth and laſt part of the buſineſs of prevention reſpects the conduct of perſons neceſſarily remaining in infected places, eſpecially thoſe obliged to have ſome communication with perſons infected." Thoſe obliged to remain in places infected, but not to have any near communication with the ſick, muſt avoid all near communication with other perſons or their goods; and it is probable, that a ſmall diſtance will ſerve, if, at the ſame time, there be no ſtream of air to carry the effluvia of perſons or goods to ſome diſtance. Thoſe who are obliged to have a near communication with the ſick ought to avoid any of the debilitating cauſes which render the body ſuſceptible of infection, as a ſpare diet, intemperance in drinking, exceſs in venery, cold, fear, or other depreſſing paſſions of the mind. A full diet of animal food is alſo to be avoided, becauſe it increaſes the irritability of the body, and favours the operation of contagion; and indigeſtion, whether from the quantity or quality of the food, contributes very much to the ſame.

Beſides theſe, it is probable that the moderate uſe of wine and ſpirituous liquors, moderate exerciſe, and the cold bath, may be of uſe; tonic medicines alſo, of which the Peruvian bark is deſervedly accounted the chief, may alſo be uſed with great probability of ſucceſs. If any thing is to be expected from antiſeptics, Dr. Cullen thinks camphire preferable to any other. In general, however, every one is to be indulged in the medicine of which he hath the beſt opinion, provided it is not evidently hurtful.

Cure. Here the indications are the ſame as in fever in general, but are not all equally important. The meaſures for moderating the violence of reaction, which operate by diminiſhing the action of the heart and arteries, have ſeldom any place here, excepting that the antiphlogiſtic regimen is generally proper. Some phyſicians have recommended bleeding, and Sydenham even ſeems to think it an effectual cure; but many other phyſicians deem it, for the moſt part unneceſſary, and in many caſes hurtful. Purging has alſo been recommended; and in ſome degree it may be uſeful, in drawing off the putreſcent matter frequently preſent in the inteſtines; but a large evacuation this way may certainly be hurtful.

The moderating the violence of reaction, as far as it can be done, by taking off the ſpaſm of the extreme veſſels, is a meaſure of the utmoſt neceſſity in the cure of the plague; and the whole of the means formerly mentioned, as ſuited to this indication, are extremely proper. The giving an emetic, at the firſt approach of the diſeaſe, would probably be of great ſervice; and it is probable, that, at ſome other periods of the diſeaſe, emetics might be uſeful, both by evacuating bile abounding in the alimentary canal, and by taking off the ſpaſm of the extreme veſſels.

From ſome principles with reſpect to fever in general, and with reſpect to the plague in particular, that after the exhibition of the firſt vomit, the body ſhould be diſpoſed to ſweat; but this ſweat ſhould be raiſed only to a moderate degree, though it muſt be continued for 24 hours or more if the patient bears it eaſily.

The ſweating is to be excited and conducted according to the rules laid down under Synocha; and muſt be promoted by the plentiful uſe of diluents rendered more grateful by vegetable acids, or more powerful by being impregnated with ſome portion of neutral ſalts. To ſupport the patient under the continuance of the ſweat, a little weak broth, acidulated with the juice of lemons, may be given frequently, and ſometimes a little wine if the heat of the body be not conſiderable. If ſudorific medicines are judged neceſſary, opiates will be found moſt effectual and ſafe; but they ſhould not be combined with aromatics, and probably may be more effectual if joined with a portion of emetics and of neutral ſalts. But if, notwithſtanding the uſe of emetics and ſudorifics in the beginning, the diſeaſe ſhould ſtill continue, the cure muſt turn upon the uſe of means for obviating debility and putreſcency; and for this purpoſe tonic medicines, eſpecially the Peruvian bark, and cold drink, are the moſt proper. For the treatment of buboes and carbuncles, ſee the article Surgery.

Genus XXVI. VARIOLA; *the* Small Pox.

Deſcription. In the *diſtinct* ſmall pox, the diſeaſe begins with a ſynocha or inflammatory fever. It generally comes on with ſome ſymptoms of a cold ſtage, and commonly with a conſiderable langour and drowſineſs. A hot ſtage is ſoon formed, and becomes more conſiderable on the ſecond and third day. During this courſe children are liable to frequent ſtartings from their ſlumbers; and adults, if they are kept a-bed, are diſpoſed to much ſweating. On the third day, children are ſometimes affected with one or two epileptic fits. Towards the end of the third day the eruption commonly appears, and gradually increaſes during the fourth; appearing firſt on the face, and ſucceſſively on the inferior parts, ſo as to be completed over the whole body on the fifth day. From the third day the fever abates, and againſt the fifth it entirely ceaſes. The eruption appears firſt in ſmall red ſpots hardly eminent, but by degrees riſing into pimples. There are generally but few on the face; but, even when more numerous, they are ſeparate and diſtinct from one another. On the fifth or ſixth day, a ſmall veſicle, containing an almoſt colourleſs fluid, appears on the top of each pimple. For two days theſe veſicles increaſe in breadth only, and there is a ſmall hollow pit in their middle, ſo that they are not raiſed into ſpheroidical puſtules till the eighth day. Theſe puſtules from their firſt formation continue to be ſurrounded with an exactly circular inflamed margin, which when they are numerous diffuſes ſome inflammation over the neighbouring ſkin, ſo as to give ſomewhat of a damaſk roſe colour to the ſpaces between the puſtules. As the puſtules increaſe in ſize, the face ſwells conſiderably if they are numerous on it; and the eye-lids particularly are ſo much ſwelled, that the eyes are entirely ſhut. As the diſeaſe proceeds, the matter in the puſtules becomes by degrees more opaque and white, and at length aſſumes a yellowiſh colour. On the eleventh day, the ſwelling of the face is abated, and the puſtules ſeem quite full. On the top of each a darker ſpot appears; and at this place the puſtule, on the eleventh day, or ſoon after, is ſpontaneouſly broken, and a portion of the matter oozes out; in conſequence of which the puſtule is ſhrivelled, and ſubſides; while the matter oozing out dries, and forms a cruſt upon its ſurface. Sometimes only a little of the matter oozes out, and what remains in the puſtule becomes thick and even hard. After ſome days, both the cruſts and the hardened puſtules fall off, leaving the ſkin which they covered of a browniſh red colour; nor doth it reſume its natural colour till many days after. In ſome caſes, where the matter of the puſtules has been more liquid, the cruſts formed by it are later in falling off, and the part they covered ſuffers ſome deſquamation, which occaſions a ſmall hollow or pit in it.

On the legs and hands the matter is frequently abſorbed; ſo that at the height of the diſeaſe, theſe puſtules appear as empty as veſicles. On the tenth and eleventh days, as the ſwelling of the face ſubſides, a ſwelling ariſes in the hands and feet; but which again ſubſides as the puſtules come to maturity. When the puſtules on the face are numerous, ſome degree of pyrexia appears on the tenth and eleventh days, but diſappears again after the puſtules are fully ripened; or perhaps remains in a very ſlight degree till the puſtules on the feet have finiſhed their courſe; and it is ſeldom that any fever continues longer in the diſtinct ſmall pox. When the puſtules are numerous on the face, upon the ſixth or ſeventh day ſome uneaſineſs in the throat, with a hoarſeneſs of the voice, comes on, and a thin liquid is poured out from the mouth. Theſe ſymptoms increaſe with the ſwelling of the face; and the liquids of the mouth and throat becoming thicker are with difficulty thrown out; and there is at the ſame time ſome difficulty in ſwallowing, ſo that liquids taken in to be ſwallowed are frequently rejected or thrown out by the noſe. But all theſe affections of the fauces are abated as the ſwelling of the face ſubſides.

In the *confluent* ſmall-pox all the ſymptoms above-mentioned are much more ſevere. The eruptive fever particularly is more violent; the pulſe is more frequent and more contracted, approaching to that ſtate of pulſe which is obſerved in typhus. The coma is more conſiderable, and there is frequently a delirium. Vomiting alſo frequently attends, eſpecially at the beginning of the diſeaſe. In very young infants epileptic fits are ſometimes frequent on the firſt days of the diſeaſe, and ſometimes prove fatal before any eruption appears, or they uſher in a very confluent and putrid ſmall-pox. The eruption appears more early on the third day, and it is frequently preceded or accompanied with an eryſipelatous efflorescence. Sometimes the eruption appears in cluſters like the meaſles. When the eruption is completed, the pimples are always more numerous upon the face, and at the ſame time ſmaller and leſs eminent. Upon the eruption the fever ſuffers ſome remiſſion, but never goes off entirely; and after the fifth or ſixth day it increaſes again, and continues to be conſiderable throughout the remaining part of the diſeaſe. The veſicles formed on the top of the pimples appear ſooner; and while they increaſe in breadth, they do not retain a circular, but are every way of an irregular figure. Many of them run into one another, inſomuch that very often the face is covered with one veſicle rather than with a number of puſtules. The veſicles, as far as they are any-way ſeparated, do not ariſe to a ſpheroidal form, but remain flat and ſometimes the whole of the face is of an even ſurface. When the puſtules are in any meaſure ſeparated, they are not bounded by an inflamed margin, but the part of the ſkin that is free from puſtules is commonly pale and flaccid. The liquor that is in the puſtules changes from a clear to an opaque appearance, and becomes whitiſh or browniſh, but never acquires the yellow colour and thick conſiſtence that appears in the diſtinct ſmall-pox. The ſwelling of the face, which only ſometimes attends the diſtinct ſmall-pox, always attends the confluent kind; it alſo comes on more early, and ariſes to a greater height, but abates conſiderably on the tenth or eleventh day. At this time the puſtules or veſicles break and ſhrivel; pouring out at the ſame time a liquor, which is formed into brown or black cruſts, which do not fall off for a long time after. Thoſe of the face, in falling off, leave the ſkin ſubject to a deſquamation, which pretty certainly produces pittings. On the other parts of the body the puſtules of the confluent ſmall-pox are more diſtinct than on the face; but never acquire the ſame maturity and conſiſtence of pus as in the properly diſtinct kind. The ſalivation, which ſometimes only attends the diſtinct ſmall-pox, very conſtantly attends the confluent; and both the ſalivation and the affection of the fauces above-mentioned, are, eſpecially in adults, in a higher degree. In infants a diarrhœa comes frequently in place of a ſalivation.

In this kind of ſmall-pox there is often a very conſiderable putreſcency of the fluids, as appears from petechiæ, ſerous veſicles, under which the ſkin ſhews a diſpoſition to gangrene, and from bloody urine or other hæmorrhages; all of which ſymptoms frequently attend this diſeaſe. In the confluent ſmall-pox alſo, the fever, which had only ſuffered a remiſſion from the eruption to the maturation, at or immediately after this period is frequently renewed again with conſiderable violence. This is what has been called the *ſecondary fever*, and is of various duration and event.

Cauſes, &c. It is evident that the ſmall-pox is originally produced by a contagion; and that this contagion is a ferment with reſpect to the fluids of the human body, which aſſimilates a great part of them to its own nature; and it is probable, that the quantity thus aſſimilated is, in proportion to their ſeveral bulks, nearly the ſame in different perſons. This quantity paſſes again out of the body, partly by inſenſible perſpiration, and partly by being depoſited in puſtules; but if the quantities generated be nearly equal, the quantities paſſing out of the body the two ways above-mentioned are very unequal in different perſons. The cauſes which determine more of the variolous matter to paſs by perſpiration, or to form puſtules, are probably certain circumſtances of the ſkin, which determine more or leſs of the variolous matter to ſtick in it, or to paſs freely through it. The circumſtance of the ſkin, which ſeems to determine the variolous matter to ſtick in it, is a certain ſtate of inflammation depending much on the heat of it: thus we have many inſtances of parts of the body, from being more heated, having a greater number of puſtules than other parts. Thus parts covered with plaſters, eſpecially thoſe of the ſtimulant kind, have more puſtules than others. Certain circumſtances alſo, ſuch as adult age, and full living, determining to a phlogiſtic diatheſis, ſeem to produce a greater number of puſtules, and *vice verſa*. It is therefore probable, that an inflammatory ſtate of the whole ſyſtem, and more particularly of the ſkin, gives occaſion to a greater number of puſtules; and the cauſes of this may produce moſt of the other circumſtances of the confluent ſmall-pox, ſuch as the time of eruption, the continuance of the fever, the effuſion of a more putreſcent matter and leſs fit to be converted into pus, together with the form and other circumſtances of the puſtules.

Prognoſis. The more exactly the diſeaſe retains the form of the diſtinct kind, it is the ſafer; and the more completely the diſeaſe takes the form of the confluent kind, it is the more dangerous. It is only when the diſtinct kind ſhews a great number of puſtules on the face or otherwiſe, by fever or putreſcency, approaching to the circumſtances of the confluent, that the diſtinct kind is attended with any danger.

In the confluent kind the danger is always very conſiderable: and the more violent and permanent the fever is, the greater the danger; and eſpecially in proportion to the increaſe of the ſymptoms of putreſcency. When the putrid diſpoſition is very great, the diſeaſe ſometimes proves fatal before the eighth day; but in moſt caſes death happens on the eleventh, and ſometimes not till the fourteenth or ſeventeenth day. Though the ſmall-pox may not prove immediately fatal, the more violent kinds are often followed by a morbid ſtate of the body, ſometimes of very dangerous event. Theſe conſequences, according to Dr. Cullen, may be imputed ſometimes to an acrid matter produced by the preceding diſeaſe, and depoſited in different parts; and ſometimes to an inflammatory diatheſis produced and determined to particular parts of the body.

Cure. The art of medicine hath never yet afforded a method of preventing the eruption of the ſmall-pox after the contagion is received; all that can be done is, to render the diſeaſe more mild, which is generally effected by INOCULATION. It is not to be ſuppoſed that the mere giving of the infection artificially could make any difference in the nature of the diſeaſe, was it not that certain precautions are commonly uſed in the caſe of thoſe who are inoculated, which cannot be uſed in the caſe of thoſe who receive them naturally. Theſe meaſures, according to Dr. Cullen, are chiefly the following.

1. The chooſing for the ſubject of inoculation perſons otherwiſe free from the diſeaſe, and not liable from their age or otherwiſe to any incidental diſeaſe. 2. The chooſing that time of life which is moſt favourable to a mild diſeaſe. 3. The chooſing for the practice a ſeaſon moſt favourable to a mild diſeaſe. 4. The preparing the perſon to be inoculated, by enjoining abſtinence from animal-food for ſometime before inoculation. 5. The preparing the perſon by courſes of mercurial and antimonial medicines. 6. The taking care at the time of inoculation to avoid cold, intemperance, fear, or other circumſtances which might aggravate the future diſeaſe. 7. After theſe preparations and precautions, the chooſing a fit matter to be employed in inoculation, by taking it from a perſon of a ſound conſtitution, and free from any diſeaſe, or ſuſpicion of it; by taking it from a perſon who has had the ſmall-pox of the moſt benign kind; and laſtly, by taking the matter from ſuch perſon as ſoon as it has appeared in the puſtules, either on the part inoculated, or on other parts of the body. 8. The introducing, by inoculation, but a ſmall portion of the contagious matter. 9. After inoculation, the continuing of the vegetable diet, at the ſame time employing frequent purging. 10. Both before and after inoculation, taking care to avoid external heat, either from the ſun, artificial fires, warm chambers, much clothing, or being much in bed; and, on the contrary, expoſing the perſon to a free and cool air. 11. Upon the appearance of the eruptive fever, the rendering that moderate by the employment of purgatives; by the uſe of cooling and antiſeptic acids; and eſpecially by expoſing the perſon frequently to a cool air, at the ſame time giving freely of cold drink. 12. After the eruption, the continuing the application of cool air, and the uſe of purgatives, during the courſe of the diſeaſe, till the puſtules are fully ripened.

As the common infection may often ſeize perſons under a diſeaſed ſtate, which may render the ſmall-pox more violent, it is evident that inoculation muſt have a great advantage by avoiding ſuch concurrence. But as the avoiding of this may in the mean time frequently leave perſons expoſed to the common infection, it is well worth while to inquire what are the diſeaſed ſtates which ſhould reſtrain from the practice of inoculation.

Though inoculation hath been practiſed with ſafety upon perſons of all ages, yet there is reaſon to conclude, that adults are more liable to a violent diſeaſe than perſons of younger years. At the ſame time it is obſerved, that children, in the time of their firſt dentition, are liable, from the irritation of that, to have the ſmall-pox rendered more violent; and that infants, before the time of dentition, upon receiving the contagion of the ſmall-pox are liable to be afflicted with epileptic fits, which frequently prove fatal. Hence it is evident, that though circumſtances may admit and approve of inoculation at any age, yet for the moſt part it will be advantageous to chooſe perſons after the firſt dentition is over, and before the time of puberty. The operation of inoculation may be performed at any ſeaſon of the year; yet as it is certain that the cold of winter may increaſe the inflammatory, and the heats of ſummer increaſe the putreſcent, ſtate of the ſmall-pox, it is highly probable that inoculation may have ſome advantage from avoiding the extremes either of cold or heat.

As the uſe of animal-food may increaſe both the inflammatory andputreſcent ſtate of the human body, ſo it muſt render perſons, in receiving the contagion of the ſmall-pox, leſs ſecure againſt a violent diſeaſe; and therefore inoculation may derive ſome advantage by enjoining abſtinence from animal-food for ſome time before the operation is performed: but we are of opinion, that a longer time is neceſſary than what is commonly preſcribed.

It has commonly been ſuppoſed, that inoculation derives ſome advantage from the choice of the matter employed in it; but it is very doubtful if any choice be here neceſſary, or can be of any benefit in determining the ſtate of the diſeaſe. It is not indeed probable that there is any difference of contagion producing the ſmall-pox; for there are innumerable inſtances of the contagion ariſing from a perſon who labours under the diſtinct ſmall-pox producing the confluent kind, and the contrary. Since the practice of inoculation hath been introduced, it hath alſo been obſerved, that the ſame variolous matter would in one perſon produce the diſtinct, and in another the confluent ſmall-pox. It is therefore highly probable, that the difference of the ſmall-pox does not depend upon any difference of the contagion, but upon ſome difference in the ſtate of the perſons to whom it is applied, or in the ſtate of certain circumſtances concurring with the application of the contagion.

Some have ſuppoſed, that inoculation has an advantage over the natural infection, by introducing only a ſmall portion of contagious matter into the body; but this is by no means well aſcertained. It is not known what quantity of contagion is introduced into the body by the common infection of the ſmall-pox; and it is probable the quantity is not great: nor, though it were larger than that thrown in by inoculation, is it certain what the effects would be. A certain quantity of ferment may be neceſſary to excite fermentation in a given maſs; but when that quantity is given, the fermentation and aſſimilation are extended to the whole maſs: and we do not find that a greater quantity than is juſt neceſſary, either increaſes the activity of the fermentation, or more certainly ſecures the aſſimilation of the whole. In the caſe of the ſmall-pox, a conſiderable difference in the quantity of the contagion introduced, hath not ſhewn any effects in modifying the diſeaſe.

Purging has the effect of diminiſhing the activity of the ſanguiferous ſyſtem, and of obviating the inflammatory ſtate of it; and therefore it is probable, that the frequent uſe of cooling purgatives gives a conſiderable advantage to the practice of inoculation; and probably this is alſo obtained by diminiſhing the determination to the ſkin.

It is probable that the ſtate of the ſmall-pox depends very much upon the ſtate of the eruptive fever, and particularly in avoiding the inflammatory ſtate of the ſkin; and therefore it is alſo probable, that the meaſures taken for moderating the eruptive fever, and inflammatory ſtate of the ſkin, afford the greateſt improvement which has been made in the practice of inoculation. It hath been the practice of inoculators to continue the uſe of purgatives and the application of cold air after the eruption; but it cannot be ſaid to give any particular advantages to inoculation, and the employment of purgatives ſeems often to have led to an abuſe. When the ſtate of the eruption is determined, when the number of puſtules is very ſmall, and the fever hath entirely ceaſed, the ſafety of the diſeaſe may be ſaid to be aſcertained, and further remedies abſolutely ſuperfluous: in ſuch caſes therefore the uſe of purgatives is unneceſſary, and may be hurtful.

It remains now only to conſider the treatment of the ſmall-pox, when the ſymptoms ſhall be violent, as may ſometimes happen, even after inoculation and every remedy and precaution have been uſed. The cauſe of this is not aſcertained, but it ſeems to be a putreſcent tendency of the fluids. When therefore, from the prevailing of the ſmall-pox as an epidemic, and more eſpecially when it is known that a perſon not formerly affected with the diſeaſe has been expoſed to the infection, if ſuch perſon ſhould be attacked with the ſymptoms of fever, there can be little doubt that it is the fever of the ſmall-pox, and therefore he is to be treated in every reſpect as if he had received the diſeaſe by inoculation.

It frequently happens, eſpecially in infants, that, during the eruptive fever of the ſmall-pox, convulſions occur. Of theſe, if only one or two fits appear on the evening preceding the eruption, they give a prognoſtic of a mild diſeaſe, and require no remedy: but if they occur more early, are violent, and frequently repeated, they are very dangerous, and require a ſpeedy remedy; and here bleeding and bliſtering are of no ſervice, the only effectual medicine is an opiate given in a large doſe.

Theſe are the remedies neceſſary during the eruptive fever; and if, upon the eruption, the puſtules on the face are diſtinct, and their number few, the diſeaſe requires no further remedies. But when, upon the eruption, the number of pimples on the face is conſiderable, when they are not diſtinct; and eſpecially if, upon the fifth day, the fever does not ſuffer a conſiderable remiſſion; the diſeaſe ſtill requires a great deal of attention. If, after the eruption, the fever ſhall ſtill continue, the avoiding of heat and the continuing to expoſe the body to a cool air will ſtill be proper.

If the fever is conſiderable, with a full hard pulſe, in an *adult* perſon, a bleeding will be neceſſary, and more certainly a cooling purgative: but it will be ſeldom neceſſary to repeat the bleeding, as a loſs of ſtrength very ſoon comes on; but the repetition of a purgative, or the frequent uſe of laxative glyſters, is commonly advantageous. When a loſs of ſtrength, with other marks of a putreſcent tendency of the fluids, appears, the Peruvian bark muſt be given in ſubſtance, and in a large quantity. In the ſame caſe, the uſe of acids and of nitre is advantageous, and commonly it is proper alſo to give wine very freely. From the fifth day of the diſeaſe throughout the whole courſe of it, it is proper to give an opiate once or twice a-day; taking care at the ſame time to obviate coſtiveneſs, by purgatives or by laxative glyſters. From the eighth to the eleventh day of a violent diſeaſe, it will be proper to lay on bliſters ſucceſſively on different parts of the body, and that without regard to the parts being covered with puſtules. Bliſters are alſo to be applied to the external fauces, in caſe of difficult deglutition, and viſcid ſaliva and mucus, which are thrown out with difficulty, at the ſame time that detergent gargles are to be diligently uſed. During the whole courſe of this diſeaſe, when a conſiderable fever is preſent, antimonial medicines may be given in nauſeating doſes with advantage, and theſe commonly anſwer the purpoſe of purgatives. The remedies above-mentioned are frequently proper from the fifth day till the ſuppuration is finiſhed. But as after that period the fever is ſometimes continued and increaſed; or as ſometimes, when there was little or no fever before, a fever now ariſes and continues with conſiderable danger; this is called the *ſecondary fever*, and requires a particular treatment.

When the ſecondary fever follows the diſtinct ſmall-pox, and the pulſe is full and hard, the caſe is to be treated as an inflammatory affection, by bleeding and purging; but the ſecondary fever which follows the confluent kind, is to be conſidered as a putrid diſeaſe, and bleeding is improper. Some purging may be neceſſary, but the remedies to be chiefly depended upon are the Peruvian bark and acids. When the ſecondary fever firſt appears, whether after a diſtinct or confluent ſmall-pox, it is uſeful to exhibit an antimonial emetic in nauſeating doſes, but in ſuch a manner as to produce ſome vomiting. For avoiding the pits which frequently follow the ſmall-pox, no method hitherto propoſed ſeems to be ſufficiently certain.

GENUS XXVII. VARICELLA, *or the* CHICKEN-POX.

This is a very ſlight diſeaſe; and is attended with ſo little danger, that it would not merit any notice, if it were not apt to be confounded with the ſmall-pox, and thus give occaſion to an opinion that a perſon might have the ſmall-pox twice in his life; or they are apt to deceive into a falſe ſecurity thoſe who have never had the ſmall-pox, and make them believe that they are ſafe, when in reality they are not.

The patients ſcarce ſuffer any thing throughout the whole progreſs of this illneſs, except ſome languidneſs of ſtrength and ſpirits and appetite, all which is probably owing to the confining of themſelves to their chamber. Remedies are not likely to be much wanted in a diſeaſe attended with hardly any inconvenience, and which in ſo ſhort a time is certainly cured of itſelf. The principal marks by which the chicken-pox may be diſtinguiſhed from the ſmall-pox are,

1. The appearance, on the ſecond or third day from the eruption, of that veſicle full of ſerum upon the top of the pock.

2. The cruſt, which covers the pocks on the fifth day; at which time thoſe of the ſmall-pox are not at the height of their ſuppuration. Foreign medical writers hardly ever mention the name of this diſtemper; and the writers of our own country ſcarce mention any thing more of it than its name. From the great ſimilitude between the two diſtempers, it is probable, that, inſtead of the ſmall-pox, ſome perſons have been inoculated from the chicken-pox; and that the diſtemper which has ſucceeded, has been miſtaken for the ſmall-pox by haſty or unexperienced obſervers.

GENUS XXVIII. RUBEOLA; *the* MEASLES.

Deſcription. This diſeaſe begins with a cold ſtage, which is ſoon followed by a hot, with the ordinary ſymptoms of thirſt, heat, anorexia, anxiety, ſickneſs, and vomiting; and theſe are more or leſs conſiderable in different caſes. Sometimes from the beginning, the fever is ſharp and violent: often, for the firſt two days, it is obſcure and inconſiderable; but always becomes violent before the eruption, which commonly happens on the fourth day. This eruptive fever, from the beginning of it, is always attended with hoarſeneſs, a frequent hoarſe dry cough, and frequently with ſome difficulty of breathing. At the ſame time, the eyelids are ſomewhat ſwelled; the eyes are a little inflamed, and pour out tears; and, with this, there is a coryza, and frequent ſneezing. For the moſt part, a conſtant drouſineſs attends the beginning of this diſeaſe. The eruption appears firſt in ſmall red points; but, ſoon after, a number of theſe appear in cluſters, which do not ariſe in viſible pimples, but, by the touch, are found to be a little prominent: This is the caſe on the face; but, in other parts of the body, the prominency, or roughneſs, is hardly to be perceived. On the face, the eruption retains its redneſs, or has it increaſed for two days; but, on the third, the vivid redneſs is changed to a browniſh red; and, in a day or two more, the eruption entirely diſappears, while a meally deſquamation takes place. During the whole time of the eruption, the face is ſomewhat turgid, but ſeldom conſiderably ſwelled. Sometimes, after the eruption has appeared, the fever ceaſes entirely: but this is ſeldom the caſe; and more commonly the fever continues or is increaſed after the eruption, and does not ceaſe till after the deſquamation. After the ſame period, alſo, a diarrhœa frequently comes on, and continues for ſome time. It is common for meaſles, even when they have not been of a violent kind, to be followed by inflammatory affections, particularly ophthalmia and phthiſis. If the blood be drawn from a vein in the meaſles, with the circumſtances neceſſary to favour the ſeparation of the gluten, this always appears ſeparated, and lying on the ſurface of the craſſamentum, as in inflammatory diſeaſes. For the moſt part, the meaſles, even when violent, are without any putrid tendency; but in ſome caſes, ſuch a tendency appears both in the courſe of the diſeaſe, and eſpecially after the ordinary courſe of it is finiſhed. See Dr. Watſon, in London Med. Obſ. vol. iv. art. 11.

Cauſes. The meaſles are occaſioned by ſome kind of contagion, the nature of which is not underſtood; and which like the former, affects a perſon only once in their lives.

Prognoſis. From the deſcription of this diſtemper already given, it appears that the meaſles are attended with a catarrhal affection, and by an inflammatory diatheſis to a conſiderable degree; and therefore the danger of them is to be apprehended chiefly from the coming on of a pneumonic inflammation.

Cure. From the conſideration mentioned in the prognoſis, it will be obvious, that the remedies eſpecially neceſſary are thoſe which may obviate and diminiſh the inflammatory diatheſis; and therefore, in a particular manner, blood-letting. This remedy may be employed at any time in the courſe of the diſeaſe, or after the ordinary courſe of it is finiſhed. It is to be employed more or leſs, according to the urgency of the ſymptoms of fever, cough, and dyſpnœa; and generally may be employed very freely. But, as the ſymptoms of pneumonic inflammation ſeldom come on during the eruptive fever; and, as this is ſometimes violent, immediately before the eruption, though a ſufficiently mild diſeaſe be to follow; bleeding is ſeldom very neceſſary during the eruptive fever, and may often be reſerved for the times of greater danger which are perhaps to follow. Aſſiſtance may alſo be drawn from cooling purgatives; and particularly from bliſtering on the ſides, or between the ſhoulders. The dry cough may be alleviated by the large uſe of demulcent pectorals, mucilaginous, oily, or ſweet. For moderating and quieting the cough in this diſeaſe, opiates certainly prove the moſt effectual means, whenever they can be ſafely employed. In the meaſles, in which an inflammatory ſtate prevails in a conſiderable degree, opiates may be ſuppoſed to be inadmiſſible; and, in thoſe caſes in which a high degree of pyrexia and dyſpnœa ſhew either the preſence, or at leaſt the danger, of pneumonic inflammation, opiates might be very hurtful: but, in caſes in which the dyſpnœa is not conſiderable, and in which bleeding, to obviate or abate the inflammatory ſtate, has been duly employed; in ſuch caſes, while the cough and watchfulneſs are the urgent ſymptoms, opiates may be ſafely exhibited, and with great advantage. In all the exanthemata, there is an acrimony diffuſed over the ſyſtem, which gives a conſiderable irritation; and, for obviating the effects of this, opiates are uſeful, and always proper, when no particular contra-indication prevails.

When the deſquamation of the meaſles is finiſhed, though then there ſhould be no diſorder remaining, phyſicians have thought it neceſſary to purge the patient ſeveral times, with a view to draw off the dregs of this diſeaſe, that is, a portion of the morbific matter which is ſuppoſed to remain long in the body.

From our late experience of the uſe of cold air in the eruptive fever of the ſmall pox, ſome phyſicians have been of opinion that the practice may be transferred to the meaſles; but experience determines our opinion to the contrary. We are certain, that external heat may be very hurtful in the meaſles, as in moſt other inflammatory diſeaſes; and, therefore, that the body ought to be kept in a moderate temperature during the whole courſe of the meaſles. Analogy, though ſo often the reſource of phyſicians, is is frequently fallacious; and further, though the analogy with the ſmall-pox might lead to the application of cold air during the eruptive fever of the meaſles, the analogy with catarrh is greatly againſt the practice. When the eruption is upon the ſkin, we have had many inſtances of cold air making it diſappear, and thereby producing much diſorder in the ſyſtem; and we have alſo had frequent inſtances of this diſorder being removed by reſtoring the heat of the body, and thereby again bringing out the eruption.

GENUS XXIX. SCARLATINA. *The* SCARLET FEVER.

The Mild SCARLET FEVER.

The mild ſcarlet fever is deſcribed by Sydenham, who tells us that he can ſcarce account it a diſeaſe; and indeed nothing more ſeems to be neceſſary in the treatment of it than an antiphlogiſtic regimen, avoiding the application of cold air and cold drink. The diſeaſe however ſometimes rages epidemically, and is attended with very alarming ſymptoms, bearing no ſmall reſemblance to the cynanche maligna, in which caſe it is called *ſcarlatina anginoſa.*

The Scarlatina Anginoſa, or SCARLET FEVER, *with ulcerated ſore Throat.*

The beſt deſcription of this diſtemper hath been publiſhed by Dr. Withering in the year 1778. This diſeaſe made its appearance, we are told, at Birmingham and the neighbouring villages, about the middle of May 1778. It continued in all its force and frequency to the end of October; varying, however, in ſome of its ſymptoms, as the air grew colder. In the beginning of November it was rarely met with; but towards the middle of that month, when the air became warmer, it increaſed again, and in ſome meaſure reſumed thoſe appearances it poſſeſſed in the ſummer months, but which it had loſt during the cold winds in October. It affected children more than adults; but ſeldom occurred in the former under two years of age, or in the latter when once they had paſſed their fiftieth year.

Deſcription. With various general ſymptoms of fever, the patient at firſt complains of a dejection of ſpirits, a ſlight ſoreneſs or rather ſtiffneſs in the neck, with a ſenſe of ſtraitneſs in the muſcles of the neck and ſhoulders, as if they were bound with chords. The ſecond day of the fever this ſoreneſs in the throat increaſes, and the patients find a difficulty in ſwallowing; but the difficulty ſeems leſs occaſioned by the pain excited in the attempt, or by the ſtraitneſs of the paſſage, than by an inability to throw the neceſſary muſcles in action. The ſkin feels hot and dry, but not hard; and the patients experience frequent, ſmall, pungent pains, as if touched with the point of a needle. The breath is hot and burning to the lips, and thirſt makes them wiſh to drink; but the tendency to ſickneſs, and the exertions neceſſary in deglutition, are ſo unpleaſant, that they ſeldom care to drink much at a time. They have much uneaſineſs alſo from want of reſt during the night. In the morning of the third day, the face, neck, and breaſt, appear redder than uſual: in a few hours this redneſs becomes univerſal; and increaſes to ſuch a degree of intenſity, that the face, body, and limbs, reſemble a boiled lobſter in colour, and are evidently ſwollen. Upon preſſure the redneſs vaniſhes, but ſoon returns again. The ſkin is ſmooth to the touch, nor is there the leaſt appearance of pimples or puſtules. The eyes and noſtrils partake more or leſs of the general redneſs; and in proportion to the intenſity of this colour in the eyes, the tendency to delirium prevails. Things continue in nearly this ſtate for two or three days longer, when the intenſe ſcarlet gradually abates, a brown colour ſucceeds, and the ſkin becoming rough, peels off in ſmall ſcales. The tumefaction ſubſides at the ſame time, and the patients gradually recover their ſtrength and appetite. During the whole courſe of the diſeaſe, the pulſe is quick, ſmall, and uncommonly feeble; the urine ſmall in quantity; the ſub-maxillary glands ſomewhat enlarged and painful to the touch. The velum pendulum palati, the uvula, the tonſils, and gullet, as far as the eye can reach, partake of the general redneſs and tumefaction.

Theſe are the moſt uſual appearances of this diſorder; but it too frequently aſſumes a much more fatal form. In ſome children the delirium commences in a few hours after the firſt attack; the ſkin is intenſely hot; the ſcarlet colour appears on the firſt or ſecond day, and they die very early on the third. Others again, who ſurvive this rapid termination, inſtead of recovering, as is uſual, about the time the ſkin begins to get its natural colour, fall into a kind of lingering, and die at laſt in the courſe of ſix or eight weeks.

In adults, circular livid ſpots were frequently obſerved about the breaſt, knees, and elbows; alſo large blotches of red, and others of white intermixed, and often changing places.

Happy would it be, our author obſerves, if the baneful influence of this diſorder terminated with the febrile ſymptoms. But in ten or fifteen days from the ceſſation of the fever, and when a complete recovery might be expected, another train of ſymptoms occur, which at laſt frequently terminate fatally. The patients, after a few days amendment, feel a ſomething that prevents their farther approach to health; an unaccountable langour and debility prevails, a ſtiffneſs in the limbs, an accelerated pulſe, diſturbed ſleep, diſreliſh to food, and a ſcarcity of urine. Theſe ſymptoms, we are told, are ſoon ſucceeded by ſwellings of a real dropſical nature, forming ſometimes an anaſarca, and on other occaſions an aſcites.

Dr. Withering, after examining the accounts given of this diſeaſe by different authors, proceeds to the diagnoſis. It may be diſtinguiſhed, he obſerves, from the petechial fever, by the eruption in the latter appearing ſeldom before the fourth day, by the regularity and diſtinctneſs of the ſpots, and by its principally occupying the neck, the back, and the loins. On the other hand, in the ſcarlet fever, the eruption generally appears about the third day; conſiſts either of broad blotches, or elſe one continued redneſs, which ſpreads over the face and the whole body.

In the fever called *purpura*, the puſtules are prominent, keep their colour under preſſure, and never appear early in the diſeaſe; whereas in the ſcarlet fever, the eruption appears more early, is not prominent, but perfectly ſmooth to the touch, and becomes quite white under preſſure.

Although the *purple fever* and *ſcarlatina* may be connected by ſome general cauſe, yet our author takes occaſion to obſerve, that they cannot be mere modifications of the ſame eruption: for examples occur, he ſays, of the ſame perſon being firſt ſeized with one of theſe diſorders, and afterwards with the other; but he never met with an inſtance of the ſame perſon having the ſcarlet fever twice; and he believes it to be as great an improbability as a repetion of the ſmall-pox.

Cauſes. Our author affirms that the immediate cauſe of this diſeaſe is a poiſon of a peculiar kind, communicable by contagion. 2. That this poiſon firſt takes poſſeſſion of the mucous membrane lining the fauces and the noſe; and either by its action upon the ſecretory glands, or upon the mucus itſelf, aſſimilates that mucus to its own nature. 3. That it is from this beginning, and from this only, that it ſpreads to the ſtomach, &c. and at length acts upon the ſyſtem at large. 4. That its firſt action upon the nerves, is of a ſedative or debilitating nature. 5. That in conſequence of certain laws of the nervous ſyſtem, when the debilitating effects operate upon the ſenſorium commune, a reaction takes place; and that this reaction is, *cæteris paribus*, proportioned to the debilitating power. 6. That, in conſequence of this re-action of the nervous ſyſtem, the vibratory motion of the capillary blood-veſſels dependent thereon is greatly increaſed; an unuſually large quantity of blood is accumulated in thoſe veſſels; the heart and large blood veſſels are deprived of their cuſtomary proportion; and hence, though ſtimulated to more frequent contraction, the pulſe muſt neceſſarily be feeble. 7. That as violent exertions are followed by debility, upon the ceſſation of the fever, the capillary veſſels, which had acted with ſuch unuſual violence, are left in a ſtate of extreme debility, and are long in recovering their tone; hence it is that ſo many patients afterwards become dropſical. Our author now proceeds to the conſideration of the different remedies, which either are at preſent in common uſe, or have been recommended as proper in this diſeaſe.

Cure. Blood-letting has been recommended by authors; but ſuch was the ſtate of the pulſe in this diſorder, at leaſt during the ſummer months, that it was not in any inſtance thought adviſeable to take away blood. In ſome caſes, indeed, where the fiery redneſs of the eyes ſeemed to demand the uſe of leeches, they were had recourſe to, but never with any advantage. In the harveſt months, when the pulſe was more firm, and when ſuffocation ſeemed to be threatened from the ſwelling in the fauces, blood-letting was ſometimes adviſed, but ſtill with leſs advantage than one would have expected in almoſt any other ſituation.

Vomiting.] This, our author obſerves, ſeems to be the remedy of nature; and he is ſurpriſed how it ſhould have been omitted by ſeveral authors, who have gone before him. Vomiting, he ſays, moſt amply fulfils the indications ariſing both from a conſideration of the cauſe and of the effects; and a liberal uſe of the remedy he holds forth as the true foundation for ſucceſsful practice in ſcarlet-fever and ſore-throat. His common form of emetic is a combination of tartar emetic and ipecacuanha, given in pretty ſmart dozes; and theſe are to be repeated at leaſt once in 48 hours, and in the worſt caſes ſo often as twice in 24 hours.

Purging.] The action of purgatives is conſidered by our author as altogether repugnant to the curative indications in this diſeaſe: for the poiſon, as formerly remarked, being received into the ſyſtem by the fauces, the operation of a purge, inſtead of diſcharging it, can only promote its diffuſion along the alimentary canal; and in fact, we are told, that when even a ſpontaneous purging ſupervenes in this diſeaſe, the patients ſink ſo amazingly faſt, that it is not within the reach of art to ſupport them.

Injected gargles of contrayerva decoction, ſweetened with oxymel of ſquills, &c. were found very beneficial in bringing always large quantities of viſcid ropy ſtuff from the fauces.

Animal food and fermented liquors were denied the patients, and nothing allowed but tea, coffee, chocolate, milk and water, gruel, barley-water, and ſuch articles. With reſpect to the dropſical diſorder which ſo frequently ſucceeds to this complaint, it was never obſerved, our author remarks, when the preceding ſymptoms had been properly treated.

Our author concludes his eſſay with an enumeration of ſeveral caſes, treated according to the principles above laid down. The ſucceſsful termination of theſe caſes demonſtrates the propriety of the practice which he has recommended.

Order IV. HÆMORRHAGIÆ; *Hæmorrhages.*

Genus XXX. HÆMOPTYSIS, *or Spitting of* Blood.

Deſcription. The hæmoptyſis commonly begins with a ſenſe of weight and anxiety in the cheſt, ſome uneaſineſs in breathing, pain of the breaſt or other parts of the thorax, and ſome ſenſe of heat under the ſternum; and very often it is preceded by a ſaltiſh taſte in the mouth. Immediately before the appearance of blood, a degree of irritation is at the top of the larynx. The perſon attempts to relieve this by hawking, which brings up a little florid and ſomewhat frothy blood. The irritation returns; and in the ſame manner blood of a ſimilar kind is brought up, with ſome noiſe in the wind pipe, as of air paſſing through a fluid. Sometime, however, at the very firſt, the blood comes up with coughing, or at leaſt ſomewhat of coughing accompanies the hawking above-mentioned. The blood is ſometimes at firſt in very ſmall quantity, and ſoon diſappears; but in other caſes, eſpecially when it frequently recurs, it is in greater quantity, and often continues to appear at times for ſeveral days together. It is ſometimes profuſe, but rarely in ſuch quantity as either by its exceſs or by a ſudden ſuffocation to prove immediately mortal. It is not always eaſy to diſcover whether the blood evacuated by the mouth proceeds from the internal ſurface of the mouth itſelf, from the fauces or adjoining cavities of the noſe, from the ſtomach, or from the lungs. It is, however, very neceſſary to diſtinguiſh the different caſes, by the following conſiderations.

1. When the blood proceeds from ſome part of the internal ſurface of the mouth, it comes out without any hawking or coughing; and generally, upon inſpection, the cauſe is evident.

2. When blood proceeds from the fauces, or adjoining cavities of the noſe, it may be brought out by hawking, and ſometimes by coughing. In this caſe there may be a doubt concerning its real ſource, and the patient may be allowed to pleaſe himſelf with the thoughts that the blood doth not come from the lungs. But the phyſician muſt remember that the lungs are much more frequently the ſource of hæmoptyſis than the fauces. The latter ſeldom happens but to perſons who have before been liable to an hæmorrhage from the noſe, or to ſome evident cauſe of eroſion; and in moſt caſes, by looking into the fauces, the diſtillation of the blood from thence will be perceived.

3. When blood proceeds from the lungs, the manner in which it is brought up will commonly ſhew from whence it comes; but independent of that, it may alſo be known from the cauſes of hæmoptyſis from the lungs, to be afterwards mentioned, having preceded.

4. When vomiting accompanies the throwing out of blood from the mouth, we may generally know the ſource from whence it proceeds, by conſidering that blood does not proceed ſo frequently from the ſtomach as from the lungs; that blood proceeding from the ſtomach commonly appears in greater quantity than from the lungs. The pulmonary blood alſo is uſually of a florid colour, and mixed with a little frothy mucus only; but the blood from the ſtomach is of a darker colour, more grumous, and mixed with the other contents of the ſtomach. The coughing or vomiting, as the one or the other happens firſt to ariſe, may ſometimes point out the ſource of the blood; and this hath alſo its peculiar antecedent ſigns and cauſes.

Cauſes, &c. An hæmoptyſis may be produced at any time of life by external violence; and, in adult perſons, while the arterial plethora prevails in the ſyſtem, i. e. from the age of 16 to 35, an hæmoptyſis may at any time be produced merely by a plethoric ſtate of the lungs. More frequently, however, it ariſes from a faulty proportion between the capacity of the lungs and that of the reſt of the body. Thus it is often an hereditary diſeaſe, which implies a peculiar and faulty conformation.

This diſeaſe eſpecially happens to perſons who diſcover the ſmaller capacity of their lungs by the narrowneſs of their cheſt. It happens alſo to perſons of a ſlender delicate make, of which a long neck is a mark; to perſons of much ſenſibility and irritability, and therefore of quick parts; to perſons who have formerly been liable to hæmorrhages from the noſe; to thoſe who have ſuffered a ſuppreſſion of any uſual hæmorrhage, the moſt frequent inſtance of which is in females, who have ſuffered a ſuppreſſion of their menſtrual flux; and laſtly, to perſons who have ſuffered the amputation of any conſiderable limb.

One of the exciting cauſes, and perhaps a frequent one, is external heat; which, even when in no great degree, brings on the diſeaſe in ſpring, and the beginning of ſummer, while the heat rarifies the blood more than it relaxes the ſolids, which had before been contracted by the cold of winter. Another exciting cauſe is any violent exerciſe of reſpiration. In the prediſpoſed, alſo, the diſeaſe may be occaſioned by any degree of external violence.

Prognoſis. The hæmoptyſis may ſometimes be no more dangerous than a hæmorrhage from the noſe; as when it happens to females in conſequence of a ſuppreſſion of their menſes; when, without any marks of prediſpoſition, it ariſes from external violence; or, from whatever cauſe ariſing, when it leaves no cough, dyſpnœa, or other affection of the lungs, behind it. But even in theſe caſes, a danger may ariſe from too large a wound being made in the veſſels of the lungs, from any quantity of red blood being left to ſtagnate in the cavity of the bronchiæ, and particularly from any determination of the blood being made into the veſſels of the lungs, which by renewing the hæmorrhage may have theſe conſequences.

Cure. On this ſubject Dr. Cullen differs from thoſe who preſcribe chalybeates and the Peruvian bark in the cure of hæmoptyſis. Both of theſe, he obſerves, contribute to increaſe the phlogiſtic diatheſis then prevailing in the ſyſtem, and the hæmoptyſis from prediſpoſition is always accompanied with ſuch a diatheſis. Inſtead of theſe, therefore, he recommends blood-letting in greater or ſmaller quantity, and more or leſs frequently repeated as the ſymptoms ſhall direct. At the ſame time cooling purgatives are to be employed, and every part of the antiphlogiſtic regimen is to be ſtrictly enjoined. In the London Medical Obſervations, the uſe of nitre is greatly recommended by Dr. Dickſon, to whom its efficacy was known by Dr. Letherland, phyſician to St Thomas's hoſpital. The moſt commodious method of exhibiting it he found was in an electuary. Four ounces of conſerve of roſes were made into an electuary with half an ounce of nitre; of which the bulk of a large nutmeg was directed to be given, four, ſix, or eight times a day, according to the urgency of the caſe. The good effects of this, our author tells us, have often aſtoniſhed him; and when given early in the diſeaſe, he ſays he can depend as much upon it for the cure of an hæmoptyſis, as on the bark for the cure of an intermittent. He agrees with Dr. Cullen, however, that in thoſe caſes where there is any hardneſs in the pulſe, and which almoſt always happens, there is a neceſſity for veneſection. A cool regimen, and quiet of body and mind, are certainly uſeful; but Dr. Cullen obſerves, that ſome kinds of geſtation, ſuch as ſailing, and travelling in an eaſy carriage on ſmooth roads, have often proved a remedy. When the cough is very troubleſome, it is abſolutely neceſſary to exhibit frequently a ſmall doſe of an opiate. Dr. Dickſon alſo informs us, that the nitre joined with ſpermaceti, or *pulv. e tragacanth. comp.* has produced equally good effects with the electuary above-mentioned; in the compoſition of which the Doctor at firſt conſidered the conſerve only as a vehicle for the nitre, though he means not to inſinuate that the former is totally deſtitute of efficacy.

PHTHISIS, *or* CONSUMPTION *of the* LUNGS.

Sometimes, notwithſtanding all the care we can take, the hæmoptyſis will degenerate into a phthiſis pulonalis, or conſumption of the lungs; and ſometimes an hæmoptyſis will be the conſequence of this dangerous diſorder. It hath been indeed ſuppoſed, that an ulceration of the lungs, or phthiſis, was the natural and almoſt neceſſary conſequence of an hæmoptyſis: but, this is in general a miſtake; for there are many inſtances of an hæmoptyſis from external violence without being followed by any ulceration. The ſame thing hath often been obſerved where the hæmoptyſis aroſe from an internal cauſe; and this not only in young perſons, when the diſeaſe returned for ſeveral times, but when it has often recurred during the courſe of a long life; and it may eaſily be conceived, that a rupture of the veſſels of the lungs, as well as of the veſſels of the noſe, may be ſometimes healed. The cauſes of phthiſis, therefore, may be reduced to five heads. 1. An hæmoptyſis. 2. A ſuppuration of the lungs in conſequence of a pneumonia. 3. A catarrh. 4. An aſthma; and, 5. Tubercles.

A phthiſis, indeed, moſt commonly ariſes from tubercles. Dr. Simmons informs us, that he has had opportunities of inſpecting the bodies of ſeveral people who died in this way, and never found them totally abſent. He hath likewiſe ſeen them in ſubjects of different ages, who had been troubled with no ſymptoms of an affection of the breaſt during their lifetime. In theſe, however, they were ſmall, and few in number. This proves that they may exiſt without inconvenience till they begin to diſturb the functions of the lungs by their ſize and number; or till ſome degree of inflammation is excited, either by accidental cauſes, or by certain changes that take place within their ſubſtance; for as yet we know but little of their true nature. Theſe little tumours vary in their conſiſtence; in ſome they are compoſed of a pulpy ſubſtance, and in others approach more to the nature of ſcirrhus. They are moſt commonly formed in conſequence of a certain conſtitutional prediſpoſition; but whatever is capable of occaſioning a morbid irritability of the lungs ſeems to be capable of generating them. Thus the ſpaſmodic aſthma frequently ends in tubercles and conſumption; and it is not unuſual for millers, ſtone cutters, and others, to die conſumptive, from their being ſo conſtantly expoſed to duſt, which in theſe caſes probably acts by producing ſimilar concretions: and Dr. Kirkland obſerves, that ſcythe-grinders are ſubject to a diſeaſe of the lungs, from particles of ſand mixing with iron duſt, which among themſelves they call the *grinders rot.* Tubercles likewiſe often have their ſource from a ſcrophulous acrimony; and ſome eminent phyſicians have ſuppoſed that the generality of pulmonary conſumptions are of this kind. This notion, however, they have carried too far: they have probably been miſled by theſe tuberculous concretions which, without good reaſon, have been ſuppoſed to be diſeaſed glands, and of courſe analogous to the glandular affections we meet with in the ſcrophula. Tubercles may likewiſe ſometimes be owing to the ſudden repulſion of cutaneous eruptions, or of the matter of exanthemata, &c. or to other cauſes.

The perſons who are moſt liable to conſumption are thoſe of a fair complexion, fine and ſoft ſkin, florid cheeks, and a ſlender make; with high cheek bones, hollow temples, long neck, narrow cheſt, and a remarkable prominence of the proceſſes of the os ſacrum. To theſe marks we may add, that of *ſound teeth*, which, as the diſeaſe advances, uſually become of a milky white colour, and more or leſs tranſparent. Of thoſe who are carried off by this diſeaſe, Dr. Simmons aſſerts, the greater number will be found never to have had a carious tooth.

Perſons of the above deſcription often remain for a long time without feeling any other inconvenience than ſome oppreſſion at the breaſt in moiſt weather, or in hot apartments. Their breathing is eaſily hurried, ſometimes by the ſlighteſt motion; and they become languid, paler, and thinner. All this while, however, they feel no heat or painful cenſation in the breaſt. As the evil increaſes, the patient begins to be attacked with a ſlight, frequent, and dry cough, which is moſt troubleſome in the night time. This, however, by proper care, is often relieved; and the patient remains in this ſtate for a conſiderable time, and even for many years, if he is ſenſible of his danger, and careful to guard againſt it by a ſuitable manner of living. More commonly, however, we find the cough increaſing, and ſometimes accompanied with more or leſs of catarrh. This is uſually aſcribed to cold; and but too generally neglected, till the diſeaſe becomes alarming by its obſtinacy and its effects. This may be conſidered as the *beginning*, or firſt period, of the diſeaſe. During this ſtage, the cough is ſometimes dry from the firſt; and ſometimes, when it ſets in the form of a catarrh, is attended with more or leſs expectoration of mucus.

Deſcription. When the diſeaſe has been neglected, or our attempts to remove it in the beginning have failed, both of which circumſtances but too frequently happen, the patient begins to complain of a ſoreneſs, and of ſlight lancinating pains ſhooting through the breaſt, ſometimes in the direction of the mediaſtinum, and ſometimes confined chiefly to one ſide. The ſoreneſs is pretty conſtant, and much increaſed by the cough. The pain in the ſide often prevents the patient from lying on the ſide affected; and this inability of lying, except on one ſide, frequently occurs even when no ſuch pain is felt. In this ſtage of the diſeaſe, fluſhing heats are felt in the palms of the hand and ſoles of the feet: the breathing is ſhort and laborious; and it is not long before the patient begins to expectorate a thin and frothy phlegm, at firſt in ſmall quantities, couched up with difficulty and ſoreneſs, and now and then ſtreaked with blood: this may be conſidered as the *inflammatory period* of the diſeaſe, to which ſucceeds the *ſuppurative ſtage.* In the latter, the expectoration becomes more copious and purulent, the breath proportionably offenſive, and the exacerbations of the hectic more conſiderable: an increaſed quickneſs of the pulſe comes on about the middle of the day; but the moſt conſiderable paroxyſm of the fever is at night, and at firſt continues till towards morning, commonly till three or four o'clock, when it terminates in a ſweat, which uſually begins upon the breaſt. As the diſeaſe advances, the ſweats become more profuſe, and ſometimes come on almoſt as ſoon as the pulſe begins to quicken, but without affording any relief to the patient. During the exacerbations, we obſerve a circumſcribed redneſs of the cheeks, while the reſt of the face is pale, and appears as if it were not clean waſhed. The coſtiveneſs that commonly accompanies the beginning of the diſeaſe is uſually ſucceeded by a diarrhœa; the ſpitting leſſens, and all the purulent matter ſeems to be carried downwards. The waſting of the fat and the loſs of nouriſhment occaſion the nails to curve inwards, the hair to fall off, and the eyes to ſink in their ſockets. In the mean time, the legs commonly ſwell; till at length death cloſes a ſcene which is melancholy to all but the patient himſelf, who in general continues ſenſible to the laſt moment, and even then indulges a vain hope of prolonging a miſerable exiſtence. In ſome caſes, and that not unfrequently, a delirium comes on towards the cloſe of the diſeaſe.

The hectic fever that attends this and ſome other chronic diſeaſes, is evidently the effect of acrimony, and moſt commonly of pus abſorbed and carried into the circulation. The nature of this acrimony, and the different irritability of different patients, are probably the ſources of the variety we obſerve in fevers of this denomination; a variety which is doubtleſs much greater than we are aware of. Thus we find that the matter of the ſmall-pox excites a fever of this kind; but this *ſecondary fever*, as it is called, differs from the hectic attendant on conſumptions; nor does the latter correſpond with that which ſometimes accompanies the ſuppuration of a cancerous ulcer. In the pulmonary conſumption, or at leaſt in the third ſtage of it, the fever induced is truly of the putrid kind, and has been well denominated *febris hectica putrida* by the judicious Morton, who conſiders it as being combined with a peripneumonic or inflammatory fever, which recurs as often as freſh tubercles begin to inflame. For although we have named one period of the diſeaſe, the *inflammatory*, and another the *ſuppurative period*, yet we are not to ſuppoſe that the latter is exempt from inflammation. While matter is poured into the bronchiæ, or abſorbed and carried into the ſyſtem from one part of the lungs, other parts are in a crude ſtate of inflammation, or advancing towards ſuppuration; ſo that, on examining the lungs of perſons who die conſumptive, we find ſome tubercles that are ſmall and juſt formed, ſome that are large and full of matter, and others that are in a ſtate of ulceration. This eaſily accounts for the occaſional combination of inflammatory ſymptoms with thoſe of the putrid hectic.

When the matter abſorbed is a laudable pus, as in the caſe of a pſoas abſceſs, we find the form of the hectic differing from either thoſe we have mentioned.

Cure. When the cough ſets in the form of a catarrh, and appears to be occaſioned by an increaſed ſecretion of a thin ſaltiſh mucus irritating the membrane of the trachea, all judicious practitioners agree in recommending an attention to regimen, the free uſe of diluting liquors, bland emulſions, ſmall doſes of nitre, the taking away a few ounces of blood if there be much inflammation, the inhaling the ſteams of warm water, and the occaſional uſe of ſuch a doſe of elixir paregoricum as will be ſufficient to allay the irritation of the bronchiæ, and to promote a gentle moiſture on the ſkin. Theſe methods will generally be found to be efficacious, eſpecially if the patient's chamber is of a moderate temperature, and he carefully avoids expoſure to a cold, damp, or raw air, till the complaint is removed. In caſes in which the cough has been obſtinate, and the inflammatory ſymptoms conſiderable, Dr. Simmons has often experienced the great advantages of the warm bath, the heat of which did not exceed 92°. When this is had recourſe to, the patient ſhould remain in it only a very few minutes, and go ſoon afterwards to bed; but not with a view to force a ſweat by an increaſed weight of bed-clothes, as is too often injudiciouſly practiſed.

Patients of a conſumptive habit, who have had an attack of this kind at the beginning of winter, are particularly liable to a return of the complaint during the continuance of the cold ſeaſon, on the ſlighteſt occaſion and with greater violence. A relapſe is therefore to be carefully guarded againſt; and nothing will be found to do this more effectually than the uſe of ſocks and a flannel under-waiſtcoat. The uſe of flannel has been condemned by ſeveral medical writers as increaſing the inſenſible perſpiration; but in the preſent caſe, to ſay nothing of ſome others in which it may not be uſeful, it will in general be found to have the beſt effects. It will prevent a too great determination to the lungs, and ſhould not be left off till the approach of ſummer. In ſome few inſtances in which flannel was found to have a diſagreeable effect, a piece of dimity, worn over the breaſt next the ſkin, prevented the return of colds and coughs in perſons of a delicate habit, who had before been liable to them on the ſlighteſt occaſions. In theſe caſes, circumſtances that are ſeemingly of the moſt trifling nature become of importance.

In the catarrhal cough juſt now mentioned, many practitioners are too eager to adminiſter the Peruvian bark, with the view, as they term it, of ***bracing up*** the patient: but this never fails to increaſe the cough, and of courſe to do great and very often irreparable miſchief. The oily remedies ſeldom fail to exaſperate this cough, which at firſt is dry, frequent, and often extremely violent, but which ſeldom fails to give way to one or two gentle pukes, and the occaſional uſe of mild purges. The cough, as in other caſes, often continues from habit after the cauſe that gave riſe to it has been removed, and may then be checked by opiates.

In theſe different periods of the diſeaſe, the curative indications are ſufficiently obvious. To prevent the formation of freſh tubercles; to obviate the inflammation of thoſe already formed; to promote their reſolution; to allay morbid irritability, the cough, and other troubleſome ſymptoms; and, above all, to check the tendency to hectic, are the views that every rational phyſician propoſes to himſelf in the treatment of the genuine conſumption. We know of no medicines that can exert their ſpecific effects upon the lungs by diſſolving tuberculous concretions; nor is it probable, from what we know of the animal œconomy, that any ſuch will ever be diſcovered. Yet medicines that operate in a general manner upon the ſyſtem, may, by promoting abſorption, and diminiſhing the determination to the lungs, tend to diſperſe tubercles, or to prevent their formation. There are not wanting inſtances of wonderful recoveries in caſes where the evil was ſuppoſed to be beyond the power of phyſic; and in ſome, where nature was left to herſelf; ſo that a phyſician who has obſerved the various and powerful reſources nature has within herſelf, will be very cautious how he aſſerts that a diſeaſe is incurable.

The moſt formidable effects of ulcerated lungs are the abſorption and conſequent hectic. It ſeems evident, that, in many caſes, death is brought on by this, rather than by the lungs themſelves being rendered unfit for the purpoſes of reſpiration. So that if we can obviate the effects of the abſorption, diminiſh the preternatural determination to the lungs, and fulfil the other general indications juſt now mentioned, we may very often enable nature to recover herſelf. It may be alledged indeed, that the phyſician's art has hitherto proved very unſucceſsful in theſe caſes; but may not this be owing to the remedies that are adopted being very often ſuch as are inimical to the cure?

The bark is, perhaps, the moſt commonly employed of any, and often confided in as an ultimate reſource in theſe caſes. But beſides this, the elixir of vitriol, the balſams, and frequent bleedings, have each had their partizans. The uſe of bliſters and iſſues, opiates, a milk and vegetable diet, exerciſe, and change of air, are pretty generally recommended by all. Concerning the bark, Default long ago obſerved, that it had been productive of great miſchief in conſumptive caſes; and Dr. Fothergill, in a paper publiſhed by him on this ſubject, very judiciouſly remarks, that the bark is ſo far from curing the hectic ariſing from diſtempered lungs, that, according to the beſt of his obſervations, it not only takes up that time which might probably have been better employed in the uſe of other medicines, but for the moſt part aggravates the diſeaſe beyond remedy. Indeed it will be found by every attentive obſerver, that, whenever pus, or any kind of matter excites an hectic, by being abſorbed and carried into the circulation, the bark will never fail to exaſperate the complaint, eſpecially if it is accompanied with any degree of inflammatory diatheſis, unleſs the matter has a free outlet from the ſyſtem; as in the caſe of abſceſſes, for inſtance, in which we often find the bark productive of excellent effects. It is likewiſe well known to be uſed as a tonic, to obviate the effects of fluor albus, or any other immoderate evacuation in delicate perſons, which, by enfeebling the ſyſtem, very often lays the foundation of phthiſis: but the moment we have reaſon to ſuſpect that the lungs are ulcerated, it ought to be laid aſide; and in the genuine tuberculous conſumption, it is at all times inadmiſſible.

In phthiſical complaints, a prudent trial of the bark ſeems neceſſary. Small doſes of the decoction, either alone, or joined with the ſaline mixture or ſuch other additions as the phyſician thinks proper, may be given. But if the breath becomes more tight and oppreſſed, the cough dry, the pulſe more quick and hard, and eſpecially if ſlight tranſitory pains or ſtitches about the thorax are more frequently complained of, a perſeverance in the uſe of the bark will increaſe the diſeaſe. If ſuch alſo ſhould be the appearances in the progreſs of the diſeaſe, or, from whatever cauſe, if the bark is accompanied with ſuch effects, the uſe of it ought to be with-held.

If, on the other hand, no pain, tightneſs, or oppreſſion, is perceived, and there appears a manifeſt abatement of the ſymptoms, it will be adviſeable to proceed. The adminiſtration of this medicine, however, requires a judicious obſerver; and it ought neither to be given in the early inflammatory ſtage of this diſeaſe, nor be continued in any ſubſequent period, if it produces the effects abovementioned. By its tonic virtues it will often enable nature to conquer many difficulties. In confirmation of this remark, Dr. Fothergill farther obſerves, that he has ſeen it of uſe in promoting expectoration, when this became deficient from want of ſtrength towards the end of peripneumonic fevers; but that it ſtops this diſcharge, changes ſlight wandering pains into ſuch as are fixed, and increaſes them with all their conſequences, in a variety of caſes.

The elixir of vitriol is often exhibited in conſumptive caſes, with no leſs impropriety than the bark. This medicine, from its aſtringency, is obviouſly improper in the inflammatory ſtate of the diſeaſe. But in the latter ſtage, when a general tendency to putrefaction takes place, it is ſerviceable in reſiſting the effect; it reſtrains the colliquative ſweats; and if the lungs are not injured paſt repair, it is allowed to be a very uſeful auxiliary.

Various are the opinions concerning the efficacy of Briſtol water in this diſeaſe. The experienced author laſt mentioned informs us, that he has ſeen many perſons recover, from pulmonary diſeaſes after drinking theſe waters, whoſe cure ſeemed to be doubtful from any other proceſs; and he thinks this circumſtance, added to the general reputation of Briſtol waters in phthiſical caſes, affords ſufficient inducement to recommend the trial of them in the early ſtage of ſuch complaints. It is however, before the approach of a confirmed phthiſis that patients ought to repair to Briſtol; otherwiſe a journey thither will not only be without benefit, but may even prove detrimental. Some have imagined, that the journey, a better air, change of ſituation and of objects, have contributed to the patient's recovery; and theſe may doubtleſs be of advantage. It ſeems, however, that the water drank freſh at the pump, actually contains principles conducive to the recovery of patients affected with phthiſical complaints. It ſeems to poſſeſs a ſlight calcareous ſtypticity, and perhaps the air it contains may alſo have an antiſeptic quality. On the whole, it appears to be an efficacious medicine, and is often found of remarkable benefit to conſumptive patients.

Change of air, ſometimes even from good to bad, is of great conſequence in all chronic diſeaſes of the lungs. In conſumptive caſes, however, the air of all large cities is found to be particularly injurious. In this diſeaſe, the pulſe, calm in the morning, becomes more frequent in the afternoon and night, attended with heat and other feveriſh ſymptoms. Exerciſe therefore, at this time, can only add to the miſchief of the fever. For this reaſon he prudently recommends to all hectic perſons, eſpecially thoſe who ſhall travel to diſtant places on account of a better air, or the benefit expected from any particular water, that their travelling ſhould be ſlow, confined to a very few hours, and only in the morning.

Horſe exerciſe, however, ſeems to be chiefly beneficial in thoſe caſes where conſumption is a ſecondary diſeaſe. It may likewiſe be uſeful in obviating an attack of phthiſis, or in carrying off a dry huſky cough in a perſon of a conſumptive habit, when there is reaſon to ſuppoſe that no tubercles are as yet formed. On the other hand, in the confirmed phthiſis, when the lungs are inflamed or ulcerated, much or violent exerciſe will be improper; and there have been inſtances where the death of the patient was evidently accelerated by it. Riding on horſeback agitates the viſcera more than walking, and is therefore preferable to it in many chronic diſeaſes; but when a perternatural determination to the lungs has taken place, it will be liable to increaſe the evil.

The beſt adapted diet in conſumptive caſes, is milk, particularly that of aſſes. It may however be remarked, that there are conſtitutions in which this ſalutary nutriment ſeems to diſagree. A propenſity to generate bile, or too ſtrong a diſpoſition to aceſcency from a weakneſs of the digeſtive organs, both merit attention. Whey, either from cows or goats milk, appears to be more ſuitable in the former caſe; and for correcting acidity, lime-water may be added to the milk. Dr. Simmons obſerves, that the patient's taſte ſhould be conſulted; and ſays that a moderate uſe of animal-food, where the ſalted and high-ſeaſoned kinds are avoided, is not to be denied. Shell fiſh, particularly oyſters, are uſeful, as well as ſnails ſwallowed whole, or boiled in milk.

A remark which has been judiciouſly made by Dr. Fothergill, ought not to be omitted in the account of this diſeaſe. It is, that young delicate females, from the age of 15 or 16, and upwards, are often ſubject to conſumptions. When the diſeaſe has advanced conſiderably, the *menſes*, if they have made their appearance, moſt generally ceaſe. This alarms their female friends, and they call upon the phyſician to uſe his utmoſt endeavours for reſtoring the diſcharge; believing the ceſſation of it to be the immediate cauſe of the phthiſical complaint. Induced by their ſolicitations, medicines have ſometimes been adminiſtered, that, without obtaining this end, have tended to aggravate the diſtemper. This deficiency is often of no real diſadvantage in thoſe caſes; and in many the evacuation would prove injurious, by diminiſhing the ſtrength, which is already too much impaired. Even ſmall bleedings at the regular periods, have often done more harm than good. A ſudden ſuppreſſion may require bleeding; but when the evacuation fails through want of ſtrength, and from poverty of blood, the renewal of it increaſes the diſeaſe.

Beſides theſe remedies, Dr. Simmons ſtrongly recommends a frequent repetition of vomits. Many phyſicians have ſuppoſed that where there is any increaſed determination to the lungs, vomits do miſchief; but our author is perſuaded, that inſtead of augmenting they diminiſh this determination; and that much good may be expected from a prudent uſe of this remedy, than which none has a more general or powerful effect on the ſyſtem. If any remedy is capable of diſperſing a tubercle, he believes it to be vomits. The affectations of the liver, that ſometimes accompany pulmonary complaints, give way to repeated emitics ſooner than to any other remedy. In ſeveral caſes where the cough and the matter expectorated, the fluſhing heats, loſs of appetite, and other ſymptoms, threatened the moſt fatal event; the complaints were greatly relieved, and in others wholly removed, by the frequent uſe of emetics. Other ſuitable remedies were indeed employed at the ſame time; but the relief the patients generally experienced after the emetic, was a ſufficient proof of its ſalutary operation. By this however, our author does not mean that vomits will be uſeful in every period of the diſeaſe, or in every patient. In general, it will be found that the earlier in the diſeaſe emetics are had recourſe to, the more likely they will be to do good and the leſs likely to do harm. The caſes in which this may be reckoned improper, are commonly thoſe in which the diſeaſe is rapid in its progreſs; or in that ſtage of it, when there is great debility, with profuſe colliquative ſweats.

With regard to the drains, ſuch as bliſters, iſſues, and ſetons, that are ſo frequently recommended in pulmonary complaints, there is leſs danger of abuſe from them, than from the practice of veneſection. The diſcharge they excite is not calculated to weaken the patient much; and the relief they have ſo often been found to afford, is a ſufficient reaſon for giving them a trial. Bliſters, as is well known, act in a twofold manner; by obviating ſpaſm, and producing revulſion: Iſſues and ſetons act chiefly in the latter of theſe two ways; and in this reſpect their effects, though leſs ſudden and leſs powerful at firſt, are more durable from the continuance of the diſcharge they occaſion. It is perhaps hardly neceſſary to remark, that, if much ſervice is to be expected from either of theſe remedies, they ſhould be applied early in the diſeaſe. The ingenious Mr. Mudge, who experienced the good effects of a large ſcapulary iſſue on his own perſon, very properly obſerves, that the diſcharge in theſe caſes ought to be conſiderable enough to be felt. But it is ſeldom poſſible for us to prevail on the delicate perſons, who are moſt frequently the victims of this diſeaſe, to ſubmit to the application of a cauſtic between the ſhoulders. The diſcharge produced by a ſeton is by no means inconſiderable; and as in theſe caſes there is generally ſome inflammatory ſtitch, ſome part of the breaſt that is more painful or more affected by a deep inſpiration than the reſt, a ſeton in the ſide, as near as can be to the ſeat of the inflammation, will be an uſeful auxiliary. Our author has ſeen it evidently of great uſe in ſeveral caſes.

GENUS XXXI. HÆMORRHOIS, *the* HEMORRHOIDI, *or* PILES.

Deſcription. The diſcharge of blood from ſmall tumours on the verge of the anus conſtitutes what is called the *hæmorrhoids* or *piles*. They are diſtinguiſhed into the *external* and *internal*, according to the ſituation of the tumours, either without or within the anus. Sometimes, however, theſe tumours appear without diſcharging any blood; and in this caſe they are called the *hæmorrhoides cœcæ* or *blind piles*. Sometimes the diſeaſe appears without the verge of the anus in diſtinct ſeparate tumours; but frequently only one tumid ring appears, ſeeming as it were the anus puſhed without the body. Sometimes theſe tumours appear without any previous diſorder of the body: but more frequently, before the blood begins to flow, and ſometimes even before the tumours are formed, various affections are perceived in different parts of the body; as head-ach, vertigo, ſtupor, difficulty of breathing, ſickneſs, colic pains, pain of the back and loins, and frequently a conſiderable degree of pyrexia; while along with theſe ſymptoms there is a ſenſe of fullneſs, heat, itching, and pain, in and about the anus. Sometimes the diſeaſe is preceded by a ſerous diſcharge from the anus; and ſometimes this ſerous diſcharge, accompanied with ſwelling, ſeems to come in place of the diſcharge of blood, and to relieve the above-mentioned diſorders of the ſyſtem. This ſerous diſcharge hath therefore been named the *hæmorrhois alba*.

In this diſeaſe the quantity of blood diſcharged is different upon different occaſions. Sometimes it flows only when the perſon goes to ſtool, and commonly follows the diſcharge of fæces. In other caſes it flows without any diſcharge of fæces; and then generally in conſequence of the diſorders above-mentioned, when it is alſo commonly in larger quantity. This is often very conſiderable, and, by the repetition, ſo great, that we could hardly ſuppoſe the body to bare it but with the hazard of life. Indeed, though rarely, it has been ſo great as to prove ſuddenly fatal, as probably was the caſe with ARIUS and COPERNICUS. Theſe conſiderable diſcharges occur eſpecially to perſons who have been frequently liable to the diſeaſe. They often induce great debility, and frequently a leucophlegmatia or dropſy, which prove fatal. Sometimes the tumours and diſcharges of blood in this diſeaſe recur exactly at ſtated periods. In the decline of life it frequently happens, that the hæmorrhoidal flux, formerly frequent, ceaſes to flow; and in that caſe it generally happens that the perſons are affected with apoplexy or palſy. Sometimes hæmorrhoidal tumours are affected with inflammation, which ends in ſuppuration, and gives occaſion to the formation of fiſtulous ulcers in thoſe parts.

The hæmorrhoidal tumours have often been conſidered as varices or dilatations of the veins; and in ſome caſes varicous dilatations have appeared upon diſſection. Theſe, however, do not appear; and Dr. Cullen is of opinion that they are uſually formed by an effuſion of blood into the cellular texture of the inteſtine near to its extremity. When recently formed they contain fluid blood, but after they remain for ſome time they are uſually of a firmer conſiſtence.

Cauſes, &c. It would ſeem probable, that the hæmorrhoidal tumours are produced by ſome interruption of the free return of the blood from the rectum, by which a rupture of the extremities of the veins is occaſioned. But conſidering that the hæmorrhage occurring here is often preceded by pain, inflammation, and a febrile ſtate, and with many other ſymptoms which ſhew a connection of the topical affection with the ſtate of the whole ſyſtem, it is probable that the interruption of the venous blood produces a conſiderable reſiſtance to the motion of the venous blood through the arteries, and conſequently that the diſcharge of blood is commonly from the latter. Some have thought, that a difference of the hæmorrhois, and of its effects upon the ſyſtem, might ariſe from the difference of the hæmorrhoidal veſſels from whence the blood iſſued. But we can ſcarce ever diſtinguiſh the veſſels from which the blood flows; and the frequent inoſculations of both arteries and veins belonging to the lower extremity of the rectum, will render the effects of the hæmorrhage much the ſame, from whatever ſcource it proceeds.

With regard to the hæmorrhoids, they are, for the moſt part, merely a topical affection. They take place before the period of life at which a venous plethora happens. They happen to females, in whom a venous plethora determined to the hæmorrhoidal veſſels cannot be ſuppoſed; and they happen to both ſexes, and to perſons of all ages, from cauſes which do not affect the ſyſtem, and are manifeſtly ſuited to produce a topical affection only.

Theſe cauſes are, in the firſt place, the frequent voiding of hard and bulky fæces, which, by their long ſtagnation in the rectum, and eſpecially when voided, muſt neceſſarily preſs upon the veins of it, and interrupt the courſe of the blood in them. For this reaſon the diſeaſe ſo frequently happens to thoſe who are habitually coſtive. From the ſame cauſes, the diſeaſe happens frequently to thoſe who are ſubject to a prolapſus ani. In voiding the fæces, it almoſt always happens that the internal coat of the rectum is more or leſs protruded; and, during this protruſion, it ſometimes happens that the ſphincter ani is contracted: in conſequence of this, a ſtrong conſtriction is made, which preventing the fallen-out gut from being replaced, and at the ſame time preventing the return of blood from it, occaſions a conſiderable ſwelling, and the formation of a tumid ring round the anus.

Upon the ſphincter's being a little relaxed, as it is immediately after its ſtrong contraction, the portion of the gut which had fallen out is commonly taken into the body again; but by the frequent repetition of the accident, the ſize and fulneſs of the ring formed by the prolapſed inteſtine is much increaſed. It is therefore more ſlowly and difficultly replaced; and in this conſiſts the chief uneaſineſs of hæmorrhoidal perſons. As the internal edge of this ring is neceſſarily divided by clefts, the whole often puts on the appearance of a number of diſtinct ſwellings; and it alſo frequently happens, that ſome portions of it are more conſiderably ſwelled, become more protuberant, and form thoſe ſmall tumours more ſtrictly called *hæmorrhoids*, or *piles*.

From conſidering that the preſſure of the fæces, and other cauſes interrupting the return of venous blood from the lower extremity of the rectum, may operate a good deal higher up than that extremity, we may underſtand how tumours may be formed within the anus; and probably it alſo happens, that ſome of the tumours formed without the anus may continue when taken within the body, and even be increaſed by the cauſes juſt mentioned. Thus may the production of internal piles be explained, which, on account of their ſituation and bulk, are not protruded on the perſon's going to ſtool, and are therefore more painful.

The production of piles is particularly illuſtrated by this, that pregnant women are frequently affected with the diſeaſe. This is to be accounted for, partly by the preſſure of the uterus upon the rectum, and partly by the coſtive habit to which pregnant women are liable. Many inſtances of piles happen for the firſt time during the ſtate of pregnancy; and there are few women who have borne children, that are afterwards entirely free from piles. Purgatives alſo, eſpecially thoſe of the more acrid kind, and particularly aloetics, are apt to produce the piles, when frequently uſed; and as they ſtimulate particularly the great guts, they may be juſtly reckoned among the exciting cauſes of this diſeaſe.

Prognoſis. Though the hæmorrhoids are commonly, as we have ſaid, to be eſteemed a topical diſeaſe, they may, be frequent repetition, become habitual and connected with the whole ſyſtem. It is to be particularly obſerved, that when the hæmorrhoidal diſeaſe has either been originally, or has become a ſyſtematic affection, it then acquires a particular connection with the ſtomach; ſo that certain affections of the ſtomach excite the hæmorrhoidal diſeaſe, and certain ſtates of this diſeaſe excite the diſorders of the ſtomach.

It hath been an almoſt univerſally received opinion, that the hæmorrhoidal flux is a ſalutary evacuation, which prevents many diſeaſes that would otherwiſe have happened; and that it even contributes to give long life: and as this opinion hath been ſtrenuouſly adopted by Dr. Stahl, it hath had a very conſiderable influence on the practice of phyſic in Germany. But we can never expect to reap much benefit from this flux, which at firſt is purely topical; and, granting that it ſhould become habitual, it is never proper to be encouraged. It is a naſty, diſagreeable diſeaſe; ready to go to exceſs, and thereby to prove hurtful, and ſometimes even fatal. At beſt it is liable to accidents, and thus to unhappy conſequences. Even the firſt approaches of the diſeaſe are to be guarded againſt; and though it ſhould have proceeded for ſome time, it ought always to be moderated, and the neceſſity of it ſuperſeded.

Cure. When any evident cauſe for this diſeaſe is perceived, we ought immediately to attempt a removal of that cauſe. One of the moſt frequent remote cauſes is an habitual coſtiveneſs; which muſt be obviated by a proper diet, as the perſon's own experience will beſt direct; or if the management of diet be not effectual, the belly muſt be kept open by medicines, which may prove gently laxative, without irritating the rectum. In moſt caſes it will be of advantage to acquire a habit with regard to time, and to obſerve it exactly. Another cauſe of the hæmorrhois to be eſpecially attended to is the prolapſus ani, which is apt to happen on a perſon's having a ſtool. If this ſhall occur to any conſiderable degree, and be not at the ſame time eaſily and immediately replaced, it moſt certainly produces piles, or increaſes them when otherwiſe produced. Perſons therefore who are liable to this prolapſus, ſhould, after having been at ſtool, take great pains to have the gut immediately replaced, by lying down in an horizontal poſture, and preſſing gently upon the anus, till the reduction ſhall be completely obtained. When this prolapſus is occaſioned only by the voiding of hard and bulky fæces, it is to be removed by obviating the coſtiveneſs which occaſions it. But in ſome perſons it is owing to a laxity of the rectum; and in thoſe it is often moſt conſiderable on occaſion of a looſe ſtool. In theſe caſes, it is to be treated by aſtringents, and proper artifices to keep the gut in its place.

When the diſeaſe has frequently recurred from neglect, and is thus in ſome meaſure eſtabliſhed, the methods above-mentioned are no leſs proper; but in this caſe ſome other meaſures muſt alſo be uſed. It is eſpecially proper to guard againſt a plethoric ſtate of the body; and therefore to avoid a ſedentary life, full diet, and intemperance in the uſe of ſtrong liquor, which in all caſes of hæmorrhagy is of the moſt pernicious conſequence.

Exerciſe of all kinds is of great ſervice in obviating and removing a plethoric ſtate of the body; but upon occaſion of the hæmorrhoidal flux, when this is immediately to come on both walking and riding, as increaſing the determination of the blood into the hæmorrhoidal veſſels, are to be avoided. At other times, when no ſuch determination is already formed, theſe modes of exerciſe may be very properly employed.

Another method of removing plethora is by cold bathing; but this muſt be employed with caution. When the hæmorrhoidal flux is approaching, it may be dangerous to divert it; but during the intervals of the diſeaſe, cold bathing may be employed with ſafety and advantage; and in thoſe who are liable to a prolapſus ani, the frequent waſhing of the anus with cold water may be uſeful. When the flux has actually come on, we are to moderate it as much as poſſible, by cauſing the patient to lie in a horizontal poſture on a hard bed; by avoiding exerciſe in an erect poſture, uſing a cool diet, and avoiding external heat. But with reſpect to the further cure of this diſeaſe, we muſt obſerve, that there are only two caſes in which it is common for hæmorrhoidal perſons to call for medical aſſiſtance. The one is, when the affection is accompanied with much pain; and the other, when the piles are accompanied with exceſſive bleeding. In the firſt caſe, we muſt conſider whether the piles are external or internal. The pain of the external piles happens eſpecially when a conſiderable protruſion of the rectum has happened; and while it remains unreduced, it is ſtrangled by the conſtriction of the ſphincter; and at the ſame time no bleeding happens to take off the ſwelling of the protruded portion of the inteſtine; and ſometimes an inflammation ſupervenes, which greatly aggravates the pain. In this caſe, emollient fomentations and poultices are ſometimes of ſervice, but the application of leeches is generally to be preferred.

In caſe of exceſſive bleeding, we are on all occaſions to endeavour to moderate the flux, even where the diſeaſe has occurred as a critical diſcharge; for if the primary diſeaſe ſhall be entirely and radically cured, the preventing any return of the hæmorrhois ſeems entirely ſafe and proper. It is only when the diſeaſe ariſes from a plethoric habit, and from a ſtagnation of blood in the hypochondriac region, or when, though originally topical, it hath by frequent repetition become habitual, and has thereby acquired a connection with the ſyſtem, that any doubt can ariſe about curing it entirely. In any of theſe caſes, however, we are of opinion that it will be proper to moderate the bleeding, leſt, by its continuance or repetition, the plethoric ſtate of the body, and the particular determination of the blood into the hæmorrhoidal veſſels, be increaſed, and the return of the diſeaſe be too much favoured. In all caſes of exceſſive bleeding, or any approach to it, aſtringents both internal and external may be ſafely and properly applied; not indeed to induce an immediate and total ſuppreſſion; but to moderate the hæmorrhage, and by degrees to ſuppreſs it altogether; while at the ſame time meaſures are taken for the removing the neceſſity of its recurrence. In caſe of a connection between the hæmorrhoidal affection and the ſtate of the ſtomach, the ſame method is to be uſed in the atonic gout.

GENUS XXXII. MENORRHAGIA, or *Immoderate Flow of the* MENSES.

Deſcription. The quantity of the menſtrual flux is different in different women, and likewiſe in the ſame woman at different times. An unuſual quantity therefore is not always to be conſidered as morbid: but when a larger flow of the menſes has been preceded by head-ach, giddineſs, or dyſpnœa; has been uſhered in by a cold ſtage, and is attended with much pain of the back and loins, with a frequent pulſe, heat and thirſt; it may then be conſidered as preternaturally large. On the other hand, when the face becomes pale, the pulſe weak, an unuſual debility is felt in exerciſe, and the breathing is hurried by little labour; when the back becomes pained from any continuance in an erect poſture, when the extremities become frequently cold, and when at night the feet appear affected with œdematous ſwelling; from all theſe ſymptoms we may conclude, that the flow of the menſes, hath been immoderate, and has already induced a dangerous ſtate of debility. The debility, induced in this caſe, often appears alſo by affections of the ſtomach, an anorexia, and other ſymptoms of dyſpepſia; by a palpitation of the heart, and frequent faintings; by a weakneſs of mind, liable to ſtrong emotions from ſlight cauſes, eſpecially thoſe preſented by ſurpriſe. A flow of the menſes attended with barrenneſs, in married women, may generally be conſidered as preternatural and morbid. Generally, alſo, that flow of the menſes may be conſidered as immoderate, which is preceded and followed by a leucorrhœa.

Cauſes, &c. The proximate cauſe of the menorrhagia is either the effort of the uterine veſſels preternaturally increaſed, or a preternatural laxity of the extremities of the uterine arteries. The remote cauſes may be, 1. Thoſe which increaſe the plethoric ſtate of the uterine veſſels: as a full and nouriſhing diet, much ſtrong liquor, and frequent intoxication. 2. Thoſe which determine the blood more copiouſly and forcibly into the uterine veſſels; as violent ſtrainings of the whole body: violent ſhocks from falls; ſtrokes or contuſions on the lower belly; violent exerciſe, particularly in dancing; and violent paſſions of the mind. 4. Thoſe which particularly irritate the veſſels of the uterus; as exceſs in venery; the exerciſe of venery in the time of menſtruation; a coſtive habit, giving occaſion to violent ſtraining at ſtool; and cold applied to the feet. 4. Thoſe which have forcibly overſtrained the extremities of the uterine veſſels; as frequent abortions, frequent child-bearing without nurſing, and difficult tedious labours. Or, laſtly, thoſe which induce a general laxity; as living much in warm chambers, and drinking much of warm enervating liquors, ſuch as tea, coffee, &c.

Cure. The treatment and cure of the menorrhagia, muſt be different, according to the different cauſes of the diſeaſe. In all caſes, the firſt attention ought to be given to avoiding the remote cauſes, whenever that can be done; and by ſuch attention the diſeaſe may be often entirely cured. When the remote cauſes cannot be avoided, or when the avoiding them has been neglected, and a copious menſtruation has come on, it ſhould be moderated as much as poſſible, by abſtaining from all exerciſe at the coming on or during the continuance of the menſtruation; by avoiding even an erect poſture as much as poſſible; by ſhunning external heat, and therefore warm chambers and ſoft beds; by uſing a light and cool diet; by taking cold drink, at leaſt as far as former habits will allow; by avoiding venery; by obviating coſtiveneſs, or removing it by laxatives which give little ſtimulus. The ſex are commonly negligent, either in avoiding the remote cauſes, or in moderating the firſt beginnings of this diſeaſe. It is by ſuch neglect that it ſo frequently becomes violent and of difficult cure; and the frequent repetition of a copious menſtruation may be conſidered as a cauſe of great laxity in the extreme veſſels of the uterus.

When the immoderate flow of the menſes ſhall ſeem to be owing to a laxity of the veſſels of the uterus, as may be concluded from the general debility and laxity of the perſon's habit; from the remote cauſes that have occaſioned the diſeaſe; from the abſence of the ſymptoms which denote increaſed action in the veſſels of the uterus; from the frequent recurrence of the diſeaſe; and particularly from this, that the perſon in the intervals of menſtruation is liable to a leucorhœa; in ſuch a caſe, the diſeaſe is to be treated, not only by employing all the means above-mentioned for moderating the hæmorrhagy, but alſo by avoiding all irritation, every irritation having the greater effect in proportion as the veſſels are more lax and yielding. If, in ſuch a caſe of laxity, it ſhall appear that ſome degree of irritation concurs, opiates may be employed to moderate the diſcharge; but in uſing theſe much caution is requiſite. If, notwithſtanding theſe meaſures having been taken, the diſcharge ſhall prove very large, aſtringents, both external and internal, may be employed. In ſuch caſes, Dr. Hunter aſks, May ſmall doſes of emetics be of ſervice?

When the menorrhagia depends on the laxity of the uterine veſſels, it will be proper, in the intervals of menſtruation, to employ tonic remedies; as cold bathing, and chalybeates. The exerciſes of geſtation alſo may be very uſeful, both for ſtrengthening the whole ſyſtem, and for taking off the determination of the blood to the internal parts. Theſe remedies may be employed in all caſes of menorrhagia, from whatever cauſe it may have proceeded, if it ſhall have already induced a conſiderable degree of debility in the body.

ABORTION.

Deſcription. The *fluor albus*, female weakneſs, or *whites*, as commonly called, is a diſeaſe of the womb and its contiguous parts; from which a pale coloured, greeniſh or yellow fluid is diſcharged, attended with loſs of ſtrength, pain in the loins, bad digeſtion, and a wan ſickly aſpect.

Cauſes, &c. The quantity, colour, and conſiſtence of the diſcharge chiefly depend upon the time of its duration, the patient's habit of body, and the nature of the cauſe by which it was produced. Taking cold, ſtrong liquor, immoderate heat and moiſture, or violent exerciſe, are all obſerved to produce a bad effect, as to its quantity and quality.

Weakly women of lax ſolids, who have had many children, and long laboured under ill health, are of all others the moſt ſubject to this diſagreeable diſeaſe; from which they unfortunately ſuffer more ſevere penance than others, as the niceſt ſenſations are often connected with ſuch a delicacy of bodily frame as ſubjects them to it.

In Holland it is very frequent, from the dampneſs of its ſituation; the ſurrounding air being ſo overcharged with moiſture as to relax the body, ſtop perſpiration, and throw it upon the bowels, or womb; producing in the firſt, a diarrhœa or flux; in the laſt, the *fluor albus*, or female weakneſs.

The diſcharge proceeds from the veſſels ſubſervient to menſtruation; becauſe, in delicate habits, where thoſe veſſels are weak, and conſequently remain too long uncontracted, the *fluor albus* ſometimes immediately follows the menſes, and goes off by degrees as they gradually cloſe. It alſo comes from the mucous glands of the womb, as is particularly evident in very young females of eight and ten years old; in whom, though very rarely, it has been obſerved, and where it muſt then neceſſarily have eſcaped from thoſe parts; for the uterine veſſels are not ſufficiently enlarged for its paſſage at ſo early a period.

Sometimes, as in women with child, it proceeds from the paſſage to the womb, and not from the womb itſelf; which, during pregnancy, is cloſely ſealed up, ſo that nothing can paſs from thence till the time of labour. The application of thoſe inſtruments called *peſſaries*, from the pain and irritation they occaſion, are alſo apt to bring on this diſcharge. Hence we may conclude, that this diſeaſe may happen although the blood is in a pure ſtate. Here the fault ſeems to be placed in the veſſels or ſtrainers, by which the fluids are vitiated and changed from their natural qualities.

The *fluor albus* has been ſuppoſed to ſupply the want of the menſes; becauſe, where the firſt prevails, the laſt is generally either irregular. or totally wanting: but it might more properly be ſaid, that the preſence of the *fluor albus*, which is a preternatural evacuation, occaſions the abſence of that which is natural; as is evident from the return of the menſes, after the *fluor albus* has been taken away. Indeed, when this diſcharge appears about the age of 13 or 14, and returns once a month, with ſymptoms like thoſe of the menſes, then it may deemed ſtrictly natural, and therefore ought not to be ſtopped.

Prognoſis. The *fluor albus* may be diſtinguiſhed into two kinds. The firſt ariſes from a ſimple weakneſs, or the relaxation of the ſolids; which may either be *general*, where the whole bodily ſyſtem is enervated and unſtrung; or *partial*, where the womb only is thus affected, in conſequence of hard labour, frequent miſcarriages, a ſuppreſſion or immoderate quantity of the menſes, or a ſprain of the back or loins.

In the firſt caſe, the diſcharge being generally mild, may be ſafely taken away. In the ſecond, it may proceed from a vitiated, or impure blood, where the body, from thence, is loaded with groſs humours, which nature for her own ſecurity and relief thus endeavours to carry off. In ſuch caſes, the diſcharge is often of a reddiſh colour, like that from old ulcerous ſores; being ſometimes ſo ſharp as to excoriate the contiguous parts, and occaſion a ſmarting and heat of urine.

A deep-ſeated, darting pain, with a forcing down, attending ſuch a diſcharge, is a very dangerous and alarming ſign, and indicates an ulceration or cancerous ſtate of the womb. This malignant ſtate of the diſeaſe, if of long continuance, is extremely difficult of cure; and diſpoſes the patient to barrenneſs, a bearing down, the dropſy, or a conſumption.

Cure, &c. The cauſes of thoſe two kinds of this diſeaſe being different, ſo they will require a very different method of cure. To anſwer this intention; in the firſt caſe, nothing will be more proper than nouriſhing ſimple food, ſuch as veal broths, jellies, freſh eggs, and milk diet. The acid fruits will alſo be proper; and the patient may take a reſtorative, ſtrengthening infuſion, which will give firmneſs to the body, and aſſiſt the weakened fibres of the womb in returning to their natural ſtate.

The ſame method may be uſed with ſucceſs, where the *fluor albus* follows the menſes, as already obſerved.

The Tunbridge or Spa waters may be drank at the ſame time; and if neceſſary, an infuſion of green tea, or pure ſmith's-forge-water, may be uſed with a womb-ſyringe as an injection twice a-day. Should the diſeaſe prove uncommonly obſtinate; the patient may go into the cold bath every other day; and alſo drink lime-water with milk, which will expedite the cure, and prevent a relapſe. A volatile liniment, and afterwards a ſtrengthening plaſter, may be applied to the ſmall of the back.

By way of caution, ſhe ſhould abſtain from the immoderate uſe of tea; and be removed into a dry clear air; or if ſhe is obliged to remain in one leſs proper, ſhe may apply the fleſh-bruſh, and wear a flannel ſhift next her ſkin, impregnated with the fumes of burning frankincenſe, or any of the grateful aromatic gums. Cold ſpring-water pumped on the loins, or a bliſtering plaſter applied to the bottom of the ſpine or back, are both very powerful in their effects, and have ſometimes ſucceeded after other remedies had been tried in vain.

In the ſecond ſort of the diſeaſe, where the diſcharge is ſharp and of long ſtanding, it would be extremely dangerous to ſuppreſs it ſuddenly, either by aſtringents internally taken, or applied as injections, until the blood is freed from its impurities by proper purgatives, and otherwiſe corrected by ſuch medicines as not only carry off the ſharp ſcorbutic ſalts and putrid juices, but alſo impart to it that ſoft balmy quality of which it had been deprived.

A purging potion may be taken twice a-week, and in the intervals an alterative pill night and morning. After this courſe has been continued a fortnight or three weeks, ſhe may begin with the ſtrengthening, bitter infuſion, or other tonic, in the quantity of a tea-cupful twice a day, or more, as her ſtomach will allow.

The ſame ſort of food and regimen will here be proper as in the firſt kind of the diſeaſe. The patient ſhould abſtain from malt liquors, and drink rice-water, in each pint of which half an ounce of gum arabic has been diſſolved; or if ſhe is weak, and of a cold bloated habit of body, a little French brandy may be added occaſionally.

When ſhe begins to take the bitter infuſion, it will be proper to uſe the Tunbridge or Pyrmont water for common drink; but if thoſe cannot conveniently be had, the *artificial Spa water*, impregnated with iron and fixed air, will make an excellent ſubſtitute. If it ſhould render her coſtive, and occaſion the head-ach; ſhe may deſiſt, and drink imperial water or a little ſenna-tea ſweetened with manna, till thoſe complaints are removed.

In ſhort, as this is a malady of the moſt diſagreeable kind, which, by long continuance or neglect, becomes difficult of cure, and often produces an *ulceration of the womb, bearing down, barrenneſs*, a *dropſy*, or *conſumption*; it were to be wiſhed, that women, on ſuch occaſions, would be more attentive to their own ſafety, by uſing poſſible means, in due time, to prevent thoſe diſorders.

Dr. Leake ſays, he has attended more patients labouring under the *fluor albus* in the autumn than at any other ſeaſon of the year, eſpecially when the weather was uncommonly moiſt and cold: moſt of them were cured by change of diet, an increaſed perſpiration, and the proper uſe of Peruvian bark with aromatics. He obſerved, that ſeveral about this time who eſcaped the diſorder, were viſited with bad colds, a defluxion of rheum on the throat, or a diarrhœa, which were removed by a ſimilar treatment.

As women are ſometimes connected with thoſe who do not conſcientiouſly regard their ſafety, it is a circumſtance of the utmoſt conſequence *to diſtinguiſh a freſh venereal infection from the fluor albus or whites*; for, if the firſt is miſtaken for the laſt, and is either neglected or treated accordingly, the diſorder may unfortunately end in a confirmed *lues* or pox.

The following ſigns will beſt inform the patient whether there is occaſion for her doubts or not.

A freſh infection, called *gonorrhœa*, is malignant and inflammatory; the *fluor albus* moſt commonly ariſes from relaxation and bodily weakneſs: and therefore, the remedies proper in the firſt diſorder would render the laſt more violent, by locking up and confining the infectious matter.

In the gonorrhœa, the diſcharge chiefly proceeds from the parts contiguous to the urinary paſſage, and continues whilſt the menſes flow; but in the *fluor albus*, it is ſupplied from the cavity of the womb and its paſſage, and then the menſes are ſeldom regular.

In the gonorrhœa, an itching, inflammation, and heat of urine, are the fore-runners of the diſcharge; the orifice of the urinary paſſage, is prominent and painful, and the patient is affected with a frequent irritation to make water. In the *fluor albus*, pains in the loins, and loſs of ſtrength, attend the diſcharge; and if any inflammation or heat of urine follow, they happen in a leſs degree, and only after a long continuance of the diſcharge, which, becoming ſharp and acrimonious, excoriates the ſurrounding parts.

In the gonorrhœa, the diſcharge ſuddenly appears without any evident cauſe; but in the *fluor albus*, it comes on more ſlowly, and is often produced by irregularities of the menſes, frequent abortion, ſprains, or long-continued illneſs.

In the gonorrhœa, the diſcharge is greeniſh or yellow, leſs in quantity, *and not attended with the ſame ſymptoms of weakneſs*. In the *fluor albus*, it is alſo often of the ſame colour, eſpecially in bad habits of body, and after long continuance; but is uſually more offenſive, and redundant in quantity.

ORDER V. PROFLUVIA, PYREXIA; *with an increaſed Secretion.*

GENUS XXXIII. THE CATARRH.

Deſcription. The catarrh is an increaſed excretion of mucus from the mucous membrane of the noſe, fauces, and bronchiæ, attended with pyrexia.

Practical writers and noſologiſts have diſtinguiſhed the diſeaſe by different appellations, according as it happens to affect thoſe different parts of the mucous membrane, the one part more or leſs than the other: but Dr. Cullen is of opinion, that the diſeaſe in thoſe different parts is always of the ſame nature, and proceeds from the ſame cauſe in the one as in the other. Very commonly indeed thoſe different parts are affected at the ſame time; and therefore there is little room for the diſtinction mentioned. The diſeaſe has been frequently treated of under the title of *tuſſis*, or *cough*; and a cough, indeed, always attends the chief form of catarrh, that is, the increaſed excretion from the bronchiæ; but it is ſo often alſo a ſymptom of many other affections, which are very different from one another, that it is in our opinion improperly uſed as a generic title.

The diſeaſe generally begins with ſome difficulty of breathing through the noſe, and with a ſenſe of ſome fulneſs ſtopping up that paſſage. This again is often attended with ſome dull pain and a ſenſe of weight in the forehead, as well as a ſtiffneſs in the motion of the eyes. Theſe feelings, ſometimes at their very firſt beginning, and always ſoon after, are attended with the diſtillation of a thin fluid from the noſe, and ſometimes from the eyes; and theſe fluids are often found to be ſomewhat acrid, both by their taſte and by their fretting the parts over which they paſs. Theſe ſymptoms conſtitute the coryza and gravedo of authors, and are commonly attended with a ſenſe of laſſitude over the whole body. Sometimes cold ſhiverings are felt; at leaſt the body is more ſenſible than uſual to the coldneſs of the air; and with all this the pulſe is more frequent than ordinary, eſpecially in the evenings

Theſe ſymptoms have ſeldom continued long before they are accompanied with ſome hoarſeneſs, and a ſenſe of roughneſs and ſoreneſs in the trachea, with ſome difficulty of breathing, expreſſed by a ſenſe of ſtraitneſs in the cheſt, and with a cough which ſeems to ariſe from ſome irritation felt at the glottis. This cough is generally at firſt dry and painful, occaſioning pains about the cheſt, and more eſpecially in the breaſt; ſometimes, together with theſe ſymptoms, pains reſembling thoſe of the rheumatiſm are felt in ſeveral parts of the body, particularly about the neck and head. With all theſe ſymptoms, the appetite is impaired, ſome thirſt ariſes, and a feveriſh laſſitude is felt all over the body. Theſe ſymptoms mark the height and violence of the diſeaſe; but commonly it does not continue long. By degrees the cough becomes attended with a more copious excretion of mucus; which is at firſt thin, but gradually becoming thicker, is brought up with leſs frequent and leſs laborious coughing. The hoarſeneſs and ſoreneſs of the trachea are alſo relieved or removed; and the febrile ſymptoms abating, the expectoration becomes again leſs, and the cough leſs frequent, till at length they ceaſe altogether.

Such is generally the courſe of this diſeaſe, neither tedious nor dangerous; but it is ſometimes in both reſpects otherwiſe. When a catarrh has been occaſioned by a violent cauſe, when it has been aggravated by improper management, and eſpecially when it has been rendered more violent by freſh and repeated applications of cold, it often paſſes into a pneumonic inflammation, attended with the utmoſt danger.

Unleſs, however, ſuch accidents as thoſe happen, a catarrh, in ſound perſons not far advanced in life, is always a ſlight and ſafe diſeaſe: but, in perſons of a phthiſical diſpoſition, a catarrh may readily produce a hemoptyſis, or perhaps form tubercles in the lungs; and, more certainly in perſons who have tubercles already formed in the lungs, an accidental catarrh may occaſion the inflammation of theſe tubercles, and in conſequence produce a phthiſis pulmonalis.

In elderly perſons, a catarrh ſometimes proves a dangerous diſeaſe. Many perſons as they advance in life, and eſpecially after they have arrived at old age, have the natural mucus of the lungs poured out in greater quantity, and requiring a frequent expectoration. If, therefore, a catarrh happen to ſuch perſons, and increaſe the afflux of fluids to the lungs, with ſome degree of inflammation, it may produce the peripneumonia notha, which in ſuch caſes is very often fatal.

Cauſes, &c. The proximate cauſe of catarrh ſeems to be an increaſed afflux of fluids to the mucous membrane of the noſe, fauces, and bronchiæ, along with ſome degree of inflammation affecting the ſame. The latter circumſtance is confirmed by this, that, in the caſe of catarrh, the blood drawn from a vein commonly exhibits the ſame inflammatory cruſt which appears in the caſe of phlegmaſiæ. The remote cauſe of catarrh is moſt commonly cold applied to the body. This application of cold producing catarrh is generally evident and obſerved; and would always be ſo, were men acquainted with and attentive to the circumſtances which determine cold to act upon the body.

The application of cold which occaſions a catarrh, probably operates by ſtopping the perſpiration uſually made by the ſkin, and which is therefore determined to the mucous membrane of the parts above-mentioned. As a part of the weight which the body daily loſes by inſenſible evacuation, is owing to an exhalation from the lungs, there is probably a connection between this exhalation and the cutaneous reſpiration, ſo that the one may be increaſed according as the other is diminiſhed; and therefore we may underſtand how the diminution of cutaneous perſpiration, by the application of cold, may increaſe the afflux of fluids to the lungs, and thereby produce a catarrh.

Dr. Cullen obſerves that there are ſome obſervations of Dr. James Keil which may render this matter doubtful; but ſays there is a fallacy in thoſe obſervations. The evident effects of cold in producing coryza, leave the matter, in general, without doubt; and there are ſeveral other obſervations which ſhew a connection between the lungs and the ſurface of the body.

Whether from the ſuppreſſion of perſpiration, a catarrh be produced merely by an increaſed afflux of fluids, or whether further the matter of perſpiration be at the ſame time determined to the mucous glands, and there excites a particular irritation, may be uncertain; but our author thinks the latter ſuppoſition is moſt probable. Although, in the caſe of a common catarrh, which is in many inſtances ſporadic, it may be doubtful whether any morbific matter be applied to the mucous glands; we are, however, certain that the ſymptoms of a catarrh do frequently depend upon ſuch a matter being applied to theſe glands, as appears from the caſe of meaſles, chincough, and eſpecially from the frequent occurrence of contagious and epidemical catarrhs.

The phenomena of contagious catarrhs have been much the ſame with thoſe of the others; and the diſeaſe has always been particularly remarkable for this, that it has been the moſt widely and generally ſpreading epidemic known. It has ſeldom appeared in any one country of Europe, without appearing ſucceſſively in every different part of it; and, in ſome inſtances, it has been alſo transferred to America, and has been ſpread there in like manner, ſo far as we have had opportunities of being informed. The catarrh from contagion appears with nearly the ſame ſymptoms as thoſe above-mentioned. It ſeems often to come on in conſequence of the application of cold. It comes on with more cold ſhivering than the catarrh ariſing from cold alone; and the former does alſo not only ſooner ſhew febrile ſymptoms, but to a more conſiderable degree. Accordingly, it more ſpeedily runs its courſe, which is commonly finiſhed in a few days. It ſometimes ends by a ſpontaneous ſweat; and this, in ſome perſons, produces a miliary eruption. It is, however, the febrile ſtate of this diſeaſe eſpecially, that is finiſhed in a few day; for the cough and other catarrhal ſymptoms do frequently continue longer, and often when they appear to be going off, they are renewed by any freſh application of cold.

Cure. The cure of catarrh is nearly the ſame, whether it proceeds from cold or contagion; only in the latter caſe remedies are commonly more neceſſary than in the former. In the caſes of a moderate diſeaſe, it is commonly ſufficient to avoid cold, or to abſtain from animal-food for ſome days, or perhaps for the ſame time to lie a-bed, and, by taking frequently ſome mild and diluent drink, a little warmed, to promote a very gentle ſweat, and after this to take care to return very gradually only to the uſe of the free

air

When the diſeaſe is more violent, not only the antiphlogiſtic regimen, exactly obſerved, but various remedies alſo, become neceſſary. To take off the phlogiſtic diatheſis, which always attends this diſeaſe, blood-letting, more or leſs, according as the ſymptoms ſhall require, is the proper remedy. After blood-letting for reſtoring the determination of the fluids to the ſurface of the body, and at the ſame time for expediting the ſecretion of mucus in the lungs, which may take off the inflammation of its membrane, vomiting is the moſt effectual means. For the laſt mentioned purpoſe, it has been ſuppoſed that ſquills, gum-ammoniac, the volatile alkali, and ſome other medicines, might be uſeful; but their efficacy has never been found conſiderable: and if ſquills have ever been very uſeful, it ſeems to have been rather by their emetic than by their expectorant powers. When the inflammatory affections of the lungs ſeem to be conſiderable, it is proper, beſides blood-letting, to apply bliſters to the back or ſides.

As a cough is often the moſt troubleſome circumſtance of this diſeaſe, ſo demulcents may be employed to alleviate it. But after the inflammatory ſymptoms are much abated, if the cough ſtill remains, opiates afford the moſt effectual means of relieving it; and, in the circumſtances juſt now mentioned, they may be very ſafely employed. After the inflammatory and febrile ſtates of this diſeaſe are very much gone, the moſt effectual means of diſcuſſing all remains of the catarrhal affection, is by ſome exerciſe of geſtation diligently employed.

Beſides the remedies above-mentioned, Mr. Mudge, in a treatiſe on this diſeaſe, recommends the ſteam of warm water from the inhaler, as a moſt efficacious and ſafe remedy for a catarrh, and which indeed he ſeems to conſider as little leſs than *infallible:* but he gives a caution to people in health, who may accidentally ſee his machine, not to make the experiment of breathing through cold water with it, or they will be almoſt certain of catching a ſevere cold with it. His directions for thoſe troubled with the catarrh are as follow:

"In the evening, a little before bed-time, the patient, if of adult age, is to take three drachms, or as many tea-ſpoonfuls, of elixir paregoricum, in a glaſs of water: if the ſubject is younger, for inſtance, under five years old, one tea-ſpoonful; or within that and ten years, two. Each tea-ſpoonful contains ſomewhat leſs than one quarter of a grain of opium. About three quarters of an hour after, the patient ſhould go to bed, and, being covered warm, the inhaler three parts filled with water nearly boiling, (which, from the coldneſs of the metal, and the time it ordinarily takes before it is uſed by the patient, will be of a proper degree of warmth,) and being wrapped up in a napkin, but ſo that the valve in the cover is not obſtructed by it, is to be placed at the arm-pit, and the bed clothes being drawn up and over it cloſe to the throat, the tube is to be applied to the mouth, and the patient ſhould inſpire and expire through it about twenty minutes or half an hour.

"It is very evident, as the whole act of reſpiration is performed though the machine, that in inſpiration the lungs will be filled with air which will be hot, and loaded with vapour, by paſſing through the body of water; and in expiration, all that was contained in the lungs will, by mixing with the ſteam on the ſurface of the water, be forced through the valve in the cover, and ſettle on the ſurface of the body under the bed-cloaths.

"The great uſe of this particular conſtruction of the inhaler is this. Firſt, as there is no neceſſity, at the end of every inſpiration, to remove the tube from the mouth, in order to exſpire from the lungs the vapour which had been received into them, this machine may therefore be uſed with as much eaſe by children as older people. And, ſecondly, as a feveriſh habit frequently accompanies the diſorder, the valve in that reſpect alſo is of the utmoſt importance: for a ſweat, or at leaſt a free perſpiration, not only relieves the patient from the reſtleſs anxiety of a hot, dry, and ſometimes parched ſkin, but is alſo, of all others, the moſt eligible evacuation for removing the fever; and it will be generally found, that, after the inhaler ſo conſtructed hath been uſed a few minutes, the warm vapour under the cloaths will, by ſettling upon the trunk, produce a ſweat, which will gradually extend itſelf to the legs and feet.

"In a catarrhous fever, or any feveriſh habit attending this cough, it would be proper to take a draught of warm thin whey a few minutes before the inhaler is uſed; and after the proceſs is over, the ſweat which it has produced may be continued by occaſional ſmall draughts of weak warm whey or barley water. The ſweating is by no means ſo neceſſary to the cure of the catarrhous cough, as that the ſucceſs of the inhaler againſt that complaint at all depends upon it; yet I cannot help once more remarking, that when this diſorder happens to be accompanied with a feveriſh habit, the advantages of this particular conſtruction will be very important.

"After this reſpiratory proceſs is over, the patient uſually paſſes the night without the leaſt interruption from the cough, and feels no farther moleſtation from it than once or twice in the morning to throw off the trifling leakage which, unperceived, had dripped into the bronchæ and veſicles during the night; the thinner parts of which being evaporated, what remains is ſoon got rid of with a very gentle effort.

"I cannot, however, take leave of this part of my ſubject, without pointedly obſerving, that if the patient means not to be diſappointed by my aſſurances or his own expectations, it is eſſentially neceſſary that the following remarks, with regard to the time and manner of uſing this proceſs, ſhould be ſtrictly attended to.

"Firſt, That as tender valetudinary people are but too well acquainted with the firſt notices of the diſorder, the remedy muſt, or ought to be, uſed the ſame evening; which will, in an ordinary ſeizure, be attended with an immediate cure: but if the ſoreneſs of the reſpiratory organs, or the petulance of the cough, ſhew the cold which has been contracted to have been very ſevere, the inhaler, without the opiate, ſhould be again repeated for the ſame time the next morning.

"Secondly, if the uſe of the inhaler, &c. is delayed till the ſecond night, it will be always right to repeat it again the next morning without the opiate, but with it if the ſeizure has been violent.

"And, laſtly, if the cough is of ſome days ſtanding, it will be always neceſſary to employ both parts of the proceſs at night and the ſucceeding morning, as the firſt ſimple inflammatory miſchief is now moſt probably aggravated by an additional one of a chronic tendency.

"But if, through the want of a timely application, or a total neglect of this or any other remedy, the cough ſhould continue to harraſs the patient, it is, particularly in delicate and tender conſtitutions, of the utmoſt conſequence to attempt the removal of it as ſoon as poſſible, before any floating acrimony in the conſtitution (from the perpetual irritation) receives an habitual determination to an organ ſo eſſential to life as the lungs.

"If the patient expectorates with eaſe and freedom a thick and well-digeſted inoffenſive phlegm, there is generally but little doubt of his ſpitting off the diſorder, with common care, in a few days; and till that is accompliſhed, a proper doſe of elixir paregoricum for a few ſucceſſive nights will be found very uſeful in ſuppreſſing the fatiguing irritation and ineffectual cough, occaſioned by a matter which, dripping in the early ſtate of the diſeaſe into the bronchiæ during the night, is commonly at that time too thin to be diſcharged by thoſe convulſive efforts.

"If, however, notwithſtanding a free and copious expectoration, the cough ſhould ſtill continue, and the diſcharge, inſtead of removing the complaint, ſhould itſelf, by becoming a diſeaſe, be a greater expence than the conſtitution can well ſupport, it is poſſible that a tender patient may ſpit off his life through a weak relaxed pair of lungs, without the leaſt appearance of purulence, or any ſuſpicion of ſuppuration. In thoſe circumſtances, beſides, as was mentioned before, increaſing the general perſpiration by the ſalutary friction of a flannel waiſtcoat, change of ſituation, and more eſpecially long journeys on horſeback, conducted as much as poſſible through a thin, ſharp, dry air, will ſeldom fail of removing the complaint.

"But, on the contrary, if the cough ſhould, at the ſame time that it is petulant and fatiguing to the breaſt, continue dry, huſky, and without expectoration; provided there is reaſon to hope that no tubercles are forming, or yet actually formed, there is not perhaps a more efficacious remedy for it than half a drachm of gum ammoniacum, with 18 or 20 drops of laudanum, made into pills, and taken at bed-time, and occaſionally repeated. This excellent remedy Sir John Pringle did me the honour to communicate to me; and I have accordingly found it, in a great many inſtances, amazingly ſucceſsful, and generally very expeditiouſly ſo; for it ſeldom fails to produce an expectoration, and to abate the diſtreſſing fatigue of the cough. In thoſe circumſtances I have likewiſe found the common remedy of ʒſs or ℈ij of *balſ. ſulph. aniſat.* taken twice a-day, in a little powdered ſugar, or any other vehicle, a very efficacious one. I have alſo, many times, known a ſalutary revulſion made from the lungs by the ſimple application of a large plaſter, about five or ſix inches diameter, of *pix Burgund.* between the ſhoulders; for the perſpirable matter, which is locked up under it, becomes ſo ſharp and acrid, that in a few days it ſeldom fails to produce a very conſiderable itching, ſome little tendency to inflammation, and very frequently a great number of boils. This application ſhould be continued (the plaſter being occaſionally changed) for three weeks or a month, or longer, if the complaint is not ſo ſoon removed.

"And here I cannot help obſerving, that, though ſeemingly a trifling, it is however by no means a uſeleſs caution to the tender patient, not to expoſe his ſhoulders in bed, and during the night, to the cold; but when he lies down to take care they are kept warm, by drawing the bed-cloathes up cloſe to his back and neck.

"If, however, notwithſtanding theſe means, the cough, continuing dry or unattended with a proper expectoration, ſhould perſevere in harraſſing the patient; if, at laſt, it ſhould produce, together with a ſoreneſs, ſhooting pains through the breaſt and between the ſhoulders, attended alſo with ſhortneſs of the breath: and if, added to this, fluſhes of the cheeks after meals, ſcalding in the hands and feet, and other ſymptoms of a hectic, ſhould accompany the diſorder; there is certainly no time to be loſt, as there is the greateſt reaſon to apprehend that ſome acrimony in the habit is determined to the tender ſubſtance of the lungs, and that conſequently tubercular ſuppurations will follow. In this critical and dangerous ſituation, I think I can venture to ſay from long experience, that, accompanied from change of air and occaſional bleedings, the patient will find his greateſt ſecurity in a drain from a large ſcapulary iſſue, aſſiſted by a diet of aſſes milk and vegetables.

Genus XXXIV. DYSENTERIA, *the* Dysentery.

Deſcription. The dyſentery is a diſeaſe in which the patient has frequent ſtools, accompanied with much griping, and followed by a teneſmus. The ſtools, though frequent, are generally in ſmall quantity; and the matter voided is chiefly mucus, ſometimes mixed with blood. At the ſame time, the natural fæces ſeldom appear; and, when they do, it is generally in a compact and hardened form. This diſeaſe occurs eſpecially in ſummer and autumn, at the ſame time with autumnal, intermittent, and remittent fevers; and with theſe it is often complicated. It comes on ſometimes with cold ſhiverings and other ſymptoms of pyrexia; but more commonly the ſymptoms of the topical affection appear firſt. The belly is coſtive, with an unuſual flatulence in the bowels. Sometimes, though more rarely, ſome degree of diarrhœa is the firſt appearance. In moſt caſes, the diſeaſe begins with griping, and a frequent inclination to go to ſtool. In indulging this, little is voided, but ſome teneſmus attends it. By degrees the ſtool becomes more frequent, the griping more ſevere, and the teneſmus more conſiderable. With theſe ſymptoms there is a loſs of appetite, and frequently ſickneſs, nauſea, and vomiting, alſo affecting the patient. At the ſame time there is always more or leſs of pyrexia preſent. It is ſometimes of the remittent kind, and obſerves a tertian period. Sometimes the pyrexia is manifeſtly inflammatory, and very often of a putrid kind. Theſe febrile ſtates continue to accompany the diſeaſe during its whole courſe, eſpecially when it terminates ſoon in a fatal manner. In other caſes, the febrile ſtate almoſt entirely diſappears, while the proper dyſenteric ſymptoms remain for a long time after.

Accompanied with theſe circumſtances, the diſeaſe proceeds for a longer or a ſhorter time. When the pyrexia attending it is of a violent inflammatory kind, and more eſpecially when it is of a very putrid nature, the diſeaſe often terminates fatally in a very few days, with all the marks of a ſupervening gangrene. When the febrile ſtate is more moderate, or diſappears altogether, the diſeaſe is often protracted for weeks, and even for months; but, even then, after a various duration, it often terminates fatally, and generally in conſequence of a return and conſiderable aggravation of the inflammatory and putrid ſtates. In ſome caſes, the diſeaſe ceaſes ſpontaneouſly; the frequency of ſtools, the griping, and teneſmus, gradually diminiſhing, while natural ſtools return. In other caſes, the diſeaſe, with moderate ſymptoms, continues long, and ends in a diarrhœa, ſometimes accompanied with lienteric ſymptoms.

Cauſes. The dyſentery often does manifeſtly ariſe from the application of cold, but the diſeaſe is always contagious; and, by the propagation of ſuch contagion, independent of cold, or other exciting cauſes, it becomes epidemic, in camps and other places. It is, therefore, to be doubted if the application of cold ever produces the diſeaſe, unleſs where the ſpecific contagion has been previouſly received into the body: and, upon the whole, it is probable that a ſpecific contagion is to be conſidered as always the remote cauſe of this diſeaſe.

The common opinion has been that the diſeaſe depends upon an acrid matter thrown upon or by ſome means generated in the inteſtines, exciting their periſtaltic motion, and thereby producing the frequent ſtools which occur in this diſeaſe. But this ſuppoſition cannot be admitted; for, in all the inſtances known, of acrid ſubſtances applied to the inteſtines, and producing frequent ſtools, as might be expected from acrid ſubſtances applied to any length of the inteſtines. This, however, is not the caſe in dyſentery, in which the ſtools, however frequent, are generally in very ſmall quantity, and ſuch as may be ſuppoſed to proceed from the lower parts of the rectum only. With reſpect to the ſuperior portions of the inteſtines, and particularly thoſe of the colon, it is probable they are under a preternatural and conſiderable degree of conſtriction: for, as we have ſaid above, the natural fæces are ſeldom voided; and when they are, it is in a form which gives reaſon to ſuppoſe they have been long retained in the cells of the colon, and conſequently that the colon had been affected with a preternatural conſtriction. This is confirmed by almoſt all the diſſections which have been made of the bodies of dyſenteric patients; in which, when gangrene had not entirely deſtroyed the texture and form of the parts, conſiderable portions of the great guts have been found affected with a very conſiderable conſtriction.

The proximate cauſe of dyſentery, or at leaſt the chief part of the proximate cauſe, ſeems to conſiſt in a preternatural conſtriction of the colon, occaſioning, at the ſame time, thoſe ſpaſmodic efforts which are felt in ſevere gripings, and which efforts, propagated downwards to the rectum, occaſion there the frequent mucous ſtools and teneſmus.

Cure. The moſt eminent of our late practitioners, and of greateſt experience in this diſeaſe, ſeem to be of opinion, that it is to be cured moſt effectually by purging, aſſiduouſly employed. The means may be various: but the moſt gentle laxatives are uſually ſufficient; and, as the medicine muſt be frequently repeated, theſe are the moſt ſafe, the more eſpecially as an inflammatory ſtate ſo frequently accompanies the diſeaſe. Whatever laxatives produce an evacuation of natural fæces, and a conſequent remiſſion of the ſymptoms, will be ſufficient to effectuate the cure. But, if the gentle laxatives ſhall not produce the evacuation now mentioned, ſomewhat more powerful muſt be employed; and nothing is more proper or convenient than tartar emetic, given in ſmall doſes, and at ſuch intervals as may determine their operation to be chiefly by ſtool.

Vomiting has been held a principal remedy in this diſeaſe; and may be uſefully employed in the beginning of the diſeaſe, with a view to both the ſtate of the ſtomach and of the fever: but it is not neceſſary to repeat it often; and, unleſs the emetics employed operate alſo by ſtool, they are of little ſervice. Ipecacuanha is by no means a ſpecific; and it proves only uſeful when ſo managed as to operate chiefly by ſtool.

For relieving the conſtriction of the colon, and evacuating the retained fæces, glyſters may ſometimes be uſeful; but they are ſeldom ſo effectual as laxatives, given by the mouth; and acrid glyſters, if they be not effectual in evacuating the colon, may prove hurtful by ſtimulating the rectum too much.

The frequent and ſevere griping attending this diſeaſe, leads almoſt neceſſarily to the uſe of opiates; and they are very effectual for the purpoſe of relieving from the gripes; but, by occaſioning an interruption of the action of the ſmall guts, they favour the conſtriction of the colon, and thereby aggravate the diſeaſe.

From our account of the nature of this diſeaſe, it will be ſufficiently obvious, that the uſe of aſtringents in the beginning of it muſt be abſolutely pernicious. Whether an acrid matter be the original cauſe of the dyſentery may be uncertain; but, from the indigeſtion, and the ſtagnation of fluids, which attend the diſeaſe, we may ſuppoſe that ſome acrid matters are conſtantly preſent in the ſtomach and inteſtines, and therefore that demulcents may be always uſefully employed. At the ſame time, from this conſideration that mild oily matters thrown into the inteſtines in conſiderable quantity always prove laxative; therefore the oleaginous demulcents are the moſt uſeful.

As this diſeaſe is ſo often of an inflammatory or of a putrid nature, it is evident that the diet employed in it ſhould be vegetable and aceſcent. Milk in its entire ſtate, is of doubtful quality in many caſes; but ſome portion of the cream is often allowable, and whey is always proper. At the beginning of the diſeaſe, abſorbents ſeem to be ſuperfluous; and, by their aſtringent and ſeptic powers, they may be hurtful.

When this diſeaſe is complicated with an intermittent, and is protracted from that circumſtance chiefly, it is to be treated as an intermittent, by adminiſtering the Peruvian bark, which in the ealier periods of the diſeaſe is hardly to be admitted.

CLASS II. NEUROSES;

An Injury of the Sense and Motion, without any local Affection.

Order I. COMATA.

Genus XXXV. APOPLEXY; *the Sanguineous* Apoplexy.

Deſcription. In this diſeaſe the patients fall ſuddenly down, and are deprived of all ſenſe and voluntary motion, but without convulſions. A giddineſs of the head, noiſe in the ears, coruſcations before the eyes, and redneſs of the face, uſually precede. The diſtinguiſhing ſymptom of the diſeaſe is a deep ſleep, attended with violent ſnorting; if any thing is put into the mouth, it is returned through the noſe; nor can any thing be ſwallowed without ſhutting the noſtrils; and even when this is done, the perſon is in the utmoſt danger of ſuffocation. Sometimes apoplectic patients will open their eyes after having taken a large doſe of an emetic; but if they ſhew no ſign of ſenſe, there is not the leaſt hope of their recovery. Sometimes the apoplexy terminates in an hemiplegia; in which caſe it comes on with a diſtortion of the mouth towards the ſound ſide, drawing of the tongue the ſame way, and ſtammering of the ſpeech. Diſſections ſometimes ſhew a rupture of ſome veſſels of the meninges, or of the brain itſelf; though ſometimes, if we may believe Dr. Willis, no defect is to be obſerved either in the cerebrum or cerebellum.

Cauſes, &c. The general cauſe of the ſanguineous apoplexy is a plethoric habit of body, with a determination to the head. The diſeaſe therefore may be brought on by whatever violently urges on the circulation of the blood; ſuch as ſurfeits, intoxication, violent paſſions of the mind, immoderate exerciſe, &c. It takes place, however, for the moſt part, when the venus plethora hath ſubſiſted for a conſiderable time in the ſyſtem. For that reaſon it commonly does not attack people till paſt the age of 60; and that whether the patients are corpulent and have a ſhort neck, or whether they are of a lean habit of body. Till people are paſt the age of childhood, apoplexy never happens.

Prognoſis. This diſeaſe very often kills at its firſt attack; and few ſurvive a repetition of the fit; ſo that thoſe who make mention of people who have ſurvived ſeveral attacks of the apoplexy, have probably miſtaken the epilepſy for it. In no diſeaſe is the prognoſis more fatal; ſince thoſe who ſeem to be recovering from a fit, are frequently and ſuddenly carried off by its return, without either warning of its approach, or poſſibility of preventing it. The good ſigns are when the diſeaſe apparently wears off, and the patient evidently begins to recover; the bad ones are when all the ſymptoms continue and increaſe.

Cure. This is to be attempted, by large and repeated bleedings; emetics and ſtimulating glyſters. The body is to be kept in a ſomewhat erect poſture, and the head kept up.

Apoplexy *from Poiſons.*

The poiſons which bring on an apoplexy when taken internally are thoſe of the ſtimulant and ſedative kind, as ſpirituous liquors, opium, and the more violent kinds of vegetable poiſons. The vapours of mercury, or of lead, in great quantity, will ſometimes produce a ſimilar effect; though commonly they produce rather a paralyſis, and operate ſlowly. The vapours of charcoal, or fixed air, in any form, breathed in great quantity, alſo produce an apoplexy, or a ſtate very ſimilar to it; and even cold itſelf produces a fatal ſleep, though without the apoplectic ſnorting. To enumerate all the different ſymptoms which affect the unhappy perſons who have followed opium, or any of the ſtronger vegetable poiſons, is impoſſible, as they are ſcarce to be found the ſame in any two patients. The ſtate induced by them ſeems to differ ſomewhat from that of a true apoplexy; as it is commonly attended with convulſions, but hath the particular diſtinguiſhing ſign of apoplexy, namely, a very difficult breathing or ſnorting, more or leſs violent according to the quantity of poiſonous matter ſwallowed.

Of the poiſonous effects of fixed air, Dr. Percival gives the following account. "All theſe noxious vapours, whether ariſing from burning charcoal, the fermenting grape, the Grotti di Cani, (ſee Grotto) or the cavern of Pyrmont, operate nearly in the ſame manner. When accumulated and confined, their effects are often inſtantaneous; they immediately deſtroy the action of the brain and nerves, and in a moment arreſt the vital motions. When more diffuſed, their effects are ſlower, but ſtill evidently mark out a direct affection of the nervous ſyſtem.

"Thoſe who are expoſed to the vapours of the fermenting grape, are as inſtantly deſtroyed as they would be by the ſtrongeſt electrical ſhock. A ſtate of inſenſibility is the immediate effect upon thoſe animals which are thruſt into the Grotti di Cani, or the cavern of Pyrmont: the animal is deprived of motion, lies as if dead; and if not quickly returned into the freſh air, is irrecoverable. And if we attend to the hiſtories of thoſe who have ſuffered from the vapours of burning charcoal, we ſhall in like manner find, that the brain and moving powers are the parts primarily affected.

"A perſon was left reading in bed with a pan of charcoal in a corner of the room. On being viſited early the next morning, he was found with his eyes ſhut, his book open and laid on one ſide, his candle extinguiſhed, and to appearance like one in a deep ſleep. Stimulants and cupping-glaſſes gave no relief; but he was ſoon recovered by the free acceſs of freſh air.

"Were the following cautions generally attended to, they might in ſome inſtances be the happy means of preſerving life. Never to be confined with burning charcoal in a ſmall room, or where there is not a free draught of air by a chimney or ſome other way. Never to venture into any place in which air has been long pent up, or which from other circumſtances ought to be ſuſpected; unleſs ſuch ſuſpected place be either previouſly well ventilated, or put to the teſt of the lighted candle. For it is a ſingular and well-known fact, that the life of flame is in ſome circumſtances ſooner affected and more expeditiouſly extinguiſhed by noxious vapours, than animal-life.

"The moſt obvious, effectual, and expeditious means of relief to thoſe who have unhappily ſuffered from this cauſe, are ſuch as will diſlodge and waſh away the poiſon, reſtore the energy of the brain and nerves, and renew the vital motions. Let the patient therefore be immediately carried into the open air, and let the air be fanned backwards and forwards to aſſiſt its action: let cold water be thrown on the face; let the face, mouth, and noſtrils, be repeatedly waſhed; and as ſoon as practicable, get the patient to drink ſome cold water. But if the caſe is too far gone to be thus relieved, let a healthy perſon breathe into the mouth of the patient; and gently force air into the mouth, throat, and noſtrils. Frictions, cupping, bleeding, and bliſters, are likewiſe indicated. And if, after the inſtant danger is removed, a fever be excited, the method of cure muſt be adapted to the nature and prevailing ſymptoms of the fever."

With regard to the poiſon of opium, Dr. Mead recommends the following method of cure. Beſides evacuations by vomiting, bleeding, and bliſtering, acid medicines and lixivial ſalts are proper. Theſe contract the relaxed fibres, and by their diuretic force make a depletion of the veſſels. Our author ſays he hath given repeated doſes of a mixture of ſalt of wormwood and juice of lemons, with extraordinary ſucceſs.

Apoplexy *from Paſſions of the Mind.*

Apoplexies from violent paſſions may be either ſanguineous or ſerous, though more commonly of the former than the latter ſpecies. The treatment is the ſame in either caſe. Or they may partake of the nature of catalepſy; in which caſe the method of treatment is the ſame with that of the genuine catalepſy.

Apoplexy *from Suffocation.*

This is the kind of apoplexy which takes place in thoſe who are hanged or drowned. For the treatment of thoſe perſons, ſee the articles Hanging and Drowning.

Beſides the ſpecies above-mentioned, the apoplexy is a ſymptom in many other diſtempers, ſuch as fevers both continued and intermitting, exanthemata hyſteria, epilepſy, gout, worms, iſchuria, and ſcurvy.

Genus XXXVI. PARALYSIS, *the* Palsy.

Deſcription. The palſy ſhows itſelf by a ſudden loſs of tone and vital power in a certain part of the body. In the ſlighter degrees of the diſeaſe, it only affects a particular muſcle, as the ſphincter of the anus or bladder, thus occaſioning an involuntary diſcharge of excrements or of urine; of the muſcles of the tongue, which occaſions ſtammering, or loſs of ſpeech; of the muſcles of the larynx, by which the patient becomes unable to ſwallow ſolids, and ſometimes even liquids alſo. In the higher degrees of the diſeaſe, the paralytic affection is diffuſed over a whole limb, as the foot, leg, hand, or arm; and ſometimes it affects a whole ſide of the body, in which caſe it is called ***hemiplegia***; and ſometimes, which is the moſt violent caſe, it affects all the parts below the waſte, or even below the head, though this laſt is exceedingly rare. In theſe violent caſes, the ſpeech is either very much impeded, or totally loſt. Convulſions often take place in the ſound ſide, with the cynic ſpaſm or involuntary laughter, and other diſtortions of the face. Sometimes the whole paralytic part of the body becomes livid, or even mortifies before the patient's death; and ſometimes the paralytic parts gradually decay and ſhrivel up, ſo as to become much leſs than before.

Cauſes, &c. Palſies muſt commonly ſupervene the different ſpecies of coma, eſpecially the apoplexy. They are alſo occaſioned by any debilitating power applied to the body, eſpecially by exceſſes in venery. Sometimes they are a kind of criſis to other diſtempers, as the colic of Poictou, and the apoplexy. The hemiplegia eſpecially often follows the laſt mentioned diſeaſe. Aged people, and thoſe who are by any other means debilitated, are ſubject to palſy; which will ſometimes alſo affect even infants, from the repulſion of exanthemata of various kinds. Palſies are alſo the infallible conſequences of injuries of the large nerves.

Prognoſis. Except in the ſlighter caſes of palſy, we have little room to hope for a cure; however, death doth not immediately follow even the moſt ſevere paralytic affections. In an hemiplegia it is not uncommon to ſee the patients live ſeveral years; and even in the paraplegia, if death does not enſue within two or three weeks, it may not take place for a conſiderable time. It is a promiſing ſign when the patient feels a ſlight degree of painful itchineſs in the affected parts; and if a fever ſhould ariſe, it bids fair to cure the palſy. When the ſenſe of feeling remains, there is much more room to hope for a cure than when it is gone, as well as the power of motion. But when we obſerve the fleſh to waſte, and the ſkin to appear withered and dry, we may look upon the diſeaſe to be incurable. Convulſions ſupervening on a palſy are a fatal ſign.

Cure. Many remedies have been recommended in palſies: but it muſt be confeſſed, that, except in the ſlighter caſes, medicines ſeldom prove effectual; and before any ſcheme of cure can be laid down, every circumſtance relative to the patient's habit of body and previous ſtate of health ſhould be carefully weighed. If an hemiplegia or paraplegia ſhould come on after an apoplexy, attended with thoſe circumſtances which phyſicians have ſuppoſed to denote a viſcid ſtate of the blood, a courſe of the attenuant gums, with fixed alkaline ſalts, and chalybeate waters, may do ſervice; to which it will be proper to add frictions with the volatile liniment all down the ſpine; but in habits where the blood is rather inclined to the watery ſtate, it will be neceſſary to give emetics from time to time; to apply bliſters, and cut iſſues.

The natural hot baths are often found uſeful in paralytic caſes; and where the patients cannot avail themſelves of theſe, an artificial bath may be tried by diſſolving ſalt of ſteel in water, and impregnating the water with fixed air. Frictions of the parts, and ſcourging them with nettles, have alſo been recommended, and may do ſervice, as well as volatile and ſtimulating medicines taken inwardly.

Order II. ADYNAMIÆ.

Diminution of the Involuntary Motions.

Genus XXXVII. SYNCOPE, or Fainting.

Deſcription. A ſyncope begins with a remarkable anxiety about the heart; after which follows a ſudden extinction, as it were, not only of the animal powers, and actions, but alſo of the vital powers, ſo that the patients are deprived of pulſe, ſenſe, and motion, all at once. In thoſe caſes which phyſicians have diſtinguiſhed by the name of *leipothymia*, the patient does not entirely loſe his ſenſes, but turns cold, and pale; and the pulſe continues to beat, though weakly; the heart alſo ſeems to tremble rather than beat; and the reſpiration is juſt perceptible. But in the true ſyncope or full aſphyxia, not the ſmalleſt ſign of life can be perceived; the face hath a death-like paleneſs, the extremities are cold, the eyes ſhut, or at leaſt troubled; the mouth ſometimes ſhut, and ſometimes gaping wide open; the limbs flaccid, and the ſtrength quite gone; as ſoon as they begin to recover, they fetch deep and heavy ſighs.

Cauſes, &c. Fainting is occaſioned moſt commonly by profuſe evacuations, eſpecially of blood; but it may happen alſo from violent paſſions of the mind, from ſurfeits, exceſſive pain, &c. People of delicate conſtitutions are very ſubject to it from ſlight cauſes; and ſometimes it will ariſe from affections of the heart and large veſſels not eaſy to be underſtood. Fainting is alſo a ſymptom of many diſorders, eſpecially of that fatal one called a *polypus of the heart*, of the plague, and many putrid diſeaſes.

Prognoſis. When fainting happens in the beginning of any acute diſtemper, it is by no means a good omen; but when it takes place in the increaſe or at the height of the diſeaſe, the danger is ſomewhat leſs; but in general, when fainting comes on without any evident cauſe, it is to be dreaded. In violent hæmorrhages it is favourable; as the bleeding veſſels thus have time to contract and recover themſelves, and thus the patient may eſcape.

Cure. When perſons of a full habit faint through exceſs of paſſion, they ought to be blooded without delay, and ſhould drink vinegar or lemon juice diluted with water; and, after the bowels are emptied by a clyſter, take a paregoric draught, and go to bed.

The general effects of a ſudden fright have been mentioned on a former occaſion. When theſe are ſo violent as to require medical aid, our firſt endeavours muſt be to take off the ſpaſmodic conſtriction, and reſtore freedom to the circulation; by bleeding, if the habit be at all inclined to fulneſs; and by giving a mixture, with equal parts of the vinum antimoniale and elixir paregoricum, in ſome agreeable vehicle, which will bring on ſleep and encourage perſpiration. It was formerly mentioned, that convulſions, or even an epilepſy, may be brought on by frights; which ſhould make people cautious of playing fooliſh tricks in this way.

In order to revive the patients, they ought to be laid along in a horizontal poſture, in an airy place; the legs, thighs, and arms, are to be rubbed with hot flannels; very ſtrong vinegar, or ſalt of hartſhorn, or the ſpirit of this or of ſal ammoniac are to be held to the noſtrils, and rubbed into them, or, being properly diluted, poured down the throat; cold water is to be ſprinkled on the face and neck; and when by theſe means the patient ſhall be ſufficiently revived, wine boiled up with ſome grateful aromatic, is to be given in the proper quantity.

In the fainting conſequent upon profuſe uterine hæmorrhages, it will be a ſafer practice to abſtain from all heating and ſtimulant things; as life, in theſe caſes, is preſerved by the coagulation of the blood in the extremities of the open veſſels; which might be prevented, by the pouring in hot wine, or volatile alkaline ſpirits.

Genus XXXVIII. DYSPEPSIA, *or Difficulty of* Digestion.

Deſcription. It is by no means eaſy to define exactly the diſtempter called *dyſpepſia*, when conſidered as an original diſeaſe, ſeeing there are very few maladies which ſome way or other do not ſhew themſelves by an affection of the ſtomach; and much more difficult ſtill muſt it be to enumerate all its ſymptoms. The moſt remarkable, however, and the moſt common, are the following: Want of appetite; diſtenſion of the ſtomach when no food hath been taken for ſome time before; ſlight dejection of ſpirits; a gradual decay of the muſcular ſtrength; languor, and averſion to motion; the food which is taken without appetite is not well digeſted; the ſtomach and inteſtines are much diſtended with flatus, whence the patients are tormented with ſpaſms, gripes, and ſickneſs: frequently a limpid water, having an acid or putrid taſte, is brought up; ſometimes the food itſelf is thrown up by mouthfuls; and ſometimes, though rarely, the ſame is ſwallowed again, after the manner of ruminating animals. While matters are in this ſituation, the heart ſometimes palpitates, and the breath is quick, and drawn with difficulty; the head achs and is giddy; and ſometimes both theſe ſymptoms are continual, and very violent, inſomuch that the patient is not only tormented with pain, but ſtaggers as if he was drunk. By reaſon of the too great aceſcency or putrefaction of the aliment, a cardialgia or heartburn comes on, and in this ſituation a ſpontaneous diarrhœa ſometimes carries off the diſeaſe; but in other caſes there is an obſtinate coſtiveneſs, attended with colic-pains. Frequently the pulſe is quick, ſometimes ſlow, but always weak: the circulation is ſo languid that the blood can ſcarce reach the extreme veſſels, or at leaſt ſtagnates in them, ſo that the face becomes livid, ſwelled, and has an unuſual appearance: and at the ſame time that the circulation and nervous power are in this languid ſtate, the perſpiration becomes leſs copious; the ſkin becomes dry and corrugated; the natural heat, eſpecially of the extremities, is much diminiſhed; the tongue is white; and an univerſal laxity takes place, inſomuch that the uvula and velum pendulum palati are ſometimes enlarged to ſuch a degree as to become extremely troubleſome.

Cauſes, &c. The cauſes of dyſpepſia may be any thing which debilitates the ſyſtem in general, but in a particular manner affects the ſtomach. Such are opium taken in immoderate quantities, which hurts by its ſedative and relaxing powers; ſpirituous liquors drunk to exceſs; tobacco, tea, coffee, or any warm relaxing liquor, taken in too great quantity; acid, unripe fruits; vomits or purges too frequently taken; an indolent ſedentary life, &c. &c. All theſe act chiefly upon people of a weak and delicate habit; for the robuſt and hardly ſeldom labour under a dyſpepſia, or at moſt a very ſlight one.

Prognoſis. When a dyſpepſia firſt occurs, it is frequently removed without great difficulty; when it is ſymptomatic, we muſt endeavour to cure the primary diſeaſe; but when it frequently returns with ſymptoms of great debility, hectic, or dropſy, we have great reaſon to dread the event.

Cure. A radical cure of dyſpepſia is only to be expected from tonic medicines, which can remove from the ſtomach and ſyſtem that debility on which the diſeaſe depends. But, previous to their uſe, it will be neceſſary to evacuate the contents of the alimentary canal by vomits or purgatives. If there is a tendency to putreſcency, antiſeptics muſt then be exhibited; but more frequently there is a prevailing acidity, which creates an intolerable heart-burn. To palliate this ſymptom, magneſia alba may be given; which is much preferable to the common teſtaceous powders, as being purgative when diſſolved in an acid, while the others are rather aſtringent. In the third volume of the Medical Obſervations, we have an account of two caſes of dyſpepſia attended with a very uncommon degree of cardialgia, in which magneſia was ſo ſucceſsful, that we can ſcarce doubt of its efficacy in ſlighter degrees of the diſorder.

Order III. SPASMI; *Irregular Motions of the Muſcles, or Muſcular Fibres.*

Genus XXXIX. CONVULSION.

Deſcription. When convulſions attack only particular parts of the body, they are generally attended with ſome kind of paralyſis at the ſame time, by which means the affected parts are alternately convulſed and relaxed; a permanent convulſion, or unnatural contraction, of particular muſcles, is called a *ſpaſm*, or *cramp*. Theſe partial convulſions may attack almoſt any part of the body; and are not unfrequently ſymptomatic, in fevers, the cholera morbus, &c. The involuntary ſtartings of the tendons, the picking of the bed-clothes, &c. in acute diſeaſes, &c. are all of them convulſive diſorders.

Cauſes. Convulſions, not only of particular parts, but alſo over the whole body, often take place from cauſes not very evident. Sometimes they ſeem to depend on a certain delicacy or irritability of the nervous ſyſtem, which is framed with ſuch exquiſite ſenſibility as to be ſtrongly affected by the ſlighteſt cauſes. Delicate women are often ſubject to hyſterical convulſions, as alſo hypochondriac people. Convulſions, however, often take their riſe from wounds, irritations of the ſtomach and inteſtines by worms, poiſons, violent cathartics and emetics, &c.; and very often they are ſymptomatic, as in dentition, the ſmall-pox, and many kinds of fevers.

Prognoſis. Except in ſome few caſes, convulſive diſorders are always to be dreaded; but leſs in young people than in ſuch as are advanced in life. Thoſe which attack girls under the age of puberty will generally ceaſe on the appearance of the menſes; and boys have likewiſe a chance of being relieved as they advance in life: but in grown up people, unleſs the cauſe is very evident, a cure is hardly to be expected.

Cure. See Epilepsy.

Genus XL. EPILEPSY, *or* Falling-Sickness.

Deſcription. The epilepſy often attacks ſuddenly, and without giving any warning: but more frequently is preceded by a pain in the head, laſſitude, ſome diſturbance of the ſenſes, unquiet ſleep, unuſual dread, dimneſs of ſight, a noiſe in the ears, palpitation of the heart, coldneſs of the joints, and in ſome there is a ſenſation of formication, or a cold air, &c. aſcending from the lower extremities towards the head. In the fit, the perſons fall ſuddenly to the ground (whence the name of the *falling-ſickneſs*), frequently with a violent cry. The thumbs are ſhut up cloſe in the palms of the hands, and are with difficulty taken out; the eyes are diſtorted, ſo that nothing but the whites are to be ſeen; all ſenſation is ſuſpended, inſomuch, that by no ſmell, noiſe, or otherwiſe, nor even by pinching the body, can they be brought to themſelves; they froth at the mouth, with a hiſſing kind of noiſe; the tongue is frequently lacerated by the teeth, and there is a violent convulſive motion of the arms and legs. Sometimes, however, the limbs, inſtead of being agitated by convulſive motions, are all ſtiff, and the patients are as immoveable as a ſtatue. In children the penis is erected; and in young men there is an emiſſion of the ſemen, and the urine is often thrown out to a conſiderable diſtance. At length there is a remiſſion of the ſymptoms, and the patients recover after a longer or ſhorter interval; when they complain of a pain, torpor, and heavineſs of the head, with a laſſitude of all the joints.

Cauſes, &c. The diſſection of epileptic ſubjects has ſhewn a variety of morbid appearances, which may be ſuppoſed to have contributed to the diſeaſe; ſuch as, indurations in the brain or meninges; caries of the internal ſurface of the cranium; projections of the boney ſubſtance of the ſame, preſſing upon the brain; collections of ſerum or purulent matter, and earthy concretions within the ſcull; beſides many others which are recorded by Bonetus, Morgagni, and Lieutaud. But often the cauſes are impoſſible to be diſcovered; for even in thoſe who have died of the diſeaſe, the brain and all other parts of the nervous ſyſtem have been apparently ſound. The diſeaſe will attack ſtrong as well as weak people; and in thoſe who are ſubject to it, any conſiderable exceſs in drinking, a ſurfeit, violent paſſion, or venery, &c. will certainly bring on a fit. Some have epileptic paroxyſms returning periodically after conſiderable intervals.

Prognoſis. If the epilepſy comes on before the time of puberty, there are ſome hopes of its going off at that time. But it is a bad ſign when it attacks about the 21ſt year, and ſtill worſe if the fits grow more frequent; for then the animal-functions are often deſtroyed, as well as thoſe of the mind, and the patient becomes ſtupid and fooliſh. Sometimes it will terminate in melancholy or madneſs, and ſometimes in a mortal apoplexy or palſy. It hath ſometimes, however, been obſerved, that epilepſies have been removed by the appearance of cutaneous diſeaſes, as the itch, ſmall-pox, meaſles, &c. While the diſeaſe is recent, therefore, we are not to deſpair of a cure; but if it is of long ſtanding, or hereditary, there is very little reaſon to expect that it can be removed.

Cure. In all convulſive diſorders, excepting thoſe which are cured by nature about the time of puberty, the cure by artificial means is very difficult. Numberleſs ſpecifics have been recommended, but all of them have failed of anſwering the expectation. When the cauſe can be diſcovered, that muſt be removed. In other caſes, the cold bath, valerian root, caſtor, muſk, opium, the fœtid gums, Peruvian bark, with the whole tribe of nervous and antiſpaſmodic medicines, have been recommended: but none of theſe, or indeed any combination of them, have been found generally uſeful; though the ſlighter, or ſymptomatic caſes, may often be removed by them.

Of late the *calx*, improperly called the *flowers*, of zinc, have obtained ſuch reputation in convulſive diſorders as to be received into the Edinburgh diſpenſatory. They were propoſed by Dr. Gaubius as an antiſpaſmodic, in his *Adverſaria*; and their efficacy hath ſince been confirmed by various obſervations. In an inaugural diſſertation publiſhed by Dr. Hart at Leyden, the medical virtues of the flowers of zinc are conſidered. He obſerves, that they have long been uſed externally, chiefly for inflammations of the eyes from acrid lymph. Glauber firſt propoſed the internal uſe of them; and Gaubius diſcovered them to be the remedy of the celebrated empiric Luddemannus, under the title of *luna fixata*. After this he exhibited them with ſucceſs in convulſive and ſpaſmodic diſeaſes. Our author ſuppoſes, that they act either as abſorbents, or as poſſeſſing a ſpecific virtue: but is a ſtrong advocate for their efficacy, on whatever principles they may operate; and, in favour of his opinion, relates ſeven caſes in which they proved ſucceſsful. Dr. Gaubius affirms that he has uſed the flowers of zinc in caſes of the chincough, hyſteric hiccough, and ſpaſmus cynicus; that they frequently did more than other medicines, but were by no means ſucceſsful in every caſe. The other cures mentioned by Dr. Hart are ſimilar to thoſe above mentioned, and it does not appear that he ever ſaw a confirmed epilepſy cured by this medicine.

In the firſt volume of *Edin. Medical Commentaries*, p. 204, we have an account by Mr. Benjamin Bell, of a man afflicted with a confirmed epilepſy, who was conſiderably relieved by the flowers of zinc. He was about 35 years of age, and had been ſubject to the diſeaſe for 10 years.

Dr. Percival relates ſome caſes of epilepſy which ſeem to have been cured by the flowers of zinc; and in other caſes, where the diſeaſe was not entirely removed by it, the ſpaſms were nevertheleſs much mitigated. The good effects of flowers of zinc as an antiſpaſmodic are alſo atteſted by Dr. Haygarth of Cheſter and Dr. White of York. The former gives a teſt of their goodneſs which may be of uſe to thoſe who do not prepare them, namely, that the true flowers of zinc when ſtrongly heated become yellow, but reaſſume their white colour on being allowed to cool. The latter gives a caſe of hieranoſos, or ſtrange convulſions of almoſt all the muſcles of the body, cured by zinc, after a number of other remedies had failed. The patient, however, had been formerly much relieved by Ward's antimonial pill.

GENUS XLI. ASTHMA.

The aſthma is a chronic diſeaſe, which may continue to give very great diſtreſs, at intervals, for a conſiderable number of years. Sir John Floyer, when he wrote his celebrated treatiſe, had laboured under repeated paroxyſms for 30 years.

The common diſtinction is into *humid* and *dry*; the former is accompanied with an expectoration of mucus or purulent matter, but the latter is not ſo attended. In the genuine humoral aſthma, the patients are obliged to lean forward; the inſpiration is ſhort and ſpaſmodic; and the expiration very ſlow.

Aſthmatic perſons have generally ſome warning of the attack, from a langour, loſs of appetite, oppreſſion, and ſwelling of the ſtomach from flatulence, which precede the fit; but it is uſually in the middle of the night, that the violent difficulty of breathing comes on.

The duration of the paroxyſm is uncertain, as it will ſometimes terminate in three or four hours, while at other times it ſhall continue for as many days; nay, it has been known to laſt three weeks without intermiſſion. While it ſubſiſts, the patient is in very great diſtreſs, not being able to lie in bed, nor ſcarcely to ſpeak or expectorate, ſo great is the difficulty of breathing; and yet, notwithſtanding all this apparent interruption to the free paſſage of the blood through the lungs, an inflammation here ſeldom or never ſupervenes a fit of the aſthma. As the paroxyſm wears off, and the breathing becomes free, there is more or leſs of an expectoration of mucus; and the urine, from being pale and limpid, becomes high-coloured, and lets fall a copious ſediment.

In order to obtain relief in the fit, we muſt ſometimes bleed, unleſs extreme weakneſs or old age ſhould forbid, and repeat it according to the degrees of ſtrength and fulneſs: a purging clyſter, with a ſolution of aſafœtida, muſt be immediately injected; and if the violence of the ſymptoms ſhould not ſpeedily abate, it will be proper to bliſter the nape of the neck. A very ſtrong infuſion of roaſted coffee has been found to give eaſe in an aſthmatic paroxyſm. Dr. Pringle ſays it is the beſt abater of the paroxyſms of the periodic aſthma that he has ſeen. The coffee ought to be of the beſt Moco, newly burnt, and made very ſtrong immediately after grinding it. He commonly ordered an ounce for one diſh; which is to be repeated freſh after the interval of a quarter, or half an hour; and which is to be taken without milk or ſugar. The medicine in general is mentioned by Muſgrave in his treatiſe *de Arthritide anomala*; but he firſt heard of it from a phyſician in Litchfield, who had been informed by the old people of that place, that Sir John Floyer, during the latter part of his life, kept free from, or at leaſt lived eaſy under his aſthma, from the uſe of very ſtrong coffee. This diſcovery, it ſeems, he made after the publication of his book upon that diſeaſe. Dr Percival ſays he has frequently directed coffee in the aſthma with great ſucceſs.

In the intervals of the fits, perſons ſubject to the aſthma, eſpecially the humid ſpecies, ſhould take emetics from time to time. An infuſion of tobacco is an emetic that has been found very ſerviceable in ſome aſthmatic caſes; and ſmoaking or chewing the ſame has been known to prevent the frequency and ſeverity of the paroxyſms. They ſhould alſo uſe the lac ammoniaci, with a due proportion of *oxymel ſcilliticum* and *vinum antimoniale*, with a view to promote expectoration; or the gum ammoniac, and others of ſimilar virtues, may be formed into pills, and combined with ſoap, as before mentioned for the dyſpnœa pituitoſa; or a maſs may be compoſed of aſafœtida and balſam of Tolu, with *ſyr. ex allio*; and theſe pills may be waſhed down by a medicated wine, impregnated with ſquills, horſe-radiſh root, and muſtard-ſeed; or a ſtrong bitter infuſion, with a little antimonial wine.

The *dry* or *ſpaſmodic aſthma*, during the extreme violence of the fit, is beſt relieved by opiates; and ſometimes very large doſes are required. But, in order to obtain permanent relief, nothing is found to anſwer better than the *radix ipecacuanha*, in ſmall doſes. Three, five, eight or ten grains, according to the ſtrength and conſtitution of the patient, given every other day, have been productive of the happieſt effects; acting ſometimes as an evacuant, pumping up the viſcid phlegm; at others, as an antiſpaſmodic or or ſedative. Iſſues are generally recommended in both ſpecies, and will often be found uſeful.

Changes of weather are uſually felt very ſenſibly by aſthmatic people, who in general cannot live with tolerable eaſe in the atmoſphere of large cities. A light diet of meats that are eaſy of digeſtion, and not flatulent, is requiſite for aſthmatic people; and the exerciſe of riding is indiſpenſably neceſſary.

GENUS XLII. COLICA. *The* COLIC.

Deſcription. The colic is chiefly known by a violent pain in the abdomen, commonly about the umbilical region. The pain reſembles various kinds of ſenſations, as of burning, twiſting, boring, a ligature drawn very tight, &c. The belly is generally coſtive, though ſometimes there is violent evacuation of bilious matters upward and downwards.

The pain comes on generally after a meal, and ſoon occaſions nauſea and vomiting. Sometimes the diſeaſe is attended with pyrexia, violent thirſt, and a full pulſe; the vomiting becomes more violent, and excrementitious matters are thrown up with the moſt exquiſite pain and tention of the abdomen; an hickup comes on, which continues obſtinately; till at laſt a ceſſation of pain and fœtid breath indicates a mortification of the inteſtines, and approaching death. Sometimes the periſtaltic motion of the inteſtines is ſo totally inverted, that all the contents of the inteſtines are evacuated by the mouth, and even clyſters will be vomited; which conſtitutes that diſeaſe commonly called the *illiac paſſion*.

Cauſes, &c. Colics may ariſe from any ſudden check given to perſpiration, as by violent cold applied to any part of the body, eſpecially to the lower extremities and abdomen. Very frequently they are occaſioned by auſtere, acid, or indigeſtible aliments taken into the ſtomach. By any of theſe, a violent colic, or indeed an iliac paſſion, may be occaſioned; for this laſt, though commonly accounted a different ſpecies of the diſeaſe, differs from a colic in no other way than in being in every reſpect in a much higher degree. In thoſe who have died of this diſeaſe and been diſſected, the gut hath ſometimes been found twiſted; but more commonly there hath been an *introſuſception* of the inteſtine, that is, one part of the gut ſeems to have entered within the other. In the Edinburgh Medical Eſſays, Vol. III. we have a diſſertation on the uſe of the warm bath in the bilious colic, in which the author derives the diſorder from a ſpaſmodic conſtriction of the inteſtine occaſioned by the acrimony of the bile. By this, he ſays, the inteſtine is not only contracted into an unuſual narrowneſs, but coats of it have been found, upon diſſection, ſo cloſely joined, that no paſſage could be made downwards more than if they had been ſtrongly tied by a ligature.

If this happens in the human body, there is the greateſt danger of a mortification, becauſe the part which is conſtricted, and at any rate diſpoſed to inflammation, hath that diſpoſition very much increaſed by its confinement within the other, and by the preſſure of the contents of the alimentary canal from the ſtomach downwards upon it. An iliac paſſion may alſo ariſe from the ſtrangulation of part of the inteſtine in a hernia; and even a very ſmall portion of it thus ſtrangulated may occaſion a fatal diſeaſe. In the Medical Obſervations, Vol. IV. however, we have an account of an iliac paſſion ariſing from a very different cauſe, which could neither have been ſuſpected nor cured by any other way than the operation of *gaſtrotomy*, or opening the abdomen of the patient, in order to remove the cauſe of the diſorder. The patient, a woman of about 28 years of age, after ſuffering extreme torture for ſix days. The body being opened, ſome quantity of a dirty coloured fluid was found in the cavity of the abdomen. The jejunum and ileon were greatly diſtended with air. A portion of the omentum adhered to the meſentery, near that part where the ileon terminates in the cæcum. From this adheſion, which was cloſe to the ſpine, there ran a ligamentous cord or proceſs about two inches and a half long, unequally thick, in ſome places not thicker than a packthread; which by its other extremity adhered to the coats of the ileon, about two inches above the cæcum. This chord formed a circle with the meſentery, large enough to admit a hen's egg to paſs through it. The chord had formed a nooſe (in a manner difficult to be explained), which included a doubling of about two inches of the lower end of the ileon; and was drawn ſo tight, that it not only put a ſtop to the paſſage of every thing through the bowels, and brought on a gangrene of the ſtrangulated part, but it had even cut through all the coats of the inteſtine on the oppoſite ſide to the meſentery, and made an aperture about an inch long. In the Memoirs of the Academy of Surgery are mentioned ſeveral ſimilar caſes.

Prognoſis. The colic is never to be reckoned void of danger, as it may unexpectedly terminate in an inflammation and gangrene of the inteſtines. Thoſe ſpecies of it which are attended with purging muſt be conſidered aſmuch leſs dangerous than thoſe in which the vomiting is very violent. The iliac paſſion, or that attended with the vomiting of fæces, is always to be accounted highly dangerous; but if the paſſage through the inteſtines is free, even though their periſtaltic motion ſhould be inverted, and clyſters evacuated by the mouth, there is much more hope of a cure, than when the belly is obſtinately coſtive, and there is ſome fixed obſtruction which ſeems to bid defiance to all remedies.

Cure. As the chief danger in colics ariſes from an inflammation and conſequent mortification of the inteſtines, it is eſſentially neceſſary, in the firſt place, to diminiſh the tendency to a pyrexia, if there ſhould happen to be any. This is accompliſhed by bleeding, emollient injections, warm bathing, and cooling medicines taken inwardly. Dr. Porter ſtrongly recommends the warm bath in thoſe colics attended with violent evacuations of bile. He ſuppoſes it to do ſervice by relaxing the conſtriction of the inteſtines, and thus preventing or removing the introſuſceptio. In the mean time opiates may be given to eaſe the pain, while every method is tried, by cathartics and glyſters of various kinds, to procure a ſtool. In obſtinate caſes, where ſtimulating cathartics have proved ineffectual the milder kinds, ſuch as manna, ſenna, oleum ricini, &c. will ſucceed; but where every thing of this kind fails, recourſe muſt be had to ſome of the more extraordinary methods. Some have recommended the ſwallowing of leaden bullets, on a ſuppoſition that by their weight they would force through the obſtruction into the gut; but theſe ſeem much more likely to create than to remove an obſtruction. It is impoſſible they can act by their gravity, becauſe the inteſtines do not lie in a ſtraight line from the pylorus to the anus; and though this were actually the caſe, we cannot ſuppoſe that the weight of a leaden bullet could prove very efficacious in removing either a ſpaſmodic conſtriction, or an obſtruction from any other cauſe. But when we conſider, not only that the inteſtines conſiſt of a great multitude of ſolids, but that their periſtaltic motion (by which only the contents are forced through them) is inverted, the futility of his remedy muſt be evident. It might rather be ſuppoſed to aggravate the diſeaſe; as the lead, by its preſſure, would tend to fix the introſuſception more firmly, or puſh it ſtill further on. The ſame thing may be ſaid of quickſilver: not to mention the pernicious conſequences to be apprehended from ſwallowing large quantities of this mineral, even if it ſhould prove efficacious in relieving the patient for the preſent. Another method hath been propoſed, in the Medical Eſſays, for relieving the miſerable patients in this diſorder, which at leaſt can be attended with no bad conſequences, and in many caſes hath been known to do ſervice. The patient is to be taken out of bed, and made to walk about on the cold floor of a damp apartment. At the ſame time, porringers of cold water are to be daſhed on his feet, legs, and thighs; and this muſt be continued for an hour or longer, if a ſtool is not procured before that time, though this will generally be the caſe much ſooner. The exerciſe doth not at all impair the patient's ſtrength, but rather adds to it; and ſome very remarkable inſtances are adduced in the 6th volume of the Medical Eſſays, where this proved effectual after all other medicines had failed. In one perſon the diſeaſe had come on with an habitual coſtiveneſs, and he had been for a week tormented with the moſt violent pain and vomiting, which could be ſtopped neither by anodynes nor any other medicines, the ſharpeſt clyſters being returned unaltered, and all kinds of purgatives thrown up ſoon after they were ſwallowed; but by the above-mentioned method, a ſtool was procured in 35 minutes, and the patient recovered. In ſome others the coſtiveneſs had continued for a much longer time. Other remedies are, the blowing air into the inteſtines by means of a bellows, and the injecting clyſters of the ſmoke of tobacco. But neither of theſe ſeem very capable of removing the diſeaſe. They can affect only the parts below the obſtruction; while, to cure the diſeaſe, it is neceſſary that the obſtructed parts themſelves ſhould be reached by the medicine, and therefore we have not many well atteſted inſtances of their ſucceſs. The cold water gives a general and very conſiderable ſhock to the ſyſtem, checks the perſpiration, and thus drives the humours inward upon the inteſtines, by which they receive a much more effectual ſtimulus than can be ſuppoſed to ariſe from any kind of clyſter. But when all methods have failed, the only chance the patient can have for life is by a manual operation. See SURGERY.

In thoſe colics which are attended with faintings, &c. from the beginning, and which generally attack hyſteric women and other debilitated perſons, all kinds of evacuations are pernicious; and the cure is to be attempted by anodynes and cordials, which will ſeldom fail of ſucceſs.

GENUS XLII. LUMBRICI INTESTINORUM; *Maw, or Belly Worms.*

Thoſe infeſting the human body are chiefly of three kinds: the *aſcarides*, or round and ſhort white worm; the *teres*, or round and long worm; and the *tænia*, or tape-worm.

The *aſcarides* have uſually their ſeat in the rectum. The round worms are about a ſpan long, round and ſmooth: they are ſeated for the moſt part in the upper ſmall inteſtines; but ſometimes they are lodged alſo in the ſtomach, and in any part of the inteſtines, even to the rectum. The tape-worms are from two to forty feet long, according to the teſtimony of Platerus; they generally poſſeſs the whole tract of the inteſtines, but eſpecially the ileum; they very much reſemble a tape in their appearance, whence the name of *tape worm.*

In the Medical Tranſactions, Vol. II. Dr. Heberden gives a very accurate account of the ſymptoms produced by the *aſcarides*, from an eminent phyſician who was troubled with them all his life. They brought on an uneaſineſs in the rectum, and an almoſt intolerable itching in the anus; which ſenſations moſt uſually came on in the evening, and prevented ſleep for ſeveral hours. They were attended with heat, ſometimes ſo conſiderable as to produce a ſwelling in the rectum both internally and externally; and if theſe ſymptoms were not ſoon relieved, a teneſmus was brought on, with a mucous dejection. Sometimes there was a griping pain in the lower part of the abdomen, a little above the *os pubis.* If this pain was very ſevere, a bloody mucus followed, in which there were often found aſcarides alive. They were alſo ſometimes ſuſpected of occaſioning diſturbed ſleep, and ſome degree of head-ach.

On this caſe Dr. Heberden obſerves, that the general health of the patient did not ſeem to have ſuffered from the long continuance of the diſeaſe, nor the immediate inconveniencies of the diſorder itſelf to have increaſed. "It is, (ſays he) perhaps univerſally true, that this kind of worms, though as difficult to be cured as any, yet is the leaſt dangerous of all. They have been known to accompany a perſon through the whole of a long life, without any reaſon to ſuſpect that they had haſtened its end. As in this caſe there was no remarkable ſickneſs, indigeſtion, giddineſs, pain of the ſtomach, nor itching of the noſe.

The abovementioned patient uſed purging and irritating clyſters with very little ſucceſs. Limewater was alſo uſed as a clyſter; which brought on a coſtiveneſs, but had no good effect. Six grains of ſalt of ſteel were diſſolved in ſix ounces of water, and injected. This clyſter in a few minutes occaſioned an itching in the rectum, griped a little without purging, and excited a teneſmus. Some few aſcarides were brought off with it; but all of them were alive. The uneaſy ſituation in the rectum did not abate till ſome warm milk was thrown up. Whenever the teneſmus or mucous ſtools were thought worth the taking notice of, warm milk and oil generally gave immediate relief. Oil given as a clyſter ſometimes brought off theſe animalcules: the oil ſwam on the ſurface of the mucus, and the aſcarides were alive and moving in the mucus itſelf, which probably hindered the oil from coming in contact with them and killing them.

The Doctor alſo obſerves, that mucus or ſlime is the proper neſt of the aſcarides, in which they live, and is perhaps the food by which they are nouriſhed; and it is this mucus which preſerves them unhurt, though ſurrounded with many other liquors, the immediate touch of which would be fatal. It is hard to ſatisfy ourſelves by what inſtinct they find it out in the human body, and by what means they get at it; but it is obſervable in many other parts of nature, as well as here, that where there is a fit ſoil for the hatching and growth of animals and vegetables, nature has taken ſufficient care that their ſeeds ſhould find the way thither. Worms are ſaid to have been found in the inteſtines of infants born dead. Purges, by leſſening this ſlime, never fail to relieve the patient: and it is not unlikely, that the worms which are not forced away by this quickened motion of the inteſtines, may, for want of a proper quantity of it, languiſh, and at laſt die; for if the aſcarides are taken out of their mucus, and expoſed to the open air, they become motionleſs, and apparently die in a very ſhort time. Dr. Heberden ſuppoſes that the kind of purge made uſe of is of little conſequence in the cure of all other worms as well as aſcarides; the inſects being always defended by the mucus from the immediate action of medicines; and that therefore thoſe purges are the beſt which act briſkly, and of which a repetition can be moſt eaſily borne. Purging waters are of this ſort, and jalap eſpecially for children; two or more grains of which, mixed with ſugar, are moſt eaſily taken, and may be repeated daily.

From the caſe above-mentioned, and from Dr. Heberden's obſervations, we may eaſily ſee why it is ſo difficult to deſtroy theſe inſects; and why anthelmintics, greatly celebrated for ſome cures, are yet ſo far from being ſpecifics in the diſeaſe. As the worms which reſide in the cavities of the human body are never expoſed to the air, by which all living creatures are invigorated, it is evident, that in themſelves they muſt be the moſt tender and eaſily deſtructible creatures imaginable, and much leſs will be requiſite to kill them than any of our common inſects. The moſt pernicious ſubſtances to any of the common inſects are oil, cauſtic fixed alkali, lime, and lime water. The oil operates upon them by ſhutting up the pores of their bodies; the lime-water, lime, and cauſtic alkali, by diſſolving their very ſubſtance. In the caſe of inteſtinal worms, however, the oil can have very little effect upon them, as they are defended from it by the moiſture and mucus of the inteſtines; the like happens with lime-water; and therefore it is neceſſary that the medicine ſhould be of ſuch a nature as to deſtroy both mucus and inſects together; for which purpoſe the cauſtic fixed alkali is at once ſafe and efficacious, nor is it probable that any caſe of worms whatever could reſiſt the proper uſe of this medicine. A very large doſe of any ſalt indeed will alſo deſtroy the mucus, and deſtroy the worms; but it is apt to inflame and excoriate the ſtomach and inteſtines, and thus to produce worſe diſtempers than that which it was intended to cure.

The long round worms ſeem to be the moſt dangerous which infeſt the human body, as they often pierce through the ſtomach and inteſtines, and thus bring on a miſerable death. The common ſymptoms of theſe are nauſea, vomiting, looſeneſs, fainting, ſlender intermitting pulſe, itching of the noſe, epileptic fits. By the conſumption of the chyle they produce hunger, paleneſs, weakneſs, coſtiveneſs, tumor of the abdomen, eructations, and rumbling of the inteſtines; but it is from the perforation of the inteſtines that the diſeaſe proves ſo frequently fatal. A child may be known to have worms, from his cold temperament, paleneſs of the countenance, livid eye-lids, hollow eyes, itching of the noſe, voracity, ſtartings, and grinding of the teeth in ſleep; and more eſpecially by a very fœtid breadth. Very frequently, however, they are voided by the mouth and anus, in which caſe there is no room for doubt. In the medical Commentaries, Vol. II. we have an account of the inteſtines being perforated by a worm, and yet the patient recovered. The patient was a woman troubled with an inflammation in the lower part of the abdomen. The pain was ſo violent, that for ſix days ſhe could not ſleep; the tumour then broke, diſcharged upwards of a pound of thin watery ſanies, immediately after which the excrements followed. The next day ſhe was extremely low; her pulſe could ſcarcely be felt; the extremities were cold; and there was a conſiderable diſcharge from the wound, which had already begun to mortify. She got a a decoction of the bark with wine, which alleviated the ſymptoms: but in removing the mortified parts, a worm was found among them nine inches long, and as thick as an eagle's quill. By proper applications, the diſcharge of excrements ceaſed, and ſhe recovered perfect health. She was ſenſible of no accident giving riſe to the inflammation; ſo that in all probability it aroſe entirely from the worm itſelf.

The *tænia*, or *tape-worm*, as it is called, is one of thoſe moſt difficult to be cured. It is of two kinds, *tænia ſolium* and *tænia lata*; for a deſcription of which, ſee the article TÆNIA. The reaſon of its being ſo difficult to cure, is, that though portions of it are apt to break off and be diſcharged, it is endowed with a power of reproduction, ſo that the patient is little or nothing better. The ſymptoms occaſioned by it are not different from thoſe above deſcribed. A ſpecific againſt the *tænia lata* was once ſo much celebrated in France, that the king thought proper to purchaſe it from the proprietor Madam Nouffer.

This ſpecific, however, is not to be conſidered as a new diſcovery; the efficacy of fern in caſes of tænia having been known long ago. Theophraſtus preſcribes its root, in doſes of four drams, given in water ſweetened with honey, as uſeful in expelling flat worms. Dioſcorides orders it in the ſame doſe, and adds, that its effects are more certain when it is mixed with four oboli (40 grains) of ſcammony or black hellebore; he particularly requires that garlic ſhould be taken before hand. Pliny, Galen, Oribaſius, and Aëtius, aſcribe this ſame virtue to fern; and are followed in this by Avicenna, and the other Arabian phyſicians.

Simon Paulus; quoted by Ray and Geoffroy, conſiders it as the moſt efficacious of all poiſons againſt the flat worm, and as being the baſis of all the ſecret remedies extolled by empirics in that diſeaſe. Andry (*gênêr des Vers, p.* 246, 249) prefers diſtilled fern-water to the root in powder, or he employs it only in the form of an opiate, or mixed with other ſubſtances.

Theſe are not the only authors who have mentioned the tenia; many others have deſcribed this worm, the ſymptoms it excites, and the treatment proper to expel it. Almoſt all of them mention the fern-root, but at the ſame time they point out other remedies as poſſeſſing equal efficacy. Amongſt theſe we find the bark of the root of the mulberry-tree, the juice of the *auricula muris*, the roots of *chamæleon niger*, ginger, zedoary; decoctions of mugwort, ſouthernwood, worm-wood, penny-royal, origanium, hyſſop, and in general of all bitter and aromatic plants, &c. Some of them direct the ſpecific to be ſimply mixed and taken in wine or honey and water; others join to it the uſe of ſome purgative remedy, which they ſay adds to its efficacy.

In Sweden, it has been a practice to drink ſeveral gallons of cold water, and then to take ſome draſtic purge. Boerhaave ſays, that he himſelf ſaw a *tænia* meaſuring 300 ells expelled from a Ruſſian by means of the *vitriolum martis*. All theſe methods, however, have been too often ineffectual.

GENUS XLIV. DIARRHOEA, *or* LOOSENESS.

This is occaſioned by the too great quantity of matter thrown into the alimentary canal; and what is diſcharged hath not the appearance of excrements, but is much whiter, and of a thinner conſiſtence. Voracious people who do not ſufficiently chew their food, gormandizers, and even thoſe who ſtammer in their ſpeech, are ſaid to be liable to this diſeaſe. In ſlighter caſes it is removed without any medicine, or by a doſe of rhubarb; but where the matters have acquired a putrid taint, the diſorder may be exceedingly protracted and become dangerous. In this caſe lenient antiſeptic purgatives are to be made uſe of, after which the cure is to be completed by aſtringents.

The Bilious DIARRHOEA.

This diſtemper ſhews itſelf by copious ſtools of a very yellow colour, attended with gripes and heat of the bowels, thirſt, bitterneſs, and dryneſs of the mouth, yellowneſs of the tongue, and frequently follows an intermitting or bilious fever. When the fever is gone, the diarrhœa is to be removed by acidulated and cooling drinks, with ſmall doſes of nitre.

The Mucous DIARRHOEA.

This kind of diarrhœa, beſides the matters uſually excreted, is attended with a copious dejection of the mucus of the inteſtines with great pain; while the patient daily pines away, but without any fever. Perſons of all ages are liable to it, and it comes on uſually in the winter-time; but is ſo obſtinate, that it will ſometimes continue for years. In obſtinate looſeneſſes of this kind, vomits frequently repeated are of the greateſt ſervice. It is alſo very beneficial to keep the body warm, and rub the belly with ſtimulating ointments; at the ſame time that aſtringent clyſters, rhubarb, and ſtomachic medicines, are to be exhibited. Starch clyſters are very often efficacious. Some kinds of looſeneſs are contagious; and Sir John Pringle mentions a ſoldier who laboured under an obſtinate diarrhœa, who infected all thoſe that uſed the ſame privy with himſelf. In the looſeneſs which frequently followed a dyſentery, the ſame author tells us that he began the cure with giving a vomit of ipecacuanha, after which he put the patients on a courſe of aſtringents. He uſed a mixture of three drachms of extract of logwood, diſſolved in an ounce and a half of ſpirituous cinnamon-water, to which was added ſeven ounces of common water, and two drachms of japonic tincture. Of this the patient took two ſpoonfuls once in four or five hours, and ſometimes alſo an opiate at bed-time. He recommends the ſame medicine in obſtinate diarrhœas of all kinds. A decoction of ſimarauba bark was alſo found effectual, when the dyſenteric ſymptoms had gone off. Dr. Huck, who uſed this remedy in North-America, alſo recommends it in diarrhœas. Two or three ounces of it are to be boiled in a pound and a half of water to a pound, and the whole quantity taken throughout the day. He began with the weakeſt decoction; and, when the ſtomach of the patient could eaſily bear it, he then ordered the ſtrongeſt: but at the ſame time he acknowledges, that, unleſs the ſick found themſelves ſenſibly better within three days from the time they began the medicine, they ſeldom afterwards received any benefit from it. But when all aſtringents have failed, Sir John Pringle informs us, he hath known a cure effected by a milk and farinaceous diet; and he thinks in all caſes the diſorder would be much more eaſily removed, if the patients could be prevailed on to abſtain entirely from ſpirituous liquors and animal-food. If the milk by itſelf ſhould turn four on the ſtomach, a third part of lime-water may be added. In one caſe he found a patient receive more benefit from good butter-milk than from ſweet-milk. The chief drinks are decoctions of barley, rice, calcined hartſhorn, toaſt and water, or milk and water.

GENUS XLV. DIABETES, *or too great a Quantity of* URINE.

Deſcription. The diabetes firſt ſhews itſelf by dryneſs of the mouth and thirſt, white frothy ſpittle, and the urine in ſomewhat larger quantity than uſual. A heat begins to be perceived in the bowels, which at firſt is a little pungent, and gradually increaſes. The thirſt continues to augment by degrees, and the patient gradually loſes the power of retaining his urine for any length of time. It is remarkable, that, though the patients drink much, the quantity of urine always exceeds what is drank. When the urine is retained a little while, there is a ſwelling of the loins, ilia, and teſtes; the ſtrength gradually decays; the ſkin is dry and ſhrivelled; œdematous ſwellings ariſe in various parts of the body, but afterwards ſubſide without relieving the diſeaſe in the leaſt; and the patient is frequently carried off by convulſions.

Cauſes. Theſe are exceedingly obſcure and uncertain; ſpaſms of the nervous ſyſtem, debility, and every thing inducing it, but eſpecially ſtrong diuretics and immoderate venery, have been accuſed as bringing on the diabetes. It hath, however, occurred in perſons where none of all theſe cauſes could be ſuſpected; nor have the beſt phyſicians been able to determine it. Diſſections have only ſhewn that the kidneys were in an enlarged and lax ſtate. In one of Dr. Home's patients who died, they ſmelled ſour; which ſhewed that the urine peculiar to diabetes came from the kidneys, and was ſent directly from the inteſtines by a retrograde motion of the lymphatics, as ſome imagine.

Prognoſis. The diabetes is rarely cured, unleſs when taken at the very beginning, which is ſeldom done; and in a confirmed diabetes, the prognoſis muſt therefore be unfavourable.

Cure. The only hopes of a cure in this diſtemper are from aſtringent and ſtrengthening medicines, ſuch as the bark in ſubſtance, with ſmall doſes of rhubarb; decoction of the bark, with the acid elixir of vitriol; the cold infuſion of the bark; Dover's powder; alum-whey; lime-water; antimonials combined with *tinctura Thebaica.* The body ſhould be kept conſtantly open, either with rhubarb, or the infuſion of ſenna joined with rhubarb. The common drink ſhould be rice-water, barley-water, lime-water and milk; lime-water alone; ſage, balm, or mint-tea; ſmall-beer, ſimple water, and water acidulated with the vitriolic acid. In ſeven months, theſe remedies, judiciouſly varied, may make ſome progreſs in removing the diſeaſe. In Dr. Home's patients, all theſe medicines, and many others, were tried without the leaſt good effect; inſomuch that he uſes this remarkable expreſſion: "Thus, theſe two patients have exhauſted all that experience had ever recommended, and almoſt all that theory could ſuggeſt; yet, in both caſes, the diſeaſe has reſiſted all the means of cure uſed." It is remarkable, that though ſeptics were given to both, in ſuch quantity as evidently to produce a putreſcency in the *primæ viæ,* the urine remained unaltered, both in quantity and quality.

GENUS XLVI. HYSTERIA, HYSTERICS.

Deſcription. The hyſteria is a convulſive diſeaſe which comes on at uncertain intervals, ſometimes longer and ſometimes ſhorter, but at no ſtated time. The paroxyſms commonly begin with a languor and debility of the whole body; yawning, ſtretching, and reſtleſſneſs. A ſenſe of coldneſs, alſo, in the extremities, almoſt always precedes, and for the moſt part remains during the whole time of the paroxyſm. To this ſometimes ſucceeds a ſenſe of heat; and the two ſenſations alternate with each other in different parts of the body. The face is ſometimes fluſhed and ſometimes pale; and ſometimes the paleneſs and fluſhing come alternately. There is a violent pain in the head; the eyes become dim, and pour out tears; there is a rumbling and inflation of the inteſtines; a ſenſation is felt like that of a globe aſcending from the lower part of the abdomen or hypogaſtrium, which ſometimes ſeems to roll along the whole alimentary canal. It aſcends to the ſtomach, ſometimes ſuddenly, ſometimes ſlowly; and there produces a ſenſe of inflation and weight, together with anxiety, nauſea, and vomiting. At laſt it comes up to the throat, where it produces a ſenſe of ſuffocation, and difficulty of breathing or ſwallowing. All this time there are the moſt violent pains both in the external and internal parts of the abdomen; the muſcles are convulſed; the navel is drawn inwards; and there are frequently ſuch ſpaſms of the inteſtines, that neither clyſters can be injected, nor even flatus paſs downwards. Sometimes the paroxyſm remits after theſe ſymptoms have continued for a certain time, but more frequently the patients fall into fainting fits; ſometimes they lie without motion, as if they were in a deep ſleep; ſometimes they beat their breaſts violently and continually with their hands, and ſometimes they are ſeized with general convulſions, and the diſeaſe puts on the appearance of an epilepſy. In ſome patients the extremities become cold and ſtiff, and the body has the appearance of one in a catalepſy. Sometimes a moſt violent beating pain takes place in ſome part of the head, as if a nail was driving into it, and all viſible objects ſeem to turn round; grievous pains attack the loins, back, and bladder, and the patients make a ſurpriſing quantity of urine as limpid as water; which laſt is one of the ſureſt ſigns of the diſeaſe. The mind is very much affected as well as the body. Sometimes the patients are tormented with vain fears; ſometimes they will laugh, at other times cry immoderately; and ſometimes their temper becomes ſo peeviſh and fretful, that they cannot enjoy a moment's quiet.

Cauſes, &c. The general cauſe of hyſteria is thought by the beſt phyſicians to conſiſt in a too great mobility and irritability of the nervous ſyſtem, and of conſequence may be brought on by whatever debilitates and renders the body irritable. Hence the diſeaſe moſt frequently attacks females of a weak and lax habit of the body, though there are ſome inſtances of men alſo attacked by it. The diſeaſe generally comes on between the time of puberty and the age of 35, and makes its attacks during the time of menſtruation more frequently than at any other. It alſo more uſually ſeizes barren women and young widows, than ſuch as are bearing children.

Prognoſis. Though the appearance of this diſeaſe is ſo very terrible, it ſeldom proves mortal unleſs by wrong treatment: but notwithſtanding this, it is extremely difficult of cure, and rarely admits of any thing elſe than being palliated; for though it ſhould ſeem to be conquered by medicine for a time, it very quickly returns, and that from the ſlighteſt cauſes.

Cure. The moſt powerful remedy hitherto diſcovered in hyſteric caſes is opium, or the ſolution of it called *laudanum.* By this commonly the moſt violent paroxyſms are ſtopped, though it is ſufficient to accompliſh a radical cure. In Home's Clinical Experiments we find an inſtance of a cure performed by veneſection, though this remedy hath been generally condemned in hyſterical caſes. Aſafœtida ſeems to ſtand next in virtue to opium; though with ſome it diſagrees, and occaſions pains in the ſtomach and vomiting. Æther will alſo frequently remove an hyſteric fit: but its effects are of ſhort duration; and if it do not effect a cure ſoon after its exhibition, no ſervice is to be expected either by perſeverance in the uſe of it or by increaſing the doſe, and with ſome conſtitutions it diſagrees to ſuch a degree as to occaſion convulſions. If the patient is ſeized with a violent fit, ſo that ſhe can ſwallow nothing, which is frequently the caſe, it will be proper to apply ſome ſtrong volatile alkali to her noſe; or if that be not at hand, the vapour of burning feathers is ſometimes very efficacious. A plaſter of galbanum and aſafœtida will alſo prove ſerviceable: but it muſt be remembered, that none of theſe things will prevent the return of the diſeaſe; and therefore a radical cure is to be attempted by exerciſe, the Peruvian bark, chalybeates, mineral waters, and other tonics.

GENUS XLVII. HYDROPHOBIA; *the Dread of* WATER.

Deſcription. This diſeaſe commonly does not make its attack till a conſiderable time after the bite. In ſome few inſtances it hath commenced in ſeven or eight days from the accident; but generally the patient continues in health for 20, 30, or 40 days, or even much longer. The bite hath been healed long before that time, frequently with the greateſt eaſe; though ſometimes it reſiſts all kinds of healing applications, and forms a running ulcer which diſcharges a quantity of matter for many days. The patient becomes melancholy, loves ſolitude and hath a ſickneſs at ſtomach. Sometimes the peculiar ſymptom of the diſeaſe, *the dread of water,* comes on all at once. Sometimes the diſeaſe begins like a common ſore throat; and the ſoreneſs daily increaſing, the hydrophobic ſymptoms ſhew themſelves like a convulſive ſpaſm of the muſcles of the fauces. Dr. James, in his treatiſe on canine madneſs, mentions a boy ſent out to fill up two bottles with water, who was ſo terrified by the noiſe of the liquid running into them, that he fled into the houſe crying out that he was bewitched He mentions alſo the caſe of a farmer, who, going to draw ſome ale from the caſk, was terrified to ſuch a degree at its running into the veſſel, that he ran out in great haſte with the ſpigot in his hand. But in whatever manner this ſymptom comes on, it is certain that the moſt painful ſenſations accompany every attempt to ſwallow liquids. Nay, the bare ſight of water, of a looking-glaſs, of any thing clear or pellucid, will give the utmoſt uneaſineſs, or even throw them into convulſions.

With regard to the affection of the mind itſelf in this diſeaſe, it does not appear that the patients are deprived of reaſon. Some have, merely by the dint of reſolution, conquered the dread of water, though they never could conquer the convulſive motions which the contact of liquids occaſioned: while this reſolution hath been of no avail; for the convulſions and other ſymptoms increaſing, have almoſt always deſtroyed the unhappy patients.

In this diſeaſe there ſeems to be an extreme ſenſibility and irritability of the nervous ſyſtem. The eyes cannot bear the light, or the ſight of any thing white; the leaſt touch or motion offends them, and they want to be kept as quiet and in as dark a place as poſſible. In all there is a great flow of viſcid ſaliva into the mouth; which is exceedingly troubleſome to the patients, as it has the ſame effect upon their fauces that other liquids have. This therefore they perpetually blow off with violence, which in a patient of Dr. Fothergill's occaſioned a noiſe not unlike the hollow barking of a dog, and which he conjectures might have given riſe to the common notion that hydrophobous patients bark like dogs. They have an inſatiable thirſt; but are unable to get down any drink, except with the utmoſt difficulty; though ſometimes they can ſwallow bread ſoaked in liquids, ſlices of oranges, or other fruits. There is a pain under the *ſcrobiculus cordis,* and the patients mournfully point to that place as the ſeat of the diſeaſe. Dr. Vaughan is of opinion that it is this pain, rather than any difficult in ſwallowing, which diſtreſſes the patient on every attempt to drink. The voice is commonly plaintive and mournful; but Dr. Vaughan tells us there is a mixture of fierceneſs and timidity in the countenance which he cannot deſcribe, but by which he could know a hydrophobous perſon without aſking any queſtions.

In this diſtemper, indeed, the ſymptoms are ſo various, that they cannot be enumerated; for we ſeldom read two caſes of hydrophobia which do not differ very remarkably in this reſpect. Some ſeem to have at times a furious delirium, and an inclination to ſpit at or bite the byſtanders; while others ſhew no ſuch inclination, but will even ſuffer people to wipe the inſide of their mouths with the corner of a handkerchief, in order to clear away the viſcid ſaliva which is ready to ſuffocate them. In ſome male patients there is an involuntary erection of the penis, and emiſſion of the ſemen;

and the urine is forced away by the frequent return of the ſpaſms. In a letter from Dr. Wolf of Warſaw to Henry Baker, F. R. S. dated Warſaw Sept. 26th, 1767, we have the following melancholy account of the caſes of five perſons who died of the hydrophobia, "None of them quite loſt their right ſenſes; but they were all talking without intermiſſion, praying, lamenting, deſpairing, curſing, ſighing, ſpitting a frothy ſaliva, ſcreeching, ſometimes belching, retching, but rarely vomiting. Every member is convulſed by fits, but moſt violently from the navel up to the breaſt and œſophagus. The fit comes on every quarter of an hour; the fauces are not red, nor the tongue dry. The pulſe is not at all feveriſh, and when the fit is over nearly like a ſound pulſe. The face grows pale, then brown, and during the fit almoſt black; the lips livid: the head is drowſy, and the ears tingling; the urine limpid. At laſt they grow weary; the fits are leſs violent, and ceaſe towards the end; the pulſe becomes weak, intermittent, and not very quick; they ſweat, and at laſt the whole body becomes cold. They compoſe themſelves quietly as if to get ſleep, and ſo they expire.

Cauſes, &c. In no diſeaſe whatever are we more at a loſs to diſcover the cauſes than in the hydrophobia. In dogs, foxes, and wolves, it ſeems to come on ſpontaneouſly; though this is conteſted by ſome authors. It is ſaid, that the cauſes commonly aſſigned, viz. heat, feeding upon putrid fleſh, want of water, &c. are not ſufficient for producing the diſtemper. It does not appear that madneſs is more frequent among dogs in the warm than in the cold climates; nay, in the iſland of Antigua, where the climate is very hot, and the water very ſcarce, the dogs are ſaid not to be ſubject to this diſtemper.

With regard to the immediate cauſe among mankind, there is not the leaſt doubt that the hydrophobia is occaſioned by the ſaliva of the mad animal being mixed with the blood. It doth not appear that this can operate through the cuticula; but, when that is rubbed off, the ſmalleſt quantity is ſufficient to communicate the diſeaſe, and a ſlight ſcratch with the teeth of a mad animal hath been found as pernicious as a large wound. It is certain alſo, that the infection hath been communicated by the bites of dogs, cats, wolves, foxes, weaſels and ſwine, when in a ſtate of madneſs.

When we attempt to inveſtigate the nature of the cauſe of the hydrophobia by diſſections, our inquiries are commonly diſappointed. In two bodies opened by Dr. Vaughan, there was not the leaſt morbid appearance; in the very fauces, where we might have expected that the diſeaſe would have ſhewn itſelf moſt evidently, there was not the leaſt appearance even of inflammation. The ſtomach, inteſtines, diaphragm, œſophagus, &c. were all in a natural ſtate: neither do we find in authors of credit any certain accounts of morbid appearances in the bodies of hydrophobous perſons after death.

Prognoſis. When a perſon is bit, the prognoſis with regard to the enſuing hydrophobia is very uncertain. All thoſe who are bit do not fall into the diſeaſe; nay, Dr. Vaughan relates, that out of 30 bit by a mad dog, only one was ſeized with the hydrophobia. During the interval betwixt the bite and the time the diſeaſe comes on, there are no ſymptoms by which we can judge whether it will appear or not. When once it hath made its appearance, the prognoſis is exceedingly fatal.

Prevention and Cure. It hath been generally allowed by practitioners, that though the hydrophobia may be prevented, yet it can ſeldom or ever be cured after it has made its appearance. A great number of different methods of prevention have been attempted. Bathing in cold water, eſpecially in the ſea, and drinking ſea-water for a certain time, have been preſcribed, and by ſome accounted a certain preventative. When this was known to fail, a long courſe of antiphlogiſtic regimen, violent ſubmerſion in water even to danger of drowning, and keeping the wounded place open with cauteries, were recommended. To this extreme ſeverity Dr. Mead objected; and in his treatiſe on this ſubject endeavours to ſhew, that in all ages the greateſt ſucceſs hath been reaped from diuretics, for which reaſon he propoſes the following powder: "Take aſh-coloured ground-liverwort, half an ounce; black-pepper, two drachms: reduce them ſeparately to powder, then mix them together." But this medicine, which was inſerted in former editions of the London Diſpenſatory under the name of *Pulvis Antilyſſus*, has long loſt its credit.

There is a famous Eaſt-India medicine, compoſed of 24 grains of native and as much factitious cinnabar, made into a powder with 16 grains of muſk. This is called the *Tonquin* medicine, and muſt be taken in a tea-cup-full of arrack or brandy; and is ſaid to ſecure the patient for 30 days, at the expiration of which it is to be repeated; but if he has any ſymptoms of the diſeaſe, it muſt be repeated in three hours, which is ſaid to be ſufficient for a cure. The firſt doſe is to be taken as ſoon after the bite as poſſible.

Another celebrated remedy is Palmarius's powder, compoſed of the leaves of rue, vervain, ſage, polypody, wormwood, mint, mugwort, balm, betony, St. John's-wort, and leſſer centaury. Theſe herbs muſt be gathered in their prime, dried ſeparately in the ſhade, and then powdered. The doſe is a drachm, or a drachm and a half, taken every day.

A remedy which might promiſe to be more efficacious than any of thoſe hitherto mentioned is mercury. This hath been recommended in frictions, and to be taken inwardly in the form of calomel and turbith-mineral, in order if poſſible to raiſe a ſlight ſalivation, on which the efficacy was thought to depend. Beſides this, veneſection, opium, the bark, camphire, have been tried in very large quantities; the warm bath; and, in ſhort, every thing which human invention could ſuggeſt.

The laſt celebrated antidote againſt the poiſon of a mad dog hath been known for ſome years by the name of the *Ormſkirk medicine*. The true compoſition of this is kept a ſecret by the proprietors: however, it hath been analyſed, and the following compoſition publiſhed by Dr. Heyſham as perfectly ſimilar to it in all reſpects.

"Take half an ounce of chalk, three drachms of Armenian bole, ten grains of alum, one drachm of elecampane in powder; mix them all together, and add ſix drops of oil of aniſe."

They muſt certainly be very credulous who can put confidence in ſuch an inſignificant medicine as a preſervative againſt the hydrophobia: however, there is a poſſibility that there may be ſome unknown ingredient in the genuine powder; for it is difficult to analyſe powders after the ingredients are thoroughly mixed together. The efficacy of the medicine therefore muſt depend on the virtues of that unknown ingredient, if any ſuch there is.

Many inſtances might be adduced of the inefficacy of this pretended ſpecific: the danger of acquieſcing in which, will, it is hoped, create a due degree of caution in thoſe to whom they who are ſo unfortunate as to be bit by a mad animal may commit themſelves. Of the great variety of remedies which have had their day of reputation, there is not one which has not poſſeſſed the credit, ſome time or other, of preventing the noxious effects ariſing from the bite of a mad dog. A more adequate experience has with all of them diſcovered the deception. It was above obſerved, that the hydrophobia is by no means the infallible conſequence of being bit by a mad animal; and that of between 20 and 30 perſons who were bit by the dog which gave the fatal wound to one of Dr. Vaughan's patients, not one felt the leaſt ill effect but himſelf. "In the above number (ſays the Doctor) were ſome who took the Ormſkirk Medicine; others went to the ſalt-water; and a part of them uſed no remedy, who yet fared equally well with the moſt attentive to their injury. The ſame thing has often happened before; and much merit, I doubt not, has been attributed to the medicine taken, from that celebrated one of *Sir George Cobb*, down to the *infallible* one which my good *Lady Bountiful's* receipt-book furniſhes."

From all that has been ſaid the reader will judge how far the hydrophobia is capable of being ſubdued by any of the medicinal powers which have yet been tried. Some eminent phyſicians aſſert that it is totally incurable; and alledge that the inſtances recorded by different authors of its cure have not been the genuine kind, but that which comes on ſpontaneouſly, and which is by no means ſo dangerous. Indeed two of Dr. Wolf's patients recovered, where the diſeaſe ſeems to have been perfectly genuine: but in theſe the poiſon ſeemed to vent itſelf partly on ſome other place beſides the nervous ſyſtem. In one the blood was evidently infected, as it had an abominable fœtor; and the other had a violent pain and ſwelling in the belly. In all the others, it ſeemed to have attacked only the nervous ſyſtem; which perhaps hath not the ſame ability to throw off any offending matter that the vaſcular ſyſtem hath.

Dr. Wolf himſelf adopts this hypotheſis, that perhaps the *ſerum* may become frothy; but in blood drawn from a vein not the leaſt fault appears either in the ſerum or craſſamentum. He affirms, however, that the duodenum appears to be one of the parts firſt and principally affected; and as it is not inflamed, it would ſeem that the affection it ſuſtains muſt ariſe from the vitiated ſtate of its juices.

Be this as it will, however, in the hydrophobia, the ſtomach ſeems totally, or in a great meaſure, to loſe the power which at other times it poſſeſſes. Two grains of *cuprum ammoniacale* were repeatedly given to a child of eight years of age without effect; but this doſe would occaſion violent vomiting in a ſtrong healthy man. Something or other therefore muſt have prevented this ſubſtance from acting on the nervous coat of the ſtomach; and this we can only ſuppoſe to have been the exceedingly diſordered ſtate of the gaſtric juice, which occaſioned ſuch violent irritation through the whole body, that the weaker ſtimulus of the medicine was entirely loſt. It would ſeem proper therefore to conſider the ſtomach in hydrophobic caſes as really containing a poiſonous matter, which could not be expelled by vomiting, becauſe it is renewed as faſt as evacuated. The indication therefore muſt be, to change its nature by ſuch medicines as are certainly more powerful than the poiſon; and this indication will naturally lead us to think of large doſes of alkaline ſalts. Theſe, it is certain will deſtroy any animal-ſubſtance with which they come in contact, and render even the poiſon of ſerpents inactive. By exhibiting a few doſes of them, larger no doubt than what could be ſafely done on other occaſions, we ſhould be certain, to change the ſtate of the ſtomachic juices; and thus might free the patient from thoſe intolerable ſpaſms which always occaſion death in ſuch a ſhort time. Dr. Wolf ſeems inclined to think that volatile alkalies were of ſervice; but the above hypotheſis would incline us to uſe rather the fixed kind.

At any rate, it ſeems vain for phyſicians to truſt much to the power of opium, mercury, muſk or cinnabar, either ſingly, or combined in any poſſible way. The bark hath alſo failed, and the moſt celebrated ſpecifics have been found ineffectual. Alkalies are the next moſt powerful remedies which the *materia medica* affords, and they cannot be more unſucceſsful than the others have generally been.

Where corroſive mercury hath been ſwallowed, alkaline ſalt is recommended to deſtroy the poiſon which nature cannot expel by vomiting; and why ſhould not ſomething be attempted to deſtroy the poiſon which the ſtomach ſeems to ſecrete in the hydrophobia, and which nature attempts to expel, though in vain, by violent efforts to vomit?

But whatever plan may be purſued in the hopes of curing this dreadful malady after any of the ſymptoms have made their appearance, we ought, in every inſtance of the accident that gives riſe to it, to direct our immediate care to *prevention*, as being perhaps the only real ground of hope: and the moſt certain and efficacious way of preventing the ill conſequences, is inſtantly (if it may be done) to cut out the piece in the place that happens to be bitten. Dr. James, indeed, ſays, that he would have little opinion of cutting or cauteriſing, if ten minutes were ſuffered to elapſe from the receiving of the bite before the operation was performed. But in an inaugural diſſertation lately publiſhed at Edinburgh by Dr. Parry, the author is of opinion that exciſion will be of uſe a conſiderable time after the bite is received. He adopts this opinion from what happens in the ſmall-pox, where the blood doth not ſeem to receive the infection till ſome days after inoculation hath been performed. A ſecond inflammation, he tells us, then takes place, and the infection is conveyed into the blood. In like manner, when the hydrophobous infection is about to be conveyed into the blood, according to him, the wound, or its cicatrix, begins again to be inflamed; aud it is this ſecond inflammation which does all the miſchief. Exciſion, or the cautery, will therefore be effectual any time betwixt the bite and the ſecond inflammation of the wound. Without implicitly truſting to this doctrine, however, or conſidering it as in any degree aſcertained in what manner the poiſon diffuſes itſelf, by what marks its progreſs may be known, or how ſoon the ſyſtem may be irremediably tainted with its malignity; it is undoubtedly ſafeſt not to loſe unneceſſarily a moment's time in applying the knife. This, or a dilation of the wound, if it be ſmall, Dr. Vaughan conſiders as the only prophylactics that can be depended upon. In the latter caſe, he directs to fill the wound with gunpowder, and ſet fire to it; which would produce a laceration of the part, and poſſibly the action of ignited powder upon the poiſon may have its uſe.

On theſe caſes Dr. Wolf makes the following obſervations. "Thus we ſee, that the bark, the mercury, the acids, the muſk, the feeding on the moſt famous herbs, the ſweating, the *cura antiphlogiſtica*, are no ſpecifics."

ORDER IV. VESANIÆ; *Diſorders of the Judgment.*

GENUS XLVIII. MELANCHOLIA, MELANCHOLY *Madneſs.*

The treatment of the melancholic madneſs, being nearly ſimilar to that of the maniac; we ſhall refer our readers to the following Genus.

GENUS XLIX. MANIA, RAVING *or* FURIOUS *Madneſs.*

Although theſe diſtempers may be conſidered as diſtinct genera, yet they are ſo nearly allied, and ſo readily change into each other, that it ſufficiently juſtifies the treating of them both at once.

The diſtinguiſhing characteriſtic of madneſs, according to Dr. Battie, is a *falſe perception*; and under this general character may be comprehended all kinds of what is called *madneſs*, from the moſt ſilly ſtupidity and idiotiſm to the moſt furious lunacy. Frequently the different kinds of madneſs are changed into each other by the caſual excitement of ſome paſſion: thus, an idiot may become furiouſly mad, by being put in a violent paſſion; though this does not ſo often happen as the change of melancholy into the raving madneſs, and *vice verſa.*

It is a very ſurpriſing circumſtance, that mad people are not only leſs liable to be ſeized with infectious diſorders than thoſe who are in perfect health, but even when labouring under other diſeaſes, if the patients chance to be ſeized with madneſs, they are ſometimes freed from their former complaints. Of this kind Dr. Mead relates two very remarkable inſtances.

On the other hand, it has been known, that an intermittent fever, ſupervening madneſs of long ſtanding, has proved a cure for the madneſs: the ſenſes having returned, when the fever terminated. Dr. Monro ſaw two inſtances of this himſelf; and mentions it as an obſervation of his predeceſſor int he care of Bethlem hoſpital.

Another remarkable circumſtance is, that immoderate joy, long continued, as effectually diſorders the mind as anxiety and grief. For it was obſervable in the famous South-Sea year, when ſo many immenſe fortunes were ſuddenly gained, and as ſuddenly loſt, that more people had their heads turned, from the prodigious flow of unexpected riches, than from the entire loſs of their whole ſubſtance.

Mad people, eſpecially of the melancholic kind, ſometimes obſtinately perſevere in doing things which muſt excite great pain; whence it ſhould ſeem as if their minds were troubled with ſome diſtracting notions, which make them patiently bear the preſent diſtreſs, leſt more ſevere tortures ſhould be inflicted; or poſſibly they may think, that, by thus tormenting the body, they render themſelves more acceptable to the divine Being, and expiate the heinous ſins of which they may imagine themſelves to have been guilty.

Cure, &c. All the ſpecies and degrees of madneſs which are hereditary, or that grow up with people from their early youth, are out of the power of phyſic; and ſo, for the moſt part, are all maniacal caſes of more than one year's ſtanding, let them ariſe from what ſource ſoever. Very often, mere waſte, or the dregs of ſome particular diſeaſe, ſuch as the ague, ſmall-pox, or a nervous fever, ſhall occaſion different degrees of fooliſhneſs, or madneſs. In theſe caſes, the cure muſt not be attempted by evacuations; but, on the contrary, by nouriſhing diet, clear air, moderate exerciſe, and the uſe of wine: whereas, in almoſt all the other maniacal caſes which ariſe from different ſources, and which come on in conſequence of intemperate living, violent paſſions, or intenſe thinking, it is generally held, that evacuations of every kind are neceſſary, unleſs the conſtitution of the patient be ſuch as abſolutely forbids them.

Blood is moſt conveniently drawn either from the arm or jugulars; and if the weakneſs be ſuch as renders it improper to take away much blood, we may apply cupping-glaſſes to the occiput.

Vomiting, in weakly people, muſt be excited by the vinum ipecacoanæ; but, in the more robuſt, by emetic tartar, or antimonial wine: the moſt efficacious cathartics, are the infuſion or tincture of black hellebore, or infuſion of ſenna, quickened with tincture of jalap; but if there be ſuppreſſion of the menſes, or hæmorrhoidal diſcharge, then aloetic purges will be more proper. In general, mad people require very large doſes, both of the emetics and cathartics, before any conſiderable operation enſues.

Dr. Monro aſſures us, that the evacuation by vomiting is infinitely preferable to any other: the prodigious quantity of phlegm, with which the patients in this dieaſe abound, he ſays, is not to be got the better of but by repeated vomits; and he obſerves, that the purges have not their right effect, or do not operate to ſo good purpoſe, until the phlegm is broken and attenuated by frequent emetics. He mentions the caſe of a gentleman who had laboured under a melancholy for three years, from which he was relieved entirely by the uſe of vomits, and a proper regimen. Increaſing the diſcharge by urine, is alſo of the greateſt moment, eſpecially when any degree of fever is preſent. The cutaneous diſcharges are alſo to be promoted, for which purpoſe the hot bath is of the higheſt ſervice in maniacal caſes. Hoffman aſſerts, that he has ſeen numerous inſtances, both of inveterate melancholy and raging madneſs, happily cured by means of warm bathing; bleeding and nitrous medicines having been premiſed. Camphor has alſo been highly commended; but, if we believe Dr. Locker of Vienna, not very deſervedly.

Both reaſon and experience ſhew the neceſſity of confining ſuch as are deprived of their ſenſes; and no ſmall ſhare of the management conſiſts in hindering them to hurt themſelves, or do miſchief to other perſons. It has ſometimes been uſual to chain and to beat them: but this is both cruel and abſurd; ſince the contrivance called the *ſtrait waiſtcoat*, anſwers every purpoſe of reſtraining the patients, without hurting them.

It is of great uſe in practice to bear in mind, that all mad people are cowardly, and can be awed even by the menacing look of a very expreſſive countenance; and when thoſe who have charge of them once impreſs them with the notion of fear, they eaſily ſubmit to any thing that is required. The phyſician, however, ſhould never deceive them in any thing, but more eſpecially with regard to their diſtemper: for as they are generally conſcious of it themſelves, they acquire a kind of reverence for thoſe who know it; and by letting them ſee that he is thoroughly acquainted with their complaint, he may very often gain ſuch an aſcendant over them that they will readily follow his directions.

It is a more difficult matter to manage thoſe whoſe madneſs is accompanied either with exceſſive joy, or with great dejection and deſpondency, than thoſe who are agitated with rage: and all that can be done is to endeavour to excite contrary ideas, by repreſſing the immoderate fits of laughter in the one kind by chiding or threatening, (taking care, however, not abſolutely to terrify them, which can never be done without danger, and has often added to the miſery of the unhappy ſufferer); and diſpelling the gloomy thoughts in the other, by introducing pleaſing concerts of muſic, or any other ſpecies of entertainment which the patients have been known to delight in while they had the uſe of their reaſon

Though bliſtering the head has generally been directed, Dr. Mead ſays he has oftener found it to do harm than ſervice: but he recommends iſſues in the back; and adviſes to keep the head always cloſe ſhaved, and to waſh it from time to time with warm vinegar. Opium is uſually forbidden in maniacal caſes, as ſuppoſing that it always increaſes the diſturbance; but there are inſtances where large doſes of this medicine have been found to prove a cure, and perhaps if it were tried oftener we ſhould find powerful effects from it: there certainly cannot much harm enſue from a few doſes, which may be immediately diſuſed if they ſhould be found to exaſperate the diſeaſe.

The diet of maniacal patients ought to be perfectly light and thin: their meals ſhould be moderate; but they ſhould never be ſuffered to live too low, eſpecially while they are under a courſe of phyſic: they ſhould be obliged to obſerve great regularity in their hours: even their amuſements ſhould be ſuch as are beſt ſuited to their diſpoſition; and after the diſeaſe appears to be ſubdued, chalybeate waters and the cold bath will be highly proper, to ſtrengthen their whole frame, and ſecure them againſt a relapſe.

CLASS III. CACHEXIÆ.

A depraved Habit of the whole or greateſt Part of the Body.

Order I. MARCORES; *a Waſting of the whole* Body.

Genus L. TABES, *or Waſting of the* Body.

This diſorder is occaſioned by the abſorption of pus from ſome ulcer external or internal, which produces an hectic fever. The primary indication therefore muſt be to heal the ulcer, and thus take away the cauſe of the diſeaſe. If the ulcer cannot be healed, the patient will certainly die in an emaciated ſtate. But for the proper treatment of the tabes proceeding from this cauſe, ſee Ulcer, Siphylis, Scrophula, Scurvy, &c. alſo the article Surgery.

Genus LI. ATROPHY, or Nervous Consumption.

Deſcription. This is a waſting of the body, without any remarkable fever, cough, or difficulty of breathing; but attended with want of appetite, and a bad digeſtion, whence the whole body grows languid, and waſtes by degrees. Dr. Cullen, however, aſſerts, that ſome degree of fever, or at leaſt of increaſed quickneſs of the pulſe, always attends this diſeaſe.

Cauſes. Sometimes this diſtemper will come on without any evident cauſe. Sometimes it will ariſe from paſſions of the mind; from an abuſe of ſpirituous liquors; from exceſſive evacuations, eſpecially of the ſemen, in which caſe the diſtemper hath got the name of *tabes dorſalis.* It will ariſe from mere old age, or from famine.

Prognoſis. This diſtemper, from whatever cauſe it may ariſe, is very difficult to cure, and often terminates in a fatal dropſy.

Cure. Stomachic and nervous medicines are only to be depended upon in this caſe. The Peruvian bark, elixir of vitriol, and chalybeates, are excellent; and the diet ſhould be as light and nutritive as poſſible. In that ſpecies of the diſtemper occaſioned by venereal exceſſes, it is ſo eſſentially neceſſary to abſtain from them, that without it the beſt remedies will prove uſeleſs. But this is ſo ſeldom complied with, that the tabes dorſalis almoſt always proves mortal.

Order II. INTUMESCENTIÆ; *External Tumours.*

Genus LII. POLYSARCIA, *or* Corpulency.

In a natural and healthy ſtate, the fat, or animal oil, is not allowed to diffuſe itſelf throughout the cellular interſtices at large, but is confined to the places where ſuch an oily fluid is neceſſary, by a particular apparatus of diſtinct veſicles. But in many conſtitutions the oily part of the blood appears to exceed the requiſite proportion, and eaſily ſeparates from the other conſtituent parts; and then it is apt to accumulate in ſuch quantities, that we may ſuppoſe it to burſt thoſe veſicles which were originally deſtined to hinder it from ſpreading too far.

The increaſe of the omentum particularly, and the accumulation of fat about the kidneys and meſentery, ſwell the abdomen, and obſtruct the motions of the diaphragm; whence one reaſon of the difficulty of breathing which is peculiar to corpulent people; while the heart, and the large veſſels connected therewith, are in like manner ſo encumbered, that neither the ſyſtaltic nor ſubſultory motion can be performed with ſufficient freedom, whence weakneſs and ſlowneſs of the pulſe: but when the whole habit is in a manner overwhelmed with an oily fluid, the enlargement of the cellular interſtices will neceſſarily interrupt the general diſtribution and circulation throughout the nervous and vaſcular ſyſtems; impeding the action of the muſcular fibres, and producing inſenſibility, ſomnolency, and death.

Theſe caſes are the more deplorable, as there is but little proſpect of a cure. For the animal oil is of too groſs a nature to be eaſily taken up by abſorption: and we know, that when fluids are accumulated in the cellular ſyſtem, there are only two ways in which they can be carried off or eſcape; namely, by the abſorbents, which take their riſe from the cellular interſtices and through the pores of the ſkin by tranſudation.

Another misfortune is, that the diſeaſe ſteals on ſo imperceptibly, that it becomes inveterate by the time that people begin to think of purſuing the proper means of relief.

Soap has been propoſed as a remedy to melt down and facilitate the abſorption of the fat in corpulent people; and Dr. Fleming ſome years ago publiſhed a little treatiſe, wherein he recommends this medicine, and relates the caſe of a gentleman who is ſaid to have received conſiderable benefit from it. But perhaps the ſoap-lees would be more powerful, and might be more eaſily taken, ſheathed, as hereafter directed, when recommended as a diſſolvent of the ſtone.

Lieutaud adviſes to take *acetum ſcilliticum* in ſmall doſes, with frequent purging and briſk exerciſe. But it will ſeldom happen that the patients will be found ſufficiently ſteady to perſiſt in any of theſe courſes, it being the nature of the diſorder to render them irreſolute and inattentive to their condition. Therefore the principal uſe of rules muſt be with a view to prevention; and perſons who are diſpoſed to corpulency ſhould take care in time to prevent it from becoming an abſolute diſeaſe, by uſing a great deal of exerciſe, not indulging in ſleep, and abridging their meals, eſpecially that of ſupper. Salted meats are leſs fattening than ſuch as are freſh; and drinking freely of coffee is recommended to corpulent people.

But Dr. Fothergill obſerves, that a ſtrict adherence to vegetable diet reduces exuberant fat more certainly than any other means that he knows of; and gives two caſes wherein this regimen ſucceeded remarkably well. The famous Dr. Cheyne brought himſelf down in this way, from a moſt unweildy bulk, to a reaſonable degree of weight; as he himſelf informs us.

Genus LIII. PNEUMATOSIS, Emphysema, *Windy Swelling*

The emphyſema ſometimes comes on ſpontaneouſly; but more frequently is occaſioned by wounds of the lungs, which giving vent to the air, that fluid inſinuates itſelf into the cellular texture, and often blows it up to a ſurpriſing degree. It muſt be obſerved, however, that it is only in caſes of laceration of the lungs where this diſeaſe can take place; for in a ſimple wound, the effuſion of blood always prevents the air from getting out. The cure is to be accompliſhed by the ſcarifications and compreſſes, and in ſome caſes only by the paracenteſis of the thorax.

Genus LIV. TYMPANITES, *the* Tympany.

This is an inflation of the abdomen, and is of two kinds: 1. That in which the flatus is contained in the inteſtines, in which the patient has frequent exploſions of wind, with a ſwelling of the belly frequently unequal. 2. When the flatus is contained in the cavity of the abdomen; in which caſe the ſwelling is more equal, and the belly ſounds when ſtruck, without any conſiderable emiſſion of flatus. In both caſes the reſt of the body falls away.

Cauſes, &c. The tympany ſometimes takes place in thoſe who have been long troubled with flatulencies in the ſtomach and inteſtines. It happens frequently to women after abortion; to both ſexes after the ſuppreſſion of the hæmorrhoids; and ſometimes from tedious febrile diſorders injudiciouſly treated.

Prognoſis. This diſeaſe is generally very obſtinate, and for the moſt part proves fatal by degenerating into an aſcites. Sometimes, if the patient be healthy and ſtrong, the diſeaſe may terminate favourably, and that the more readily if it has followed ſome other diſorder. A hectic conſumption, dry cough, and emaciated countenance in a tympany, with a ſwelling of the feet, denote approaching death in a very ſhort time.

Cure. The cure of the tympany is to be attempted by carminative, reſolvent, and ſtomachic medicines, gentle laxatives, and at laſt tonics, eſpecially chalybeates.

Genus LV. PHYSOMETRA, *or* Windy Swelling *of the Uterus.*

The treatment of this is not different from that of the tympany.

Genus LVI. ANASARCA, *or* Watery Swelling *over the Whole Body.*

In this diſeaſe the feet firſt begin to ſwell, eſpecially in the evening, after exerciſe, and when the patient has ſtood or ſat long; which ſwelling riſes frequently to the thighs. By lying in bed, the ſwelling becomes leſs, or even almoſt diſappears. In the progreſs of the diſeaſe, the ſwelling often riſes to the hips, loins, and belly, and at laſt covers the whole body. This diſeaſe, beſides the other ſymptoms hereafter mentioned under Ascites, is attended with a remarkable difficulty of breathing. For the cure, ſee Ascites. Only it may be here noticed, that in anaſarca it is uſual to ſcarify the feet and legs. By this means the water is often diſcharged: but the operator muſt be cautious not to make the inciſion too deep; they ought barely to penetrate through the ſkin; and eſpecial care muſt be taken, by ſpirituous fomentations and proper digeſtives, to prevent a gangrene. Dr. Fothergill obſerves, that the ſafeſt and moſt efficacious way of making theſe drains is by the inſtrument uſed for cupping, called a *ſcarficator*; and he always orders it to be ſo applied as to make the little wounds tranſverſely; as they not only diſcharge better, but are alſo longer in healing, than when made longitudinally.

Genus LVII. ASCITES, *or* Dropsy *of the Abdomen.*

Deſcription. This diſeaſe aſſumes three different forms: 1. When the water immediately waſhes the inteſtines. 2. When it is interpoſed between the abdominal muſcles and peritonæum; or, 3. It may be contained in ſacs and hollow glands, in which caſe it is called the *encyſted dropſy.* Some phyſicians of great reputation have aſſerted, that the water was often placed within the duplicature of the peritonæum: but this is alleged by Dr. Milman to be a miſtake, as that membrane is looked upon by the beſt anatomiſts to be ſingle; and he thinks that the abovementioned phyſicians have been led into the miſtake from obſerving the water collected in the cellular ſubſtance of the peritonæum.

In the beginning of an aſcites the patient becomes languid, breathleſs, and hath an averſion to motion: to his belly ſwells; and when ſtruck, the ſound of fluctuating water is perceptible; there is a difficulty of breathing when the belly is preſſed. There is an almoſt continual thirſt, which in the progreſs of the diſeaſe becomes very urgent; the urine is thick, in ſmall quantity, and red. The pulſe is ſmall and frequent; and as the belly ſwells, the other parts waſte away. A fever at laſt ariſes, which, conſtantly increaſing, at laſt carries off the patient. Theſe ſymptoms are moſt urgent where the waters are in immediate contact with the inteſtines; in the other kinds the reſt of the body is leſs waſted; nor is there ſo great thirſt or difficulty of breathing.

Cauſes, &c. The immediate cauſe of dropſy is a greater effuſion of ſerum by the exhalent arteries than the abſorbents can take up. This may be occaſioned either by two great a quantity of liquid thrown out by the former, or by an inability of the latter to perform their office. This commonly happens in people whoſe bodies are of a weak and lax texture, and hence women are more ſubject to this malady than men; chlorotic girls eſpecially are very apt to become dropſical.

Sometimes, however, this diſeaſe is occaſioned by a debility of the vital powers, by great evacuations of blood, or by acute diſeaſes accidentally protracted beyond their uſual period; and although this cauſe ſeems very different from a laxity of fibres, yet the dropſy ſeems to be produced in a ſimilar manner by both. For the vital powers being debilitated by either of theſe cauſes, naturally bring on a certain debility and laxity of the ſolids; and on the other hand a debility of the ſolids always brings on a debility of the vital powers; and from this debility of the vital powers in both caſes it often happens, that thoſe humours which ought to be expelled from the body are not, but accumulate by degrees in its cavities. There is, however, this difference between the two kinds of dropſy ariſing from theſe two different cauſes: That in the one which ariſes from laxity, the ſolid parts are more injured than in that which ariſes from a debility of the vital powers. In the former, therefore, the water ſeems to flow out from every quarter, and the body ſwells all over. But when the diſeaſe is occaſioned by a debility of the vital powers, though the ſolids are leſs damaged, yet the power of the heart being much diminiſhed, and the humours ſcarce propelled through the extreme veſſels, the thin liquids by which, in a healthy ſtate the body is daily recruited, are carried by their own weight either into the cavities or into the cellular texture. Hence thoſe aqueous effuſions which follow great evacuations of blood, or violent looſeneſſes, begin in the more depending parts of the body, gradually aſcending, till they arrive at the cavity of the abdomen, or even the thorax.

But another and much more ſufficient cauſe for the production of dropſy is an obſtruction of the circulation; and this may take place from polypi in the heart or large veſſels, and hard ſwellings in the abdomen. Inſtances have been obſerved of a dropſy ariſing from ſteatomatous tumours in the omentum, and many more from a ſcirrhous liver or ſpleen, and from an infarction and obſtruction of the meſenteric glands, by which means the lymph coming from the extremities is prevented from arriving at the heart.

Laſtly, whatever, either within or without the veſſels, contracts or ſhuts up their cavities, produces a more copious and eaſy tranſmiſſion of the thin humours through the exhalent arteries, at the ſame time that it prevents their return by the abſorbent veins. This hath been eſtabliſhed by experiment. For Lower having perforated the right ſide of the thorax in a dog, tied the *vena cava*, and ſewed up the wound. The animal languiſhed for a few hours, and then died. On diſſection, a great quantity of ſerum was found in the abdomen, as if he had long laboured under an aſcites. In like manner, having tied the jugular veins of another dog, a ſurprizing ſwelling took place in thoſe parts above the ligatures, and in two days the creature died. On diſſection, all the muſcles and glands were vaſtly diſtended, and quite pellucid, with limpid ſerum. From theſe experiments, and ſome caſes of diſeaſe mentioned by different authors, it appears, that when the veins are obſtructed ſo that they cannot receive the arterial blood, the ſerum is ſeparated as by a filtre into the more open cavities and laxer parts of the body, while the thicker part ſtagnates and is collected in the proper blood-veſſels.

The too great tenuity of the humours is very frequently accuſed as the cauſe of dropſy, and many authors have aſſerted that dropſy might ariſe merely from a ſuperabundance of water in the blood. For this ſome experiments of Haleſius are quoted, from which they would infer, that when a great quantity of aqueous fluid is introduced into the blood, the ſuperfluous fluid ought by no means to paſs through the extremities of the ſanguiferous arteries into the veins in the common courſe of circulation, but by being effuſed into the cavities ſhould produce a dropſy. But this can only happen when the vital powers are very much diminiſhed; for, in a natural ſtate, the ſuperfluous quantity is immediately thrown out by the ſkin or kidneys; and agreeable to this we have an experiment of Schultzius, who induced a dropſy in a dog by cauſing him to drink a great quantity of water; but he had firſt bled him almoſt *ad deliquium*, ſo that the vital powers were in a manner oppreſſed by the deluge of water. In this manner do thoſe become hydropic, who are ſeized with the diſeaſe on drinking large quantities of water either when wearied with labour, or weakened by ſome kinds of diſeaſes. Dr. Fothergill relates an inſtance of a perſon who, being adviſed to drink plentifully of barley water, in order to remove a fever, raſhly drunk 12 pounds of that liquor every day for a month, and thus fell into an almoſt incurable diſtemper. But if this quantity had been taken only during the prevalence of the fever, he would in all probability have ſuffered no inconvenience.

The remote cauſes of dropſy are many and various. Whatever relaxes the ſolids in ſuch a manner as to give an occaſion of accumulation to the ſerous fluids, diſpoſes to the dropſy. A lazy indolent life, rainy wet weather, ſwampy or low ſoils, and every thing which conduces to vitiate the viſcera, or inſenſibly to produce obſtructions in them, paves the way for a dropſy. Hence thoſe are ready to fall into the diſeaſe who uſe hard and viſcid aliments, ſuch as poor people in ſome countries who are fed with unwholeſome aliments; and the ſame thing happens to thoſe who drink immoderately of ſpirituous liquors.

Prognoſis. When the dropſy ariſes from a ſcirrhus of the liver or ſpleen, or any of the other viſcera, the prognoſis muſt always be fatal, as alſo when it ariſes from diſorders of the lungs. Neither is the caſe more favourable to thoſe in whom the ſmall veſſels are ruptured, and pour out their liquids into the cavity of the abdomen. Thoſe certainly die who have polypi in the veſſels, or tumours compreſſing the veins and veſſels of the abdomen. A dropſy ariſing from obſtructions in the menſenteric glands is likewiſe difficult to cure, whether ſuch obſtructions ariſe from a bad habit of body, or from any other cauſe; but if we can by any means remove the diſeaſe of the glands, the dropſy eaſily ceaſes. But in thoſe who fall into dropſy without any diſeaſe preceding, it is not quite ſo dangerous; and even though a diſeaſe hath preceded, if the patient's ſtrength is not greatly weakened, if the reſpiration is free, and the perſon is not affected with any particular pain, we may entertain great hopes of a cure. But where a great loſs of blood is followed by a fever, and that by a dropſy, the patients almoſt always die, and that in a ſhort time; but they are very frequently cured who fall into this diſeaſe without any preceding hæmorrhage.

Cure. In the cure of this diſeaſe authors chiefly mention two indications. 1. To expel the ſuperfluous quantity of water; and, 2. To prevent its being again collected. But before we proceed to ſpeak of the remedies, it is neceſſary to take notice, that by the animal œconomy, if a great evacuation of a fluid takes place in any part of the body, all the other fluids in the body are directed towards that part, and thoſe which lie as it were lurking in different parts will be immediately abſorbed, and thrown out by the ſame paſſage. Hence the humours which in hydropic perſons are extravaſated into the different cavities of the body will be thrown into the inteſtines, and evacuated by purgatives; or by diuretics will be thrown into the kidneys, and evacuated by urine. It is not, however, only neceſſary to excite theſe evacuations in order to remove this malady, but they muſt be aſſiduouſly promoted and kept up till the abundant humour is totally expelled. For this reaſon Sydenham has adviſed purgatives to be adminiſtered every day, unleſs, either through the too great weakneſs of the body, or the violent operation of the purgative, it ſhall be neceſſary to interpoſe a day or two now and then; becauſe if any conſiderable intervals are allowed to take place between the exhibition of the purgatives, an opportunity is given to the waters of collecting again. In this method, however, there is the following inconvenience, that, when the waters are totally evacuated, the ſtrength is at the ſame time ſo much exhauſted, that the diſtemper commonly returns in a very ſhort time. Hence almoſt our only hopes of curing a dropſy, conſiſt in gently evacuating the waters by means of diuretics. But the efficacy of theſe is generally very doubtful. Dr. Friend hath long ago obſerved, that this part of medicine is of all others the moſt lame and imperfect; but a certain French phyſician named *Bacher*, lately found a method of making the diuretics much more ſucceſsful. His reputation became at laſt ſo great, that the French king thought proper to purchaſe his ſecret for a great ſum of money. The baſis of his medicine was hellebore-root, the malignant qualities of which he pretended to correct.

But though *Bacher* was firmly of opinion that his pills cured the dropſy by reaſon of the correction; yet it is certain, that, in the hands of other practitioners, his pills have failed. It is alſo certain that different medicines will prove equally efficacious in dropſical caſes, provided a regimen is made uſe of.

For a great number of ages it hath been recommended to dropſical patients to abſtain as much as poſſible from drink, and thus to the torments of their diſeaſe was added that of an intolerable thirſt; and how great this torment was, we may underſtand from an example of a friend of king Antigonus, who, having been cloſely watched both by order of the phyſicians and alſo of the king, was ſo unable to bear the raging thirſt occaſioned by his diſeaſe, that he ſwallowed his own excrements and urine, and thus ſpeedily put an end to his life. Dr. Milman ſhews at great length the pernicious tendency of this practice. He maintains that it is quite contrary to the ſentiments of Hippocrates and the beſt ancient phyſicians. He aſſerts, that unleſs plenty of diluting drink is given, the beſt diuretics can have no effect. He condemns alſo in the ſtrongeſt terms the practice of giving dropſical patients only dry, hard, and indigeſtible aliments. Theſe would oppreſs the ſtomach even of the moſt healthy, and how much more muſt they do ſo to thoſe who are already debilitated by labouring under a tedious diſorder? By what means alſo are theſe aliments to be diſſolved in the ſtomach, when drink is withheld? In this diſeaſe the ſaliva is viſcid, and in ſmall quantity; from whence it may be reaſonably conjectured, that the reſt of the fluids are of the ſame nature, and the gaſtric juices likewiſe depraved. Thus the aliments lie long in the ſtomach; and if the viſcera were formerly free of obſtructions, they are now generated; the ſtrength fails; perſpiration and other excretions are obſtructed; the viſcid and pituitous humours produced by theſe kinds of food float about the præcordia, and increaſe the diſeaſe, while the ſurface of the body becomes quite dry. Nay, ſo much does this kind of diet conſpire with the diſeaſe, that 1000 pounds of fluid will ſometimes be imbibed in a few days by hydropic perſons who take no drink. Even in health, if the body from any cauſe becomes dry, or deprived of a conſiderable part of its juices, as by hunger, labour, &c. it will imbibe a conſiderable quantity of moiſture from the air; ſo that we muſt impute the abovementioned extraordinary inhalation, in part at leaſt, to the denial of drink, and to the nature of the aliment given to the ſick. The following is the method, related by Dr. Milman, of his practice in the Middleſex hoſpital.

If the patient is not very much debilitated, he is ſometimes treated with the purging waters, and a doſe of jalap and calomel alternately. On the intermediate days he gets a ſaline mixture, with 40 or 60 drops of *acetum ſcilliticum* every ſixth hour; drinking with the purgatives oat-gruel and ſome thin broths. That he might the better aſcertain what ſhare the liquids given along with the medicines had in producing a copious flow of urine, he ſometimes gave the medicines in the beginning of the diſtemper without allowing the drink: but though the ſwellings were uſually diminiſhed a little by the purgatives, the urine ſtill continued ſcanty, and the patients were greatly weakened. Fearing, therefore, leſt, by following this courſe, the ſtrength of the ſick might be too much reduced, he then began his courſe of diuretic medicines, giving large quantities of barley-water with a little *ſal diureticus*; by which means, ſometimes in the ſhort ſpace of 48 hours after the courſe was begun, the urine flowed out in a very large quantity: but as ſaline drinks are very diſagreeable to the taſte, a drink was compoſed purpoſely for hydropic perſons, of half an ounce of cream of tartar diſſolved in two pounds of barley-water, made agreeably ſweet with ſyrup, adding one or two ounces of French brandy.

To this compoſition Dr. Milman was induced by the great praiſes given to cream of tartar by ſome phyſicians in hydropic caſes. In the *Acta Bononienſia*, 15 caſes of hydropic patients are narrated who were cured only by taking half an ounce of cream of tartar daily. But it is remarkable, that by theſe very patients the cream of tartar was taken for 20, 30, nay 40 days, often without any perceptible effect; yet when diſſolved in a large quantity of water, it ſhewed its ſalutary effects frequently within as many hours, by producing a plentiful flow of urine. This liquor is now the common drink of hydropic patients in the hoſpital above-mentioned, of which they drink at pleaſure along with their medicines.

Among purgative medicines Dr. Milman recommends the *radix ſenekæ*; but ſays, when the decoction of it is too ſtrong, he always found it excite vomiting and thus greatly to diſtreſs the patients: but when only half an ounce or ſix drachms of the root are uſed to a pound of decoction, inſtead of a whole ounce, he found it an excellent remedy.

The water having been drawn off, we are to put the patient on a courſe of ſtrengtheners; ſuch as the cortex and filings of iron, with ſome of the warm aromatics, and a due proportion of rhubarb infuſed in wine. Enjoin briſk exerciſe and frictions on the belly, with ſuch a courſe of diet as ſhall be light and nouriſhing.

When the patient can by no other means be relieved, the operation of paracenteſis muſt be had recourſe to.

ORDER III. IMPETIGINES; *Cachexies deforming the Skin and External Parts of the Body.*

GENUS LVIII. SCROPHULA, or KING'S-EVIL.

Deſcription. This diſeaſe ſhews itſelf by hard, ſcirrhous, and often indolent tumours, which ariſe by degrees in the glands of the neck, under the chin, arm-pits, and different parts of the body; but moſt commonly in the neck, and behind the ears. In proceſs of time, the cellular ſubſtance, ligaments of the joints, and even the bones themſelves, are affected. In ſcrophula the ſwellings are much more moveable than thoſe of the ſcirrhous kind; they are generally ſofter, and ſeldom attended with much pain: they are tedious in coming to ſuppuration; are very apt to diſappear ſuddenly, and again to riſe in ſome other part of the body. We may likewiſe mention as characteriſtic circumſtances of this diſeaſe, a remarkable ſoftneſs of the ſkin, a kind of fulneſs of the face, generally with large eyes, and a very delicate complexion.

Cauſes. A variety of cauſes have been mentioned as tending to produce ſcrophula, viz. a crude indigeſtible food; bad water; living in damp, low ſituations; its being an hereditary diſeaſe, and in ſome countries endemic, &c. But whatever may in different circumſtances be the exciting or prediſpoſing cauſes of the ſcrophula, the diſeaſe itſelf either depends upon, or is at leaſt much connected with, a debility of the conſtitution in general, and probably of the lymphatic ſyſtem in particular, the complaint always ſhowing itſelf by ſome affections of the latter. And that debility has at leaſt a conſiderable influence on its production is probable, not only from the manifeſt nature of ſome of the cauſes ſaid to be productive of ſcrophula, but likewiſe from ſuch remedies as are found moſt ſerviceable in the cure, which are all of a tonic invigorating nature.

Prognoſis. The ſcrophula is a diſtemper which often eludes the moſt powerful medicines, and therefore phyſicians cannot with any certainty promiſe a cure. It is ſeldom, however, that it proves mortal in a ſhort time, unleſs it attacks the internal parts, ſuch as the lungs, where it frequently produces tubercles that bring on a fatal conſumption. When it attacks the joints, it frequently produces ulcers, which continue for a long time, and gradually waſte the patient; while in the mean time the bones become foul and corroded, and death enſues after a long ſcene of miſery. The prognoſis in this reſpect muſt be regulated entirely by the nature of the ſymptoms.

Cure. It was long ſuppoſed, that ſcrophula depended upon an acid acrimony of the fluids; and this, it is probable, gave riſe to the uſe of burnt ſponge, different kinds of ſoap, and other alkaline ſubſtances, as the beſt remedies for acidity. But although a ſoreneſs of the ſtomach and *primæ viæ* does no doubt frequently occur in theſe complaints, yet it ſeems to be entirely the conſequence of that general relaxation which in ſcrophula ſo univerſally prevails, and which does not render it in the leaſt neceſſary to ſuppoſe a general aceſcency of the fluids to take place; as the one very frequently, it is well known, even in other complaints, occurs without the leaſt ſuſpicion of any acid acrimony exiſting. This is alſo rendered very probable from the indolent nature of ſcrophulous tumours, which have been known to ſubſiſt for years without giving any uneaſineſs; which could not have been the caſe, if an acid, or any other acrimony, had prevailed in them.

Gentle mercurials are ſometimes of uſe as reſolvents in ſcrophulous ſwellings; but nothing has ſuch conſiderable influence as a frequent and copious uſe of Peruvian bark. Cold bathing too, eſpecially in the ſea, together with frequent moderate exerciſe, is often of ſingular ſervice here; as is likewiſe change of air, eſpecially to a warm climate.

In the ſcrophulous inflammation of the eyes, or ophthalmia ſtrumoſa, the bark has alſo been given with extraordinary advantage: and we meet with an inſtance of its having cured the gutta roſacea in the face; a complaint which it is ſo often difficult to remove, and is extremely diſagreeable to the fair ſex. From the various caſes related of tumefied glands it appears, that when the habit is relaxed and the circulation weak, either from conſtitution or accident, the bark is a moſt efficacious medicine, and that it acts as a reſolvent and diſcutient. It will not, however, ſucceed in all caſes; but there are few in which a trial can be attended with much detriment. Dr. Fothergill obſerves, that he has never known it avail much where the bones are affected, nor where the ſcrophulous tumour is ſo ſituated as to be accompanied with much pain, as in the joints, or under the membranous coverings of the muſcles; for when the diſeaſe attacks thoſe parts, the perioſteum ſeldom eſcapes without ſome injury, by which the bone will of courſe be likewiſe affected. Here the bark is of no effect: inſtead of leſſening, it rather increaſes the fever that accompanies thoſe circumſtances; and, if it does not really aggravate the complaint, it ſeems at leaſt to accelerate the progreſs of the diſeaſe.

Various are the modes in which the bark is adminiſtered; but Dr. Fothergill makes uſe of a decoction, with the addition of ſome aromatic ingredients and a ſmall quantity of liquorice-root, as a form in which a ſufficient quantity may be given without exciting diſguſt. The powder ſoon becomes diſagreeable to very young patients; and the extract ſeems not ſo much to be depended upon as may have been imagined. In making the extract, it is expoſed to ſo much heat, as muſt have ſome effect upon its virtues, perhaps to their detriment. In adminiſtering it, likewiſe, if great care be not taken to mix it intimately with a proper vehicle, or ſome very ſoluble ſuſtance, in weak bowels it very often purges, and thereby not only diſappoints the phyſician, but injures the patient. A ſmall quantity of the *cortex Winteranus* added, gives the medicine a grateful warmth; and a little liquorice, a few raiſins, gum arabic, or the like, added to the decoction before it is taken from the fire, by making the liquor viſcid, enables it to ſuſpend more of the fine particles of the bark; by which proceſs the medicine is not only improved in efficacy, but at the ſame time rendered leſs diſagreeable.

In indolent ſwellings of the glands from viſcid humours, ſea-water alſo has been ſtrongly recommended by Dr. Ruſſel.

Dr. Fothergill alſo acquaints us, that the cicuta is not without a conſiderable ſhare of efficacy in removing ſcrophulous diſorders. He mentions the caſe of a gentlewoman, about 28 years of age, afflicted from her infancy with ſcrophulous complaints, ſevere ophthalmies, glandular ſwellings, &c. cured by the *extractum cicutæ* taken conſtantly for the ſpace of a year. He obſerves, however, that when given to children even in very ſmall doſes, it is apt to produce ſpaſmodic affections; for which reaſon he rarely exhibits it to them when very young, or even to adults of very irritable habits.

Our author gives ſeveral other inſtances of the ſucceſs of cicuta in ſcrophulous caſes, and even in one which ſeemed to be not far removed from a confirmed phthiſis, but owns that it ſeldom had ſuch good effects afterwards; yet he is of opinion, that where there are ſymptoms of tubercles forming, a ſtrumous habit, and a tendency to phthiſis, the cicuta will often be ſerviceable. It is anodyne, corrects acrimony, and promotes the formation of good matter. With regard to the quality of the medicine; our author obſerves, the extract prepared from hemlock before the plant arrives at maturity, is much inferior to that which is made when the hemlock has acquired its full vigour and is rather on the verge of decline; juſt when the flowers fade, the rudiments of the ſeeds become obſervable, and the habit of the plant inclines to yellow, ſeems the proper time to collect the hemlock. It has then had the full benefit of the ſummer-heat, and the plants that grow in expoſed places will generally be found more virous than thoſe that grow in the ſhade. The leſs heat it undergoes during the preparation the better. Therefore, if a conſiderable quantity of the dry powder of the plant, gathered at a proper ſeaſon, is added, the leſs boiling will be neceſſary, and the medicine will be the more efficacious. But let the extract be prepared in what manner ſoever it may, provided it is made from the genuine plant, at a proper ſeaſon, and is not deſtroyed by boiling; the chief difference obſervable in uſing it is, that a larger quantity of one kind is required to produce a certain effect than of another. Twenty grains of one ſort of extract have been found equal in point of efficacy to thirty, nay near forty of another; yet both of them made from the genuine plant, and moſt probably prepared with equal fidelity. To prevent the inconveniencies ariſing from this uncertainty, it ſeems always expedient to begin with ſmall doſes, and proceed, ſtep by ſtep, till the extract produces certain effects, which ſeldom fail to ariſe from a full doſe. Theſe effects are different in different conſtitutions. But, for the moſt part, a giddineſs affecting the head, and motions of the eyes as if ſomething puſhed them outwards, are firſt felt; a ſlight ſickneſs, and trembling agitation of the body; a laxative ſtool or two. One or all theſe ſymptoms are the marks of a full doſe, let the quantity in weight be what it will. Here we muſt ſtop till none of theſe effects are felt; and, in three or four days, advance a few grains more. For the general experience, of all who have uſed this medicine to any good purpoſe agree, that the cicuta ſeldom procures any benefit, though given for a long time, unleſs in as large a doſe as the patient can bear without ſuffering any of the inconveniencies abovementioned.

Patients commonly bear a greater quantity of the extract at night than at noon, and at noon than in the morning. Two ounces may be divided into thirty pills, not gilt. Adults begin with two in the morning, two at noon, and three or four at night, with directions to increaſe each doſe, by the addition of a pill to each, as they can bear it.

GENUS LIX. SYPHILIS, *the* LUES VENEREA, *or French Pox.*

Astruc, who wrote the hiſtory of the lues venerea, is fully convinced that it is a new diſeaſe, which never appeared in Europe till ſome time between the years 1494 and 1496, having been imported from America by the companions of Chriſtopher Columbus; though this opinion is not without its opponents.

The venereal infection, however, cannot, like the contagious miaſmata of the ſmall-pox and ſome other diſeaſes, be carried through the air, and thus ſpread from place to place: for unleſs it is tranſmitted from the parents to the children, there is no other way of contracting the diſeaſe but by actually touching ſome perſon who is affected. Thus, when a nurſe happens to labour under the diſeaſe, the infant that ſhe ſuckles will receive the infection; as, on the other hand, when the child is infected, the nurſe is liable to receive it: and there have even been inſtances known of lying-in women being infected very violently, from having employed a perſon to draw their breaſts who happened to have venereal ulcers in the throat. It may be caught by touching venereal ſores if the cuticle be abraded or torn, and in this way accoucheurs and midwives have ſometimes been infected ſeverely. Dr. Macbride ſays, the moſt inveterate pox he ever ſaw, was caught by a midwife, who happened to have a whitelow on one of her fingers, when ſhe delivered a woman ill of the lues venerea. But by far the moſt ready way of contracting this diſeaſe is by coition, the genital parts being much more bibulous than the reſt of the body. When the diſorder is communicated, the places where the morbific matter enters are generally thoſe where it firſt makes its appearance; and as coition is the moſt uſual way of contracting it, ſo the firſt ſymptoms uſually appear on or near the pudenda.

The patient's own account will, for the moſt part, help us to diſtinguiſh the diſeaſe; but there are ſometimes caſes wherein we cannot avail ourſelves of this information, and where, inſtead of confeſſing, the parties ſhall conceal all circumſtances; while, on the other hand, there are now and then people to be met with, who perſuade themſelves, that ſymptoms are venereal, which in reality are owing to ſome other cauſe: and therefore it is of the utmoſt importance to inform ourſelves thoroughly of the nature of thoſe ſymptoms and appearances which may be conſidered as pathognomic ſigns of lues venerea. In the firſt place, when we find that the local ſymptoms, ſuch as chancres, buboes, phymoſis, and the like, do not give way to the uſual methods; or when theſe complaints, after having been cured, break out again without a freſh infection; we may juſtly ſuſpect that the virus has entered the whole maſs of lymph; and if at the ſame time ulcers break out in the throat, and the face is deformed by callous tubercles covered with a brown or yellow ſcab, we may be aſſured that the caſe is now become a confirmed lues, which will require a mercurial courſe.

Venereal ulcers affecting the mouth are diſtinguiſhable from thoſe which are ſcorbutic, in the following manner: 1. Venereal ulcers firſt affect the tonſils, fauces, and uvula; then the gums, but theſe very rarely: on the contrary, ſcorbutic ulcers affect the gums firſt of all; then the fauces, tonſils, and uvula. 2. Venereal ulcers frequently ſpread to the noſe; ſcorbutic ones never. 3. Venereal ulcers are callous in the edges; ſcorbutic ones are not ſo. 4. Venereal ulcers are circumſcribed, and, for the moſt part, are circular, at leaſt they are confined to certain places; ſcorbutic ones are of a more irregular form, ſpread wider, and frequently affect the whole mouth. 5. Venereal ulcers are for the moſt part hollow, and generally covered at bottom with a white or yellow ſlough; but ſcorbutic ones are more apt to grow up into looſe fungi. 6. Venereal ulcers are red in their circumference, but ſcorbutic ones are always livid. 7. Venereal ulcers frequently rot the ſubjacent bones, the ſcorbutic ones ſeldom or ever. 8. And laſtly, Venereal ulcers are moſt combined with other ſymptoms which are known to be venereal; ſcorbutic ones with the diſtinguiſhing ſigns of ſcurvy, ſuch as ſtrait breathing, liſtleſſneſs, ſwelling of the legs, rotten gums, &c.

Another ſure ſign of the confirmed lues, are certain deep-ſeated nocturnal pains, particularly of the ſhins, arms, and head. As for any ſuperficial wandering pains, that have no fixed ſeat, and which affect the membranes of the muſcles and ligaments of the joints, they, for the moſt part, will be found to belong to the gout or rheumatiſm, and can never be conſidered as venereal unleſs accompanied with ſome other evident ſigns; but with regard to the pains that are deeply ſeated, and always fixed to the ſame place, and which affect the middle and more ſolid part of the ulna, tibia, and bones of the cranium, and rage chiefly and with greateſt violence in the fore-part of the night, ſo that the patient can get no reſt till morning approaches, theſe may ſerve to convince us that the diſeaſe has ſpread itſelf throughout the whole habit, whether they be accompanied with other ſymptoms of the lues or not. *Gummata* in the fleſhy parts, *nodes* in the perioſteum, *ganglia* upon the tendons, *tophi* upon the ligaments, *exoſtoſes* upon the bones, and *fici* at the verge of the anus, are all of them ſigns of the confirmed lues: theſe are hard indolent ſwellings; but as they ſometimes ariſe independent of any venereal infection, and perhaps may proceed from a ſcrophulous taint, unleſs they are accompanied, or have been preceded, by ſome of the more certain and evident ſymptoms of the lues, we muſt be cautious about pronouncing them venereal. When theſe ſwellings are not owing to the ſyphilitic virus, they are very ſeldom painful, or tend to inflame and ſuppurate; whereas thoſe that are venereal uſually do, and if they lie upon a bone generally bring on a caries.

Theſe then are the principal and moſt evident ſigns of the confirmed lues. There are others which are more equivocal, and which, unleſs we can fairly trace them back to ſome that are more certain, cannot be held as ſigns of the venereal diſeaſe: Such are, 1. Obſtinate inflammations of the eyes, frequently returning with great heat, itching, and ulceration of the eye-lids. 2. A ſinging and hiſſing noiſe in the ears, with ulcers or caries in the bones of the meatus auditorius. 3. Obſtinate head-achs. 4. Obſtinate cutaneous eruptions, of the itchy or leprous appearance, not yielding to the milder methods of treatment. 5. Swellings of the bones; and, 6. Wandering and obſtinate pains. None of theſe ſymptoms however can be known to be venereal, except they happen to coincide with ſome one or other of the more certain ſigns. Upon the whole, we are firſt to diſtinguiſh and conſider the ſeveral ſymptoms apart; and then, by comparing them with each other, a clear judgment may be formed upon the general review.

Prognoſis. Being thorougly convinced that the caſe is venereal, we are to conſider, firſt of all, whether it be of a longer or ſhorter date; for the more recent it is, it will, *cæteris paribus,* be leſs difficult to remove. But there are other circumſtances which will aſſiſt us in forming a prognoſtic as to the event. As,

1. The age of the patient. The diſorder is more dangerous to infants and old people, than to ſuch as are in the flower and vigour of life, in whom ſome part of the virus may be expelled by exerciſe, or may be ſubdued in ſome degree by the ſtrength of the conſtitution.

2. The ſex. Though women are for the moſt part weaker than men, and therefore ſhould ſeem leſs able to reſiſt the force of any diſeaſe, yet experience ſhews that this is eaſier borne by them than by men: which ſeems owing to the menſtrual and other uterine diſcharges, by which perhaps a good ſhare of the virus may be carried off immediately from the parts where it was firſt applied; for it is obſervable, that whenever theſe diſcharges are obſtructed, or ceaſe by the ordinary courſe of nature, all the ſymptoms of this diſeaſe grow worſe.

3. The habit of body. Perſons who have acrid juices will be liable to ſuffer more from the venereal poiſon than ſuch as have their blood in a milder ſtate; hence, when people of a ſcorbutic or ſcrophulous habit contract venereal diſorders, the ſymptoms are always remarkably violent, and difficult to cure. And for the ſame reaſons, the confirmed lues is much more to be dreaded in a perſon already inclined to an aſthma, phthiſis, dropſy, gout, or any other chronic diſtemper, than in one of a ſound and healthy conſtitution. For, as the original diſeaſe is increaſed by the acceſſion of the venereal poiſon, ſo the lues is aggravated by being joined to an old diſorder. The more numerous the ſymptoms, and the more they affect the bones, the more difficult the cure; but if the acrimony ſhould ſeize on the nobler internal parts, ſuch as the brain, the lungs, or the liver, then the diſeaſe becomes incurable, and the patient will either go off ſuddenly in an apoplectic fit, or ſink under a conſumption.

Cure. Some practitioners have affirmed, that the diſeaſe may be totally extirpated without the uſe of mercury: but, excepting in ſlight caſes, it appears from the moſt accurate obſervations, that this grand ſpecific is indiſpenſable; whether it be introduced through the pores of the ſkin, in the form of ointments, plaſters, waſhes, &c.; or given by the mouth, diſguiſed in the different ſhapes of pills, troches, powders, or ſolutions.

Formerly it was held as a rule, that a ſalivation ought to be raiſed, and a great diſcharge excited. But this is now found to be unneceſſary: for, as mercury acts by ſome ſpecific power in ſubduing and correcting the venereal virus, all that is required is to throw in a ſufficient quantity of the medicine for this purpoſe; and if it can be diverted from the ſalivary glands, ſo much the better, ſince the inconveniences attending a ſpitting are ſuch as we ſhould always wiſh to avoid.

Mercury, when combined with any ſaline ſubſtance, has its activity prodigiouſly increaſed; hence the great variety of chymical preparations, which have been contrived to unite it with different acids.

Corroſive ſublimate is one of the moſt active of all the mercurial preparations, inſomuch as to become a poiſon even in very ſmall doſes. It therefore cannot be given in ſubſtance; but muſt be diſſolved, in order to render it capable of a more minute diviſion. We may ſee, by looking into Wiſeman, that this is an old medicine, though ſeldom given by regular practitioners. How it came to be introduced into ſo remote a part of the world as Siberia, is not eaſily found out; but Dr. Clerc, author of the *Hiſtoire Naturelle de l'Homme Malade*, aſſures us, that the ſublimate ſolution has been of uſe there time out of mind. It appears to have been totally forgotten in other places, until of late years, when the Baron Van Swieten brought it into vogue; ſo that now, if we credit Dr. Locker, they uſe no other mercurial preparation at Vienna. The number of patients cured by this remedy alone in the hoſpital of St. Mark, which was under the care of that gentleman, from 1754 to 1761 incluſive, being 4880.

The way to prepare the ſolution is, to diſſolve as much ſublimate in any kind of ardent ſpirit (at Vienna they uſe only corn-brandy) as will give half a grain to an ounce of ſolution. The doſe to a grown perſon is one ſpoonful mixed with a pint of any light ptiſan or barley water, and this to be taken morning and evening: the patients ſhould keep moſtly in a warm chamber, and lie in bed to ſweat after taking the medicine: their diet ſhould be light; and they ought to drink plentifully throughout the day, of whey, ptiſan, or barley water. If the ſolution does not keep the belly open, a mild purge muſt be given from time to time; for Locker obſerves, that thoſe whom it purges two or three times a day, get well ſooner than thoſe whom it does not purge: he alſo ſays, that it very ſeldom affects the mouth, but that it promotes the urinary and cutaneous diſcharges. This courſe is not only to be continued till all the ſymptoms diſappear, but for ſome weeks longer. The ſhorteſt time in which Locker uſed to let the patients out, was ſix weeks; and they were continued on a courſe of decoction of the woods for ſome weeks after they left off the ſolution.

This method has been introduced both in Britain and Ireland, though by no means to the excluſion of others; but it appears, that the ſolution does not turn out ſo infallible a remedy, either in theſe kingdoms, or in France, as they ſay it has done in Germany. It was ſeldom ever found to perform a radical cure, and the frequent uſe of it proved in many caſes highly prejudicial. It has therefore been ſucceeded in practice by a remedy firſt recommended by Dr. Plenck, and ſince improved by Dr. Saunders; conſiſting of mercury united with mucilage of gum arabic, which is ſaid to render its exhibition perfectly mild and ſafe. For particulars, we refer to Dr. Saunders's treatiſe. If it is determined to have recourſe to the mercurial frictions, the patient muſt be prepared by going into the warm bath ſome days ſucceſſively; having been previouſly blooded if of a plethoric habit, and taking a doſe or two of ſome proper cathartic. The patient being fitted with the neceſſary apparatus of flannels, is then to enter on the courſe. If the perſon be of a robuſt habit, and in the prime of life, we may begin with two drachms of the *unguentum cœruleum fortius*, (Ph. Lond.) which is to be rubbed in about the ankles by an aſſiſtant whoſe hands are covered with bladders: then having intermitted a day, we may expend two drachms more of the ointment, and reſt for two days; after which, if no ſoreneſs of the mouth comes on, uſe only one drachm; and at every ſubſequent friction aſcend till the ointment ſhall reach the trunk of the body; after which the rubbings are to be begun at the wriſts, and from thence gradually extended to the ſhoulders. In order to prevent the mercury from laying too much hold of the mouth, it muſt be diverted to the ſkin, by keeping the patient in a conſtant perſpiration from the warmth of the room, and by drinking plentifully of barley-water, whey, or ptiſan; but if, nevertheleſs, the mercury ſhould tend to raiſe a ſpitting, then, from time to time, we are either to give ſome gentle cathartic, or order the patient into a vapour-bath: and thus we are to go on, rubbing in a drachm of the ointment every ſecond, third, or fourth night, according as it may be found to operate; and on the intermediate days, either purging or bathing, unleſs we ſhould chooſe to let the ſalivation come on; which, however, it is much better to avoid, as we ſhall thus be able to throw in a larger quantity of mercury.

It is impoſſible to aſcertain the quantity of mercury that is neceſſary to be rubbed in, as this will vary according to circumſtances; but we are always to continue the frictions for a fortnight at leaſt, after all ſymptoms of the diſeaſe ſhall have totally diſappeared; and when we have done with the mercury, warm bathing, and ſudorific decoctions of the woods, are to be continued for ſome time longer. Some venereal caſes are ſo very obſtinate as not to yield to mercury; and ſome of the particular ſymptoms will remain even after repeated courſes, particularly the nodes and ſwellings of the perioſteum. Theſe are ſometimes cured by a decoction of the roots of mezereon, an ounce being boiled in a gallon of water down to two quarts; a pint of this decoction is to be conſumed in the courſe of a day. Such other ſymptoms as are found to reſiſt mercury, may perhaps be conquered by a long continuance of the decoction of ſarſaparilla, aided by the warmth of a ſouthern climate.

This is a general ſketch of the methods of treatment for the confirmed lues; but for a complete hiſtory of the diſeaſe, and for ample directions in every ſituation, we refer to Aſtruc, and his abridger Dr. Chapman. We have to add, however, that a method of curing this diſeaſe by fumigation has been lately recommended in France; but it ſeems not to meet with great encouragement. The moſt recent propoſal for the cure of the venereal diſeaſe is that of Mr. Clare, and conſiſts in rubbing a ſmall quantity of mercury on the inſide of the cheek; by which means we not only avoid the inconveniences of unction, but alſo the purgative effects that are often produced by this medicine when taken into the ſtomach.

Genus LX. SCORBUTUS, *the* Scurvy.

Deſcription. The firſt indication of the ſcorbutic diatheſis, is generally a change of colour in the face, from the natural and healthy look to a pale and bloated complexion, with a liſtleſsneſs, and averſion to every ſort of exerciſe; the gums ſoon after become itchy, ſwell, and are apt to bleed on the lighteſt touch; the breath grows offenſive; and the gums ſwelling daily more and more, turn livid, and at length become extremely fungous and putrid, as being continually in contact with the external air; which in every caſe favours the putrefaction of ſubſtances diſpoſed to run into that ſtate, and is indeed abſolutely requiſite for the production of actual rottenneſs. But what is very remarkable in this diſeaſe, notwithſtanding the various and immenſe load of diſtreſs under which the patients labour, there is no ſickneſs at the ſtomach, the appetite keeps up, and the ſenſes remain entire almoſt to the very laſt; when lying at reſt, they make no complaints, and feel little diſtreſs or pain; but the moment they attempt to riſe, or ſtir themſelves, then the breathing becomes difficult, with a kind of ſtraitneſs or catching, and great oppreſſion, and ſometimes they have been known to fall into a ſyncope. This catching of breath upon motion, with the loſs of ſtrength, dejection of ſpirit, and rotten gums, are held as the eſſential or diſtinguiſhing ſymptoms of the diſeaſe. The ſkin is generally dry, except in the very laſt ſtage, when the patients become exceedingly ſubject to faintings, and then it grows clammy and moiſt: in ſome it has an anſerine appearance; but much oftener it is ſmooth and ſhining; and, when examined, is found ſpread over with ſpots not riſing above the ſurface, of a reddiſh, bluiſh, livid, or purple colour, with a ſort of yellow rim round them. At firſt theſe ſpots are for the moſt part ſmall, but in time they increaſe to large blotches. The legs and thighs are the places where they are moſtly ſeen; more rarely on the head and face. Many have a ſwelling of the legs, which is harder, and retains the impreſſion of the finger longer than the common dropſical or truly œdematous ſwellings. The ſlighteſt wounds and bruiſes, in ſcorbutic habits, degenerate into foul and untoward ulcers. And the appearance of theſe ulcers is ſo ſingular and uniform, that they are eaſily diſtinguiſhed from all others. Scorbutic ulcers afford no good digeſtion, but a thin and fetid ichor mixed with blood, which at length has the appearance of coagulated gore lying caked on the ſurface of the ſore, not to be ſeparated or wiped off without ſome difficulty. The fleſh underneath theſe ſloughs feels to the probe ſoft and ſpungy, and is very putrid. Neither detergents, nor eſcharotics, are here of any ſervice; for though ſuch ſloughs be with great pains taken away, they are found again at the next dreſſing, where the ſame ſanguinous putrid appearance always preſents itſelf. Their edges are generally of a livid colour, and puffed up with excreſcences of proud fleſh ariſing from below the ſkin. As the violence of the diſeaſe encreaſes, the ulcers ſhoot out a ſoft bloody fungus, which often riſes in a night's time to a monſtrous ſize; and although deſtroyed by cauteries, actual or potential, or cut away with the knife, is found at next dreſſing as large as ever. It is a good while, however, before theſe ulcers, bad as they are, come to affect the bones with rottenneſs. Theſe appearances will always ſerve to aſſure us that an ulcer is ſcorbutic; and ſhould put us on our guard with reſpect to the giving mercurials, which are the moſt pernicious things that can be adminiſtered in theſe caſes.

The pulſe is variable; but moſt commonly ſlower and more feeble than in the time of perfect health. A ſtiffneſs in the tendons, and weakneſs in the joints of the knees, appear early in the diſeaſe; but as it grows more inveterate, the patients generally loſe the uſe of their limbs altogether; having a contraction of the flexor-tendons in the ham, with a ſwelling and pain in the joint of the knee.

Some have their legs monſtrouſly ſwelled, and covered over with livid ſpots or ecchymoſes; others have had tumours there; ſome, though without ſwelling, have the calves of the legs and the fleſh of the thighs quite indurated. As perſons far gone in the ſcurvy are apt to faint, and even expire, on being moved and brought out into the freſh air, the utmoſt care and circumſpection are requiſite when it is neceſſary to ſtir or remove them.

Scorbutic patients are at all times, but more eſpecially as the diſeaſe advances, extremely ſubject to profuſe bleedings from different parts of the body; as from the noſe, gums, inteſtines, lungs, &c. and from their ulcers, which generally bleed plentifully if the fungus be cut away. It is not eaſy to conceive a more diſmal and diverſified ſcene of miſery than what is beheld in the third and laſt ſtage of this diſtemper; it being then that the anomalous and more extraordinary ſymptoms appear, ſuch as the burſting out of old wounds, and the diſſolution of old fractures that have been long united.

Cauſes. The term *ſcurvy* hath been indiſcriminately applied, even by phyſicians, to almoſt all the different kinds of cutaneous foulneſs; owing to ſome writers of the laſt century, who comprehended ſuch a variety of ſymptoms under this denomination, that there are few chronic diſtempers which may not be ſo called, according to their ſcheme: but the diſeaſe here meant is the true putrid ſcurvy, ſo often fatal to ſeamen, and to people pent up in garriſons without ſufficient ſupplies of ſound animal-food and freſh vegetables: or which is ſometimes known to be endemic in certain countries, where the nature of the ſoil, the general ſtate of the atmoſphere, and the common courſe of diet, all combine in producing that ſingular ſpecies of corruption in the maſs of blood, which conſtitutes this diſeaſe; for the appearances, on diſſecting ſcorbutic ſubjects, ſufficiently ſhew that the ſcurvy may, with great propriety, be termed a diſeaſe of the blood.

Dr. Lind has, in a poſtſcript to the third edition of his treatiſe on the ſcurvy, given the reſult of his obſervations drawn from the diſſection of a conſiderable number of victims to this fatal malady, from which it appears that the true ſcorbutic ſtate, in an advanced ſtage of the diſtemper, conſiſts in numerous effuſions of blood into the cellular interſtices of moſt parts of the body, ſuperficial as well as internal; particularly the gums, and the legs; the texture of the former, being almoſt entirely cellular, (and theſe cells naturally occupied by pure blood), and the generally dependent ſtate of the latter, rendering theſe parrs, of all others in the whole body, the moſt apt to receive, and retain the ſtagnant blood, when its craſis comes to be deſtroyed, and it loſes that glutinous quality which, during health, hinders it from eſcaping through the pores in the coats of the blood-veſſels.

A dropſical indiſpoſition, eſpecially in the legs and breaſt, was frequently, but not always, obſerved in the ſubjects that were opened, and the pericardium was ſometimes found diſtended with water; the water, thus collected, was often ſo ſharp as to ſhrivel the hands of the diſſector; and in ſome inſtances, where the ſkin happened to be broken, it irritated and feſtered the wound.

The fleſhy fibres were found ſo extremely lax and tender, and the bellies of the muſcles in the legs and thighs ſo ſtuffed with the effuſed ſtagnating blood, that it was always difficult, and ſometimes impoſſible, to raiſe or ſeparate one muſcle from another. He ſays that the quantity of this effuſed blood was amazing; in ſome bodies it ſeemed that almoſt a fourth part of the whole maſs had eſcaped from the veſſels; and it often lay in large concretions on the perioſteum, and in ſome few inſtances under this membrane, immediately on the bone. And yet, notwithſtanding this diſſolved and depraved ſtate of the external fleſhy parts, the brain always appeared perfectly ſound, and the viſcera of the abdomen, as well as thoſe in the thorax, were, in general, found quite uncorrupted. There were ſpots indeed, from extravaſated blood, obſerved on the meſentery, inteſtines, ſtomach, and omentum; but theſe ſpots were firm, and free from any mortified taint; and, more than once, an effuſion of blood, as large as a hand's breadth, has been ſeen on the ſurface of the ſtomach; and what was remarkable, that very ſubject was not known while living to have made any complaint of ſickneſs, pain, or any other diſorder, in either ſtomach, or bowels. Theſe circumſtances, and appearances, with many others that are not here enumerated, all prove to a demonſtration the putreſcent ſtate of the blood, and yet Dr. Lind takes no ſmall pains to combat the idea of the ſcurvy's proceeding from animal-putrefaction; a notion, which, according to him, "may, and hath miſled phyſicians to propoſe and adminiſter remedies for it altogether ineffectual."

He alſo, in the preface to his third edition, talks of the miſchief done by an attachment to deluſive theories; ſays, "it is not probable that a remedy for the ſcurvy will ever be diſcovered from a preconceived hypotheſis, or by ſpeculative men in the cloſet, who have never ſeen the diſeaſe, or who have ſeen at moſt only a few caſes of it," and adds, "that though a few partial facts and obſervations may, for a little, flatter with hopes of greater ſucceſs, yet more enlarged experience muſt ever evince the fallacy of all poſitive aſſertions in the healing art."

And hence we may underſtand how it may poſſibly happen, that when perſons are greatly weakened by ſome preceding diſorder, and at the ſame time debarred the uſe of proper bodily exerciſe, the ſcorbutic diatheſis ſhould take place, even though they enjoy the advantages of pure air and wholeſome diet. But theſe are ſolitary caſes, and very rarely ſeen; for whenever the ſcurvy ſeizes numbers, it will be found to depend on a combination of the major part, or perhaps all, of the following circumſtances:

1. A moiſt atmoſphere, and more eſpecially if cold be joined to this moiſture. 2. Too long ceſſation from bodily exerciſe, whether it be from conſtraint, or a lazy ſlothful diſpoſition. 3. Dejection of mind. 4. Neglect of cleanlineſs, and want of ſufficient cloathing. 5. Want of wholeſome drink, either of pure water, or fermented liquors. And 6. above all, the being obliged to live continually on ſalted meats, perhaps not well cured, without a due proportion of the milder farinaceous or mucilaginous vegetables, ſufficient to correct the pernicious tendency of the ſalt, by ſupplying the bland oil and ſaccharine matter requiſite for the purpoſes of nutrition.

Prevention and Cure. The ſcurvy may be prevented, by obviating and correcting thoſe circumſtances in reſpect of the non-naturals which were mentioned as contributing to the diſeaſe, and laid down as cauſes. It is therefore a duty highly incumbent on officers commanding at ſea, or in garriſons, to uſe every poſſible precaution; and, in the firſt place, to correct the coldneſs and moiſture of the atmoſphere, by ſufficient fires; in the next, to ſee that their men be lodged in dry, clean, and well ventilated births, or apartments: thirdly, to promote cheerfulneſs, and enjoin frequent exerciſe, which alone is of infinite uſe in preventing the ſcurvy: fourthly, to take care that the cloathing be proper, and cleanlineſs of perſon ſtrictly obſerved: fifthly, to ſupply them with wholeſome drink, either pure water, or ſound fermented liquors; and if ſpirits be allowed, to have them properly diluted with water, and ſweetened with molaſſes or coarſe ſugar: and laſtly, to order the ſalted meats to be ſparingly uſed, or ſometimes entirely abſtained from; and, in their place, let the people live on different compoſitions of the dried vegetables, freſh meat and recent vegetables being introduced as often as they can poſſibly be procured.

A cloſe attention to theſe matters will, in general, prevent the ſcurvy from making its appearance at all, and will always hinder it from ſpreading its influence far. But when theſe precautions have been neglected, or the circumſtances ſuch that they cannot be put in practice, and the diſeaſe hath actually taken place, our whole endeavour muſt be to reſtore the blood to its original ſtate of ſoundneſs: and happily, ſuch is the nature of this diſeaſe (which confirms the hypotheſis that it is ſeated in the groſs fluids, and particularly the blood), that if a ſufficiency of new matter, of the truly mild nutritious ſort, can be thrown into the circulation while the fleſhy fibres retain any tolerable degree of firmneſs, the patient will recover; and that in a ſurpriſingly ſhort ſpace of time, provided a pure air, comfortable lodgings, ſufficient cloathing, cleanlineſs, and exerciſe, lend their neceſſary aid.

This being the caſe, the plan of treatment is to be conducted almoſt entirely in the dietetic way; as the change in the maſs of blood, which it is neceſſary to produce, muſt be brought about by things that can be received into the ſtomach by pints, or pounds, and not by thoſe which are adminiſtered in drops or grains, drachms or ounces. For here, as the ſubtile fluids are not ſenſibly affected, and there is no diſorder of the nervous ſyſtem, we have no need of thoſe active drugs, which are indiſpenſibly neceſſary in febrile or nervous diſeaſes; the ſcorbutic diatheſis being quite oppoſite to that which tends to produce a fever, or any ſpecies of ſpaſmodic diſorder; nay Dr. Lind ſays, he has repeatedly found, that even the infection of an hoſpital fever is long reſiſted by a ſcorbutic habit.

It will now naturally occur to the reader, what thoſe alimentary ſubſtances muſt be which bid the faireſt to reſtore the blood to its healthy ſtate; and he needs ſcarcely to be told, that they are of thoſe kinds which the ſtomach can bear with pleaſure though taken in large quantities, which abound in jelly or mucilage, and which allow theſe nutricious parts to be eaſily developed; for though the viſcera in ſcorbutic patients may be all perfectly ſound, yet we cannot expect, that either the digeſtive fluids, or organs, ſhould poſſeſs the ſame degrees of power, which enable them, during health, to convert the crude dry farinacea, and the hard ſalted fleſh of animals, into nouriſhment. We muſt therefore ſearch for the *antiſcorbutic virtue* in the tender ſweet fleſh of graminivorus animals; in new milks, and in the mucilaginous juices of recent vegetables, whether they be fruits, leaves, or roots. And provided they be freſh, and ſucculent, and of ſuch mildneſs as will permit them to be abundantly taken, it is of little importance whether they be ſweet or ſour, aceſcent or alkaleſcent; for ſuch is the power of the alimentary fermentation, that by the time the chyle is ready to enter the lacteals, their native qualities are obliterated, and the oily ſaccharine matter which lay hid in the mucilage entirely extricated.

The ſour juices of lemons, oranges, and limes, have been generally held as antiſcorbutics in an eminent degree, and their power aſcribed to their acid; from an idea that acids of all kinds are the only correctors of putrefaction. But the general current of practical obſervations ſhews, and our experiments confirm it, that the virtue of theſe juices (and, we preſume, of every other that has been known to cure the ſcurvy) depends on their *aërial principle*, and conſequently reſides in the mucilage, whether it be ſweet or ſour; accordingly, while perfectly recent and in the mucilaginous ſtate, and eſpecially if mixed with wine and ſugar, the juices of any of theſe fruits will be found a moſt grateful and powerful antiſcorbutic.

But if the belly ſhould not be looſened by the uſe of the freſh vegetables, nor the ſkin become ſoft and moiſt, then they muſt be aſſiſted by ſtewed prunes, or a decoction of tamarinds with cream of tartar, in order to abate the coſtiveneſs; and by drinking a light decoction of the woods, and warm bathing, in order to relax the pores of the ſkin; for nothing contributes more to the recovery of ſcorbutic patients than moderate ſweating. We are always to be careful that ſcorbutic perſons, after a long abſtinence from greens and fruits, be not permitted to eat voraciouſly at firſt, leſt they fall into a fatal dyſentery.

All this, however, that has been laid down as neceſſary towards the cure, ſuppoſes the patients to be in ſituations where they can be plentifully furniſhed with all the requiſites; but unhappily theſe things are not to be procured at ſea, and often deficient in garriſons: therefore, in order that a remedy for the ſcurvy might never be wanting, Dr. Macbride, in the year 1762, firſt conceived the notion, that *infuſion of malt*, commonly called *wort*, might be ſubſtituted for the common antiſcorbutics, and it was accordingly tried.

More than three years elapſed, before any account arrived of the experiment's having been made: at length, ten narratives of caſes were received, wherein the wort had been tried, with very remarkable ſucceſs; and this being judged a matter of much importance to the ſeafaring part of mankind, theſe were immediately communicated to the public in a pamphlet with the title of *An hiſtorical account of a new method of treating the ſcurvy at ſea.*

This was in 1767; but ſince that time a conſiderable number of letters and medical journals, ſufficient to make up a large volume, have been printed, particularly by the ſurgeons of his Majeſty's ſhips that have been employed of late years for making diſcoveries in the ſouthern hemiſphere. Certain it is, that in many inſtances it has ſucceeded beyond expectation.

During Captain Cook's laſt voyage, the moſt remarkable, in reſpect of the healthineſs of the crew, that ever was performed, the wort is acknowledged to have been of ſingular uſe.

In a letter which this very celebrated and ſucceſsful circumnavigator wrote to Sir John Pringle, he gives an account of the methods purſued for preſerving the health of his people; and which were productive of ſuch happy effects, that he performed "a voyage of three years and 18 days, through all the climates from 52° north to 71° ſouth, with the loſs of one man only by diſeaſe, and who died of a complicated and lingering illneſs, without any mixture of ſcurvy. Two others were unfortunately drowned, and one killed by a fall; ſo that out of the whole number (118) with which he ſet out from England, he loſt only four.

He ſays that much was owing to the extraordinary attention of the admiralty, in cauſing ſuch articles to be put on board as either by experience or conjecture were judged to tend moſt to preſerve the health of ſeamen; and with reſpect to the wort, he expreſſeth himſelf as follows.

"We had on board a large quantity of *malt*, of which was made *ſweet wort*, and given (not only to thoſe men who had manifeſt ſymptoms of the ſcurvy, but to ſuch alſo as were, from circumſtances, judged to be moſt liable to that diſorder) from one or two to three pints in the day to each man, or in ſuch proportion as the ſurgeon thought neceſſary, which ſometimes amounted to three quarts in the 24 hours: this is without doubt one of the beſt antiſcorbutic ſea-medicines yet found out; and, if given in time, will, with proper attention to other things, I am perſuaded, prevent the ſcurvy from making any great progreſs for a conſiderable time: but I am not altogether of opinion that it will cure it, in an advanced ſtate, at ſea."

On this laſt point, however, the Captain and his Surgeon differ; for this gentleman poſitively aſſerts, and his journal (in Dr. Macbride's poſſeſſion) confirms it, that the infuſion of malt did effect a cure in a confirmed caſe, and at ſea.

The malt, being thoroughly dried, and packed up in ſmall caſks, is carried to ſea, where it will keep ſound, in every variety of climate, for at leaſt two years: when wanted for uſe, it is to be ground in a hand-mill, and the infuſion prepared from day to day, by pouring three meaſures of boiling water on one of the ground malt; the mixture being well maſhed, is left to infuſe for 10 or 12 hours, and the clear infuſion then ſtrained off. The patients are to drink it in ſuch quantities as may be deemed neceſſary, from one to three quarts in the courſe of 24 hours: a panado is alſo neceſſary to be made of it, by adding biſcuit, and currants or raiſins; and this palatable meſs is uſed by way of ſolid food. This courſe of diet, like that of the recent vegetables, generally keeps the bowels ſufficiently open; but in caſes where coſtiveneſs nevertheleſs prevails, gentle laxatives muſt be interpoſed from time to time, together with diaphoretics, and the topical aſſiſtants, fomentations and gargles, as in the common way of management.

Captain Cook was alſo provided with a large ſtock of *ſour krout*; (cabbage-leaves cut ſmall, fermented and ſtopped in the ſecond ſtage of fermentation.) A pound of this was ſerved to each man, twice a-week, while they were at ſea. He had alſo a liberal ſupply of *portable ſoup*; of which the men had generally an ounce, three days in the week, boiled up with their peaſe; and ſometimes it was ſerved to them oftener: and when they could get freſh greens, it was boiled up with them, and made ſuch an agreeable meſs, that it was the means of making the people eat a greater quantity of greens than they would otherwiſe have done. And what was ſtill of further advantage, they were furniſhed with ſugar, in lieu of butter or oil, which is ſeldom of the ſweeteſt ſort; ſo that the crew were undoubtedly great gainers by the exchange.

In addition to all theſe advantages of being ſo well provided with every neceſſary, either in the way of diet or medicine, Captain Cook was remarkably attentive to all the circumſtances reſpecting cleanlineſs, exerciſe, ſufficient cloathing, proviſion of pure water, and purification of the air, in the cloſer parts of the ſhip.

Newly brewed *ſpruce-beer* (made from a decoction of the tops of the ſpruce-fir, and molaſſes) is an excellent antiſcorbutic; acts in the ſame way that the wort does, and will be found of equal efficacy, therefore may be ſubſtituted. But in ſituations where neither the one nor the other can be had, a moſt ſalutary meſs may be prepared from oatmeal, by infuſing it in water, in a wooden veſſel, till it ferments, and begins to turn ſouriſh; which generally happens, in moderately warm weather, in the ſpace of two days. The liquor is then ſtrained off from the grounds, and boiled down to the conſiſtence of a jelly, which is to be eat with wine and ſugar, or with butter and ſugar.

Nothing is more commonly talked of, than a *land-ſcurvy*, as a diſtinct ſpecies of diſeaſe from this which has been now deſcribed; but no writer has yet given a deſcription ſo clear as to enable us to diſtinguiſh it from the various kinds of cutaneous foulneſs and eruption, which indeed are vulgarly termed *ſcorbutic*, but which are a kin to the itch or leproſy, and for the moſt part require mercurials.

GENUS LXI. ICTERUS, *the* JAUNDICE.

Deſcription. The jaundice firſt ſhews itſelf by a liſtleſſneſs and want of appetite, the patient becomes dull, oppreſſed, and generally coſtive. Theſe ſymptoms have continued but a very ſhort time, when a yellow colour begins to diffuſe itſelf over the *tunica albuginea*, or white part of the eye, and the nails of the fingers; the urine becomes high-coloured, with the yellowiſh ſediment capable of tinging linen; the ſtools are whitiſh or grey. In ſome there is a moſt violent pain in the epigaſtric region, which is conſiderably increaſed after meals. Sometimes the patient hath a continual propenſity to ſleep; but in others there is too great watchfulneſs and ſometimes the pain is ſo great, that though the patient be ſleepy he cannot compoſe himſelf to reſt. The pains come by fits; and all the women who have had the jaundice and borne children, agree, that they are more violent than labour-pains. As the diſeaſe increaſes, the yellow colour becomes more and more deep; an itching is felt all over the ſkin; and even the internal membranes of the viſcera, the bones, and the brain itſelf, become tinged, as hath been ſhewn from diſſections, where the bones have been found tinged ſometimes for years after the jaundice hath been cured.

In like manner, all the ſecretions are affected with the yellow colour of the bile, which in this diſeaſe is diffuſed throughout the whole maſs of fluids. The ſaliva becomes yellow and bitter: the urine exceſſively high-coloured, in ſuch a manner as to appear almoſt black; nay, the blood itſelf is ſometimes ſaid to appear of a yellow colour when drawn from a vein; yet Dr. Heberden ſays that he never ſaw the milk altered in its colour, even in caſes of very deep jaundice. In proceſs of time the blood begins to acquire a tendency to diſſolution and putrefaction; which is known by the patient's colour changing from a deep yellow to a black or dark yellow. Hæmorrhages enſue from various parts of the body, and the patients frequently die of an apoplexy; tho' in ſome the diſeaſe degenerates into an incurable dropſy; and there have not been wanting inſtances of ſome who have died of the dropſy after the jaundice itſelf had been totally removed.

Cauſes. As the jaundice conſiſts in a diffuſion of the bile throughout the whole ſyſtem, it thence follows, that whatever may favour this diffuſion is alſo to be reckoned among the cauſes of jaundice. Many diſputes have ariſen concerning the manner in which the bile is reſorbed into the blood; but it is now generally agreed that it is taken up by the lymphatics of the gall-bladder and biliary ducts. Hence, a jaundice may ariſe from any thing obſtructing the paſſage of the bile into the duodenum, or from any thing which alters the ſtate of the lymphatics in ſuch a manner as to make them capable of abſorbing the bile in its natural ſtate. Hence, the jaundice may ariſe from ſchirrhi of the liver or other viſcera preſſing upon the biliary ducts, and obſtructing the paſſage of the bile; from flatus diſtending the duodenum, and ſhutting up the entrance of the ductus communis choledochus into it; from the ſame orifice being plugged up by viſcid bile, or other ſordes: but by far the moſt frequent cauſe of jaundice is the formation of calculi. Theſe are found of almoſt all ſizes, from that of a ſmall pea to that of a walnut, or bigger; are of different colours; and ſometimes appear as if formed in the inward part by cryſtallization,

zation, but of lamellæ on the outer part; though ſometimes the outward part is covered with rough and ſhining cryſtals, while the inward part is lamellated. Theſe enter into the biliary ducts, and obſtruct them, cauſing a jaundice, with violent pain for ſome time; and which can be cured by no means till the ſtone is either paſſed entirely through the ductus communis, or returned into the gall-bladder. Sometimes, in the opinion of many celebrated phyſicians, the jaundice is occaſioned by ſpaſmodic conſtrictions of the biliary ducts; but this is denied by others, and it is not yet aſcertained whether theſe ducts are capable of being affected by ſpaſm or not, as the exiſtence of muſcular fibres in them hath not with certainty been diſcovered. It cannot, however, be denied that violent fits of paſſion have often produced jaundice, ſometimes temporary, but frequently permanent. This hath been by ſome deemed a ſufficient proof of the ſpaſmodic contraction of the ducts; but their opponents ſuppoſe, that the agitation occaſioned by the paſſion might puſh forward ſome biliary concretion into a narrow part of the duct, by which means a jaundice would certainly be produced, till the concretion was either driven backward or forward into the duodenum altogether.

In a very relaxed ſtate of the body there is alſo an abſorption of the bile, as in the yellow fever; and indeed in all putrid diſorders there is a kind of yellowiſh taint over the ſkin, though much leſs than in the true jaundice. The reaſon of this is, that in theſe diſorders there is uſually an increaſed ſecretion of bile, commonly of a thinner conſiſtence than in a healthy ſtate, while the orifices of the lymphatics are probably enlarged, and thus ready to abſorb a fluid ſomewhat thicker than what they ought to take up in a healthy ſtate; but theſe diſorders are of ſhort duration in compariſon with the real jaundice, which ſometimes laſts for many years.

Prognoſis. As jaundice may ariſe from many different cauſes, ſome of which cannot be diſcovered during the patient's life, the prognoſis muſt on this account be very uncertain. The only caſes which admit of a cure are thoſe depending upon biliary concretions, or obſtructions of the biliary ducts by viſcid bile; for the ſtones are ſeldom of ſuch a ſize but that the ducts will let them paſs through, though frequently not without extreme pain. Indeed this pain, though ſo violent, and almoſt intolerable to the ſick perſon, affords the beſt prognoſis; as the phyſician may readily aſſure his patient, that there is great hope of his being relieved from it. The coming on of a gentle diarrhœa attended with bilious ſtools, together with the ceſſation of pain, are ſigns of the diſeaſe being cured. We are not, however, always to conclude, becauſe the diſeaſe is not attended with acute pain, that it is therefore incurable; for frequently the paſſage of a ſtone through the biliary ducts is accompanied only with a ſenſation of ſlight uneaſineſs.

Cure. When the jaundice ariſes from indurated ſwellings or ſchirrhi of the viſcera, it is abſolutely incurable; nevertheleſs, as theſe cannot always be diſcovered, the phyſician muſt proceed in every caſe of jaundice as if it aroſe from calculi. The indications here are, 1. To diſſolve the concretions; and, 2. To prevent their formation a ſecond time. But unhappily the medical art hath not yet afforded a ſolvent for biliary concretions. They cannot even be diſſolved when taken out of the body either by acids or alkalies, or any thing beſides a mixture of oil of turpentine and ſpirit of wine; and theſe ſubſtances are by far too irritating to be given in ſufficient quantity to affect a concretion in the biliary ducts. Boerhaave obſerves, that diſeaſes of the liver are much worſe to cure than thoſe in any other part of the body; becauſe of the difficulty there is in getting at the part affected, and the tedious and roundabout paſſage the blood hath to it. The juice of common graſs hath indeed been recommended as a ſpecific in the jaundice, but on no very good foundation. Gliſſon obſerves, that black cattle are ſubject to biliary concretions when fed with hay or dried ſtraw in winter, but are cured by the ſucculent graſs in the ſpring; and Van Swieten tells a ſtrange ſtory of a man who cured himſelf of the jaundice by living almoſt entirely on graſs, of which he devoured ſuch quantities, that the farmers were wont to drive him out of their fields: but other practitioners have by no means found this in any degree effectual. The only method of cure now attempted in the jaundice is, to expel the calculus into the inteſtines; for which vomits and exerciſe are the principal medicines. The former are juſtly reckoned the moſt efficacious medicines, as they powerfully ſhake all the abdominal and thoracic viſcera; and thus tend to diſlodge any obſtructing matter that may be contained in them. But if there be a tendency to inflammation, vomits muſt not be exhibited till bleeding has been premiſed. We muſt alſo proceed with caution if the pain is very ſharp; for in all caſes where the diſeaſe is attended with violent pain, it will be neceſſary to allay it by opiates before the exhibition of an emetic. There is alſo danger, that, by a continued uſe of vomits, a ſtone which is too large to paſs, may be ſo impacted in the ducts, that it cannot even be returned into the gall-bladder, which would otherwiſe have happened. In all caſes therefore, if no relief follows the exhibition of the ſecond or third doſe, it will be prudent to forbear their farther uſe for ſome time.

Of all kinds of exerciſe, that of riding on horſe back, is moſt to be depended upon in this diſeaſe. It operates in the ſame manner with vomits, namely, by the ſhake it gives to the viſcera; and therefore the cautions neceſſary to be obſerved in the uſe of vomits are alſo neceſſary to be obſerved in the uſe of riding. Cathartics alſo may be of ſervice, by cleanſing the *primæ viæ*, and ſoliciting a diſcharge of a bile into the inteſtines; but they muſt not be of too draſtic a nature, or they may produce incurable obſtructions, by bringing forward ſtones that are too large to paſs. Anodynes, the warm bath, and ſaponaceous medicines, are ſerviceable by their relaxing quality. Soap hath been ſuppoſed to do ſervice as a ſolvent; but this is now found to be a miſtake, and it acts in no other way than as a relaxant.

But when all means of relief fail, as in caſes of ſchirrhus, we can then only attempt to palliate the ſymptoms, and preſerve the patient's life as long as poſſible. This is beſt accompliſhed by diuretics; for thus a great quantity of bilious matter is evacuated, and the ſyſtem is freed from the bad conſequences which enſue on its ſtagnation in the habit. But even this is by no means equal to the common evacuation by ſtool; nor can all the attempts to ſupply the want of bile in the inteſtines, by bitters and other ſtomachics, reſtore the patient to his wonted appetite and vigour. If the pain be very violent, we muſt on all occaſions have recourſe to opiates; or if the blood hath acquired a tendency to diſſolution, it muſt be counteracted by proper antiſeptics.

If the diſeaſe goes off, its return muſt be prevented by a courſe of tonic medicines, particularly the Peruvian bark and antiſeptics.

In the Eaſt-Indies, mercury hath been lately recommended as exceedingly efficacious in diſorders of the liver, eſpecially thoſe which follow intermitting and remitting fevers. Dr. Monro, in his Obſervations on the means of preſerving the health of ſoldiers, acquaints us, that he has ſeen ſome icteric caſes which, he thought, received benefit from taking a few grains of *mercurius dulcis* at night, and a purge next morning; and this repeated two or three times a week.

CLASS IV. LOCALES.

An Affection of ſome Part, but not of the whole Body.

ORDER I. DYSÆSTHESIÆ.

The Senſes depraved or deſtroyed from a Diſeaſe of the external Organs.

GENUS LXII. CALIGO, *the* CATARACT.

A *cataract* is an obſtruction of the pupil, by the interpoſition of ſome opaque ſubſtance which either diminiſhes or totally extinguiſhes the ſight. It is generally an opacity in the cryſtalline humour. In a recent or beginning *cataract*, the ſame medicines are to be uſed as in the *gutta ſerena*; and they will ſometimes ſucceed. But when this does not happen, and the *cataract* becomes firm, it muſt be couched, or rather extracted; Dr. Buchan ſays he has reſolved a recent *cataract* by giving the patient ſome purges with calomel, keeping a poultice of freſh hemlock conſtantly upon the eye, and a perpetual bliſter on the neck.

GENUS LXIII. AMAUROSIS, *the* GUTTA SERENA.

A *gutta ſerena* is an abolition of the ſight without any apparent cauſe or fault in the eyes. When it is owing to a decay or waſting of the optic nerve, it does not admit of a cure; but when it proceeds from a compreſſion of the nerves by redundant humours, theſe may be in ſome meaſure drained off, and the patient relieved. For this purpoſe, the body muſt be kept open with the laxative mercurial pills. If the patient be young, and of ſanguine habit, he may be bled. Cupping with ſcarifications on the back part of the head will likewiſe be of uſe. A running at the noſe may be promoted by volatile ſalts, ſtimulating powders, &c. But the moſt likely means of relieving the patient, are iſſues or bliſters kept open for a long time on the back part of the head, behind the ears, or on the neck; which have been known to reſtore ſight even after it had been for a conſiderable time loſt. Should theſe fail, recourſe muſt be had to a mercurial ſalivation; or, what will perhaps anſwer the purpoſe better, 12 grains of the corroſive ſublimate of mercury may be diſſolved in an Engliſh pint and a half of brandy, and a table-ſpoonful of it twice a-day, drinking half a pint of the decoction of ſarſaparilla after it. Of late electricity hath been much celebrated as efficacious, when no other thing could do ſervice.

GENUS LXIV. PARACUSIS, *or Depravation of* HEARING.

The functions of the ear may be injured by wounds, ulcers, or any thing that hurts its fabric. The hearing may likewiſe be hurt by exceſſive noiſe; violent colds in the head; fevers; hard wax, or other ſubſtances ſticking in the cavity of the ear; too great a degree of moiſture or dryneſs of the ear. Deafneſs is very often the effect of old age, and is incident to moſt people in the decline of life. Sometimes it is owing to an original fault in the ſtructure or formation of the ear itſelf. When this is the caſe it admits of no cure; and the unhappy perſon not only continues deaf, but generally likewiſe dumb, for life.

When deafneſs is the effect of wounds, or ulcers of the ears, or of old age, it is not eaſily removed. When it proceeds from cold of the head, the patient muſt be careful to keep his head warm, eſpecially in the night; he ſhould likewiſe take ſome gentle purges, and keep his feet warm, and bathe them frequently in luke-warm water at bed-time. When deafneſs is the effect of a fever, it generally goes off after the patient recovers. If it proceeds from dry wax ſticking in the ears, it may be ſoftened by dropping oil into them; afterwards they muſt be ſyringed with warm milk and water.

If deafneſs proceeds from dryneſs of the ears, which may be known by looking into them, half an ounce of the oil of ſweet almonds, and the ſame quantity of liquid opodeldoc, or tincture of

aſafœtida,

aſafœtida, may be mixed together, and a few drops of it put into the ear every night at bed-time, ſtopping them afterwards with a little wool, or cotton. Some, inſtead of oil, put a ſmall ſlice of the fat of bacon into each ear, which is ſaid to anſwer the purpoſe very well. When the ears abound with moiſture, it may be drained off by an iſſue or ſeton, which ſhould be made as near the affected parts as poſſible.

Neither the eyes nor ears ought to be tampered with; they are tender organs, and require a very delicate touch. For this reaſon, what we would chiefly recommend in deafneſs, is to keep the head warm. From whatever cauſe the diſorder proceeds, this is always proper; and more benefit has often been derived from it alone, in the moſt obſtinate caſes of deafneſs, than from any medicines whatever.

GENUS LXV. ANOSMIA, *or Defect of* SMELLING.

Cauſes. The ſenſe of ſmelling may be diminiſhed or deſtroyed by diſeaſes; as, the moiſture, dryneſs, inflammation or ſuppuration of that membrane which lines the inſide of the noſe, commonly called the *olfactory membrane*; the compreſſion of the nerves which ſupply this membrane, or ſome fault in the brane itſelf at their origin. A defect, or too great a degree of ſolidity, of the ſmall ſpungy bones of the upper jaw, the caverns of the forehead, &c. may likewiſe impair the ſenſe of ſmelling. It may alſo be injured by a collection of fetid matter in thoſe caverns, which keeps conſtantly exhaling from them. Few things are more hurtful to the ſenſe of ſmelling than taking great quantities of ſnuff.

Cure. When the noſe abounds with moiſture, after gentle evacuations, ſuch things as tend to take take off irritation and coagulate the thin ſharp ſerum may be applied; as the oil of aniſe mixed with fine flour, camphire diſſolved in oil of almonds, &c. The vapours of amber, frankincenſe, gum-maſtic, and benjamin, may likewiſe be received into the noſe and mouth. For moiſtening the mucus when it is too dry, ſome recommend ſnuff made of the leaves of marjoram, mixed with oil of amber, marjoram, and aniſeed; or a ſternutatory of calcined white vitriol, 12 grains of which may be mixed with two ounces of marjoram-water and filtrated. The ſteam or vapour of vinegar upon hot iron received up the noſtrils is likewiſe of uſe for ſoftening the mucus, opening obſtructions, &c.

If there be reaſon to ſuſpect that the nerves which ſupply the organs of ſmelling are inert or want ſtimulating; volatile ſalts ſtrong ſnuffs, and other things which occaſion ſneezing, may be applied to the noſe. The forehead may likewiſe be anointed with balſam of Peru, to which may be added a little of the oil of amber.

GENUS LXVI. AGHEUSTIA, *or Defect of* TASTING.

Cauſe. The taſte may be diminiſhed by cruſts, filth, mucus, aphthæ, pellicles, warts, &c. covering the tongue: it may be depraved by a fault of the ſaliva, which being diſcharged into the mouth, gives the ſame ſenſation as if the food which the perſon takes had really a bad taſte; or it may be entirely deſtroyed by injuries done to the nerves of the tongue and palate. Few things prove more hurtful either to the ſenſe of taſting or ſmelling than obſtinate colds, eſpecially thoſe which affect the head.

Cure. When the taſte is diminiſhed by filth, mucus, &c. the tongue ought to be ſcraped, and frequently waſhed with a mixture of water, vinegar, and honey, or ſome other detergent. When the ſaliva is vitiated, which ſeldom happens unleſs in fevers or other diſeaſes, the curing of the diſorder is the cure of this ſymptom. To relieve it, however, in the mean time, the following things may be of uſe: if there be a bitter taſte, it may be taken away by vomits, purges and other things which evacuate bile: what is called a *nidorous taſte*, ariſing from putrid humours, is corrected by the juice of citrons, oranges, and other acids: a ſalt taſte is cured by plentiful dilution with watery liquors: an acid taſte is deſtroyed by abſorbents and alkaline ſalts, as powder of oyſter-ſhells, ſalt of wormwood, &c.

When the ſenſibility of the nerves which ſupply the organs of taſte is diminiſhed, the chewing horſe-radiſh, or other ſtimulating ſubſtances, will help to recover it.

GENUS LXVII. ANÆSTHÆSIA, *or Defect of the Senſe of* FEELING.

Cauſes, &c. This ſenſe may be hurt by any thing that obſtructs the nervous influence, or prevents its being regularly conveyed to the organs of touching, as preſſure, extreme cold, &c. It may likewiſe be hurt by too great a degree of ſenſibility, when the nerve is not ſufficiently covered by the cuticle or ſcarf-ſkin, or where there is too great a tenſion of it, or it is too delicate. Whatever diſorders the functions of the brain and nerves, hurts the ſenſe of touching. Hence it appears to proceed from the ſame general cauſes as palſy and apoplexy, and requires nearly the ſame method of treatment.

In a *ſtupor*, or defect of touching, which ariſes from an obſtruction of the cutaneous nerves, the patient muſt firſt be purged; afterwards ſuch medicines as excite the action of the nerves, or ſtimulate the ſyſtem, may be uſed. For this purpoſe the ſpirit of hartſhorn, *ſal volatile oleoſum*, horſe radiſh, &c. may be taken inwardly; the diſordered parts, at the ſame time, may be frequently rubbed with freſh nettles or ſpirit of *ſal ammoniac*. Bliſters and ſinapiſms applied to the parts will likewiſe be of uſe; as alſo warm bathing, eſpecially in the natural hot baths.

ORDER II. DYSOREXIA.

Defect of Appetite, or preternatural Deſires.

GENUS LXVIII. SATYRIASIS.

Satyriaſis is a violent deſire of venery in men, even ſo that reaſon is depraved by it. The pulſe is quick, and the breathing ſhort; the patient is ſleepleſs, thirſty, and loathes his food; the urine is evacuated with difficulty, and a fever ſoon comes on. The nature and cure are much the ſame as are thoſe of the following diſeaſe.

GENUS LXIX. NYMPHOMANIA, *or* FUROR UTERINUS.

The *furor uterinus* is a ſpecies of madneſs, or an high degree of hyſterics. Its immediate cauſe is a preternatural irritability of the uterus and pudenda of women (to whom the diſorder is proper), or an unuſual acrimony of the fluids in theſe parts. Its preſence is known by the wanton behaviour of the patient: ſhe ſpeaks and acts with unreſtrained obſcenity; and as the diſorder increaſes, ſhe ſcolds, cries, and laughs, by turns. While reaſon is retained ſhe is ſilent, and ſeems melancholy, but her eyes diſcover an unuſual wantonneſs. The ſymptoms are better and worſe, until the greateſt degree of the diſorder approaches, and then by every word and action her condition is too manifeſt. In the beginning a cure may be hoped for; but if it continues, it degenerates into a mania. In order to the cure, bleed in proportion to the patient's ſtrength. Camphor in doſes of 15 or 20 grains, with nitre, and ſmall doſes of the *tinct. Theb.* ſhould be repeated at proper intervals. Some venture to give the *ſac. ſaturn.* in doſes of three to five grains. Beſides bleeding, cooling purges ſhould alſo be repeated in proportion to the violence of ſymptoms, &c. What is uſeful in maniacal and hypochondriac diſorders, is alſo uſeful here, regard being had to ſanguine or phlegmatic habits, &c. When delirium is at the height, give opiates to compoſe; and uſe the ſame method as in a phrenitis or a mania. Injections of barley-water, with a ſmall quantity of hemlock-juice, according to Riverius, may be frequently thrown up into the uterus: this is called *ſpecific*; but matrimony, if poſſible, ſhould be preferred.

ORDER III. DYSCINESIÆ;

A Depravation of Motion from a Diſorder of the Organs.

GENUS LXX. APHONIA, *or Loſs of* VOICE.

The loſs of voice may proceed from various cauſes. If one of the recurrent nerves, which are formed by the *par vagum* and the *nervus acceſſorius*, and reach the larynx, is cut, the perſon is capable of only as it were a half-pronunciation; but if both are cut, the ſpeech and voice are both loſt. The loſs of ſpeech happening in hyſteric patients is alſo called *aphonia*; but more properly that loſs of ſpeech is thus named which depends on ſome fault of the tongue.

Seeing that the motion of any part is deſtroyed, or leſſened at leaſt, by the interception of the nervous fluid in its paſſage thither, and that the nerves deſtined for the motion of the tongue ariſe principally from the fifth pair, it appears that the ſeat of this diſorder is in the ſaid fifth pair of nerves, and that the immediate cauſe is a diminution or total deſtruction of the nervous fluid through them. Hence a palſy of the tongue, which is either antecedent or ſubſequent to hemiplectic or apoplectic diſorders, demand our utmoſt attention.

The *prognoſtics* vary according to the cauſe or cauſes. That ſpecies which is owing immediately to ſpaſms, ſoon gives way on the removal of them. If a palſy of the tongue is the cauſe, it is very apt to return, if relieved, but often continues incurable.

In order to the *cure*, endeavour firſt to remove whatever obſtructs the influx of the nervous fluid into the tongue, and ſecondly to ſtrengthen the weak parts. Theſe general intentions, in all caſes, being regarded, the particular cauſes muſt be removed as follows:

In caſe of a congeſtion of blood about the head, bleeding and nitrous antiſpaſmodics are to be uſed. That ſpecies of aphony which remains after the ſhock of an hemiplexy or apoplexy, requires bliſters to be applied to the nape of the neck; other means are rarely effectual. If ſpaſmodic contrictions about the fauces and tongue are the cauſe, external paregorics are of the greateſt ſervice, anodyne antiſpaſmodics may be laid under the tongue, and the feet bathed in warm water; carminative clyſters alſo are uſeful.

GENUS LXXI. MUTITAS, DUMBNESS.

Dumb people are generally born deaf; in which caſe the diſtemper is incurable by medicine: though even ſuch people may be taught not only to read and write, but alſo to ſpeak and to underſtand what others ſay to them. See the article DUMBNESS. When it proceeds from a defect of any of the organs neceſſary for ſpeech, the tongue for inſtance, it is alſo incurable; but if it ariſes from a palſy, the medicines applicable in that caſe will ſometimes reſtore the ſpeech.

GENUS LXXII. CONTRACTURA, *Contractions of the* LIMBS.

The contraction of various muſcles of the body is generally the conſequence of ſome other diſeaſe, as the rheumatiſm, gout, ſcurvy, or palſy, eſpecially that ſpecies of the latter which follows the *colica Pictonum*. It is exceedingly difficult of cure; though the warm medicinal waters are much recommended, and have ſometimes done great ſervice. Of late electricity hath been found to perform ſurpriſing cures in this way.

ORDER IV. APOCENOSES.

A Flux of Blood or ſome other Humour more copious than uſual.

GENUS LXXIII. PROFUSIO, *or* FLUX *of* BLOOD.

For the treatment of this genus, ſee MENORRHAGIA, HÆMOPTYSIS, &c.

GENUS LXXIV. EPHIDROSIS, *or Exceſſive* SWEATING.

This is generally ſymptomatic; and occurs in almoſt all fevers, but eſpecially in the latter ſtages of the hectic. Sometimes it is a primary diſeaſe, ariſing merely from weakneſs; and then eaſily admits of a cure by the uſe of the Peruvian bark, the cold bath, and other tonics.

GENUS LXXV. ENURESIS, *an Involuntary* FLUX *of* URINE.

This is a diſtemper which frequently affects children, otherwiſe healthy, when aſleep; and is extremely diſagreeable. Often it is merely the effect of lazineſs, and may be driven off by proper correction; but ſometimes it proceeds from an atony or weakneſs of the ſphincter of the bladder. Many ridiculous cures have been preſcribed for it, and among the reſt field-mice dried and powdered. Tonics are frequently of uſe; but ſometimes the diſtemper proves obſtinate, in ſpite of every thing we can uſe. In the Medical Obſervations we find bliſters greatly recommended in this diſeaſe, when applied to the region of the os ſacrum. There are many caſes in which the power of bliſters in removing this diſtemper ſeems to exceed that of every other medicine whatever.

GENUS LXXVI. GONORRHŒA, *or* CLAP.

The gonorrhœa is a flux of viſcid matter of various colours, from the urethra in men, and the vagina in women. It commonly proceeds from coition with a perſon infected with the venereal diſeaſe, and is the firſt ſymptom by which that diſeaſe uſually ſhews itſelf.

Deſcription. The firſt ſymptoms of the diſeaſe in men, are commonly a ſenſation at the end of the penis not unlike a flea-bite, together with a fulneſs of the lips of the urethra, and ſome degree of tenſion in the penis, the urinary canal feeling as if tightened, and the urine flowing in a ſmall and unequal ſtream: a little whitiſh mucus is to be ſeen about the orifice of the urethra, and oozing from it when ſlightly preſſed, eſpecially if the preſſure is made on the ſpot where the ſoreneſs is moſt felt. The diſcharge ſoon increaſes in quantity, and varies in its colour according to the degree of inflammation. The patient feels a ſenſation of heat and pain in evacuating his urine, particularly at certain ſpots of the urethra, and above all towards its orifice; and the involuntary erections to which he is ſubject from the ſtimulus, particularly when warm in bed, occaſion a diſtortion or curvature of the penis, attended with exquiſite pain. When the inflammation is violent, the glans appears tumid and tranſparent, the tenſion extends through the whole of the penis, the perinæum is affected with ſwelling and redneſs, and even the loins, buttocks, and anus, ſympathize and afford a very uneaſy ſenſation. Sometimes the prepuce inflames about the end of the penis, and cannot be drawn back, occaſioning what is called a *phymoſis*; at others, as in the *paraphymoſis*, it remains in an inflamed ſtate below the glans, ſo that it cannot be drawn forwards; and, if the ſtricture and inflammation are violent, may terminate in gangrene. Now and then, eſpecially when there is a phymoſis, we may perceive a hard chord extending along the back of the penis. This is an inflamed lymphatic, and may be conſidered as a prelude to a bubo.

In mild caſes, the ſeat of the diſeaſe is in the urethra, not far from its orifice; but it frequently happens that the virus inſinuates itſelf much higher up, ſo as to affect Cowper's glands, the proſtate, and parts very near to the neck of the bladder.

In the generality of caſes, the inflammation goes on increaſing for ſeveral days, commonly for a week or a fortnight when medicines are taken; after which, the ſymptoms begin to abate; and the running, when left to itſelf, gradually leſſens in quantity, and becomes whiter and thicker, till at length it totally ſtops. The colour of the mucus, however, is by no means a certain guide in theſe caſes: for in many patients it is of a yellowiſh, and ſometimes of a greeniſh hue to the very laſt; but in general it becomes more conſiſtent towards the cloſe of the diſeaſe.

In women, the parts of generation being fewer and more ſimple, the diſeaſe is leſs complicated than in men. Sometimes the vagina only is affected; and when this happens, the ſymptoms are very trifling; but in general it comes on with an itching and ſenſation of heat as in the other ſex; and is attended with inflammation of the nymphæ, inſide of the *labiæ, clitoris, carunculæ myrtiformes*, the orifice and ſometimes the whole of the *meatus urinarius*. Very often the deep-ſeated glands of the vagina are affected, and it is ſometimes difficult to diſtinguiſh the diſcharge of a gonorrhœa from that of the fluor albus.

Cauſes, &c. Many ingenious arguments have of late been advanced to prove, that the gonorrhœa and the lues venerea are different affections, originating from two diſtinct ſpecies of virus. It would be happy for mankind if this opinion were well founded; but, unfortunately, every day's experience ſhews it to be erroneous. It has been proved, that the matter of a chancre introduced into the urethra will generate a gonorrhœa; and that the diſcharge of a gonorrhœa will produce a chancre, bubo, and lues.

The matter of a gonorrhœa itſelf, when abſorbed into the patient's own body, will alſo produce a lues, but in order for it to do this, it is perhaps neceſſary (though this is by no means certain) that it ſhould be taken up from an ulcerated ſurface; and there are many practitioners, of no inconſiderable eminence, who deny that any ſuch ulceration is ever produced in the urethra by a gonorrhœa.

They contend that the increaſed ſecretion in theſe caſes is exactly ſimilar to what happens in the catarrh. But the compariſon will by no means hold good: in the latter the whole membrane of the noſe is equally irritated; whereas in the gonorrhœa, only particular parts of the urethra ſeem to be affected.

It is certain, that wherever there is conſiderable inflammation, there will be danger of ulceration. Beſides, from a neglected or badly-treated gonorrhœa, we often ſee fiſtulas *in perineo*, and other ulcers of the urethra penetrating through its ſubſtance, and affording a paſſage to the urine. And there can be no doubt that ſlight ulcerations of this canal often occur, and are afterwards perfectly obliterated, in a ſimilar manner to what happens in the papillæ of the tongue, the tonſils, &c. Such an obliteration will the more readily take place in a part like the urethra, defended with mucus, and not expoſed to the air, which is known to have no little effect in hardening a cicatrix.

Perhaps, all things conſidered, the moſt rational idea we can form of the cauſes and phænomena of this diſeaſe, will be, that particles of the venereal virus being blended with the ſemen, and with the mucus that oozes from the urethra, during coition, may be drawn up a certain way into that canal, where the irritation they occaſion will be in proportion to the virulence of the infecting matter, and the irritability, habit of body, &c. of the patient. The conſequences of this irritation will be inflammation and an increaſed ſecretion of mucus, and ſo far the complaint will be local. But now and then it will happen, as in other inflammations, that ulceration will take place, and expoſe the patient to the danger of a conſtitutional infection. Nay, we are not certain but this may happen without ulceration. Draſtic purges are known to be great promoters of abſorption, and ſome inſtances of lues venerea have been met with which ſeemed to be owing to the imprudent uſe of ſuch remedies in a previous gonorrhœa.

Nothing can be more variable than the period at which the diſeaſe makes its appearance after infection. Perhaps, at a medium, we may place it between the 4th and 14th day: but in ſome caſes it happens within 24 hours; and in others, not before the end of five, or even ſix weeks: neither of theſe extremes, however, are common.

Cure. From the foregoing deſcription of the progreſs of the diſeaſe, it will eaſily be perceived that the chief curative indications are to ſubdue inflammation, and remove the virus that occaſions it.

General remedies, ſuch as occaſion blood-letting, a cooling diet, the liberal uſe of diluting liquors, and mild purges, are by all allowed to be uſeful and even neceſſary.

In perſons of a delicate habit, and of an irritable fibre, the evacuation will do no good; but, if repeated, will certainly be liable to do harm, by increaſing irritability, and of courſe rendering the patient more ſuſceptible of ſtimulus.

The utility, and even the neceſſity of a cooling regimen are ſufficiently obvious; wine and ſpirituous liquors, ſpiceries, a fiſh-diet, much animal-food, and ſalted and high-ſeaſoned diſhes of every ſort, will conſtantly add to the complaint. The patient ſhould eat meat only once a-day, and that ſparingly. He ſhould abſtain from hot ſuppers. Milk, mild vegetables, and fruit, ſhould conſtitute the principal part of his diet while the inflammatory ſymptoms continue. Every thing that tends to excite the venereal imagination ſhould be ſtudiouſly avoided; for whatever promotes erections of the penis will increaſe the inflammation, and of courſe add fuel to the diſeaſe. For the ſame reaſons much walking or riding on horſeback will be hurtful, from the irritation kept up in the perinæum by ſuch means. Violent exerciſe of any kind, or any thing that is liable to increaſe the heat and momentum of the blood, will of courſe be improper.

The drinking freely of mild, cooling, mucilaginous liquors, ſuch as linſeed-tea, orgeat, whey, milk and water, almond emulſion, and the like, will be extremely uſeful, by diluting the urine, and preventing its ſalts from ſtimulating the urethra. When the heat and pain in making water are very conſiderable, mucilaginous ſubſtances are found to have the beſt effect, particularly the gum tragacanth. It is a common practice to give equal doſes of this gum or gum-arabic, and nitre, and to diſſolve nitre in the patient's drink, with a view to leſſen the inflammation. But in theſe caſes nitre is always improper: it is known to be a powerful diuretic, its chief action being upon the urinary paſſages; ſo that the ſtimulus it occaſions will only ſerve to increaſe the evil it is intended to alleviate. Cream of tartar, on account of its diuretic quality, will be equally improper. Our view here is not to promote a preternatural flow of urine; for the virus, being inſoluble in water, cannot be waſhed away by ſuch means: but our object ought to be, to render the urine that is ſecreted as mild and as little ſtimulating as poſſible.

Mild purges, which conſtitute another material part of the general remedies, are no doubt extremely uſeful when exhibited with prudence; but it is well known that the abuſe of purgative medicines in this diſeaſe has been productive of numerous evils. Formerly it was a pretty general practice to give a large doſe of calomel at bed-time, three or four times a-week; and to work it off the next morning, with a ſtrong doſe of the *pilulæ cocciæ*, or ſome other draſtic purge. This method was perſevered in for ſeveral weeks: and as the conſtant effect of a violent draſtic purge is to promote abſorption from every cavity, the venereal virus was frequently carried into the ſyſtem, and produced a confirmed lues; or, if the patient eſcaped this evil, he at leaſt found himſelf troubled with an obſtinate gleet, and, perhaps, his conſtitution materially injured: the effect of ſuch a method being (eſpecially in irritable habits) to weaken the ſtomach and bowels, and lay the foundation of hypochondrial complaints. Violent purging likewiſe often occaſions ſtrangury, hernia humoralis, and other troubleſome ſymptoms. Now that we are well acquainted with the doctrine of abſorption, this abſurd practice is very deſervedly fallen into diſrepute; for ſurely no man, who is converſant with anatomy, will, at this time of day, attempt to diſcharge the virus of a gonorrhœa by ſtool, when he knows that it muſt firſt be taken up by the lymphatics, and carried into the circulation; and yet, ſtrange as it may ſeem, ſuch is our attachment to old cuſtoms, that we ſtill every now and then meet with caſes in which this pernicious method has been adopted.

The topical remedies that are uſed conſiſt chiefly of different ſorts of injections, the ingredients of which are extremely various; but their modes of operation may in general be referred to their mucilaginous and ſedative, or to their detergent, ſtimulating, and aſtringent qualities. In the hands of ſkilful practitioners, great advantages may doubtleſs be derived from the uſe of theſe remedies, but, on the other hand, the improper and unſeaſonable adminiſtration of them may prove a ſource of irreparable miſchief to the patient.

We know that mucilaginous and oily injections will tend to allay the local inflammation; and that a ſedative injection, ſuch as a ſolution of opium, will leſſen the irratability of the parts, and of courſe produce a ſimilar effect: the utility of ſuch applications is therefore ſufficiently obvious.

A detergent injection, or one that will act upon the mucus of the urethra, increaſe the diſcharge of it, waſh it away, and with it the venereal virus that is blended with it, can only be uſed as a prophylactic before the ſymptoms of infection have made their appearance. A ſolution of cauſtic, properly diluted, will anſwer this purpoſe. But great circumſpection is neceſſary in the uſe of this kind of injection. If it be too weak, it can be of no efficacy; and if it be too ſtrong, it may prove dangerous to the patient. A ſuppreſſion of urine hath been brought on by the improper uſe of an injection of this kind. When the ſymptoms of inflammation have once made their appearance, the ſtimulus of ſuch an injection muſt be extremely hazardous. Excoriation of the urethra has but too often been produced by remedies of this ſort in the hands of adventurous and unſkilful practitioners.

While the inflammation of the urethra continues, every thing that ſtimulates it muſt be hurtful. If the injection excites a painful ſenſation in the urethra, as is but too often the caſe, it will be liable to produce ſwelled teſticles, difficulty in making water, excoriation, and other effects of increaſed inflammation: if, by its aſtringency, the running is checked before the virus that excited the diſcharge is properly ſubdued, the patient will be expoſed to all the dangers of a confirmed lues; and, perhaps, to a variety of local complaints, ſuch as obſtructions in the urethra, and abſceſſes *in perinæo*, which are well known to be ſometimes owing to applications of this ſort improperly managed.

When the inflammation has ſubſided, gently ſtimulating and aſtringent injections may be uſed with ſafety, and with conſiderable advantage: for as the inflammation is at firſt excited by the ſtimulus of the venereal virus, ſo when the former begins to leſſen, we may be aſſured that the activity of the latter has abated in proportion; and, in general, when the inflammatory ſymptoms are entirely removed, it will be found that the mucus is no longer of an infectious nature, but is merely the effect of an increaſed ſecretion, and of relaxation. Mild aſtringents will therefore ſerve to brace and ſtrengthen the veſſels ſecreting mucus, and in this way will leſſen the diſcharge, and greatly promote the cure. It is certain, that in the greater number of caſes, a gonorrhœa, which if treated by internal remedies alone would continue for five or ſix weeks, or longer, may, when judiciouſly treated with injections, be cured in a fortnight, and very often in leſs time. The great aim, therefore, of the practitioner ought to be at firſt to make uſe of ſuch injections only as will tend to lubricate the ſurface of the urethra, and to counteract and deſtroy the ſtimulus of the virus: as the inflammation abates, he may add ſome gently aſtringent preparation to a mucilaginous and ſedative injection; taking care that its aſtringency be ſuited to the ſtate of the diſeaſe, and to the irratability of the patient. Amongſt a great variety of ſubſtances, mercury in different forms is one of thoſe that is the moſt frequently employed in injections. All theſe mercurial injections have more or leſs of aſtringency; and, according to Dr. Simmons, it is ſolely to this property that we are to aſcribe their effects: for the idea of their correcting the venereal virus was originally introduced, and has been continued upon miſtaken principles.

Calomel, mixed with the mucus diſcharged in a gonorrhœa, has no more power in deſtroying the infectious properties of that mucus than ceruſſe or any other preparation would have. A diluted ſolution of ſublimate injected into the urethra will, like a ſolution of verdigriſe, or blue vitriol, or any other ſtyptic, conſtringe the mouths of the lacunæ; but this is all that it will do, for it will never leſſen the infectious nature of the virus. The ſame thing may be obſerved of crude mercury extinguiſhed by means of mucilage, or of mercurial unction, blended with the yolk of an egg, and which, when thrown up into the urethra, will act nearly in the ſame manner as balſam of copaiva, or any other ſtimulating injection. For the truth is, that mercury has no power over the venereal virus, until it has been introduced into the body, undergone certain changes, with which we are, and probably ſhall for ever remain, unacquainted. The local application of mercury can therefore have no other effects than what it derives from its ſtimulating and aſtringent properties: for the mercury not being abſorbed in the urethra, of courſe cannot be carried into the ſyſtem; and even if it could, the quantity that would be introduced in this way would be too minute to be of any efficacy. The ſtimulus of calomel, however, has often been found of conſiderable efficacy; and in women, when the vagina only was affected, after waſhing the parts well, the cure has been accompliſhed by rubbing them repeatedly with mercurial ointment.

As the gonorrhœa is often a local affection, it may be imagined, perhaps, that the internal uſe of mercury is unneceſſary towards the cure. Very often indeed this complaint may be removed without having recourſe to mercurials. Sometimes patients have been met with whoſe general health has been greatly impaired by a long continued uſe of mercury in ſuch caſes, while the original diſeaſe, the gonorrhœa, was rendered much worſe by it. In ſome it degenerated into a gleet, that was cured with extreme difficulty; in others it brought on a variety of diſtreſſing ſymptoms. In caſes of gonorrhœa, therefore, whenever mercury is adminiſtered, it ought not to be with a view to expedite the cure, but merely to obviate the dangers of abſorption. When the infection is apparently ſlight, and the inflammation and the ſymptoms trifling, we may proceed without the aſſiſtance of mercury, eſpecially if the patient is of a weak, relaxed, and irritable habit, likely to be injured by mercurial medicines. On the other hand, whenever the diſcharge is violent, the inflammation conſiderable, or the ſeat of the diſeaſe high up in the urethra, it is adviſeable to give mercurials in ſmall doſes, and in ſuch forms as ſeem the beſt adapted to the conſtitution of the patient.

The mercurial pill of the London Diſpenſatory, on account of the turpentine that enters into its compoſition, will ſometimes paſs through the body undiſſolved, and of courſe can then be of no uſe; but when the mercury is extinguiſhed by means of honey, and made into pills, in the manner directed in the laſt edition of the Edinburgh pharmacopœia, it becomes as mild and perhaps as efficacious a preparation as any. Its efficacy will depend on its not irritating the bowels, and ſo paſſing off by ſtool; care muſt likewiſe be taken to prevent its affecting the mouth. Of the chymical preparations of mercury the mildeſt and leaſt irritating is calomel. It may be given from gr. iſs. to gr. iii. at bed-time, occaſionally interpoſing a mild purgative to prevent it from ſalivating; but in general the mercurial pill juſt mentioned is to be preferred.

When there is no chancre or bubo, no appearance, in ſhort, that the infection is likely to be carried into the ſyſtem, it would be improper to adminiſter corroſive ſublimate, the mercurius calcinatus, or any other of the more acrid preparations of mercury.

When there is no reaſon to ſuſpect a venereal taint, aſtringent injections will be of the greateſt ſervice. It will be neceſſary, at the ſame time, to attend to the health of the patient, by giving the bark, chalybeate waters, cold bathing, and ſuch other remedies as will tend to ſtrengthen the ſyſtem. When there is no tendency to inflammation, the balſam of copaiva may be preſcribed with advantage in large doſes. Dr. Simmons ſays he once ſaw a complaint of this ſort removed by applying a bliſter to the perinæum, after it had reſiſted a variety of other remedies. In the Medical Obſervations alſo we have an account of a gleet and incontinence of urine removed at once by a bliſter to the os ſacrum. In general, however, the other methods abovementioned will be ſufficient to remove it, though ſometimes it will continue for a long time in ſpite of all our endeavours to check it. Other kinds of gonorrhœa, in which the ſemen itſelf is ejected, eſpecially during ſleep, may be cured by tonics, and a mild cooling regimen.

ORDER V. EPISCHESES.

Suppreſſion of Evacuations.

GENUS LXXVII. OBSTIPATIO; COSTIVENESS.

Coſtiveneſs is ſometimes occaſioned by debility in dyſpeptic perſons, ſometimes it is the effect of rigidity, and ſometimes it is ſymptomatic of the colic. It may proceed from an exceſſive heat of the liver; drinking rough red wines, or other aſtringent liquors; too much exerciſe, eſpecially on horſeback: it may likewiſe proceed from a long uſe of cold inſipid food, which does not ſufficiently ſtimulate the inteſtines. Sometimes it is owing to the bile not deſcending to the inteſtines, as in the jaundice; and at other times it proceeds from diſeaſes of the inteſtines themſelves, as a palſy, ſpaſms, tumors, a cold dry ſtate of the inteſtines, &c.

Exceſſive coſtiveneſs is apt to occaſion pains of the head, vomiting, colics, and other complaints of the bowels. It is peculiarly hurtful to hypochondriac and hyſteric perſons, as it generates wind and other grievous ſymptoms.

Perſons who are generally coſtive ſhould live upon a moiſtening and laxative diet; as roaſted or boiled apples, pears, ſtewed prunes, raiſins, gruels with currants, butter, honey, ſugar, and ſuch like. Broths with ſpinage, leeks, and other ſoft pot-herbs, are likewiſe proper. Rye-bread, or that which is made of a mixture of wheat and rye together, ought to be eat. No perſon troubled with coſtiveneſs ſhould eat white bread alone, eſpecially that which is made of fine flour. The beſt bread for keeping the belly ſoluble is what in ſome parts of England they call *meſlin*. It is made of a mixture of wheat and rye, and is very agreeable to thoſe who are accuſtomed to it.

Coſtiveneſs is increaſed by keeping the body too warm, and by every thing that promotes the perſpiration; as wearing flannel, lying too long a-bed, &c.

The drink ſhould be of an opening quality. All ardent ſpirits, auſtere and aſtringent wines, as port, claret, &c. ought to be avoided. Malt-liquor that is fine and of a moderate ſtrength, is very proper. Buttermilk, whey, and other watery liquors, are likewiſe proper, and may be drank in turns, as the patient's inclination directs.

Thoſe who are troubled with coſtiveneſs ought, if poſſible, to remedy it by diet, as the conſtant uſe of medicines for that purpoſe is attended with many inconveniences, and often with bad conſequences. In time the cuſtom becomes neceſſary, and generally ends in a total relaxation of the bowels, indigeſtion, loſs of appetite, waſting of the ſtrength, and death.

The learned Dr. Arbuthnot adviſes thoſe who are troubled with coſtiveneſs to uſe animal-oils, as freſh butter, cream, marrow, fat broths, eſpecially thoſe made of the internal parts of animals, as the liver, heart, midriff, &c. He likewiſe recommends the expreſſed oils of mild vegetables, as olives, almonds, piſtaches, and the fruits themſelves; all oily and mild fruits, as figs; decoctions of mealy vegetables; theſe lubricate the inteſtines; ſome ſaponaceous ſubſtances which ſtimulate gently, as honey, hydromel, or boiled honey and water, unrefined ſugar, &c.

The doctor obſerves, that ſuch lenative ſubſtances are proper for perſons of dry artrabilarian conſtitutions, who are ſubject to aſtriction of the belly and the piles, and will operate when ſtronger medicinal ſubſtances are ſometimes ineffectual; but that ſuch lenitive diet hurts thoſe whoſe bowels are weak and lax. He likewiſe obſerves, that all watery ſubſtances are lenitive; and that even common water, whey, ſour milk, and butter-milk, have that effect. That new milk, eſpecially aſſes milk, ſtimulates ſtill more when it ſours on the ſtomach; and that whey, turned ſour, will purge ſtrongly. That moſt garden-fruits are likewiſe laxative; and that ſome of them, as grapes, will throw ſuch as take them immoderately, into a cholera morbus, or incurable diarrhœa.

When the body cannot be kept open without medicine, gentle doſes of rhubarb may be taken twice or thrice a-week. This is not near ſo injurious to the ſtomach as aloes, jalap, or the other draſtic purgatives, ſo much in uſe. Infuſions of ſenna and manna may likewiſe be taken, or half an ounce of ſoluble tartar diſſolved in water-gruel. About the ſize of a nutmeg of lenitive electuary taken twice or thrice a-day, generally anſwers the purpoſe very well.

GENUS LXXVIII. ISCHURIA; *or* SUPPRESSION *of Urine.*

This diſtemper is diſtinguiſhed into various ſpecies, according as the ſeat of it in the kidneys, the ureters, the bladder, or the urethra; and hence theſe ſpecies are named *renalis*, *ureterica*, *veſicalis*, and *urethralis*.

1. *Iſchuria renalis*, or a ſuppreſſion of urine from an affection of the kidneys, happens but rarely; however, Dr. Home in his Clinical Experiment deſcribes the effects of it on a patient who was under his treatment, but died after all the probable means were uſed for his relief.

2. The *iſchuria ureterica* is alſo a rare diſeaſe, unleſs the obſtruction proceeds from a ſtone or clot of blood ſtopping up the paſſage. Gravel or ſtones indeed, are very frequently formed in the kidneys; and, by falling into the ureters, occaſion an iſchuria, with violent pain, and ſymptoms more or leſs urgent in proportion to the ſize and ſhape of the ſtones. Sometimes it is attended with coldneſs of the extremities, nauſea and vomiting, and ſpaſtic conſtriction of the præcordia, a difficulty of making water, conſtipation of the belly, difficulty of breathing, ſtupor of the thigh, retraction of the teſticle to the *os pubis*, inquietude, loſs of ſtrength, ſyncope, and convulſion fits. When the violent pain has continued for ſeveral days and nights without intermiſſion, and has brought the patient exceeding low, and the ſuppreſſion of urine is complete, with coldneſs of the extremities and convulſions of the tendons, death is at hand. Nor is it a good ſign when the ſtone continues long in the ureter; for then the appetite decays, a nauſea and retching to vomit ſupervene, and the patient is conſumed with a hectic heat. Sometimes the pain is attended with an inflammation of the ſtomach and inteſtines; and ſometimes the diſeaſe ends in a dropſy of the breaſt, or lethargy, which ſoon carry off the patient.

The indications of cure are, to exclude the ſtone as eaſily as poſſible, and preventing the breeding of others. If the patient is of a ſanguineons temperament, Sydenham recommends to take away ten ounces of blood from the affected ſide; and then to give the patient a gallon of poſſet-drink in which two ounces of marſhmallow roots have been boiled, injecting at the ſame time an emollient clyſter. After the poſſet-drink has been vomited up, and the clyſter returned, give a pretty large doſe of an opiate. But if the patient is old or weak, or ſubject to the vapours, bleeding may be omitted, eſpecially if his urine at the beginning of the fit is coffee coloured, and mixed with gravel; but as to other things, the cure is the ſame. Huxham greatly recommends an emollient bath prepared of a decoction of marſh-mallow root, linſeed, fœnugreek ſeed, and flowers of chamomile, to which may be added a few white-poppy ſeeds. By the uſe of this bath he ſays he has ſeen the moſt cruel fit of the gravel ſuddenly ended, when neither copious bleeding nor opiates had the leaſt effect. Mild diuretics are alſo of ſervice. Hoffman recommends dulcified ſpirit of nitre as proper to relax the ſpaſtic ſtricture. It is to be taken with ſuitable diſtilled waters, and ſyrup of poppies; or in broth, with a few ſpoonfuls of oil of ſweet almonds. Turpentine glyſters are alſo accounted very ſerviceable; and may be prepared of ten ounces decoction of chamomile, with half an ounce of turpentine diſſolved in the yolk of an egg, with as much honey. The *ſal diureticus*, or *terra foliata tartari*, is much eſteemed by ſome, when taken along with an opiate. But when the ſtone is too big to paſs, Arbuthnot recommends a cool and diluent diet to hinder the further growth of it. Whey, linſeed, decoction of marſhmallows, and gently reſolving diuretics, are alſo proper. To put a ſtop to the vomiting, *balſamum traumaticum* may be uſed with ſucceſs when almoſt every other means have failed.

3. The *iſchuria veſichalis* may ariſe from a ſtone in the bladder; and this indeed is the moſt common cauſe of it: but there are certain caſes in which, though the uſual quantity of urine, or perhaps more, is paſſed, the patent dies from the retention of a ſtill greater quantity in the bladder. Of this Dr. Home gives the following inſtance.

A body being opened, it appeared that the tumour which was ſo diſtinctly felt in the left ſide of the abdomen, was owing to a diſtenſion of the bladder with urine. Its fundus reached to about the diviſion of the aorta into the iliacs; it entirely filled the pelvis, and contained between five and ſix pounds of urine of a pale colour. On examining the external ſurface, its neck, and the beginning of the urethra, were found to be ſurrounded with a ſcirrhoſity, which impeded the evacuation of the urine. The bladder itſelf was much thickened, but not more in one part than another. The ureters entered naturally; but were much thickened in their upper half near the kidney. The kidneys were ſomewhat enlarged; particularly the left, which had ſeveral watery veſicles on its external ſurface. The diſeaſe was miſtaken for an aſcites; and the catheter was not tried: but in another caſe the uſe of this inſtrument was apparently of more ſervice than any internal medicines.

4. The *iſchuria urethralis* ariſes from ſome tumour ſtopping up the paſſage of the urethra, and thus hindering the flow of urine. It is an uncommon diſtemper, and generally follows a gonorrhœa. Dr. Home gives us an example of this alſo. The patient was a man of 60 years of age, who had laboured under a gonorrhœa ſix months before, and which was ſtopped by ſome medicines in two or three days. He felt, ſoon afterwards, a difficulty in paſſing his urine, which gradually increaſed. About 10 days before his admiſſion into the clinical ward, it was attended with pains in the glands, and *ardor urinæ*; he had paſſed only about eight ounces the day before his admiſſion, and that with very great difficulty; and the hypogaſtric region was ſwelled and pained. On introducing the catheter, three pounds of urine were drawn off, by which the pain and ſwelling were removed. The inſtrument required force to make it paſs the neck of the bladder, and blood followed the operation; and the finger, introduced into the anus, felt a hard tumour about its neck. He was treated with mercurial pills and ointment, by which the ſwelling about the neck of the bladder ſoon began to decreaſe; but at the ſame time a ſwelling of the right teſticle appeared. He was vomited with four grains of turbith-mineral, which operated gently; and here Dr. Home obſerves, that, though theſe vomits are little uſed, from a miſtaken notion of their ſeverity, he never ſaw them operate with more violence than other vomits, or than he could have wiſhed. The ſwelling diminiſhed in conſequence of the vomit and ſome external applications; and the cure was completed by bleeding, and a decoction of mezereon-root.

GENUS LXXIX. DISURIA, *or* DIFFICULTY *of* MAKING WATER.

A difficulty of making water may ariſe from many different cauſes; as from ſome acrid matter in the blood, cantharides, for inſtance: and hence a ſtrangury very often ſucceeds the application of bliſters. In many caſes it ariſes from a compreſſion of ſome of the neighbouring parts; of the uterus, for inſtance, in a ſtate of pregnancy. Or it may ariſe from a ſpaſmodic affection of the bladder, or rather its ſphincter; or from an inflammation of theſe parts, or others near them. Hence the diſeaſe is diſtinguiſhed into ſo many ſpecies, the cure of which depends upon the remedies indicated by their different cauſes. But the moſt common, as well as the moſt dangerous ſpecies is that ariſing from a calculous concretion, or

STONE *in the* BLADDER.

The ſigns of a ſtone in the bladder are, pain, eſpecially about the ſphincter; and bloody urine, in conſequence of riding or being jolted in a carriage; a ſenſe of weight in the *perinæum*; an itchineſs of the *glans penis*; ſlimy ſediment in the urine; and frequent ſtoppages in making water; a *teneſmus* alſo comes on while the urine is diſcharged: but the moſt certain ſign is, when the ſtone is felt by the finger introduced into the anus, or by the catheter.

Cauſes, &c. It is not eaſy to ſay what the particular cauſes are that occaſion the earthy particles of the fluids to run together, and form thoſe calculous concretions which are found in different parts of the body, and eſpecially in the organs for ſtraining off and diſcharging the urine.

The gout and ſtone are generally ſuppoſed to have ſome affinity, becauſe gouty people are for the moſt part afflicted with the gravel. But perhaps this is chiefly owing to their long confinement, and to the lying on the back, which people who labour under the gout are often obliged to ſubmit to; ſince the want of exerciſe, and this poſture, will naturally favour the ſtagnation of groſs matters in the kidneys: beſides, there are many inſtances of people ſeverely afflicted with the ſtone for the greateſt part of a long life, who have never had the leaſt attack of the gout.

Whatever may be the particular cauſe of the diſpoſition to *lithiaſis*, the kidneys appear to be the moſt likely places for the earthy particles to concrete or run together, becauſe of the great quantity of blood which paſſes through the renal arteries, and which comes immediately from the heart, fraught with various newly-received matters, that have not undergone much of the action of the veſſels, and therefore cannot as yet be ſuppoſed to be thoroughly aſſimilated.

Anatomiſts who have carefully examined the kidneys in the human ſubject, particularly M. Bertin, inform us, that there are two ſets of *tubuli uriniferi*; the one continued directly from the extremities of the renal artery, and the other ſpringing from that veſicular texture which is conſpicuous in the kidney.

It is in this veſicular part of the kidney that we preſume the earthy particles firſt ſtagnate and coaleſce: for it is hardly to be ſuppoſed, that ſuch ſolid matters could be allowed to ſtop in the extremities the of renal arteries, ſince the blood, and the urine ſeparated from it, muſt flow through theſe veſſels with great degrees of force and velocity; but in the intermediate veſiculæ the earthy particles may lie, and there attracting each other, ſoon come to acquire ſenſible degrees of magnitude, and thus become ſand or gravel. As long as this ſand or gravel formed in the veſicular part of the kidney lies quiet, there will be no pain or uneaſineſs, until the concretions become large enough to preſs either on the adjoining *tubuli*, or on the blood-veſſels; then a ſenſe of weight, and a kind of obtuſe pain in the loins, will be felt. But when the ſmall pieces of earthy matter ſhall be diſlodged and waſhed off by the force of the circulating fluids, or looſened by ſome ſpaſmodic action of the motory fibres in theſe parts, they will in their paſſage create pain, raiſe different degrees of inflammation, or perhaps lacerate ſome blood-veſſels, and cauſe bloody urine. When theſe little earthy concretions happen to be detained in the pelvis of the kidney, or any other place where a flow of urine continually paſſes, they ſoon increaſe in ſize, and become calculi, from the conſtant acceſſion of earthy particles, which are attracted by the original bit of ſand, which thus becomes the nucleus of a ſtone.

It is an opinion which Hippocrates firſt advanced, and which has been almoſt univerſally adopted by his followers, and hath remained till lately uncontroverted, that the ſtone and gravel are generated by the uſe of hard water. And from this quality, which the waters of certain ſprings poſſeſs of depoſiting a large earthy ſediment, either in the aquæducts through which they are conveyed, or in the veſſels in which they are boiled or preſerved, it was obvious to infer, that in paſſing through the kidneys, and eſpecially whilſt retained in the bladder, they would let fall their groſſer particles, which by the continued appoſition of freſh matter, connected by the animal gluten, and compacted by the muſcular action of that organ, would in time form a calculus, ſufficiently large to produce a train of the moſt excruciating ſymptoms. And this reaſoning *à priori* has been ſuppoſed to be confirmed by facts and experience; for not to mention the authority of Hippocrates, Dr Liſter has obſerved, that the inhabitants of Paris are peculiarly ſubject to the ſtone in the bladder. Nicholas de Blegny has related the hiſtory of one who was diſſected at Paris, in whom the pylorus, a great part of the duodenum, and the ſtomach itſelf, were found incruſtated with a ſtony matter, to the thickneſs of a finger's breadth. And it is well known, that the water of the river Seine, with which that city is ſupplied, is ſo impregnated with calcareous matter, as to incruſtate, and in a ſhort time to choak up, the pipes through which it runs. But on the other hand it is objected, that the human calculus is of animal origin, and by chymical analyſis appears to bear very little analogy to the ſtony concretions of water.

Dr. Percival informs us that a gentleman of Mancheſter, who had been long ſubject to nephritic complaints, and often voided ſmall ſtones, was adviſed to refrain from his own pump-water, which is uncommonly hard, and to drink conſtantly the ſofter water of a neighbouring ſpring; and that this change alone, without the uſe of any medicine, hath rendered the returns of this diſorder much leſs frequent and painful. A lady alſo, much affected with the gravel, was induced by the peruſal of the firſt edition of Dr. Percival's Eſſay, to try the effect of ſoft water; and by the conſtant uſe of it remained two years entirely free from her diſorder.

When an inflammation is actually raiſed, the diſeaſe is known by the name of *nephritis*, and has been already treated of.

As ſoon as the ſtone paſſes through the ureter, and falls into the bladder, the pain and other nephritic ſymptoms ceaſe; and every thing will remain quiet, either till the ſtone is carried into the urethra, or until it has remained long enough in the bladder to acquire weight ſufficient to create new diſtreſs.

If a ſtone happens to be ſmooth, and of a roundiſh form, it may lie in the bladder and acquire conſiderable bulk before it can be perceived by the patient; but when it is angular, or has a rugged ſurface, even though it may be ſmall in ſize, yet it ſeldom fails to raiſe pain, and occaſion bloody urine, or the diſcharge of a ſlimy fluid, with teneſmus, and difficulty in making water.

There have been various attempts and pretences made to diſſolve the ſtone. The things which have been found moſt effectual are thoſe that powerfully abſorb the fixed air from bodies, and at the ſame time readily combining with oils, render them miſcible with water. There is ſcarce any earthy ſubſtance that abounds more in oil, and alſo contains ſuch a quantity of fixed air as the human *calculus*; and hence it is that the cauſtic fixed alkaline ſalt is ſuch a powerful diſſolvent of the ſtone: but this being of a very acrid nature, it requires to be well ſheathed by means of ſome gelatinous or mucilaginous vehicle. Veal-broth is as convenient as any for this purpoſe, and accordingly it is uſed by thoſe who make a ſecret of the cauſtic alkali as a vehicle for the ſoap-lees.

Mr. Blackrie, who has taken much pains in the inquiry, has proved very ſatisfactorily, that Chittick's noſtrum is no other than ſoap-lees given in veal-broth, which the patients ſend every day to the Doctor, who returns it mixed up with the medicine, in a cloſe veſſel ſecured by a lock.

It is not every caſe, however, that either requires or will bear a courſe of the cauſtic alkali. Some calculi are of that ſoft and friable nature, that they will diſſolve even in common water; and there are caſes wherein it appears that the conſtant uſe of ſome very ſimple decoction or infuſion of an inſignificant vegetable, has brought away large quantities of earthy matter, in flakes which apparently have been united together in layers to form a ſtone. Dr. Macbride aſſures us, that a decoction of raw coffee, only 30 berries in a quart of water, boiled till it acquired a deep greeniſh colour taken morning and evening to the quantity of eight or ten ounces, with ten drops of ſweet ſpirit of nitre, had the powerful effect of bringing away, in the courſe of two months, as much earthy matter in flakes as filled a large tea-cup. The patient was far advanced in years; and, before he began this decoction, had been reduced to great extremities by the continuance of pain and other diſtreſſing ſymptoms: he was purged occaſionally with *oleum ricini*.

An infuſion of the ſeeds of *daucus ſylveſtris* ſweetened with honey, is another ſimple and approved remedy; and has been found to give conſiderable eaſe in caſes where the ſtomach could not bear any thing of an acrid nature: the leaves of the *uva urſi* were ſtrongly recommended by the late very celebrated De Haen. But where the ſtomach will bear it, and there is no ulceration in the caſe, nor exceſſive ſenſibility in the uropoietic organs, either the ſoap-lees in new-milk or veal-broth, or ſoap-pills, and lime-water, will bid faireſt to do effectual ſervice, either by diſſolving the ſtony concretions, or at leaſt rendering the ſharp poins and rugged ſurface leſs capable of injuring the ſenſible membranes of the parts where theſe hard bodies lodge, or happen to paſs through.

In ſuch caſes as will not allow us to think of diſſolving the ſtony concretions, and where the only ſcheme is to palliate and procure eaſe from time to time, little more can be done than to keep the bowels open occaſionally by ſome gentle cathartic, and waſh off as much of the looſe gravelly matter and ſlime as can be removed by ſuch mild diuretic infuſions and decoctions as ſhall be found to paſs freely and ſit well on the ſtomach. Perſons afflicted with the ſtone ſhould be careful in reſpect of their diet, and ſtudiouſly avoid all heavy and flatulent food, as well as high ſauces that are apt to turn rancid. For the ſame reaſon, butter and acids are to be ſhunned; for theſe often create heart-burning, and every thing that offends the ſtomach raiſes the nephritic pain; ſuch is the ſympathy that obtains between the digeſtive and the uropoietic organs.

There have been ſurgeons bold enough to entertain an idea of cutting even into the kidney, in order to extract a ſtone: this, however, except in caſes where an abſceſs has been formed, and nature points out the way, is merely chimerical. But cutting into the bladder for the ſame purpoſe, is an ancient and well known operation, and often crowned with ſucceſs. But a deſcription of this operation belongs to the article SURGERY, to which we refer; and here ſhall only make this remark, that a ſurgeon ſhould never begin his operation, until he and his aſſiſtants are perfectly ſatisfied, from actually feeling the ſtone, that there is one in the bladder; because it has ſometimes happened, that when the inciſion has been made, no ſtone could be found: and the patient having died in conſequence of the operation, and the body being opened, it has appeared that the ſymptoms which occaſioned the belief of a ſtone in the bladder aroſe from ſome other cauſe.

When a dyſuria proceeds from an acrimonious matter thrown into the blood, it may be readily cured by bleeding, emollient clyſters, cooling and diluting drinks with gum arabic or gum tragacanth, linſeed tea, or the warm bath. When it ariſes from inflammations of the bladder or parts adjoining to it, we are to regard it only as a ſymptomatic affection; and the remedies uſed to remove the primary diſeaſe will alſo remove the dyſuria. Sometimes it may ariſe from an ulcer of the bladder, in which caſe it is generally incurable; a mild nutritious diet will, however, protract the patient's life.

Genus LXXX. AMENORRHŒA, Suppreſſion *of the* Menſes.

This, with ſome other ſymptoms, as dyſpepſia, yellowiſh, or greeniſh colour of the ſkin, unuſual appetites, &c. conſtitutes the *chloroſis* already treated of, and which ſeldom or never appears without a ſuppreſſion of the menſes.

Veneſection is recommended as an excellent remedy; the Doctor gives three inſtances of its ſucceſs, and ſays he could give many more. It acts by removing the plethoric ſtate of the uterus, relaxing the fibres, and giving the veſſels full play; ſo that their affection overcomes all reſiſtance, and the evacuation takes place. It is of no great moment from whence the blood is taken; the ſaphæna vein will perhaps empty the uterus moſt; but it is difficult to get the proper quantity from it, and it cannot be ſo well meaſured. The powder of ſavine is a powerful remedy; and proved ſucceſsful in three caſes out of four in which it was tried. It was given in the quantity of half a drachm twice a-day. It is a ſtrong topical ſtimulus, and ſeems improper in plethoric habits. Madder root is a very powerful medicine in this diſeaſe; and proved ſucceſsful in 14 out of 19 caſes in which it was tried, being ſometimes exhibited in the quantity of two ſcruples, or a drachm, four times a-day. It has ſcarce any ſenſible effects; never quickens the pulſe, or excites inflammatory ſymptoms: on the contrary, the heat, thirſt, and other complaints abate; and ſometimes theſe ſymptoms are removed, though the diſeaſe is not cured; but when it ſucceeds, the menſes appear from the third to the 12th day. For other methods of curing the amenorrhœa, ſee Chloroſis.

We have now conſidered all thoſe diſeaſes, whoſe cure is to be attempted chiefly by internal medicines. The other genera either require particular manual operations, or a very conſiderable uſe of external applications; and therefore properly fall under the article Surgery.

MEDICAL ELECTRICITY.

The application of this ſubtile fluid to medicinal purpoſes was thought of ſoon after the diſcovery of the electric ſhock; and after various turns of reputation, its medical virtues ſeem now to be pretty well eſtabliſhed. After giving ſo particular a deſcription of electrical apparatus under the proper article, it would here be ſuperfluous to ſay any thing farther on that head. We ſhall only obſerve, that Mr. Cavallo, who hath publiſhed the lateſt and the beſt treatiſe on Medical Electricity, entirely diſapproves of giving violent ſhocks, and finds it moſt efficacious to expoſe the patient to the electrical aura diſcharged from an iron or a wooden point; or if ſhocks are given, they ſhould be very ſlight, and not exceed 12 or 14 at a time. In this way he recommends it as effectual in a great number of diſorders. The patient may be electrified from three to ten minutes; but if ſparks are drawn, they ſhould not exceed the number of ſhocks abovementioned.

Rheumatic Diſorders, even of long ſtanding, are relieved, and generally quite cured, by only drawing the electric fluid with a wooden point from the part, or by drawing ſparks through flannel. The operation ſhould be continued for about four or five minutes, repeating it once or twice every day.

Deafneſs, except when it is occaſioned by obliteration, or other improper configuration of the parts, is either entirely or partly cured by drawing the ſparks from the ear with the glaſs-tube director, or by drawing the fluid with a wooden point. Sometimes it is not improper to ſend exceedingly ſmall ſhocks (for inſtance, of one-thirtieth of an inch) from one ear to the other. It has been conſtantly obſerved, that whenever the ear is electrified, the diſcharge of the wax is conſiderably promoted.

The Tooth-ach, occaſioned by cold, rheumatiſm, or inflammation, is generally relieved by drawing the electric fluid with a point, immediately from the part, and alſo externally from the face. But when the body of the tooth is affected, electrization is of no uſe; for it ſeldom or never relieves the diſorder, and ſometimes increaſes the pain to a prodigious degree.

Swellings in general, which do not contain any *matter*, are generally cured by drawing the electric fluid with a wooden point. The operation ſhould be continued for three or four minutes every day. It is very remarkable, that in ſome caſes of white ſwellings, quite cured by means of electricity, the bones and cartilages were in ſome meaſure disfigured.

Inflammation of every ſort are generally relieved by a very gentle electrization.

In Inflammations of the Eyes, the throwing of the electric fluid by means of a wooden point is conſtantly attended with great benefit; the pain being quickly abated, and the inflammation being generally diſſipated in a few days. In theſe caſes, the eye of the patient muſt be kept open; and care ſhould be taken not to bring the wooden point very near it, for fear of cauſing any ſpark. Sometimes it is ſufficient to throw the fluid with a metal point; for in theſe caſes, too great an irritation ſhould be always avoided. It is not neceſſary to continue this operation for three or four minutes without intermiſſion; but after throwing the fluid for about half a minute, a ſhort time may be allowed to the patient to reſt and to wipe his tears, which generally flow very copiouſly; then the operation may be continued again for another half minute, and ſo on for four or five times every day.

The *Gutta Serena* has been often cured by electrization; but at the ſame time it muſt be confeſſed, it has proved ineffectual in many ſuch caſes, in which it was adminiſtered for a long time and with all poſſible attention. However, it hath never been known that any body was made worſe by it. The beſt method of adminiſtering electricity in ſuch caſes, is firſt to draw the electric fluid with a wooden point for a ſhort time, and then to ſend about half a dozen ſhocks of one-twentieth of an inch from the back and lower part of the head to the forehead, very little above the eye.

A remarkable diſeaſe of the eye was ſome time ago perfectly cured by electrization; it was an opacity of the vitreous humour of the eyes. This ſeems to be the only caſe of the kind to which electricity was applied.

All the caſes of *fiſtula lacrymalis* which Mr. Cavallo hath known to have been electrified by perſons of ability for a ſufficient time, have been entirely cured. The method generally practiſed, has been that of drawing the fluid with a wooden point, and to take very ſmall ſparks from the part. The operation may be continued for about three or four minutes every day. It is remarkable, that in thoſe caſes, after curing the fiſtula lacrymalis, no other diſeaſe was occaſioned by it, as blindneſs, inflammation, &c. by ſuppreſſing that diſcharge.

Palſies are ſeldom perfectly cured by means of electricity, eſpecially when they are of long ſtanding; but they are generally relieved to a certain degree. The method of electrifying in thoſe caſes, is to draw the fluid with a wooden point, and to draw ſparks through flannel, or though the uſual covering of the part if they are not too thick. The operation may be continued for about five minutes per day.

Ulcers, or open ſores of every kind, even of a long ſtanding, are generally diſpoſed to heal by electrization. The general effects are a diminution of the inflammation, and at firſt a promotion of the diſcharge of properly formed matter; which diſcharge gradually leſſens, according as the limits of the ſore contract, till it is quite cured. In theſe caſes the gentleſt electrization muſt be uſed, in order to avoid too great an irritation, which is generally hurtful. To draw or throw the fluid with a wooden or even with a metal point, for three or four minutes per day, is abſolutely ſufficient.

Cutaneous Eruptions, have been ſucceſsfully treated with electrization: but in theſe caſes it muſt be obſerved, that if the wooden point is kept too near the ſkin, ſo as to cauſe any conſiderable irritation, the eruption will be cauſed to ſpread more; but if the point be kept at about ſix inches diſtance, or farther, if the electrical machine is very powerful, the eruptions will be gradually diminiſhed, till they are quite cured. In this kind of diſeaſe, the immediate and general effect of the wooden point is to occaſion a warmth about the electrified part, which is always a ſign that the electrization is rightly adminiſtered.

Scrophulous Tumours, when they are juſt beginning, are generally cured by drawing the electric fluid with a wooden or metal point from the part. This is one of thoſe kinds of diſeaſes in which the action of electricity requires particularly the aid of other medicines in order to affect a cure more eaſily; for ſcrophulous affections generally accompany a great laxity of the habit, and a general cachexy, which muſt be obviated by proper remedies.

In *cancers*, the pains only are moſtly alleviated by drawing the electric fluid with a wooden or metal point. Mr. Cavallo, however, mentions one caſe in which a moſt confirmed cancer of very long ſtanding, on the breaſt of a woman, has been much reduced in ſize. It is remarkable, that this patient was ſo far relieved by drawing the fluid with a metal point from the part, that the excruciating pains ſhe had ſuffered for many years almoſt diſappeared and alſo, that when the electric fluid was drawn by means of a wooden point, the pains rather increaſed. This perſon is ſtill under the application of electricity; and the cancers ſeems not unlikely to be perfectly cured, although contrary to the expectations even of the judicious phyſician who electrifies her, and who knows too well the nature of that dangerous diſeaſe.

Abſceſſes, when they are in their beginning, and in general whenever there is any tendency to form matter, electrization diſperſes them. Lately, in a caſe in which matter was formed upon the hip, called the *lumbar abſceſs*, the diſeaſe was perfectly cured by means of electricity. The *ſciatica* has alſo been often cured by it. In all ſuch caſes, the electric fluid muſt be ſent through the part by means of two directors applied to oppoſite parts, and in immediate contact either with the ſkin or with the coverings, when theſe are very thin. It is very remarkable, that the mere paſſage of the electric is in the fluid manner, is generally felt by the patients afflicted with thoſe diſorders, nearly as much as a ſmall ſhock is felt by a perſon in good health. Sometimes a few ſhocks have been alſo given, but it ſeems more proper to omit them; becauſe ſometimes, inſtead of diſperſing, they rather accelerate the formation of matter.

In caſes of *pulmonary inflammations*, when they are in the beginning, electrization has been ſometimes beneficial; but in confirmed diſeaſes of the lungs, it does not ſeem to have ever afforded any unqueſtionable benefit; however, it ſeems that in ſuch caſes the power of electricity has been but ſeldom tried.

Nervous Head-achs, even of a long ſtanding, are generally cured by electrization. For this diſeaſe, the electric fluid muſt be thrown with a wooden, and ſometimes even with a metal point, all round the head ſucceſſively. Sometimes exceedingly ſmall ſhocks have been adminiſtered; but theſe can ſeldom be uſed, becauſe the nerves of perſons ſubject to this diſeaſe are ſo very irritable, that the ſhocks, the ſparks, and ſometimes even the throwing the electric fluid with a wooden point kept very near the head, throw them into convulſions.

The *Gout*, extraordinary as it may appear, has certainly been relieved by means of electricity, in various inſtances. The pain has been generally mitigated, and ſometimes the diſeaſe has been removed ſo well as not to return for ſome time. In thoſe caſes, the electric fluid has been thrown by means of a wooden point, athough ſometimes, when the pain was too great, a metal point only has been uſed.

Agues are frequently cured by electricity, ſo that ſometimes one electrization or two have been ſufficient. The moſt effectual and ſure method has been that of drawing ſparks through flannel, or the cloaths, for about ten minutes or a quarter of an hour. The patients may be electrified either at the time of the fit, or a ſhort while before the time in which it is expected.

The Suppreſſion of the Menſes, which is a diſeaſe of the female ſex that often occaſions the moſt diſagreeable and alarming ſymptoms, is ſucceſsfully and ſpeedily cured by means of electricity, even when the diſeaſe is of long ſtanding, and after that the moſt powerful medicines uſed for it have proved ineffectual. The caſes of this ſort in which electrization has proved uſeleſs are ſo few, and the ſucceſsful ones ſo numerous, that the application of electricity for this diſeaſe may be juſtly conſidered as an efficacious and certain remedy. Great attention and knowledge is required, in order to diſtinguiſh the arreſt of the menſes from a ſtate of pregnancy. In the former, the application of electricity, as we obſerved above, is very beneficial; whereas, in the latter, it may be attended with very diſagreeable effects: it is therefore a matter of great importance to aſcertain the real cauſe of the diſeaſe, before the electricity be applied in thoſe caſes. Pregnant women may be electrified for other diſeaſes, but always uſing very gentle means, and directing the electric fluid through other parts of the body diſtant from thoſe ſubſervient to generation. In the real ſuppreſſion of the menſes, ſmall ſhocks, *i. e.* of about one-twentieth of an inch, may be ſent through the pelvis; ſparks may be taken through the cloaths from the parts adjacent to the ſeat of the diſeaſe; and alſo the electric fluid may be tranſmitted by applying the metallic or wooden extremities of two directors to the hips, in contact with the cloathes; part of which may be removed in caſe they are too thick. Thoſe various applications of electricity ſhould be regulated according to the conſtitution of the patient. The number of ſhocks may be about 12 or 14. The other applications may be continued for two or three minutes; repeating the operation every day. But either ſtrong ſhocks, or a ſtronger application of electricity than the patient can conveniently bear, ſhould be carefully avoided; for by thoſe means, ſometimes more than a ſufficient diſcharge is occaſioned, which is not eaſily cured. In caſes of uterine hæmorrhages, it is not known that the application of electricity was ever beneficial, neither that it has been often tried. Perhaps a very gentle electrization, as to keep the patient inſulated and connected with the prime conductor, whilſt the electrical machine is in action, may be of ſome benefit.

In reſpect to *unnatural diſcharges* and *fluxes* in general, it may be obſerved, that ſome diſcharges are quite unnatural or adventitious, as the fiſtula lachrymalis, and ſome ſpecies of the venereal diſeaſe; but others are only increaſed natural diſcharges, ſuch as the menſes, perſpiration, &c. Now the power of electricity in general, has been found more beneficial for the firſt, than for the ſecond ſort of diſcharges, which are moſtly increaſed by it.

The application of electricity has been found alſo beneficial in other diſeaſes beſides thoſe mentioned above; but as the facts are not ſufficiently numerous, ſo as to afford the deduction of any general rules, we have not thought proper to take any particular notice of them.

We may laſtly obſerve, that, in many caſes, the help of other remedies to be preſcribed by the gentlemen of the faculty is required to aſſiſt the action of electricity, which by itſelf would perhaps be uſeleſs; and, on the other hand, electrization may often be applied to aſſiſt the action of other remedies, as of ſudorifics, ſtrengthening medicines, &c.

CONCLUSION.

Being a Diſcourſe on the HYGEINE, *or Method of Preſerving* HEALTH.

I. RULES *for the Management of* VALETUDINARIANS.

That part of the medical ſyſtem which lays down rules for the preſervation of health, and prevention of diſeaſes, termed *Hygeine*, is not to be ſtrictly underſtood as if it reſpected only thoſe people who enjoy perfect health, and who are under no apprehenſions of diſeaſe, for ſuch ſeldom either deſire or attend to medical advice; but ſhould rather be conſidered as relating to valetudinarians, or to ſuch as, though not actually ſick, may yet have ſufficient reaſons to fear that they will ſoon become ſo: hence it is that the rules muſt be applied to correct morbific diſpoſitions, and to obviate the various things that were ſhewn to be the remote or poſſible cauſes of diſeaſes.

From the way in which the ſeveral temperaments are uſually mentioned by ſyſtematic writers, it ſhould ſeem as if they meant that every particular conſtitution muſt be referred to one or other of the four; but this is far from being reducible to practice, ſince by much the greater number of people have conſtitutions ſo indiſtinctly marked, that is hard to ſay to which of the temperaments they belong. When we actually meet with particular perſons who have evidently either, 1. Too much ſtrength and rigidity of fibre, and too much ſenſibility; 2. Too little ſtrength, and yet too much ſenſibility; 3. Too much ſtrength, and but little ſenſibility; or, 4. But little ſenſibility, joined to weakneſs;—we ſhould look on ſuch perſons as more or leſs in the valetudinary ſtate, who require that theſe morbific diſpoſitions be particularly watched, leſt they fall into thoſe diſeaſes which are allied to the different temperaments.

People of the firſt-mentioned temperament being liable to ſuffer from continued fevers, eſpecially of the inflammatory ſpecies, their ſcheme of preſerving health ſhould conſiſt in temperate living, with reſpect both to diet and exerciſe; they ſhould ſtudiouſly avoid immoderate drinking, and be remarkably cautious leſt any of the natural diſcharges be checked. People of this habit bear evacuations well, eſpecially bleeding; they ought not, however, to loſe blood but when they really require to have the quantity leſſened; becauſe too much of this evacuation would be apt to reduce the conſtitution to the ſecond-mentioned temperament, wherein ſtrength is deficient, but ſenſibility redundant.

Perſons of the ſecond temperament are remarkably prone to ſuffer from painful and ſpaſmodic diſeaſes, and are eaſily ruffled; and thoſe of the ſofter ſex who have this delicacy of habit, are very much diſpoſed to hyſterical complaints. The ſcheme here ſhould be to ſtrengthen the ſolids by moderate exerciſe, cold bathing, the cortex, and chalybeate waters; particular attention ſhould conſtantly be had to the ſtate of the digeſtive organs, to prevent them from being overloaded with any ſpecies of ſaburra which might engender flatus, or irritate the ſenſible membranes of the ſtomach and inteſtines, from whence the diſorder would ſoon be communicated to the whole nervous ſyſtem. Perſons of this conſtitution ſhould never take any of the draſtic purges, nor ſtronger emetics; neither ſhould they loſe blood but in caſes of urgent neceſſity. But a principal ſhare of management, in theſe extremely irritable conſtitutions, conſiſts in avoiding all ſudden changes of every ſort, eſpecially thoſe with reſpect to diet and cloathing, and in keeping the mind as much as poſſible in a ſtate of tranquility: hence the great advantages which people of this frame derive from the uſe of medicinal waters drank on the ſpot, becauſe of that freedom from care and ſerious buſineſs of every kind, which generally obtains in all the places laid out for the reception of valetudinarians.

The third-mentioned temperament, where there is an exceſs of ſtrength and but little ſenſibility, does not ſeem remarkably prone to any diſtreſſing or dangerous ſpecies of diſeaſe; and therefore it can hardly be ſuppoſed that perſons ſo circumſtanced will either of themſelves think of any particular ſcheme of management, or have recourſe to the faculty for their inſtructions: ſuch conſtitutions, however we may obſerve, bear all kinds of evacuations well, and ſometimes require them to prevent an over-fulneſs, which might end in an oppreſſion of the brain or ſome other organ of importance.

But the fourth temperament, where we have weakneſs joined to want of ſenſibility, is exceedingly apt to fall into tedious and dangerous diſeaſes, ariſing from a defect of abſorbent power in the proper ſets of veſſels, and from remiſſneſs of the circulation in general: whence corpulency, dropſy, jaundice, and different degrees of ſcorbutic affection. In order to prevent theſe, or any other ſpecies of accumulation and depravation of the animal-fluids, the people of this conſtitution ſhould uſe a generous courſe of diet, with briſk exerciſe, and be careful that none of the ſecretions be interrupted, nor any of the natural diſcharges ſuppreſſed. Theſe conſtitutions bear purging well, and often require it; as alſo the uſe of emetics, which are frequently found neceſſary to ſupply the place of exerciſe, by agitating the abdominal viſcera, and are of ſervice to prevent the ſtagnation of bile, or the accumulation of mucous humours, which hinder digeſtion, and clog the firſt paſſages. The free uſe of muſtard, horſe-radiſh, and the like ſort of ſtimulating dietetics, is ſerviceable in theſe torbid habits.

When the general maſs of fluids is accumulated beyond what is conducive to the perfection of health, there ariſes what the writers term a *plethora*, which may prove the ſource of different diſeaſes; and therefore, when this overfulneſs begins to produce langour and oppreſſion, care ſhould be taken in time to reduce the body to a proper ſtandard, by abridging the food and increaſing the natural diſcharges, uſing more exerciſe, and indulging leſs in ſleep. But in oppoſite circumſtances, where the fluids have been exhauſted, we are to endeavour the prevention of further waſte by the uſe of ſtrengthening ſtomachics, nouriſhing diet, and indulgence from fatigue of body or mind.

Vitiated fluids are to be conſidered as affected either with the different kinds of general acrimony, or as betraying ſigns of ſome of the ſpecies of morbific matter which give riſe to particular diſeaſes, ſuch as gout, rheumatiſm, ſtone, ſcurvy, &c.

During the ſtate of infancy, we may ſometimes obſerve a remarkable acidity, which not only ſhews itſelf in the firſt paſſages, but alſo ſeems to contaminate the general maſs of fluids. As it takes its riſe, however, from weak bowels, our views, when we mean to prevent the ill coſequences, muſt be chiefly directed to ſtrengthen the digeſtive organs, as on their ſoundneſs the preparation of good chyle depends; and hence ſmall doſes of rhubarb and chalybeates (either the natural chalybeate waters mixed with milk or the *flores martiales* in doſes of a few grains, according to the age of the child) are to be adminiſtered; and the diet is to be ſo regulated as not to add to this acid tendency: briſk exerciſe is likewiſe to be enjoined, with frictions on the ſtomach, belly, and lower extremities.

Where the fluids tend to the putrefactive ſtate, which ſhews itſelf by rottenneſs of the teeth, ſpongineſs and bleeding of the gums, a bloated look and livid caſt; the diet then ſhould be chiefly of freſh vegetables and ripe fruits, with wine in moderation, briſk exerciſe, and ſtrengthening bitters.

Where acrimony ſhews itſelf by itching eruptions, uncommon thirſt, and fluſhing heats, nothing will anſwer better than ſuch ſulphureous waters as the Harrowgate and Moffat in Britain, or the Lucan and Swadlinbar in Ireland; at the ſame time uſing a courſe of diet that ſhall be neither acrid nor heating. So far with reſpect to thoſe kinds of morbific matter which do not invariably produce a particular ſpecies of diſeaſe: but there are others of a ſpecific nature, ſome of which are generated in the body ſpontaneouſly, and ſeem to ariſe from errors in diet, or other circumſtances of ill management with reſpect to the animal œconomy; and hence it is ſometimes poſſible, in ſome degree, if not altogether, to prevent the ill conſequences. Thus, there are inſtances where returns of the gout have been prevented by adhering ſtrictly to a milk diet.

The rheumatiſm has alſo been ſometimes warded off by wearing a flannel ſhirt, or by uſing the cold bath without interruption.

The ſtone may be retarded in its progreſs, and prevented from creating much diſtreſs, by the internal uſe of ſoap and lime-water, or by ſoap-lees taken in milk or in veal broth.

The putrid ſcurvy may be prevented by warm cloathing and perſeverance in briſk exerciſe, by drinking wine or cyder, and eating freely of ſuch vegetable ſubſtances as can be had in thoſe ſituations where this diſeaſe is moſt apt to ſhew it.

In conſtitutions where there is an hereditary diſpoſition to the ſcrophula, if early precautions be taken to ſtrengthen the ſolids by cold bathing, a nouriſhing courſe of diet, and moderate uſe of wine, the acrimony which gives riſe to the diſeaſe will probably be prevented from producing any very bad effects.

The other kinds of morbific matter, which are of the ſpecific nature, are received into the body by infection or contagion. The infection of a putrid fever or dyſentery, is leſs prevented by immediately taking an emetic on the firſt attack of the ſickneſs or ſhivering; and if that does not completely anſwer, let a large bliſter be applied between the ſhoulders: by this method the nurſes and other attendants on the ſick in the naval hoſpitals have often been preſerved. As to other infections morbific matter, ſee the HYDROPHOBIA, POISONS, &c.

The ill effects that may ariſe from the different ſpecies of ſaburra are to be obviated, in general, by the prudent adminiſtration of emetics, and abſtaining from ſuch kinds of foods as are known to cauſe the accumulation of noxious matters in the firſt paſſages Crude vegetables, milk, butter, and other oily ſubſtances, are to be avoided by perſons troubled with a ſourneſs in the ſtomach; briſk exerciſe, eſpecially riding, is to be uſed, and they are to refrain from fermented liquors: the common drink ſhould be pure water; or water with a very little of ſome ardent ſpirit, ſuch as rum or brandy. Selters and Vahls water are to be drunk medicinally; and aromatic bitters, infuſions, or tinctures, with the acid elixir of vitriol, from ten to twenty drops, will be found ſerviceable, in order to ſtrengthen the fibres of the ſtomach, and promote the expulſion of its contents, thereby preventing the too haſty fermentation of the alimentary mixture. In order to procure immediate relief, the magneſia alba, or *Creta Præparata*, will ſeldom fail; and the magneſia, as well as the other, may be made into lozenges, with a little ſugar and mucilage; and in that form may be carried about and taken occaſionally by people afflicted with the acid ſaburra.

In conſtitutions where there is an exuberance or ſtagnation of bile, and a troubleſome bitterneſs in the mouth, it is neceſſary to keep the bowels always free, by taking occaſionally ſmall doſes of pure aloes, *oleum ricini*, cream of tartar, ſome of the common purging ſalts, or the natural purging waters. When there is a tendency to the empyreumatic and rancid ſaburra, people ſhould carefully avoid all the various kinds of thoſe oily and high-ſeaſoned things generally termed *made-diſhes*, and eat ſparingly of plain meat, without rich ſauces or much gravy; and in theſe caſes the propereſt drink is pure water.

Thoſe who are ſo happy as to enjoy perfect health, ſhould obſerve temperance, in order to preſerve that ineſtimable bleſſing. It is ſafer to proceed to exceſs in drink than in meat; and if the debauch ſhould create any extraordinary or diſtreſſing degree of pain or ſickneſs, and a temporary fever ſhould enſue, there are two ways of ſhaking it off, either to lie in bed and encourage perſpiration, or to get on horſe-back and by briſk exerciſe reſtore the body to its natural ſtate. The choice of theſe two methods muſt always be determined by the peculiar circumſtances of the parties concerned, and from the experience which they may have had which agrees beſt with them.

If a perſon ſhould commit exceſs in eating, eſpecially of high-ſeaſoned things, with rich ſauces; a draught of cold water, acidulated with ſpirit of vitriol, will take off the ſenſe of weight at the ſtomach, and aſſiſt digeſtion, by moderating and keeping within bounds the alimentary fermentation, and thus preventing the generation of too much flatus. The luxury of ices may be here of real ſervice at the tables of the great, as producing ſimilar circumſtances ought not to lay themſelves down to ſleep, but ſhould keep up and exerciſe until they are ſenſible that the ſtomach is unloaded, and that they no longer feel any oppreſſive weight about the præcordia.

It is alſo the advice of Celſus to vary the ſcenes of life, and not confine ourſelves to any ſettled rules: but as inaction renders the body weak and liſtleſs, and exerciſe gives vigour and ſtrength, people ſhould never long omit riding, walking, or going abroad in a carriage; fencing, playing at tennis, or dancing, as each ſhall be found moſt agreeable or convenient, are to be uſed in their turns, according to the circumſtances and tendency to any particular ſpecies of diſeaſe. But when the weakneſs of old age ſhall have rendered the body incapable of all theſe, then dry frictions with the fleſh-bruſh will be extremely requiſite to preſerve health, by accelerating the flow of humours through the ſmalleſt orders of veſſels, and preventing the fluids from ſtagnating too long in the cellular interſtices of the fleſhy parts.

Sleep is the great reſtorer of ſtrength; for, during this time, the nutritious particles appear to be chiefly applied to repair the waſte, and replace thoſe that have been abraded and waſhed off by the labour and exerciſe of the day: but too much indulgence in ſleep has may inconveniences, both with regard to body and mind, as it blunts the ſenſes, and encourages the fluids to ſtagnate in the cellular ſyſtems; whence corpulency, and its neceſſary conſequences langour and weakneſs.

The proper time for ſleep is the night ſeaſon, when darkneſs and ſilence naturally brings it on: therefore day-ſleep in general is not ſo refreſhing; and to ſome people is really diſtreſsful, as creating an unuſual giddineſs and languor, eſpecially in perſons addicted to literary purſuits. Cuſtom, however, frequently renders ſleep in the day neceſſary; and in thoſe conſtitutions where it is found to give real refreſhment, it ought to be indulged.

With regard to the general regimen of diet, it has always been held as a rule, that the ſofter and milder kinds of aliment are moſt proper for children and younger ſubjects; that grown perſons ſhould eat what is more ſubſtantial; and old people leſſen their quantity of ſolid food, and increaſe that of their drink.

We are indebted for the foregoing Syſtem to the Rev. Edward Barry, M. D. Chaplain to the late Lord Biſhop of Kildare, and Subſcriber to the work. He does not preſent it as entirely original, as it is chiefly ſelected from the works of Cullen, Huxham, Percival, Fothergill, Hunter, and other Profeſſors of the firſt eminence. The method adopted by the Doctor of claſſing the diſeaſes, we preſume will conſiderably facilitate the acquiſition of medical knowledge, as it brings together in one point of view thoſe diſeaſes which bear an affinity, and require a ſimilar treatment; by which means the Syſtem is rendered much more conciſe and inſtructive. To make it more complete, the uſes of Medical Electricity are ſubjoined, together with Rules for the obſervance of Valetudinarians, and thoſe who enjoy a perfect ſtate of health. Prefixed is the Hiſtory of Medicine, tracing it from its origin, to the circulation of the blood by Dr. Harvey.

Thoſe of our Readers who may wiſh for particular information or advice reſpecting any of the diſeaſes ſpecified in the Spſtem, are reſpectfully referred to the Author, No. 61, Titchfield Street.

THE EDITORS.

MEDIUM, in logic, or *Medium of a Syllogiſm,* called alſo the *mean,* or *middle term,* is an argument, reaſon, or conſideration, for which we affirm, or deny any thing: or, it is the cauſe why the greater extreme is attributed to, or denied of the leſs, in the concluſion. See the Syſtem, Part III. Sect. IV.

Medium, in philoſophy, is that ſpace or region through which a body paſſes in its motion towards any point. Thus ether is ſuppoſed to be the *medium* wherein the heavenly bodies move. Air the *medium* wherein bodies move near our earth. And water is the *medium* in which fiſhes live and move. And glaſs is alſo a *medium* of light, as it affords a free paſſage. That denſity or conſiſtence in the parts of the *medium,* whereby the motion of bodies in it is retarded, is called *the reſiſtance of the medium*; which, together with the force of gravity, is the cauſe of the ceſſation of the motion of projectiles. Medium, *ſubtile,* or *ætherial.* Sir Iſaac Newton makes it probable, that, beſides the particular aerial *medium,* wherein we live and breathe, there is another more univerſal one, which he calls an *ætherium medium*; vaſtly more rare, ſubtile, elaſtic, and active, than air; and by that means freely permeating the pores and interſtices of all other *mediums,* and diffuſing itſelf through the whole creation; and by the intervention of which he thinks it is, that moſt of the great phenomena of nature are effected. See Æther, Electricity, Fire, &c.

MEDULLA *Oſſium,* or *Marrow of the Bones,* is a ſoft fatty ſubſtance, placed in the cavities or pores of divers bones. See Marrow.

Medulla, *Cerebri, and Cerebelli, Medulla Oblongata, Medulla Spinalis.* For a copious deſcription of theſe three articles in anatomy, ſee the Syſtem, Part VI. Sect. II. III. IV. and V.

MEDUSA, in vermeology, a genus of inſects, of the order of Moluſca. For the claſſification, ſee the Syſtem.

MEDUSÆ *Caput,* or Medusa's *Head,* in ancient Mythology, occurs frequently both on the breaſt-plates and ſhield of Minerva; in ſome of which it is the moſt beautiful, and in others the moſt ſhocking object. In ſome figures the face is repreſented as dead, but with the moſt perfect features that can be conceived; in others, her face is full of paſſion, and her eyes convulſed; and in many others, the look is altogether frightful, and formed on purpoſe to inſpire terror. The beauties and horrors of *Meduſa's* face are mentioned by the Roman poets. Ov. Met. iv. ver. 792. Lucan, lib. ix. ver. 680. Virg. Æn. viii. ver. 438. Spence's Polymetis, p. 91.

MELANCHOLY, Melancholia, formed from μελας, *black,* and χολε, *bile,* in medicine, a low kind of delirium, without a fever; uſually attended with fear, heavineſs and ſorrow, without an apparent occaſion. For deſcription, cauſes, and methods of treatment, ſee the Syſtem, Genus LXVI.

MELEAGRIS, in the Linnæan ſyſtem of ornithology, is the 59th genus of birds, belonging to the order of Gallinæ. The head is covered with ſpongy caruncles; and there is likewiſe a membranaceous longitudinal caruncle on the throat. There are three ſpecies, viz. 1. The gallopavo, or turkey, has a caruncle both on the head and throat; and the breaſt of the male is bearded. He lives upon grain and inſects: when the cock ſtruts, he blows up his breaſt, ſpreads and erects his feathers, relaxes the caruncle on the forehead, and the naked parts of the face and neck become intenſely red. Latham makes the turkey of the 48th genus, of the ſame order. For repreſentation of this, ſee Plate III. 2. The criſtata, or Braſilican pheaſant, has an erect creſt of feathers on the head, and violet-coloured temples; it has a caruncle on the throat, but none on the head. Latham makes it the 51ſt genus. For repreſentation, ſee Plate III. 3. The ſatyra, or horned pheaſant, has two blue horns behind its eyes, and a red body ſpotted with black and white. It is a native of Bengal.

MELODY, Μελωδια, compounded of μελι, *honey,* and ωδη, *ſinging,* in muſic, is the agreeable effect of different muſical ſounds, ranged or diſpoſed in a proper ſucceſſion. *Melody* is the effect only of one ſingle part, voice, or inſtrument; by which it is diſtinguiſhed from harmony; though in common ſpeech, theſe two are frequently confounded. Harmony is properly the agreeable reſult of the union of two or more concording muſical ſounds heard in conſonance, i. e. at one and the ſame time; ſo that harmony is the effect of two parts at leaſt: as therefore a continued ſucceſſion of muſical ſounds produces *melody,* ſo does a continued combination of theſe produce harmony. Though the term *melody* be chiefly applicable to the treble, as the treble is chiefly diſtinguiſhed by its air; yet ſo far as the baſs may be made airy, and to ſing well, it may be alſo properly ſaid to be *melodious.* Of the twelve harmonical intervals of muſical ſound, diſtinguiſhed by the names of *ſecond leſſer, ſecond greater*; *third leſſer, third greater*; *fourth*; *falſe fifth, fifth*; *ſixth leſſer*; *ſixth greater*; *ſeventh leſſer, ſeventh greater,* and *octave*; all *melody,* as well as harmony, are compoſed: for the octaves of each of theſe are but replications of the ſame ſound: and whatever is ſaid of any or all of theſe ſounds, is to be underſtood alſo of their octaves. For the rules of *melody,* ſee Composition.

MELOE, in entomology, a genus of inſects of the order of Coleoptera. For deſcription and claſſification, ſee the Syſtem, Order I. Genus XXVII.

MELON, *melon,* in botany. For copious directions, for the culture, and management of melons, ſee treatiſe on Gardening, Part II. *Kitchen garden,* Month of January, February, &c. &c.

MELPOMENE, the name of one of the nine Muſes; who is repreſented with a maſk to denote her preſiding over the ſtage; and diſtinguiſhed from Thalia, the comic muſe, by greater dignity in her look, ſtature, and dreſs. *Melpomene* was ſuppoſed to preſide over all melancholy ſubjects, as well as tragedy. She is commonly repreſented with a ſerious countenance, and in a theatrical dreſs, holding crowns and ſceptres in one hand, and a dagger in the other, ſee *Horace, Book* 1, Ode 24, verſe 4.

MEMBERS, in anatomy, the exterior parts, ariſing from the trunk or body of an animal, like the boughs from the trunk of a tree. In which ſenſe, *members, membra,* amount to much the ſame with *limbs, artus:* though ſome make a difference between the two; reſtraining *members* more immediately to the fleſhy parts which cover the limbs, and artus to the bones and nerves. Phyſicians divide the body into three regions or venters; the head, the breaſt, and the lower ventricle; and the extremities, which are the *members.*

Member, in architecture, denotes any part of a building; as a frieze, cornice, or the like. *Member* is ſometimes alſo uſed for Moulding.

MEMBERED, or Membred, in heraldry, legged or clawed, applied to a bird not of prey.

MEMBRANE, Membrana, in anatomy, a ſimilar part of an animal body; being a thin, white, flexible, expanded ſkin, formed of ſeveral ſorts of fibres, interwoven together, and ſerving to cover, or wrap up, certain parts of the body. The *membranes* of the body are various; and variouſly denominated. Such are the perioſteum, pleura, pericardium, peritonæum, &c. Thoſe *membranes* which ſerve as integuments or covers of veſſels, are called *coats,* or *tunics*; and thoſe which cover the brain, are, by a peculiar name, called *meninges.* See the Syſtem, Part VI. Sect. I.

MEMOIRS, or Memorials, a term now much in uſe for hiſtories compoſed by perſons who had ſome ſhare or concern in the tranſactions they relate, or who were eye-witneſſes of them; anſwering to what the Latins called *commentarii.* The French are great dealers in this way of writing, and have an infinite number of books of *memoirs,* containing, for the generality, the lives, actions, intrigues, amours, &c. of the writers. Memoirs is alſo uſed for a journal of the acts and proceedings of a ſociety; or a collection of the matters debated, tranſacted, &c. therein. Such are the *Memoirs* of the Royal Academy of Sciences, &c.

MEMORY, μνημη, a power or faculty of the mind, which receives, retains, and exhibits again, as occaſion requires, all ideas preſented to the underſtanding. Of all the faculties, there is none harder to account for, or that has perplexed philoſophers more, than the *memory.* Some will have it a mere organ, as the eye, ear, &c. Dr. Hook, in an *Eſſay towards a mechanical Account of Memory,* makes it to conſiſt in a ſtock of ideas or images, formed occaſionally by the mind, out of the fine parts of the brain, and diſpoſed or laid by in order.

Deſcartes and his followers maintain, that the animal ſpirits, exciting a motion in the moſt delicate fibres of the brain, leave a kind of traces or footſteps, which occaſion our *remembrance.* Hence it happens, that by paſſing ſeveral times over the ſame things, the ſpirits becoming accuſtomed to the ſame paſſages, leave them open, and ſo make their way without any effort or labour; and in this conſiſts the eaſe wherewith we recollect ſuch ideas. Thus wine is found to ſharpen the *memory,* in regard the ſpirits of the wine put the animal ſpirits in motion, and agitate the fibres of the brain more briſkly.

Father Malebranche expreſſes his notion of *memory* thus: "It being granted, that all our different perceptions are owing to changes happening in the fibres of the principal part of the brain, wherein the ſoul more immediately reſides, the nature of the *memory* is obvious: for as the leaves of a tree, that have been folded for ſome time in a certain manner, preſerve a facility or diſpoſition to be folded again in the ſame manner; ſo the fibres of the brain, having once received certain impreſſions by the courſes of the animal ſpirits, and by the action of objects, preſerve, for ſome time, a facility to receive the ſame diſpoſition. Now it is in this facility that *memory* conſiſts; for we think the ſame things, when the brain receives the ſame diſpoſitions.

"Farther, as the animal ſpirits act ſometimes more briſkly, and ſometimes more languidly, on the ſubſtance of the brain; and as ſenſible objects make much deeper, and more laſting impreſſions, than the imagination alone; it's eaſy, on this ſcheme, to conceive why we do not remember all things alike: why a thing, for inſtance, ſeen twice, is repreſented more vividly to the mind than another ſeen but once: and why things that have been ſeen, are uſually remembered more diſtinctly, than thoſe that have been only imagined, &c.

"Old men are defective in *memory,* and cannot learn any thing without much difficulty, becauſe they want animal ſpirits to make new traces, and becauſe the fibres of the brain are become too hard to receive, or too moiſt to retain, ſuch impreſſions. For the ſame reaſon, thoſe who learn with the greateſt eaſe, forget the ſooneſt; in regard when the fibres are ſoft and flexible, objects make a ſlight impreſſion, which the continual courſe of animal ſpirits eaſily wears off. On the contrary, the fibres of thoſe who learn ſlowly, being leſs flexible, and leſs ſubject to be ſhaken, the traces are more deeply engraven, and laſt the longer. From all which obſervations it follows, that the *memory* is abſolutely dependent on the body; being impaired or ſtrengthened, according to the changes that befall the body; a fall, the tranſports of a fever, &c. being frequently found to eraſe or blot out all the traces, to bear away all the ideas, and to cauſe an univerſal forgetfulneſs."

The chief difficulty that clogs this doctrine of *memory* is to conceive how ſuch an infinite number of things, as the head is ſtored with, ſhould be ranged in ſo much order in the *memory*, as that the one ſhould not efface the other; and how, in ſuch a prodigious aſſemblage of traces impreſſed on the brain, the animal ſpirits ſhould awake preciſely thoſe which the mind has occaſion for.

Memory, according to Mr. Locke, is, as it were, the ſtore-houſe of our ideas. For the narrow mind of man not being capable of having many ideas under view and conſideration at once, it was neceſſary to have a repoſitory, in which to lay up thoſe ideas which it may afterwards have uſe for. But our ideas being nothing but actual perceptions in the mind, which ceaſe to be any thing when there is no perception of them; this laying up of our ideas in the repoſitory of the *memory*, ſignifies no more than this, that the mind has a power, in many caſes, to revive perceptions it has once had, with this additional perception annexed to them, that it has had them before. And it is by the aſſiſtance of this faculty, that we are ſaid to have all thoſe ideas in our underſtandings, which we can bring in ſight, and make the objects of our thoughts, without the help of thoſe ſenſible qualities which firſt imprinted them there.

In *memory*, the mind is oftentimes more than barely paſſive; for it often ſets itſelf to work to ſearch ſome hidden ideas; ſometimes they ſtart of their own accord; and ſometimes tempeſtuous paſſions tumble them out of their cells. This faculty other animals ſeem to have to a great degree, as well as men, as appears by birds learning of tunes, and their endeavours to hit the notes right. For it ſeems impoſſible that they ſhould endeavour to conform their voices (as it is plain they do) to notes whereof they have no idea. Eſſay concerning Hum. Und. book ii. chap. 10.

Dr. Hartley, agreeably to his mechanical theory of the human mind, defines *memory* to be that faculty by which traces of ſenſations and ideas recur, or are recalled, in the ſame order and proportion, accurately or nearly, as they were once preſented: and he obſerves, that *memory* depends entirely or chiefly on the ſtate of the brain, which is peculiarly conformable to his notion of VIBRATIONS. The rudiments of *memory*, he ſays, are laid in the perpetual recurrency of the ſame impreſſions, and cluſters of impreſſions: and thus he endeavours to account for the peculiar imperfections of the *memory* in children and aged perſons, as well as for other facts pertaining to the exerciſe of this faculty. Obſ. on Man, vol. i. p. 374, &c. For the difference between *memory* and imagination, ſee IMAGINATION.

Seneca ſays of himſelf, that, by the mere effort of his natural *memory*, he was able to repeat two thouſand words upon once hearing them, each in its order; though they had no dependence or connexion on each other. He alſo mentions Cyneas, ambaſſador to the Romans from king Pyrrhus, who, in one day, had ſo well learnt the names of his ſpectators, that the next day he ſaluted the whole ſenate, and all the populace aſſembled, each by his name.

The perfection of *memory* conſiſts in two things; readily to admit the impreſſions or images of things; and to preſerve them from oblivion, that the underſtanding may have recourſe to them, and employ them for ſuch purpoſes, as reaſon ſhall direct. In order to aſſiſt and improve this faculty, every kind of intemperance and exceſs muſt be carefully avoided; and when we would commit any thing to *memory*, our firſt concern ſhould be to underſtand it thoroughly; writing down any thing is likewiſe a great advantage towards remembering it; care ſhould likewiſe be taken not to overburden the *memory*: ſuch ſeaſons ſhould be made choice of as are moſt proper for the exerciſe of this faculty, ſuch are the evening and morning; and the moſt effectual way of gaining a good *memory*, is its conſtant and moderate exerciſe. Ward's Or. ii. vol. ii. ſect. 51.

A little experience and obſervation will help a perſon to diſcover the ſtrength of his memory. And care ſhould be taken not to overburden it. A long diſcourſe therefore ſhould be committed to memory by parts, ſo much at once as the memory can well receive and retain. Theſe parts ſhould not be too many, for fear of confuſion. And as it is moſt likely we may be at a loſs in paſſing from one part to another, it will not be amiſs in a more particular manner to impreſs upon the mind the beginnings of them. One letter often helps us to recover a word; that word a ſentence; and the firſt ſentence a whole argument. Some have therefore adviſed, for the aſſiſtance of weaker memories, to write each part of the diſcourſe in a ſeparate paragraph, and the firſt word in larger characters, which may ſtrike the fancy like a picture when we come to thoſe places. For every one is ſenſible of the powerful effect of imagery to excite and recall our ideas: and therefore it has been thought a further advantage, if the firſt letter of each word, written in large characters, could be joined together in one artificial word; for then the remembrance of that word would give us the firſt letter of each of thoſe initial words, which letters would help us to recollect the whole words, which was the thing deſigned by writing them in different characters. We find this method of bringing ſeveral ideas together into one artificial word of uſe in other caſes. So the figures of ſyllogiſms being diſtinguiſhed by technical words, are better known, and more eaſily remembered; as every one perceives, who is converſant in logic.

Some ancient writers ſpeak of an artificial memory, and lay down rules for attaining it. Simonides the poet is ſaid firſt to have diſcovered this, or at leaſt to have given the occaſion for it. The ſtory they tell of him is this: Being once at a feaſt, he recited a poem which he had made in honour of the perſon who gave the entertainment. But having (as is uſual in poetry) made a large digreſſion in praiſe of Caſtor and Pollux; when he had repeated the whole poem, his patron would give him but half the ſum he had promiſed, telling him he muſt get the other part from thoſe deities who had an equal ſhare in the honour of his performance. Immediately after, Simonide was told that two young men were without, and muſt needs ſpeak with him. He had ſcarce got out of the houſe, when the room where the company was fell down, killed all the perſons in it, and ſo maſhed their bodies, that, when the rubbiſh was thrown off, they could not be known one from another: upon which Simonides recollecting the place where every one had ſat, by that means diſtinguiſhed them. Hence it came to be obſerved, that to fix a number of places in the mind in a certain order, was a help to the memory: As we find by experience, that, upon returning to places once familiar to us, we not only remember them, but likewiſe many things we both ſaid and did in them. This action therefore of Simonides was afterwards improved into an art, and the nature of it is this: They bid you form in your mind the idea of ſome large place or building, which you may divide into a great number of diſtinct parts, ranged and diſpoſed in a certain order. Theſe you are frequently to revolve in your thoughts, till you are able to run them over one after another without heſitation, beginning at any part. Then you are to impreſs upon your mind as many images of living creatures, or any other ſenſible objects which are moſt likely to affect you, and be ſooneſt revived in your memory. Theſe, like characters in ſhort hand, or hieroglyphics, muſt ſtand to denote an equal number of other words, which cannot ſo eaſily be remembered. When therefore you have a number of things to commit to memory in a certain order, all that you have to do is, to place theſe images regularly in the ſeveral parts of your building. And thus they tell you, that by going over ſeveral parts of the building, the images placed in them will be revived in the mind; which of courſe will give you the things or words themſelves in the order you deſire to remember them. The advantages of the images ſeem to be this: that, as they are more like to affect the imagination than the words of which they ſtand, they will for that reaſon be more eaſily remembered. Thus, for inſtance, if the image of a *lion* be made to ſignify *ſtrength*, and this word *ſtrength* be one of thoſe I am to remember, and is placed in the porch; when in going over the ſeveral parts of the building I come to the porch, I ſhall ſooner be reminded of that image than of the word *ſtrength*. Some ancient as well as modern writers relate wonderful effects of this artifice. But they all agree it much more aſſiſts us to remember any number of ſeparate and unconnected words, than a continued diſcourſe; unleſs ſo far as the remembrance of one word may enable us to recollect more.

And, doubtleſs, the moſt effectual way to gain a good memory is, its conſtant and moderate exerciſe. In a word, the memory, like other habits, is ſtrengthened and improved by daily uſe and practice. Wherefore thoſe who have moſt occaſion for it, as orators, ſhould not ſuffer it to lie idle, but conſtantly employ it in treaſuring up and frequently reviewing ſuch things as may be of moſt importance to them. For by this means it will be more at their command, and they may put greater confidence in it upon any emergent occaſion.

MENDICANTS, or BEGGING FRIARS, ſeveral orders of religious in Popiſh countries, who having no ſettled revenues, are ſupported by the charitable contributions they receive from others.

This ſort of friars began in the 13th century. The Waldenſes, who made profeſſion of renouncing their eſtates, and leading a life of poverty, gave occaſion to this inſtitution. Two of that ſect, Bernard and Durand of Oſca, ſet up a congregation in the province of Tarragon, and called it *The Poor Catholics*. The ſame year, Dominick de Guzman, with nine more of his companions, founded the order of Preaching Friars, called from their founder *Dominicans*. The other three Mendicant orders are, the *Franciſcans*, *Auguſtins*, and *Carmelites*.

MENINGES, or MENYNGES, in anatomy, a name given to the dura and pia mater of the brain. See the SYSTEM.

MENSES, CATAMENIA, in medicine, the monthly evacuations from the uterus of women not with child, or not giving ſuck. For the diſorders which follow a ſuppreſſion, or too great a flow of the menſes, ſee the SYSTEM, Genus 46 and 126.

MENSTRUUM, in chymiſtry, any body which in a fluid or ſubtilized ſtate is capable of interpoſing its ſmall parts of other bodies, ſo as to divide them ſubtilly, and form a new uniform compound of the two.

TREATISE ON MENSURATION AND GAUGING.

MENSURATION, is the comparing of any propoſed quantity or magnitude with another of the ſame kind, thus a line is compared with a line, a ſurface with a ſurface, and a ſolid with a ſolid. The quantity with which the propoſed quantity is to be compared is always eſteemed an unit; and the number which ſhews how often the meaſuring unit is contained in the propoſed quantity, is called the content of the quantity ſo meaſured; thus a line is meaſured by another of an inch, a foot, a yard, &c. in length; a ſurface, by a ſurface of an inch ſquare, a foot ſquare, a yard ſquare, &c. and a ſolid by a cubic inch, a cubic foot, a cubic yard, &c.

SECT. I. MEASURING OF SURFACES.

ARTICLE I. *To find the Area of any Parallelogram, whether it be a Square, a Rectangle, a Rhombus, or Rhomboides.*

RULE. Multiply the length by the perpendicular height, and the product will be the area. Thus ſuppoſe in the rectangle ABCD (*fig.* 1, in Plate of Miſcellaneous Mathematics) if the length AB or DC = 6 inches; and the breadth AD or BC = 4 inches, the area is $4 \times 6 = 24$ ſquare inches, as is eaſily ſeen by dividing the length into 6 equal parts, and the breadth AD into 4, and from thence drawing lines parallel to the length and breadth; for the rectangle will then be divided into twenty-four ſquares, each of which repreſents the meaſuring unit, viz. an inch ſquare. In like manner in the Rhomboides ABCD (*fig.* 2), if a perpendicular be let fall from D to AB, the area will be equal to $AB \times DE$; for draw CF perpendicular to DC and AB, then ſince it has been ſhewn in the geometry that all parallelograms on the ſame baſe are equal, it follows that the Rhomboides ABCD is equal to the rectangle EDCF; but it has been ſhewn above that the area of the rectangle is equal to $DC \times DE$, therefore the area of the Rhomboides which is equal to it, is the ſame.

Hence in a ſquare rectangle, whoſe ſides are equal, multiply the ſide into itſelf, and you have the area.

II. *To find the Area of a Triangle.*

RULE. Multiply half the baſe by the perpendicular; or half the perpendicular by the baſe, or take $\frac{1}{2}$ the product of the perpendicular and baſe, and you will have the area required. This rule is evident, for every triangle is equal to half a parallelogram of the ſame baſe and altitude.

III. *To find the Area of a Triangle without a Perpendicular, by having the Three Sides given.*

RULE. From half the ſum of the three ſides ſubtract each ſide ſeverally; multiply the half ſum and three remainders in one continual product, and the ſquare root thereof will be the area required. Thus in the triangle ABC (*fig.* 3.) If BC = 24, CA = 36, and AB = 48 chains, by proceeding according to the rule, the area will be found 418.282.

IV. *To meaſure a right-angled Triangle by having the Baſe and one of the acute Angles given.*

RULE. As radius is to the ſine of double the acute angle, ſo is the ſquare of half the hypothenuſe to the area.

V. *Having two Sides and the included Angle of any Triangle given to find the Area.*

RULE. As radius is to the ſine of the given angle, ſo half the product of the including ſides to the area of the triangle.

VI. *To find the Area of a Triangle by having a Side and two Angles given.*

RULE. As the product of radius and the ſine of the angle oppoſite the given ſide, is to half the ſquare of the given ſide, ſo is the product of the ſines of the other two angles to the area. N. B. Theſe three laſt caſes are extremely uſeful in ſurveying.

VII. *To meaſure a Trapeſium, or four ſided Figure, as* BDEA (*fig.* 4.)

RULE. Multiply the diagonal BE by half the ſum of the perpendicular AC and DF, and you will have the area. This is obvious from what has been ſaid concerning triangles.

VIII. *To find the Area of a Trapezoid, or Quadrangle, two of whoſe Sides* AB *and* DE *are parallel.*

RULE. Multiply half the ſum of the parallel ſides by the perpendicular diſtance between them (DE or B*n*,) and you will have the area. The reaſon of this follows from what has been ſaid of triangles and parallelograms.

IX. *To find the Area of a regular Polygon, whether Pentagon as* ABCDE, (*Fig.* 6.) *or Hexagon, as* (ABCDEF, *Fig.* 7.) *or other regular Polygon whatever.*

RULE. Let fall a perpendicular from the centre of the figure, which will fall on the middle of one of the ſides, as *o*P in either of the ſaid figures, then the length of that perpendicular being known, multiply it by half one of the ſides, as AP, and that product by the number of ſides, or multiply the perpendicular by half the whole perimeter, and you will have the area. The reaſon of this is evident, for $AP \times OP =$ area of triangle A*o*B, and the figure contains as many ſuch triangles as it has ſides.

X. *To find the Area of a regular Polygon, without knowing the length of the Perpendicular.*

RULE. Divide 360° by the number, denoting the number of ſides in the polygon, and it will give the angle A*o*B (*Fig.* 6. and 7.) at the centre, which ſubtracted from 180°, will leave the ſum of the other two, and A*o* being = *o*B, therefore the angles *o*AB and *o*BA will be equal, and each equal to half the ſaid ſum; wherefore the angles being known the area of the triangle A*o*B may be found by Art. VI. and that multiplied by the number of ſides will give the area.

XI. *To find the Area of a Circle, as* ABCDEFGH (*Fig.* 8)

RULE. Multiply the radius, or half the diameter (AE) by half the circumference ABCDEFGH, or which is the ſame thing, multiply the circumference by the diameter, and take $\frac{1}{4}$ of the product, and you will have the area. The reaſon of this rule is eaſily inferred from the laſt article, for ſince in any circle a polygon may be inſcribed of as many ſides as we pleaſe, and by increaſing the number of ſides the polygon will approach nearer and nearer to the circle, ſo as to come within any aſſigned difference, in as much if it is poſſible to conceive the ſides infinitely ſmall and infinitely numerous, they would exactly coincide with the circle it follows, that if the diſtance from the centre be multiplied by half the perimeter, you will have the area ſought. But the circumference of any circle being in a certain ratio to the diameter, it is not neceſſary to meaſure both the circumference and the diameter alſo; for the one may be found from the other, by the following method.

XII. *The Diameter of a Circle being given to find the Circumference.*

RULE. Multiply the diameter by 3.1416, and you will have the circumference. Hence, the circumference being given, the diameter will be had by dividing by 3,1416, or multiplying by its reciprocal .31831.

XIII. *To find the Area of a Circle from the Diameter only.*

RULE. Multiply the ſquare of the diameter by .7854, and you will have the area. For by Article 11, the $\frac{\text{diameter} \times \text{by circumference}}{4}$ $=$ area, and by Art. 12, the circumference $=$ diameter $\times 3.1416$, therefore the diameter $\times$ by diameter $\times \frac{3.1416}{4} =$ area $=$ ſquare of diameter $\times .7854$.

XIV. *To find the Area by having the Circumference given.*

RULE. Divide the ſquare of the circumference by 12,5664, or multiply it by .079577, and you will have the area. For by Art. 11, $\frac{\text{diameter} \times \text{circumference}}{4} =$ area, and by Article 12, the diameter $=$ $\frac{\text{circumference}}{3.1416}$, therefore $\frac{\text{circumference} \times \text{circumference}}{4 \times 3.1416} =$ the area $=$ $\frac{\text{ſquare of circumference}}{12{,}5664}$, $=$ ſquare circumference $\times .079577$.

REMARK. It is proper to obſerve that the ratio to the circumference of the diameter cannot be exactly aſcertained in finite terms; but has been carried to a 100 places of decimals, by *the late Mr. John Machin, Profeſſor of Mathematics in Greſham College*, and before him, *Van Ceulen*, a *Dutchman*, determined it: by the continual biſection of an arc, to 36 places, which at that time was thought ſuch an inſurmountable undertaking, that the figures were engraven upon his *tomb ſtone*, in *St. Peter's church yard*, at *Leyden*. Indeed it muſt have coſt him immenſe trouble; but ſince the improvements in Geometry, by the diſcovery of fluxions, a great deal of that is obviated. The proportion of the diameter to the circumference to 100 places, is as 1 to 3.141592653, 5897932384, 6264338327, 9502884197, 1693993751, 0582097494, 4592307816, 4062862089, 9862803482, 5342117067, 9 + ſaid to be true to the laſt figure; the following ſeries from which Mr. Machin made his computation, is given in *Mr. Jones's Synopſis Palmariorum Matheſeos*, Page 263. The diameter to the circumference is truly as 1 to $\overline{\frac{16}{5} - \frac{4}{239}} - \frac{1}{3}.\overline{\frac{16}{5^3} - \frac{4}{239^3}} + \frac{1}{5}.\overline{\frac{16}{5^5} - \frac{4}{239^5}}, -$ &c. *ad infinitum.* This ſeries of Mr. Machin, converges much faſter than any other that has yet been diſcovered.

Archimedes, who flouriſhed about 2000 years ago, ſtated the proportion of the diameter to the circumference, as 7 to 22, which is near enough for many common purpoſes.

XV. *To find the Area of a Sector, or that Part of a Circle which is bounded by any two Radii, as* AC *and* AB (*fig.* 9.) *and their included Arc* CDB.

RULE. Multiply the radius by $\frac{1}{2}$ the length of the arc CB and the product will be the area; or if the angle at A, or the degrees of the arc be known, ſay as 360° is to the area of the whole circle, ſo is ſuch degrees to the area of the ſector.

XVI. *To find the Length of an Arc* CB *of a Circle.*

RULE. Multiply the degrees of the arc by .01745329, &c. and that product by the radius of the circle, and you will have the length. Note, when the degrees of the arc are not known, the following rule will ſerve very well for common purpoſes. viz. From 8 times the chord of half the arc, ſubtract the chord of the whole arc, and $\frac{1}{3}$ of the remainder will be the length of the arc nearly.

XVII. *To find the Area of a Segment of a Circle* ACB, *or* ADB, (*Fig.* 9.)

RULE. Find the area of the ſector having the ſame arc with the ſegment by the 15th Article, and find the area of the ſector, viz. the triangle ABO, then, when the ſegment is leſs than a ſemicircle as ACB, ſubtract that area of the triangle from the area of the ſector, and it will give the area of the ſegment; but if the ſegment is greater than a ſemicircle, add the area of the triangle to the area ſector, and you will have the area required, or the following rule will do for common caſes: add the ſquare of half the chord of the ſegment, to the ſquare of its height, and multiply the ſquare root of the ſum by 4: take the $\frac{1}{3}$ of this product, and add to it the whole chord of the ſegment; then multiply the ſum by $\frac{2}{3}$ of the height, and you will have the area *very nearly.*

XVIII. *To find the Area of a Circular Ring, or the Space included between the Circumference of two Concentric Circles; as for Inſtance, the Area of the Space included between the two Circles* AIBE, *and* CHDF, *Fig.* 10.

Rule. Multiply the ſum of the diameters (CD + AB) by their difference (AB — CD) and that product by .7854, and it will give the area required.

XIX. *To find the Area of a Lune, or the Space* ACBE *(Fig.* 11.*) included between the Interſecting of two Eccentric Circles.*

Rule. Find the areas of the two ſegments ACBD, and AEBD, and their difference will be the area required.

N. B. The following are the moſt uſeful caſes relating to the circle and its equal and inſcribed ſquare.

1. Diameter × .8862 = ſide of an equal ſquare.
2. Circumference × .2821 = ſide of an equal ſquare.
3. Diameter × .7071 = ſide of the inſcribed ſquare.
4. Circumference × .2251 = ſide of inſcribed ſquare.
5. Area × .6366 = ſide of inſcribed ſquare.
6. Side of a ſquare × 1.4142 = diameter of its circumſcribed circle.
7. Side of a ſquare × 4.443 = circumference of circumſcribing circle.
8. Side of a ſquare × 1.128 = diameter of an equal ſquare.
9. Side of a ſquare × 3.545 = circumference of an equal ſquare.

XX. *To find the Area of any Irregular Straight lined Figure, as* ABCDEFG *(Fig.* 12.*)*

Rule. Divide it into triangles, and trapeziums, and find the area of each bv itſelf; then the ſum of the whole will be the area of the whole irregular polygon.

XXI. *To find the Area of an Oval, or Ellipſis.*

Rule. Multiply the tranſverſe diameter by the conjugate, and the product again by .7854, and it will give the area required.

XXII. *To find the Area of an Elliptical Segment cut Parallel to either Axe.*

1. *When cut Parallel to the Conjugate,* the tranſverſe and conjugate axes, and the diſtance CE *(fig.* 13.*)* from the centre being known, find the area *e*B*f* of the correſponding circular ſegment in the circumſcribing circle; multiply the ſame by the conjugate, and divide the product by the tranſverſe, and you will have the area of the elliptical ſegments FBH.

2. *When it is cut Parallel to the Tranſverſe, (fig.* 14.*)* find the area *(e*D*f)* of the correſponding circular ſegment in the inſcribed circle; multiply this area by the tranſverſe, and divide the product by the conjugate, and you will have the area of the elliptical ſegment HDI.

N. B. In either caſe when the degrees of the circular arc, cut off by the baſe of the ſegment (2 EF) are known, multiply the ſame by .0174533, and from the product take the natural ſine of the ſaid degrees; then multiply the remainder by the tranſverſe, and that product by the conjugate, and divide by 8, and you will have the area of the elliptical ſegment.

XXIII. *To find the Circumference of an Ellipſis.*

Rule. Multiply the ſquare root of half the ſum of the ſquares of the two diameters by 3.1416, and the product will be the circumference *nearly.* Or multiply half the ſum of the two diameters by 3.1416, and you will have the circumference *exact enough for moſt practical purpoſes.* Or find the circumference both by the laſt and preceding methods, and $\frac{1}{2}$ the ſum of the reſults will give the anſwer *extremely near.*

N. B. The following may ſerve as a practical rule, for finding the length of the arc DF. *(Fig.* 13*).* Find the length of a circular arc intercepted by CD and CF, and whoſe radius is half the ſum of CD and CF, and it will be the elliptical arc *nearly.* But if *ſtrict accuracy* in thoſe matters is required, recourſe muſt be had to infinite ſeries, as founded upon the fluxional calculus.

XXIV. *To find the Area of a Parabola.*

Rule. Take $\frac{2}{3}$ of the product of the baſe and height, and you will have the area.

XXV. *To find the Area of the Fruſtum of a Parabola,* viz. *when the top Part is cut off Parallel to the Baſe.*

Rule. Divide the difference of the cubes of the two ends of the fruſtum by the difference of their ſquares, and multiply the quotient by $\frac{2}{3}$ of the attitude, will give the area required.

XXVI. *To find the Area of an Hyperbola.*

Rule. To the product of the tranſverſe and abſciſſa add $\frac{5}{7}$ of the ſquare of the abſciſſa, and multiply the ſquare root of the ſum by 21. Add 4 times the ſquare root of the product of the tranſverſe and abſciſſa, to the laſt found product, and divide the ſum by 75. Laſtly, divide 4 times the product of the conjugate and abſciſſa by the tranſverſe, and this quotient multiplied by the former, will give the required area *nearly.*

N. B. For the better underſtanding of what has been ſaid on the Ellipſis, Parabola, and Hyperbola, and indeed all the other ſubjects here treated of, we refer our readers to our Syſtem of Geometry, where the properties of each figure are fully explained and demonſtrated.

XXVII. *A general Method to meaſure any Irregular Figure bounded by a Curve, as Fig.* 15, 16, 17.

Rule. Divide the baſe AC in *fig.* 15. into *two equal* parts AB, and BC, and meaſure the perpendiculars A*a*, B*b*, C*c*, then the ſum of A*a* and C*c*, added to 4 times B*b*, and that ſum multiplied by $\frac{1}{6}$ of the length AC, will be the area nearly. Or, if more exactneſs is required, divide the baſe into *three equal* parts (as in *fig.* 16.) and meaſure the perpendiculars A*a*, B*b*, C*c*, D*d*, then to the ſum of the two ends A*a* and D*d*, add thrice the ſum of the two interior perpendiculars B*b* and C*c*, and multiply that ſum by $\frac{1}{8}$ of the baſe AD, and you will have the area very near. But if the ſurface be very large, it may be proper to divide it into a ſtill greater number of equal parts, as in *fig.* 17, and then it may be meaſured at two or three times by the foregoing rules. Thus, where there are five perpendiculars, the figure will be meaſured at twice by the firſt of theſe rules; where there are ſix, ſo much of it as extends to the third perpendicular, may be meaſured by the firſt rule, and then the remaining part may be meaſured by the ſecond rule; if there are ſeven perpendiculars, each part from the middle of the baſe will be meaſured by the ſecond rule. Or the whole baſe need not in ſuch caſe be divided into equal parts, but into two or more either *equal* or *unequal* parts as ſhall ſeem convenient, and then each of thoſe parts muſt be divided into two or three *equal* parts, and ſo meaſured ſeparately by one or other of the foregoing rules. By theſe means when a ſufficient number of perpendiculars are taken, you will have the area very exact, let the nature of the curve be what it may.

SECT. II. MEASURING OF SOLIDS.

Article I. *To meaſure a Cube.*

Definition. A cube is a ſolid contained under ſix equal ſquare ſides, ſuch as a *die* that is played with, *Fig.* 18.

Rule. Multiply the ſide of the cube by itſelf, and that product again by the ſide, and it will give the ſolidity required. For conceive the baſe of the cube to be divided into a number of little ſquares, each equal to the *ſuperficial meaſuring unit,* ſuppoſe an inch, then will thoſe ſquares be the baſes of a like number of ſmall cubes, which are each equal to the *ſolid meaſuring unit*; alſo the number of little ſquares contained in the baſes of the cube, being equal to the ſquare of the ſide of that baſe, as has been ſhewn in Art. I. Sect. I. it is plain if the baſe be cut off, at the height of a *meaſuring unit,* which we have already ſuppoſed to be an inch, the part ſo cut off will contain as many inch cubes, as the baſe contains inch ſquares; and if again, another equal part be cut off from the propoſed cube, that part will contain the ſame number of inch cubes as the laſt; the like for another part; and ſo on: hence the content is equal to the ſquare of the ſide of the baſe, multiplied by the height of that figure, viz. (becauſe the height is equal to the ſide of the baſe) to the ſquare of the ſide of the baſe, multiplied by the ſide of the baſe.

N. B. The ſurface of the cube, is equal to ſix times the ſquare of the ſide.

II. *To find the Content of a* Right Prism, *whether of a Triangular Square, Circular, or other Baſe.*

Rule. Multiply the area of the baſe, by the height or length of the priſm, and the product will be the ſolidity. For if the priſm be cut any where parallel to the baſe, the ſection made will be equal to the baſe, it follows that if it be cut at the diſtance of an inch from the baſe, the part cut off will contain as many cubic inches as the baſe contains ſquare inches; and therefore the whole of the cubic inches in the priſm, will be equal to the cubic inches, at 1 inch in height, depth, or length, multiplied by the number of inches in the height, depth, or length, viz. equal to the area of the baſe, multiplied by the height, depth, or length.

If the priſm has a ſquare baſe, as (*Fig* 18.) it is called a parallelopipedon; if a circular baſe, as (*Fig.* 19.) it is named a cylinder, if a triangular baſe, as (*Fig.* 20.) a triangular priſm, &c. and in all other caſes, it takes its name from the baſe where it has a regular one; if the baſe be an irregular polygon of any number of ſides, the priſm is then called an irregular priſm.

N. B. To find the ſquare inches, &c. on the regular ſurface of any priſm, multiply the perimeter of the baſe, by the height, or length, to which add twice the area of the baſe, and you will have the whole ſurface. If it is an irregular priſm, the area of each ſide muſt be found ſeparately.

III. *To find the Content of a Pyramid, whether the Baſe be Triangular, Circular, Square, or any other Figure.*

Definition. A right pyramid is ſolid, formed by having one end of a right line fixed to a given vertical point, and the other end moved quite round the baſe, ſo as to touch it in every point; when the baſe is circular, as (*Fig.* 21.) it is named a cone, when triangular, as (*Fig.* 22.) a triangular pyramid; if a ſquare, a ſquare pyramid, &c.

Rule. Multiply the area of the baſe by $\frac{1}{3}$ of the height, or length, aud you will have the ſolidity.

The above rule is thus demonſtrated. In the planes of the three ſides of the triangular priſm, ABCDEFA, (*Fig.* 23.) let the diagonals BE, BF, FD, be drawn, then will the part FBCD cut off by a plane, extended by FB and FD, be a pyramid on the baſe BCD, having the ſame altitude with the priſm itſelf. And if the remaining part of the priſm be cut by a plane extended by FB, and FE, it will be divided into two other pyramids, whoſe baſes and height are equal to the former. The priſm therefore being thus divided into three equal pyramids, it follows that a triangular pyramid is equal to $\frac{1}{3}$ of a priſm of the ſame baſe and height. The like demonſtration

Plate 2

Miscellaneous Mathematics. See the Treatises on Mensuration, Projectiles and Trigonometry. See also the Article Motion.

Fig. 1.

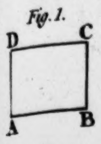

Fig. 2.

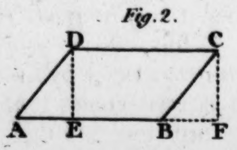

Fig. 3.

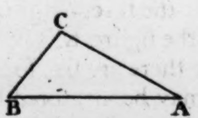

Fig. 59.

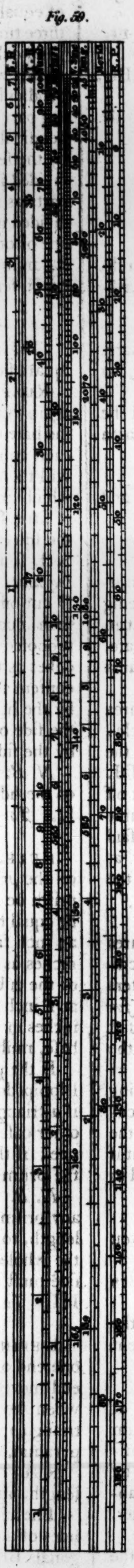

Fig. 4.

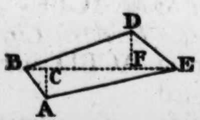

Fig. 5.

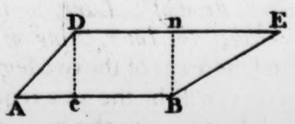

Fig. 6. Nº 1.

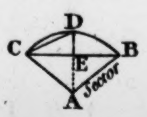
D
C
E
B
A
Sector

Fig. 6. Nº 2.

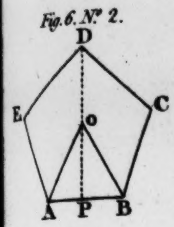

Fig. 7.

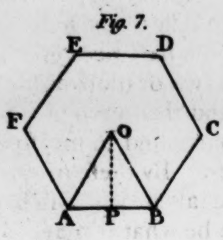

Fig. 9. Nº 2.

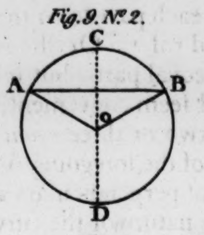

Fig. 8.

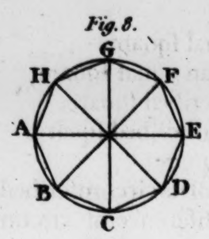

Fig. 10.

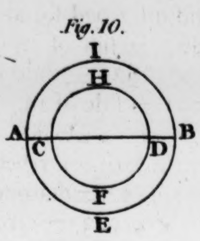

Fig. 13.

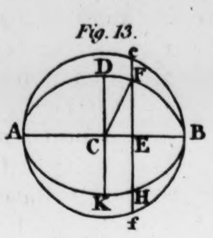
c
D
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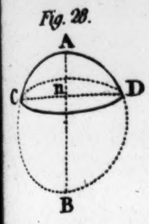
Fig. 28.



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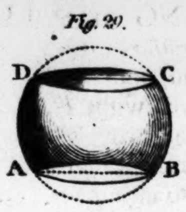
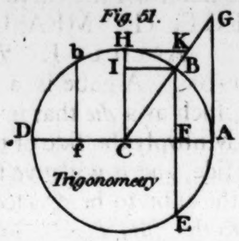


Fig. 51.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Trigonometry

Fig. 27.

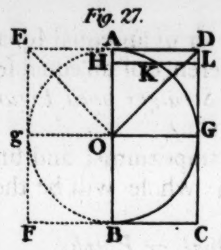
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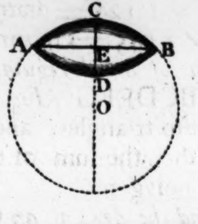
Fig. 26.



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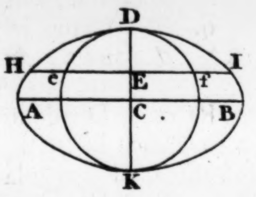

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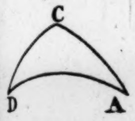

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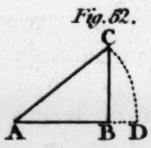

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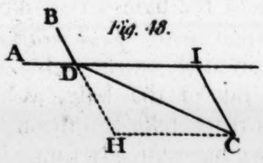

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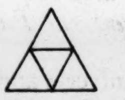

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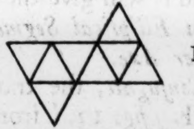
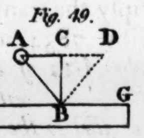


Fig. 49.



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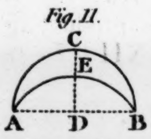
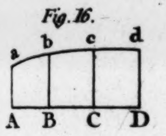


Fig. 16.



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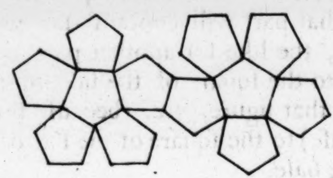

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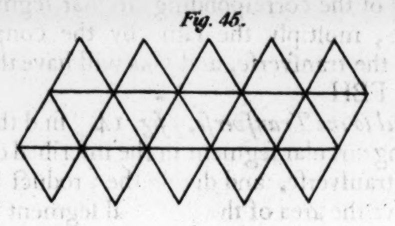
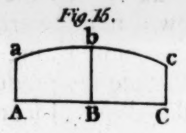


Fig. 15.



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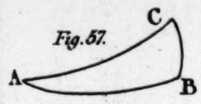

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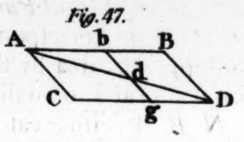

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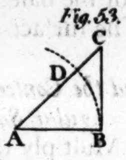

Fig. 12.

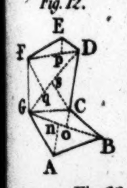

Fig. 41.

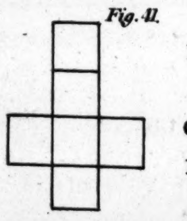

Fig. 51.

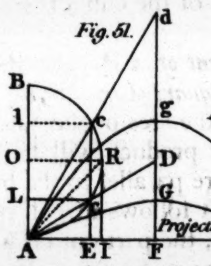
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Fig. 55.

Fig. 50.

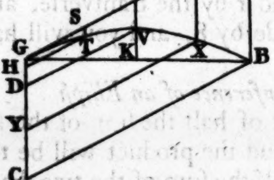
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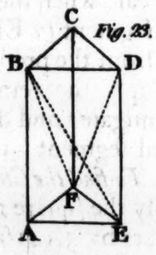
Fig. 23.



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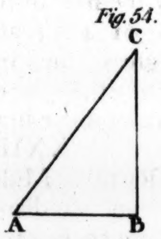


Fig. 32.

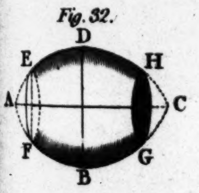


Fig. 36.

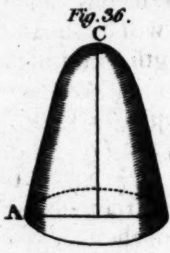


Fig. 18. Nº 1.

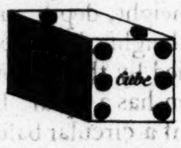


Fig. 38.

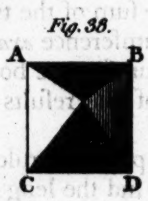


Fig. 33.

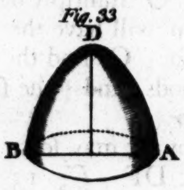
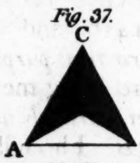


Fig. 37.



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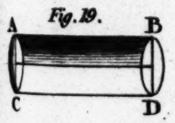

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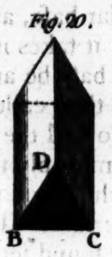

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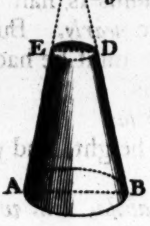

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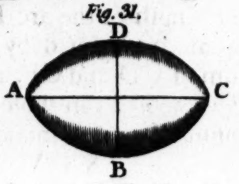
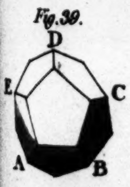


Fig. 39.



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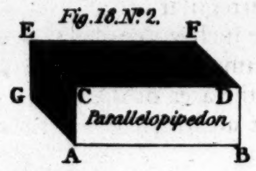
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Fig. 46.

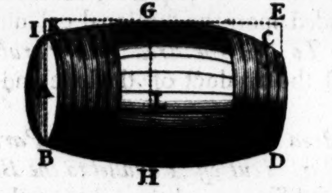

Fig. 40.

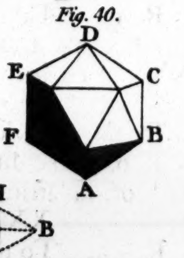

Fig. 34.

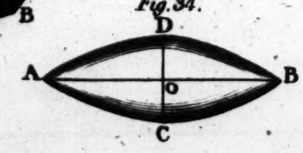

Fig. 25.

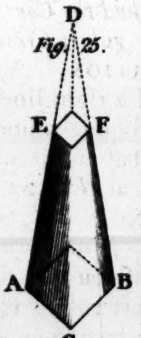

Fig. 56.

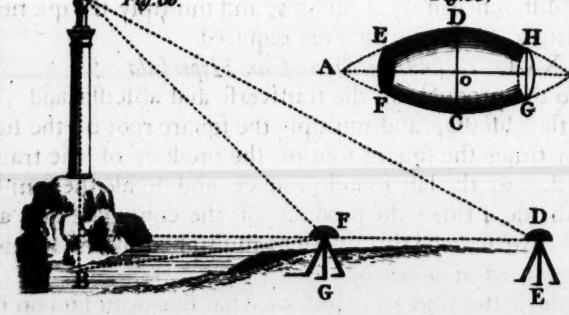

Fig. 35.

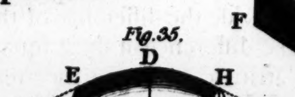

Fig. 22.

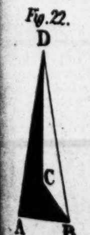

Fig. 17.

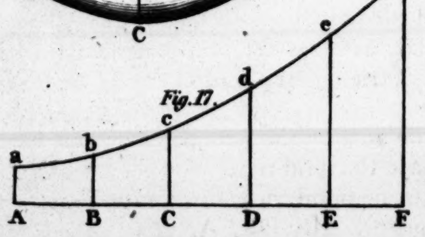
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Fig. 21

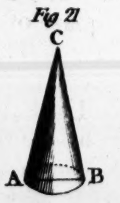
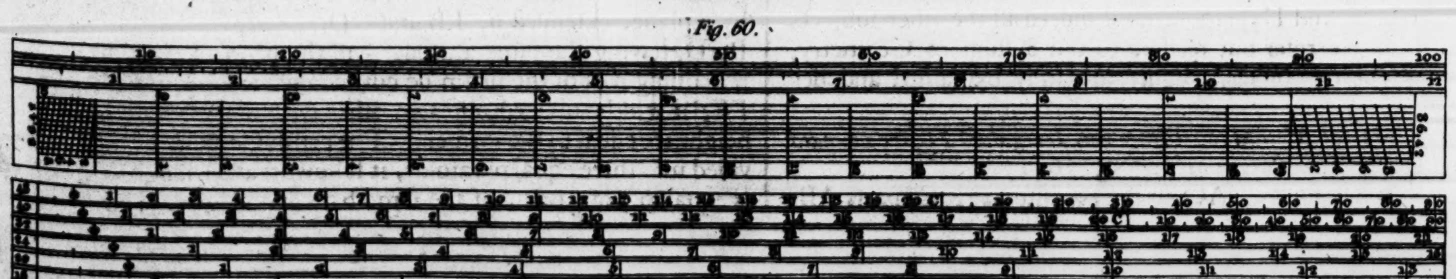


Fig. 60.



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monſtration may be extended to any other priſm, for if the baſe of the priſm has four ſides, and there be a pyramid of the ſame baſe and height, then the priſm may be divided into two triangular priſms of the pyramid, into two triangular pyramids, and each of the triangular priſms may be divided into three pyramids, each of equal ſize, with the two pyramids; and thus it will appear, that the priſm contains 6 of ſuch ſmall pyramids as the two, into which the given pyramid was divided; and hence, the ſquare priſm is treble the ſquare pyramid of the ſame baſe and height; when the priſm contains more ſides, the demonſtration may be effected in like manner; if we imagine the ſides infinite in number, it will coincide with the circle; and hence it is concluded that a cone is the $\frac{1}{3}$ of a cylinder of the ſame baſe and height. And hence, the foregoing rule is manifeſt.

The ſurface of a regular upright pyramid, is found by multiplying the ſlant height into half the perimeter of the baſe, and adding thereto the area of the baſe. When the pyramid is not a cone, the ſlant height muſt be meaſured from the vertex to the middle of one of the ſides of the baſe. If it be an irregular pyramid, the ſurface of each ſide muſt be meaſured ſeparately, and the ſum of the whole will be the meaſure of the ſurface.

IV. *To meaſure the Fruſtum of a Pyramid, of what Kind ſoever, the Fruſtum being cut off Parallel to the Baſe; ſee Fig.* 24 *and* 25.

Rule. To the areas of the two ends of the fruſtum, add the ſquare root of their product, and this ſum being multiplied by $\frac{1}{3}$ the height, will give the ſolidity.

For the fruſtum of a cone, this rule will be ſhorter, viz. To thrice the rectangle of the top and bottom diameters, add the ſquare of their difference; multiply the ſum by $\frac{1}{3}$ of the height, and that product by .7854. The ſurface of a fruſtum of any regular pyramid, is obtained by multiplying half the ſum of the perimeters of the two ends by the ſlant height, (taken between the middle points of two ſides like the ends when it is not a fruſtum of a cone) to which add the areas of the two ends, the ſum will be the whole ſurface.

V. *To meaſure a Sphere or Globe, as Fig.* 26.

Every Sphere is $\frac{2}{3}$ of its circumſcribing Cylinder. For let AB, *Fig.* 27. be the axis, about which the ſphere and cylinder are generated, by the revolution of the ſemicircle AGB, and the rectangle AGDB; let HL be any right line perpendicular to AB, cutting the periphery in K, and let OK and OD be drawn. Now AO = AD, and HI is parallel to AD, and HI = OH; alſo the circle deſcribed by HI, or the ſection of the cone generated by the rotation of the triangle AOD, about the axis AB, will be equal to the difference of the two circles generated by HL and HK, viz. equal to the *Annulus* deſcribed by KL, or the ſection of the ſolid which remains when the ſphere is taken out of the cylinder. Therefore theſe two ſections being every where equal to each other, the ſolids themſelves will likewiſe be equal, that is, the cone (EOD) will be equal to the exceſs of the cylinder, (GDE*g*) above the inſcribed hemiſphere (GA*g*), whence the cone or exceſs being $\frac{1}{3}$ part of the cylinder, the hemiſphere muſt neceſſarily be two thirds thereof. — Hence the whole ſphere is $\frac{2}{3}$ of its circumſcribing cylinder.

Hence if the diameter be cubed, and $\frac{2}{3}$ thereof be multiplied by .7854, you will have the ſolidity of the ſphere.

The convex ſurface of a ſphere is found by multiplying its diameter by the circumference.

VI. *To meaſure the Segment of a Sphere as* ACD, *Fig.* 28.

Rule. To three times the ſquare of the radius of its baſe (C*n*) add the ſquare of its height (A*n*), and this product being multiplied by $\frac{2}{3}$ of the height, and then by .7854, will give the ſolidity. The *curve ſurface* is found by multiplying its height by the whole circumference of the ſpheres.

VII. *To find the Solidity of a Fruſtum or Zone of a Sphere, as* ABCD (*Fig.* 29.)

Rule. To half the ſum of the ſquares of the radii of the two ends, D (viz. $\overline{Dn}^2 + \overline{An}^2$) add $\frac{1}{3}$ of the ſquare of their diſtance $(=\frac{1}{3}\overline{nm}^2)$ and multiply the ſum by twice the ſaid diſtance, and that product again by .7856, and you will have the ſolidity.

The convex ſurface is found as in the laſt article.

VIII. *To find the Solidity of a Circular Spindle,* ACBD (*Fig.* 30.)

Rule. To the ſquare of half the length of the ſpindle add the ſquare of half the middle diameter; divide the ſum by the middle diameter, and you will obtain A*o*, *the Radius of the Circle*: Take half the middle diameter from the radius of the circle, and it will give the central diſtance E*o*. Then find the area of the generating circular ſegment, by Art. XVIII, Sect. I. and from $\frac{2}{3}$ of the cube of the length of the ſpindle, ſubtract the product of the ſaid area by 8 times the central diſtance; multiply the remainder by .7854, and you will have the ſolidity.

In order to obtain the meaſure of the ſurface of the ſpindle, you muſt find the length of the circular arc, by Art. XVI. Sect. I. Then from the product of the longeſt diameter AB, and the radius of the revolving arc A*o*, ſubtract the product of the ſaid arc's length and central diſtance; and multiply 8 times the remainder by .7854, and you will have the meaſure of the ſurface.

IX. *To find the Solidity of a Spheroid,* as ABCD (*Fig.* 31.)

Rule. Multiply the ſquare of the revolving axe, by the fixed axe, and $\frac{2}{3}$ of that product by .7854, and you will have the ſolidity.

X. *To find the Contents of the middle Fruſtum of a Spheroid, when the Ends are circular or parallel to the revolving Axe; ſee* EDHGBF, *fig.* 32.

Rule. To twice the ſquare of the middle diameter DB, add the ſquares of the diameters EF and GH at the ends, then $\frac{1}{3}$ of this ſum being multiplied by the length, and that product by .7854, will give the ſolidity.

XI. *To find the Solidity of a Parabolic Conoid as* BDA, *fig.* 33.

Rule. Multiply the area of the baſe by half the altitude, and the product will be the content.

XII. *To find the Solidity of a Parabolic Spindle, Fig.* 34.

Rule. Multiply the ſquare of the middle diameter by the length of the ſpindle; alſo multiply $\frac{8}{15}$ of that product by .7854, and you will have the ſolidity.

XIII. *To find the Solidity of the Middle Fruſtum of a Parabolic Spindle, as* EFGH, *Fig.* 35.

Rule. Add 8 times the ſquare of the middle diameter, 3 times the ſquare of the leſs, and 4 times the product of thoſe diameters into one ſum, multiply that ſum by $\frac{2}{3}$ of the length, and that product by .7854, and you will have the contents.

XIV. *To find the Solidity of a Hyperboloid, as* ACB, *Fig.* 36.

Rule. To the ſquare of the radius of the baſe add the ſquare of the middle diameter, between the baſe and the vertex; multiply the ſum by of the altitude, and that product by .7854, will give the content.

XV. *To find the Solidities of the five regular Bodies.*

The firſt or tetracdron has four equal triangular faces, ſee *fig.* 37.

The ſecond, or hexacdron, or cube, has ſix equal ſquare faces of which we have before treated.

The third, or octacdron, has eight equal triangular faces, *fig.* 38.

The fourth, or dodecaedron, has 12 equal pentagonal faces, *fig.* 39.

The fifth, or icoſaedron, has 20 equal triangular faces *fig.* 40.

Beſides theſe no other regular ſolids, (viz. ſuch as have their reſpective ſides or baſes all equal and ſimilar) can be formed. The rules for meaſuring their contents are as under.

For the tetraedon, multiply $\frac{1}{12}$ of the cube of the linear ſide by the ſquare root of 2, and the product will be the ſolidity.

For the octaedron, multiply $\frac{1}{3}$ of the cube of the linear ſide by the ſquare root of 2, and the product will be the ſolidity.

For the dodecaedron, to 21 times the ſquare root of 5, add 47, and divide the ſum by 40; then the ſquare root of the quotient being multiplied by five times the cube of the linear ſide, will give the ſolidity.

For the icoſaedron, to three times the ſquare root of 5 add 7, then the ſquare root of half that ſum, being multiplied by $\frac{5}{6}$ of the cube of the linear ſide, will give the ſolidity. If *figures* 41, 42, 43, 44, and 45 are drawn upon paſteboard, cut half through, and turned up and glewed, they will form the five regular bodies.

The foregoing articles include all caſes that are likely to occur in practice; which we flatter ourſelves is as much as our readers will expect in a work of this nature. Thoſe who wiſh to ſee more of Menſuration, we refer to that excellent treatiſe of J. Robertſon, late librarian to the Royal Society, and to that valuable quarto work of Dr. Hutton, profeſſor of Mathematics at the Royal Academy at Woolwich. We ſhall however add as a ſupplement to this ſection the method of croſs multiplication, viz. the method of multiplying feet, inches, and parts, by feet, inches and parts, without reducing them to decimals, it being much practiſed by artificers in the meaſurement of their work, &c.

Rule. Begin with the higheſt denomination of the multiplicand; and having multiplied by it, begin with the next higheſt, and ſo on, till you have multiplied by them all; obſerving that feet multiplied by feet give feet, feet by inches give inches, feet by parts give parts; inches by inches give parts; inches by parts give ſeconds, and parts by parts give thirds.

Ft.	In.	Pts.		
12	3	4		
2	6	3		
24	6	8		
6	1	8	0 ''	
	3	0	10	0 '''
30	11	4	10	0

Hereafter having multiplied by 2 feet, I begin with 6 inches, which multiplied by 4 parts, gives 24 ſeconds, or 2 parts to be carried to the next row; then the next product produces 18 parts, which makes 8 to write down, and 1 to carry, which makes the next product 6 feet 1 inch to be ſet down. The laſt line is wrought in a ſimilar manner.

SECT. III. STEREOMETRY, OR THE ART OF GAUGING.

By gauging is chiefly underſtood the art of finding the content of any hollow veſſel, utenſil, or caſk, in ale or wine gallons, if the veſſel be of any regular form mentioned in the preceding ſection. Find the content in inches from the internal dimenſions; and then divide by 282 for ale gallons, and by 231 for wine gallons; the reaſon of which is becauſe 282 cubic inches is an ale gallon, and 231 cubic inches is a wine gallon. But ſince dividing by 282 or 231, is the ſame as multiplying by $\frac{1}{282}$ or $\frac{1}{231}$; therefore if theſe fractions be reduced to decimals, you will have multipliers (if you would prefer multiplication) which will anſwer the ſame purpoſe. Theſe multipliers are .003546 for ale, and .004329 for wine. Likewiſe, ſince in veſſels of a circular or eliptical form, you will have to multiply by .7854, in order to obtain the content in inches, and then to multiply or divide by the former multipliers or diviſors; it will be uſeful to ſhew how one operation may be made to ſerve for both. Thus, to multiply by .7854, and afterwards divide by 282 or 231, is the ſame thing as to multiply by $\frac{.7854}{282}$ or $\frac{.7854}{231}$. Theſe therefore reduced to decimals, will give the multipliers to be uſed in circular, or eliptical veſſels, for finding the ale or wine gallons, without multiplying firſt by .7854. The multipliers in theſe caſes are .0027851 for ale, and .00339999 for wine; or if you would prefer diviſion, then it is the ſame thing to multiply by $\frac{.7854}{282}$, $\frac{.7854}{231}$, as to divide by $\frac{282}{.7854}$ $\frac{231}{.7854}$, theſe therefore reduced to mixed numbers by actual diviſion become 359.05 for ale; and 294.12 for wine. Thus you have the ſeveral multipliers and diviſors for ale or wine, with the methods of finding them. In like manner if you have to gauge malt, you muſt divide the content in inches by 2150.42, and you will have the buſhels, becauſe 2150.42 cubic inches make one buſhel. Alſo $\frac{1}{2150.42}$ = .000465, the proper multiplier. In circular veſſels, the multiplier, (in order to ſave the trouble of multiplying by .7854 for the inches) will be $\frac{.7854}{2150.42}$ = .000365; or the diviſor for that purpoſe = $\frac{2150.42}{.7854}$ = 2738. In the ſame manner may multipliers and diviſors be found for gauging, or aſcertaining the quantities of bodies by weight, provided their ſpecific gravities are known. Thus 27.14 cubic inches of hard ſope, is equal to one pound, therefore if the content of any veſſel in inches be divided by 27.14, it will give the pounds of hard ſope that ſuch veſſel will hold, and by proceeding as above the multiplier, inſtead thereof, will be found .036845. But for circular utenſils, it will be .028939, and their diviſor 34.56.

N. B. A pound of green ſoft ſope contains 25.67 cubic inches. A pound of white ſoft ſope, 25.56 cubic inches; a pound of green ſtarch 34.8 cubic inches; a pound of dry ſtarch, 40.3 cubic inches, and a pound of net tallow, 31.4 cubic inches, for which the ſeveral multipliers and diviſors may be found as above, and the artiſt be thereby equipped for gauging any of thoſe articles.

OF THE SLIDING RULE.

For the eaſe of computations, there is an artificial inſtrument invented, called the Gauger's Sliding Rule, by which any calculations are readily performed, as it were by inſpection, and to a ſufficient exactneſs for practice. This rule conſiſts of certain ſcales of logarithms adapted to particular purpoſes; and ſince multiplication by logarithms is performed by addition, and diviſion by ſubtraction, it is eaſy to conceive that by moving the ſlide forward or backward with reſpect to the numbers on the fixed part of the rule, you will obtain the product or quotient of the two numbers you are concerned with. The lines of numbers on the ſliding rule are marked A, B, C, D, MD, and N. Alſo there are other lines marked S S, L L, &c. The value of the firſt figure on the rule may be aſſigned at pleaſure either 1, 10, 100, 1000, &c. or .1, .01; .001, &c. and whatever that firſt *figure* 1 is ſuppoſed to be, the firſt 2 is twice as much, the firſt 3 thrice as much, &c. and the ſecond 1 is ten times the firſt, the ſecond 2, 3, 4, &c. are ten times the value of the firſt 2, 3, 4, &c.

THE METHOD OF USING THE RULE.

Article I. *To multiply by the Sliding Rule.*

Rule. Set 1 on B to either of the factors on A, then againſt the other factor on B is the product on A.

II. *To Divide by the Sliding Rule.*

Rule. Set 1 on A to the diviſor on B, then oppoſite the dividend on B is the quotient on A.

III. *To perform a Proportion by the Sliding Rule.*

Rule. Set the firſt term on B to the ſecond on A, then oppoſite to the third on B is the fourth on A.

IV. *To extract the Square Root.*

Rule. Set the firſt 1 on C to the firſt 1 on D, then againſt the given number on C is its root on D.

V. *Between two Numbers given, to find a Geometrical Mean Proportion.*

Rule. Set one of the given numbers on C to the ſame number on D; then againſt the other given number on C is the geometrical mean on D.

VI. *To meaſure any Malt Floor, Couch, &c. by the Sliding Rule.*

Rule. Set the length on B to the breadth on MD, then againſt the height on A is the content on B.

VII. *An Account of the Gauge Points on the Rule.*

The operations on the rule for finding the contents of ſolids, are founded on this principle, that ſimilar ſurfaces are to one another, as the ſquares of the diameters or homologus ſides; and ſimilar ſolids, as the cubes of their diameters or homologus ſides; therefore if the ſide of a ſquare be found, whoſe area or content at 1 inch deep, is 1 gallon, 1 buſhel, &c. then it will be as the ſquare of that diameter or ſide (called a gauge point) is to 1, ſo is the ſquare of any other diameter to the correſponding area in gallons, buſhels, &c. at 1 inch deep; and therefore if the ſolid to be gauged be a ſquare or circular priſm, that area multiplied by the length, will be the content, or which is the ſame, as the ſquare of the gauge point is to the length ſo is the ſquare of the diameter or ſide to the content.

The ſide of a ſquare whoſe ale area is 1, is 16.79 inches; and whoſe wine area is 1 is 15.19 inches. And theſe are named the ale and wine gauge points for ſquares. The diameter of a circle whoſe ale area is 1 is 18.95 inches; and whoſe wine area is 1, is 17.15 inches; and theſe are named the circular gauge points for ale and wine reſpectively. The ſide of a ſquare, whoſe area is 1 malt buſhel is 46.37 inches, and the diameter of a circle whoſe content is 1 malt buſhel is 52.32 inches, which are therefore the ſquare and circular gauge points for malt.

Theſe ſides, diameters, or gauge points, are the ſquare roots of the proper diviſors, and conſequently by extracting the ſquare roots of the proper diviſors for ale, malt, ſope, tallow, &c. you will obtain the correſponding gauge points to each.

VIII. *To gauge a Priſm by the Sliding Rule.*

Rule. Find a mean proportion between the two ſides or diameters of the baſe, as has been already taught; then as the proper gauge point on D is to the length on C, ſo is ſuch mean proportion on D to the content on C.

A pyramid is gauged in the ſame manner, only inſtead of the length, uſe $\frac{1}{3}$ of the length.

IX. *To gauge any Fruſtum of a Right Cone or Square Pyramid, by the Sliding Rule.*

Rule. Set the proper gauge point on D to the height on C, then againſt half the ſum of the top and bottom diameters or ſide on D, take the correſponding number on C; and ſet the ſaid gauge point to $\frac{1}{3}$ of the length on C, and againſt $\frac{1}{2}$ the difference between the top and bottom diameters, or ſides, take the oppoſite number on C, the ſum of theſe two numbers thus found is the content.

X. *To gauge any Globe or Sphere by the Sliding Rule.*

Rule. Set the circular gauge point on D to $\frac{2}{3}$ of the diameter on C, and againſt the diameter on D is the content on C.

XI. *To gauge any Spheroid by the Sliding Rule.*

Set the circular gauge point on D to $\frac{2}{3}$ of the tranſverſe axis, on C, and againſt the conjugate axis on D is the meaſure of the ſpheroid on C.

XII. *To gauge the Fruſtum of any Spheroid by the Sliding Rule.*

Rule. Set the circular gauge point on D to the height or length of the fruſtum on C, then the greater and leſs diameters of the fruſtum's end being found D, take twice the number oppoſite to the firſt or greater diameter on C, and add it to the number oppoſite to the leſs diameter on C, and you will have the content.

Cask Gauging. See *Fig.* 46.

The only true method of caſk gauging that has ever been propoſed, is by taking a middle diameter between the bung and head; that being done, the following Rule will give the content.

Rule. *To the Square of twice the Middle Diameter, add the Squares of the Head and Bung Diameters. Multiply the Sum by* $\frac{1}{6}$ *of the Length, and that Product multiplied or divided by the Circular Multipliers or Diviſors for Ale or Wine, as the Caſe ſhall be, will give the Content in Gallons.*

To ullage a Caſk, or find the Quantity of Liquor remaining in a Caſk, when Part is drawn out. — This by the revenue officers is thus performed. On their ſliding rules, made by Mr. Roberts, of the old Jewry, there is one face made for ullaging ſtanding caſks, and another for lying caſks, the former marked S. S. or ſegment ſtanding; the other S. L. or ſegment lying. The ſlider is marked N. Then for a $\left\{\begin{array}{c}\text{ſtanding}\\ \text{lying}\end{array}\right\}$ caſk ſet the $\left\{\begin{array}{c}\text{length}\\ \text{bung diameter}\end{array}\right\}$ on N to 100 on $\left\{\begin{array}{c}\text{S S}\\ \text{S L}\end{array}\right\}$ and againſt the *wet* or *dry* inches on N, is the reſerved number on $\left\{\begin{array}{c}\text{S S}\\ \text{S L}\end{array}\right\}$ Again, ſet 100 on B, to the whole content on A, then again, the reſerved number on B is the ullage on A, viz. *what remains in the caſk*, if you uſed the wet inches; but *what is drawn out*, if you uſed the dry.

But the ſame in ſtanding caſks by having a middle diameter taken between the liquor's ſurface, and the neareſt head, may be performed after the manner of gauging the whole caſk; by which means the content of that part intercepted between the liquor's ſurface and neareſt head, will be determined by uſing in the calculation $\frac{1}{6}$ of that diſtance inſtead of the length, and the diameter of the liquors ſurface inſtead of the bung; then if the caſk be not half full, you have the quantity of liquor remaining therein; but if it is more than half full, ſubtract the content found as above from the whole content of the caſk, and the remainder will be the quantity of liquor in it. N. B. The diameter of the liquors ſurface and the intermediate diameter may be taken after the ſame manner as has been deſcribed for taking the middle diameter of a full caſk. Alſo in a ſimilar way, but it will be attended with a little more trouble, may the ullage of a lying caſk be found; for by knowing the wet or dry inches taken at the bung, the wet or dry inches at the middle and head will alſo be had. Then theſe being known, the area of the circular ſegments anſwering thereto, muſt be found in ale or wine gallons; and 4 times the middle area added to the ſum of the other two, and that ſum multiplied by $\frac{1}{6}$ of the caſk's length will give the true ullage.

In caſk gauging we have purpoſely inſiſted on that method only which is performed by a middle diameter, it being the only true method; for without a middle diameter there are not ſufficient data.

MERCATOR's *Chart*, or *Projection*, is a ſea-chart, or projection of the ſurface of the earth in plano. For the conſtruction, uſe, advantages, &c. of which, ſee the Syſtem of NAVIGATION.

MERCHANT, a perſon who buys and ſells commodities in groſs, or deals in exchanges; or that traffics in the way of commerce, either by importation or exportation. Formerly every one who was a buyer or ſeller in the retail way was called a *merchant*, as they ſtill are both in France and Holland; but here ſhopkeepers, or thoſe who attend fairs or markets have loſt that appellation. In republics, trading is ſtill more valued; but no where more than in England, where the younger ſons and brothers of the beſt families are frequently bred up to *merchandize*. Add to this, that many of the Italian princes are the principal merchants of their ſtates; and think it no diſcredit to make their palaces ſerve as warehouſes; and that many of the kings of Aſia, and moſt of thoſe on the coaſt of Africa and Guinea, traffic with the Europeans, ſometimes by their miniſters, and ſometimes in perſon. There are companies of *merchants* in London for carrying on conſiderable joint trade to foreign parts. See COMPANY.

Beſides theſe companies, there are other *merchants*, who are diſtinguiſhed by the country to which they trade; as Dutch *merchants*, who trade to the Weſt Indies; Canary and Portugal *merchants*: Italian *merchants*, who trade to Leghorn, Venice, &c. French, and Spaniſh *merchants*. The law of England, as a commercial country, pays a very particular regard to foreign *merchants*, in innumerable inſtances. Thus it is provided by Magna Charta, c. 30. that all *merchants*, unleſs beforehand publicly prohibited, ſhall have ſafe conduct to depart from, to come into, or tarry in, and to go through England, for the exerciſe of *merchandize*, without any unreaſonable impoſts, except in time of war: and if a war breaks out between us and their country, they ſhall be attached, if in England, without harm of body or goods, till the king, or his chief juſticiary, be informed how our *merchants* are treated in the land with which we are at war; and if our's are ſecure in that land, they ſhall be ſecure in our's. Upon which Monteſquieu remarks, with admiration, that the Engliſh have made the protection of foreign *merchants* one of the articles of their national liberty: and alſo, that the Engliſh know better than any other people upon earth, how to value at the ſame time theſe three great advantages, religion, liberty, and commerce. In this reſpect their diſpoſition is very different from the genius of the Roman people; who, in their manners, their conſtitution, and even in their laws treated commerce as a diſhonourable employment, and prohibited the exerciſe of it to perſons of birth, rank, or fortune; and equally different from the bigotry of the canoniſts, who looked on trade as inconſiſtent with Chriſtianity, and determined at the council of Melfi, under pope Urban II. A. D. 1090, that it was impoſſible with a ſafe conſcience to exerciſe any traffic, or follow the profeſſion of the law. See COMMERCE.

Previous to a perſon's engaging in a general trade, and becoming an univerſal dealer, he ought to treaſure up ſuch a fund of uſeful knowledge, as will enable him to carry it on with eaſe to himſelf, and without riſking ſuch loſſes as great ill-concerted undertaking would naturally expoſe him to. A merchant ſhould therefore be acquainted with the following parts of commercial learning. To be expert in the forms of invoices, accounts of ſales, policies of inſurance, charter-parties, bills of laden, and bills of exchange. He ſhould know the agreement between the money, weights and meaſures of all parts. If he deals in ſilk, woolen, linen, or hair manufactures, he ought to know the places where the different ſorts of merchandizes are manufactured, in what manner they are made, what are the materials of which they are compoſed, and from whence they come, the preparations of theſe materials before working up, and the places to which they are ſent after their fabrication. If he confines his trade to that of oils, wines, &c. he ought to inform himſelf particularly of the appearances of the ſucceeding crops, in order to regulate his diſpoſing of what he has on hand; and to learn as exactly as he can, what they have produced when got in, for his direction in making the neceſſary purchaſes and engagements. He ought to be acquainted with the ſorts of merchandize found more in one country than another, thoſe which are ſcarce, their different ſpecies and qualities, and the propereſt method for bringing them to a good market either by land or ſea. To know which are the merchandizes permitted or prohibited, as well on entering as going out of the kingdoms or ſtates where they are made. To be acquainted with the price of exchange, according to the courſe of different places, and what is the cauſe of its riſe and fall. To know the cuſtoms due on importation or exportation of merchandizes, according to the uſage, the tarifs, and regulations, of the places to which he trades. To know the beſt manner of folding up, embaling, or tunning, the merchandizes for their preſervation. To underſtand the price and condition of freighting and inſuring ſhips and merchandize. To be acquainted with the goodneſs and value of all neceſſaries for the conſtruction and repairs of ſhipping, the different manner of their building; what the wood, the maſts, cordage, cannons, ſails, and all requiſites, may coſt. To know the wages commonly given to the captains, officers, and ſailors, and the manner of engaging with them. He ought to underſtand the foreign languages, or at leaſt as many of them as he can attain to; theſe may be reduced to four, viz. the Spaniſh, which is uſed not only in Spain, but on the coaſt of Africa, from the Canaries to the Cape of Good Hope: the Italian, which is underſtood on all the coaſts of the Mediterranean, and in many parts of the Levant: the German, which is underſtood in almoſt all the northern countries; and the French, which is now become almoſt univerſally current. He ought to be acquainted with the conſular juriſdiction, with the laws, cuſtoms, and uſages of the different countries he does or may trade to; and in general all the ordinances and regulations both at home and abroad that have any relation to commerce. Though it is not neceſſary for a merchant to be very learned, it is proper that he ſhould know ſomething of hiſtory, particularly that of his own country; geography; hydrography; and be acquainted with the diſcoveries of the countries in which trade is eſtabliſhed, in what manner it is ſettled, of the companies formed to ſupport thoſe eſtabliſhments, and of the colonies they have ſent out.

All theſe branches of knowledge are of great ſervice to a merchant who carries on an extenſive commerce; but if his trade and his views are more limited, his learning and knowledge may be ſo too: but a material requiſite for forming a merchant is, his having on all occaſions a ſtrict regard to truth, and his avoiding fraud and deceit, as corroding cankers that muſt inevitably deſtroy his reputation and fortune.

Trade is a thing of ſo univerſal a nature, that it is impoſſible for the laws of Britain, or of any other nation, to determine all the affairs relating to it: therefore all nations, as well as Great Britain, ſhew a particular regard to the *law-merchant*, which is a law made by the merchants among themſelves: however, merchants and other ſtrangers are ſubject to the laws of the country in which they reſide. Foreign merchants are to ſell their merchandize at the port where they land, in groſs, and not by retail; and they are allowed to be paid in gold or ſilver bullion, in foreign coin or jewels, which may be exported. If a difference ariſes between the king, and any foreign ſtate, the merchants of that ſtate are allowed ſix months time to ſell their effects and leave the kingdom; during which time they are to remain free and unmoleſted in their perſons and goods.

MERCHANT *Court*, or *Court* **MERCHANT**, a kind of judicatory power, inveſted in *merchants*, choſen for that purpoſe, in ſeveral parts of Europe, in order to decide and determine in a ſummary way, all differences and litigations among themſelves and their dependents. The affairs of *merchants* are accompanied with ſuch variety of circumſtances, ſuch new and unuſual contingencies, which change and differ in every age, with a multitude of niceties and punctilios; and thoſe again altering, as the cuſtoms and uſages of countries and ſtates alter, that it has been found impracticable to make any laws that could extend to all caſes; and our law itſelf does tacitly acknowledge its own imperfection in this caſe, by allowing the cuſtom of *merchants* to paſs a kind of law in caſes of difficulty.

MERCURY, in natural hiſtory. The uſe of mercury in medicine ſeems to have been little known before the 15th century. The ancients looked upon it as a corroſive poiſon, though of itſelf perfectly void of acrimony, taſte, and ſmell; there are examples of its having been lodged for years in cavities both of bones and fleſhy parts, without its having injured or affected them. Taken into the body in its crude ſtate, and undivided, it paſſes through the inteſtines unchanged, and has not been found to produce any conſiderable effect. It has indeed been recommended in aſthmas and diſorders of the lungs; but the virtues attributed to it in theſe have not been warranted by experience. Notwithſtanding the mildneſs and inactivity of crude quickſilver undivided; when reſolved by fire into the form of fume, or otherwiſe divided into very minute particles, and prevented from re-uniting by the interpoſition of proper ſubſtances, or combined with mineral acids, it has very powerful effects; affording the moſt violent poiſons, and the moſt excellent remedies, that we are acquainted with.

The mercurial preparations, either given internally or introduced into the habit by external application, ſeem to liquify all the juices of the body, even thoſe in the minuteſt and moſt remote veſſels; and may be ſo managed as to promote excretion through all the emunctories. Hence their common uſe in inveterate chronic diſorders proceeding from a thickneſs and ſluggiſhneſs of the humours, and obſtinate obſtructions of the excretory glands; in ſcrophulous and cutaneous diſeaſes; and in the venereal lues. If their power is not reſtrained by proper additions to certain emunctories, they tend chiefly to affect the mouth; and, after having fuſed the juices in the remoter parts, occaſion a plentiful evacuation of them from the ſalival glands.

The ſalutary effects of mercurials do not depend on the quantity of ſenſible evacuation. This medicine may be gradually introduced into the habit, ſo as, without occaſioning any remarkable diſcharge, to be productive of very happy effects. To anſwer this purpoſe, it ſhould be given in very ſmall doſes, in conjunction with ſuch ſubſtances as determine its action to the kidneys or the pores of the ſkin. By this method inveterate cutaneous and venereal diſtempers have been cured, without any other ſenſible excretion than a gentle increaſe of perſpiration or urine. Where there are ulcers in any part, they diſcharge for ſome time a very fetid matter, the quantity of which becomes gradually leſs, and at length the ulcer kindly heals. If the mercury ſhould at any time, from cold or the like, affect the mouth, it may be reſtrained by omitting a doſe, and, by warmth or ſuitable medicines, promoting the perſpiration.

Mercury, in the heathen mythology. Moſt of the actions and inventions of the Egyptian Mercury, have likewiſe been aſcribed to the Grecian, who was ſaid to be the ſon of Jupiter and Maia, the daughter of Atlas. No one of all the heathen divinities had ſo many functions allotted to him as this god: he had conſtant employment both day and night, having been the common miniſter and meſſenger of the whole Pantheon; particularly of his father Jupiter, whom he ſerved with indefatigable labour, and ſometimes indeed in a capacity of no very honourable kind. Lucian is very pleaſant upon the multitude of his avocations; and, according to the confeſſion of the emperor Julian, Mercury was no hero, but rather one who inſpired mankind with wit, learning, and the ornamental arts of life, than with courage. The pious emperor, however, omits ſome of his attributes; for this god was not only the patron of trade, but alſo of theft and fraud.

Amphion is ſaid, by Pauſanias, to have been the firſt that erected an altar to this god; who, in return, inveſted him with ſuch extraordinary powers of muſic (and maſonry), as to enable him to fortify the city of Thebes in Bœotia, by the mere ſound of his lyre.

Almoſt all the ancient poets relate the manner in which the Grecian Mercury diſcovered the lyre; and tell us that it was an inſtrument with ſeven ſtrings; a circumſtance which makes it eſſentially different from that ſaid to have been invented by the Egyptian Mercury, which had but three. However, there have been many claimants beſides Mercury to the ſeven-ſtringed lyre.

His moſt magnificent temple was on mount Cylene, in Arcadia. He is deſcribed by the poets as a fair beardleſs youth, with flaxen hair, lively blue eyes, and a ſmiling countenance. He has wings fixed to his cap and ſandals, and holds the caduceus (or ſtaff ſurrounded with ſerpents with two wings on the top) in his hand; and is frequently repreſented with a purſe, to ſhow that he was the god of gain. The animals ſacred to him, were the dog, the goat, and the cock. In all the ſacrifices offered to him, the tongues of the victims were burnt; and thoſe who eſcaped imminent danger, ſacrificed to him a calf with milk and honey.

Mercury, in heraldry, a term uſed in blazoning by planets, for the purple colour uſed in the arms of ſovereign princes. See the System, Article III.

Mercury, ☿, in aſtronomy, the ſmalleſt of the inferior planets, and the neareſt to the ſun. See the System, Sect. VIII.

MERGUS, in the Linnæan ſyſtem of *ornithology*, the name of a diſtinct genus of birds, of the order of the *anſeres*. The diſtinguiſhing characteriſtic of this genus is, that the beak is ſomewhat cylindric, and has a crooked point. And its denticulations of a ſubulated form. There are ſix ſpecies; the largeſt of which is the merganſer, or gooſander, is a native of Europe. Theſe birds frequent our rivers and other freſh waters, eſpecially in hard winters; they are great divers, and live on fiſh. They are never ſeen in the ſouthern parts of Great Britain during ſummer; when they retire far north to breed; for in that ſeaſon they have been ſhot in the Hebrides. They are uncommonly rank, and ſcarce eatable. The male weighs four pounds: its length is two feet four inches; the breadth three feet two. The bill is three inches long, narrow, and finely toothed or ſerrated; the colour of that and of the irides is red. The *dun diver*, or female, is leſs than the male: the head and upper part of the neck is ferruginous; the throat white: the feathers on the hind part are long, and form a pendent creſt: the back, the coverts of the wings, and the tail, are of a deep aſh-colour: the greater quill-feathers are black, the leſſer white; the breaſt and middle of the belly are white, tinged with yellow. Latham makes this bird of the 91ſt genus. For repreſentation, ſee Plate V.

MERIDIAN, in geography, a great circle ſuppoſed to be drawn through any part on the ſurface of the earth, and the two poles; and to which the ſun is aways perpendicular at noon. In aſtronomy, the circle is ſuppoſed to be in the heavens, and exactly perpendicular to the terreſtrial one. See treatiſe on the Globes.

MERMAID, or Merman, a ſea-creature frequently talked of, ſuppoſed half human and half a fiſh. It was introduced by Heraldic painters; hence, the vulgar have ſuppoſed it a real animal. But the idea is erroneous, as no ſuch animal ever exiſted.

MEROPS, in the Linnean ſyſtem of ornithology, is the 23d genus belonging to the order of Picæ. The bill is crooked, flat, and carinated; the tongue is jagged at the point; and the feet are of the walking kind. There are ſix ſpecies, viz. 1. The apiaſter, or bee-eater, has an iron-coloured back; the belly and tail are of a bluiſh green; and the throat is yellow. It inhabits the ſouth of Europe. 2. The viridis, or Indian bee-eater, is green, with a black belt on the breaſt; and the throat and tail are black. 3. The congener, is yellowiſh, with a green rump. It inhabits the ſouth of Europe. 4. The ſuperciliosſus is green, with a white line both above and below the eyes, and a yellow throat. It is found in Madagaſcar. 5. The cinereus is variegated with red and yellow, with the two longeſt quill-feathers of the tail red. It is a native of America. 6. The caſer is grey, with a very long tail. It is a native of Ethiopia. Latham makes the firſt ſpecies, viz. the apiaſter, or bee-eater, belonging to the 26th genus. For the repreſentation, ſee Plate I.

MESENTERY, Mesenterium, formed of μεσος, *middle*, and εντερον, *inteſtine*, or Mesaræum, in anatomy, a fatty membranous body; thus called as being placed in the middle of the inteſtines, which it connects to one another. The *meſentery* is almoſt of a circular figure, with a narrow production; to which the end of the colon, and the beginning of the rectum, are tied. See the System, Part V. Sect. VII.

MESOCOLON, μεσοκωλον, in anatomy, that part of the mesentery, which, having reached the extremity of the ileum, contracts and changes its name. At this place the particular lamina, which is turned to the right ſide, forms a ſmall tranſverſe fold, called ligamentum coli dextrum. Afterwards the *meſocolon* aſcends towards the right kidney, where it ſeems to be loſt by the immediate adheſion of the colon to that kidney, and to the firſt incurvation of the duodenum. Then it appears again, and increaſing in breadth, continues its courſe almoſt tranſverſely under the liver, ſtomach, and ſpleen, where it begins to turn downward, under the left hypochondrium, towards the kidney on the ſame ſide. See the System, Part V. Sect. VII.

MESSENGERS, are certain officers chiefly employed under the direction of the ſecretaries of ſtate, and always in readineſs to be ſent with all kinds of diſpatches foreign and domeſtic. They alſo, by virtue of the ſecretaries warrants, take up perſons for high treaſon, or other offences againſt the ſtate. The priſoners they apprehend are uſually kept at their own houſes, for each of which they are allowed 6s. 8d. per day, by the government: and when the meſſengers are ſent abroad, they have a ſtated allowance for their journey, viz. 30l. for going to Paris, Edinburgh, or Dublin; 25l. for going to Holland, and to other places in the ſame proportion; part of which money is advanced for the expence of their journey. Their ſtanding ſalary is 45l. *per annum*; and their poſts, if purchaſed, are eſteemed worth 300l.

MESSIAH, a word ſignifying one anointed, or inſtalled into an office by unction. It was uſual among the Jews to anoint kings, high-prieſts, and ſometimes prophets, at the deſignation or inſtallment of them, to ſignify emblematically the mental qualifications neceſſary for diſcharging theſe offices. Saul, David, Solomon, and Joaſh, kings of Judah, received the royal unction. The name Messiah, *Anointed*, or *Chriſt* (Χριςος), was given to the kings and high prieſts of the Jews. The patriarchs and prophets are alſo called by the name of *Meſſiahs* or the *Lord's anointed*. See 1 Sam. xii. 3, 5. 1 Chron. xvi. 22. Pſ. cv. 15.

But this name *Meſſiah* was principally and by way of eminence given by the Jews to their expected great Deliverer, whoſe coming they ſtill vainly wait; and is a name the Chriſtians apply to *Jeſus Chriſt*, in whom the prophecies relating to the Meſſiah were accompliſhed. The ſum of theſe prophecies is, That there ſhould be a glorious perſon, named *Meſſiah*, deſcended from Abraham, Iſaac, and Jacob, who ſhould be born at Bethlehem, of a virgin of the family of David, then in its decline, before the Jews ceaſed to be a people, while the ſecond temple was ſtanding, and about 500 years after Ezra's time; who, though appearing in mean circumſtances, ſhould be introduced by a remarkable forerunner, whoſe buſineſs it ſhould be to awaken the attention and expectation of the people. That this illuſtrious perſon called *Meſſiah*, ſhould himſelf be eminent for the piety, wiſdom, and benevolence of his character, and the miraculous works he ſhould perform: yet that, notwithſtanding all this, he ſhould be rejected and put to death by the Jews; but ſhould afterwards be raiſed from the dead, and exalted to a glorious throne, on which he ſhould through all generations continue to rule, at the ſame time making interceſſion for ſinners. That great calamities ſhould for the preſent be brought on the Jews for rejecting him: whereas the kingdom of God ſhould by his means be erected among the Gentiles, and diſperſe itſelf even unto the ends of the earth; wherever it came, deſtroying idolatry, and eſtabliſhing true religion and righteouſneſs. In a word, That this glorious Perſon ſhould be regarded by all who believed in him, as a divine teacher, an atoning ſacrifice, and a royal governor: by means of whom, God would make a covenant with his people, very different from that made with Iſrael of old; in conſequence of which they ſhould be reſtored to, and eſtabliſhed in, the divine favour, and fixed in a ſtate of perpetual happineſs. See Jesus *Chriſt*, and Christianity.

METACARPUS, or Metacarpium, from μετα, *behind*, and καρπος, *hand*, in anatomy, that part of the hand between the wriſt and the fingers. For deſcription, ſee the Syſtem, Part II. Sect. IV. For repreſentation, ſee Plate I. *fig.* 1. Letters *i. k.*

METAL, in natural hiſtory, a ſimple, ponderous, ſhining, fixed, opake body, that fuſes, and becomes fluid, by fire, and by cold coagulates and hardens into a ſolid maſs, capable of being diſtended under the hammer. *Metal* is ſaid to be ſimple; as it may be affirmed of every the minuteſt particle of a *metal*, e. g. a grain of gold, that it is gold, or has all the properties of *gold*. *Fuſible* by fire; that is, when expoſed to a great fire, it diſſolves into parts which are eaſily moveable among themſelves, or are in actual motion. See Fusion. *Fixt*, i. e. bearing the fire without flying off in vapours; though it is only up to a certain degree that *metals* are fixed; for, by the large burning-glaſſes of Meſſ. Tſchirnhauſen and Villette, all *metals* are found to evaporate. Such is the proper idea of metals, which is not applicable to any other body in nature;

nature: for a diamond, or other ſtone, though a ſimple body, is not fuſible in the fire, nor capable of being ſtretched under the hammer. And ſalt, though diſſolvable by fire, is not malleable, but breaks under the hammer. See Syſtem of CHYMISTRY. Part II. under the Article *Metallic Subſtances*.

METAL, in heraldry. There are two metals uſed in heraldry, by way of colours, viz. gold and ſilver, in blazon called *or* and *argent*. In the common painting of arms theſe metals are repreſented by white and yellow, which are the natural colours of thoſe metals. In engraving, gold is expreſſed by dotting the coat, &c. all over; and ſilver, by leaving it quite blank.

It is a general rule in heraldry, never to place metal upon metal, nor colour upon colour: ſo that if the field be of one of the metals, the bearing muſt be of ſome colour; and if the field be of any colour, the bearing muſt be of one of the metals. See the Syſtem Sect. III. Plate II.

METALLURGY, according to Boerhaave, comprehends the whole art of working metals, from the glebe or ore, to the utenſil; in which ſenſe, aſſaying, ſmelting, refining, parting, ſmithery, gilding, &c. are only branches of metallurgy. But, in the preſent work, Gilding, Parting, Purifying, Refining, Smithering, &c. are treated under their proper names. With others, therefore, we have choſen to reſtrain *Metallurgy* to thoſe operations required to ſeparate metals from their ores for the uſes of life. Theſe operations are of two kinds: the ſmaller, or aſſaying; and the larger, or ſmelting. See the articles *Aſſaying*, *Smelting*, *Gilding*, *Refining*, *&c.*

METAMORPHOSIS, Μεταμορφωσις, formed of μετα *change*, or removal from one place or ſtate to another, and μορφη, *form*, or *figure transformation*; the change of a perſon or thing into another form. The ancients held two kinds of *metamorphoſes*; the one real, the other apparent. The *metamorphoſis* of Jupiter into a bull, and of Minerva into an old woman, were only apparent. That of Lycaon into a wolf, and of Arachne into a ſpider, and the like, they ſay, were of the real kind. Moſt of the ancient *metamorphoſes* include ſome allegorical meaning, relating either to phyſics or morality. Ovid's *Metamorphoſes* is a collection of hiſtories of ſuch transformations, poetically related. Some authors are of opinion, that a great part of the ancient philoſophy is couched under them; and Dr. Hook has made an attempt to unriddle and lay open the hidden meanings of ſeveral of them.

METAPHOR, METAPHORA, Μεταφορα, *tranſlation*, or *diſplacing*, of μετα, *trans*, and φερω, *I bear*, or *carry*, in rhetoric, a figure of ſpeech, or a ſpecies of trope, whereby a word is transferred from its proper ſignification to another, different from it, by reaſon of ſome ſimilitude between them; or whereby the proper denomination of one thing is applied to another; which other thing is more elegantly explained by this tralatitious or foreign name, than by that which naturally belongs to it. As, when we ſay, the light of the underſtanding; to burn with zeal; to float between hope and deſpair, &c. The metaphor is the moſt common of all the figures of ſpeech; and is that uſually meant, when we ſay a thing is ſpoken figuratively. See Treatiſe on ORATORY, Part III. Sect. III.

METAPHISICS is that part of philoſophy which conſiders the nature and properties of thinking beings. Ariſtotle, after treating on phyſics, begins his next book, (in which he pretends to elevate the mind above corporeal objects, to fix it on the contemplation of God, of angels, and of things ſpiritual, and to enable it to judge of the principles of ſciences by abſtraction,) with the Greek words μετα τα φυσικα, *poſt phyſicam*, i. e. *after phyſics*. His diſciples, and ſucceeding philoſophers, have formed, of theſe two, one word, METAPHYSICS, by which they mean that ſcience of which we have juſt now given the definition.

Metaphyſics is divided, according to the objects that it conſiders, into ſix principal parts, which are called 1. *Ontology*, 2. *Coſmology*. 3. *Anthrophology*. 4. *Pſychology*. 5. *Pneumatology*: and, 6. *Theodicy*, or *Metaphyſical Theology*.

1. The doctrine that is named ontology, is that part of metaphyſics which inveſtigates, and explains, the nature and general eſſence of all beings, as well as the qualities and attributes that eſſentially appertain to them, and which we ought to aſſign them by abſtraction, as conſidering them *à priori*. Hence it appears, that this doctrine ſhould proceed in its operations from the moſt ſimple ideas; ſuch as do not admit of any other qualities of which they may be compounded. Theſe ſimple ideas are, for example, thoſe of being, of eſſence, of ſubſtance, of mode, of exiſtence, as well with regard to time as place, of a neceſſary cauſe, of unity, the idea of negation, the difference between a being that is ſimple or compound, neceſſary or accidental, finite or infinite; the idea of eſſential and abſtract properties, as of the greatneſs, perfection, and goodneſs of beings; and ſo of the reſt. The buſineſs therefore of ontology, is to make us acquainted with every kind of being in its eſſence and abſtract qualities, and ſuch as are diſtinct from all other beings. This knowledge being once eſtabliſhed on ſimple principles, juſt conſequences may from thence be drawn, and thoſe things proved after which metaphyſics inquires, and which is its buſineſs to prove.

It is eaſy to conceive, that even a clear knowledge of beings, and their eſſential properties, would be ſtill defective and uſeleſs to man, if he did not know how to determine and fix his ideas by proper denominations, and conſequently to communicate his perceptions to thoſe whom he would inſtruct, or againſt whom he is obliged to diſpute, as they would not have the ſame perceptions that he has. It is, by the way, perhaps, one of the greateſt advantages that we have over other animals, to be able ſo to determine our ideas by ſigns or denominations, either of writing or ſpeech, as to refer each particular perception to its general idea, and each general perception to its particular idea. To render therefore our ideas intelligible to others, we muſt have determinate words or denominations for each being, and the qualities of each being; and ontology teaches us thoſe terms which are ſo neceſſary to fix our ideas, and to give them the requiſite perſpicuity and preciſion, that we may not diſpute about words when we endeavour to extend the ſphere of our knowledge, or when we debate concerning the eſſence of an object, or endeavour to make it more evident. It is for this reaſon that ontology was formerly regarded as a barren ſcience, that conſiſted of technical terms only; as a mere terminology: whereas the beſt modern philoſophers make it a more ſubſtantial ſcience, by annexing determinate ideas to thoſe words, and the examination of thoſe objects themſelves that theſe terms imply. But the misfortune is, to ſpeak the truth, that in this ontologic determination there is ſtill much uncertainty and ſophiſtry. For, in the firſt place, we yet know of no metaphyſics where all the definitions are juſt; and in the ſecond place, the words that are employed in theſe definitions have always ſomething equivocal in their meaning, and have conſequently themſelves need of definitions; and this manner we may recede to infinity, unleſs we recur to the firſt impreſſions that the ſimple words have made in our minds, and the primitive ideas which they there excite. The words *man*, *love*, *coach*, &c. ſay more, and make a ſtronger impreſſion, than all the definitions we can give of them; by ontologic explications they are almoſt always covered with a dark cloud.

2. Metaphyſics, after having, in as ſolid a manner as poſſible, explained and eſtabliſhed the principles above-mentioned, continues its enquiries to the ſecond part, that is called Coſmology, and examines into the eſſence of the world, and all that it contains; its eternal laws; of the nature of matter; of motion; of the nature of tangible bodies, of their attributes and eſſential qualities, and of all that can be known by abſtraction, and ſometimes alſo by adding the lights that man acquires concerning them by the experience of his ſenſes. It is alſo in coſmology that we examine the Leibnitzian ſyſtem; that is, whether God in creating the world muſt neceſſarily have created the beſt world; and if this world be ſo in effect. And in this manner they purſue the argument from conſequence to bonſequence to its laſt reſort. All philoſophers, however, do not go equally deep. Each mind has its doſe of penetration. Due care ſhould be likewiſe taken, that ſubtilty, in this chain of reaſoning, carried beyond the general bounds of the human mind, do not prejudice either the perſpicuity or the truth of ideas: ſeeing that error here too nearly approaches the truth; and that every idea, which cannot be rendered intelligible, is in effect equal to a falſe idea.

3. Anthrophology, or the knowledge of man, forms the third branch of metaphyſics. It is ſubdivided into two parts. The firſt, which conſiſts in the knowledge of the exterior parts of the human frame, does not belong to this ſcience: anatomy and phyſiology teach that. The buſineſs here is only a metaphyſical examination of man, his exiſtence, his eſſence, his eſſential qualities and neceſſary attributes, all conſidered *à priori*: and this examen leads at the ſame time to

4. Pſychology, which conſiſts in the knowledge of the ſoul in general, and of the ſoul of man in particular; concerning which the moſt profound, the moſt ſubtle and abſtract reſearches have been made, that the human reaſon is capable of producing; and concerning the ſubſtance of which, in ſpite of all theſe efforts, it is yet extremely difficult to aſſert any thing that is rational, and ſtill leſs any thing that is poſitive and well ſupported.

5. The fifth part of metaphyſics is called pneumatology. It is not a very long time ſince this term has been invented, and that metaphyſicians have made of it a diſtinct doctrine. By this they mean the knowledge of all ſpirits, angels, &c. It is eaſy to conceive that infinite art is neceſſary to give an account of what we do not abſolutely know any thing, and of which, by the nature of the ſubject itſelf, we never can know any thing. But the metaphyſician preſently offers to ſhow us, "what is the idea of a ſpirit; the effective exiſtence of a ſpirit; what are its general qualities and properties; that there are rational ſpirits, and that theſe rational ſpirits have qualities that are founded in the moral qualities of God:" for this is, in ſo many words, what is taught us by pneumatology.

6. Metaphyſical theology, which M. Leibnitz and ſome others call Theodicy, is the ſixth and laſt doctrine of metaphyſics. It teaches us the knowledge of the exiſtence of God; to make the moſt rational ſuppoſitions concerning his divine eſſence, and to form a juſt idea of his qualities and perfections, and to demonſtrate them by abſtract reaſoning *à priori*. Theodicy differs from natural theology, in as much as this laſt borrows, in fact, from theodicy proofs and demonſtrations to confirm the exiſtence of a Supreme Being; but after having ſolidly eſtabliſhed that great truth, by extending its conſequences, natural theology teaches us

what are the relations and connexions that ſubſiſt between that Supreme Being and man, and what are the moral duties that reſult from that connexion. As pneumatology is a ſcience highly inſiduous and chimerical, ſo is metaphyſical theology ſuſceptible of ſound argument and demonſtration; to the great comfort of mankind, the whole of whoſe happineſs is founded on the certainty of this ſcience. If the effects and operations of ſpirits in the univerſe were as evident as the effects and operations of the Deity, and their neceſſary exiſtence as capable of being proved *à priori*, pneumatology would be a doctrine of equal certainty with theodicy: but as neither one nor the other can be proved with regard to ſpirits in general, whilſt God manifeſts himſelf in every part of nature, we have only to deſcend from the moſt ſimple and abſtract ideas, to thoſe that are the moſt compound; and from thence to reaſcend, by a chain of reaſonings, from the creature up to the Author of the creature and of all nature: we ſhall find, that the reſult of all theſe operations of the mind will conſtantly be, The neceſſity of the exiſtence of a God; and we may at all times determine, though very imperfectly, from the weakneſs of our diſcernment, what that Supreme Being muſt be, by poſitively determining what he cannot be. Every thing that can concur to furniſh new proofs on this ſubject, or to elucidate and eſtabliſh thoſe which are already known, is therefore of ineſtimable value to mankind: and though this were the only object of metaphyſics, it would highly merit the attention of thoſe of the moſt refined and moſt exalted genius.

METAPHYSICAL, ſomething belonging to METAPHYSICS. The word is alſo uſed to denote ſomething ſubtile, abſtract, and refined. In which ſenſe we ſay, Such a reaſoning, ſuch a proof, is too metaphyſical, &c. A metaphyſical caſe is an imaginary or chimerical caſe, which can ſcarce ever happen, or not without much difficulty; and which ought not be laid down as a rule for common occaſions.

METATARSUS, from *μετα*, *beyond*, and *ταρσος*, *the tarſus*, in anatomy, that part of the human ſkeleton, containing the middle of the foot. See the Syſtem, Part II. Sect. XII. and Plate I. *fig.* 1. letter *o*.

METEMPSYCHOSIS, the doctrine of tranſmigration, which ſuppoſes, that human ſouls, upon their leaving the body, become the ſouls of ſuch kind of brutes as they moſt reſemble in their manners. This was the doctrine of Pythagoras and his followers. Pythagoras is ſaid to have borrowed the notion of a metempſychoſis from the Egyptians; others ſay from ancient Brachmans. It is ſtill retained among the ancient Banians, and other idolaters of India and China, and makes the principal foundation of their religion. Many of the modern Jews are ſaid to eſpouſe this doctrine; and, to ſupport their opinion, quote theſe words of Job, "Lo all theſe things worketh God oftentimes with man (in Hebrew, *and thrice*) to bring back his ſoul from the pit to be enlightened with the light of the living." It is certain, that at the time of Jeſus Chriſt this opinion was very common among the Jews: this appears in the goſpel, when they ſay, that ſome thought Jeſus Chriſt to be John the Baptiſt, others Elias, others Jeremiah, &c.

METEOR, (by the Greeks called *μετεωρα*, q. d. *ſublima*, or "high raiſed;" by the Latins *impreſſiones*, as making ſigns or impreſſions in the air), commonly denotes any bodies in the air that are of a flux or tranſitory nature. Hence it is extended to the phenomena of hail, rain, ſnow, thunder, &c. but is moſt commonly confined to thoſe unuſual and fiery appearances named *falling ſtars*, *ignes fatui*, *auroræ boreales*, &c. whether they appear at a great diſtance from the earth or not. Till the diſcovery of electricity theſe meteors could not be accounted for: but they are now reſolved, by the almoſt univerſal conſent of philoſophers, into the action of that fluid; which, though unheaded, hath ſhewed itſelf in all ages.

METHOD, METHODUS, from *μεθοδος*, in logic and rhetoric, the art or rule of diſpoſing things in ſuch a manner, as that they may be eaſily comprehended; either in order to diſcover the truth, which we ourſelves are ignorant of; or to ſhew or demonſtrate it to others when known, or to fix it in the memory. See Treatiſe on Logic, Part IV, and Treatiſe on ORATORY, Part II.

METHODISTS. The *Methodiſts* form a very conſiderable claſs principally of the lower people in this country. They ſprung up about fifty years ago, at Oxford, and were ſoon divided in two parties, the one under the direction of Mr. George Whitefield, and the other under that of the two brothers, John and Charles Weſley. Theſe leaders, and, if we except Mr. William Law, founders of *Methodiſm*, were educated at Oxford, and received epiſcopal ordination; and always profeſſed themſelves advocates for the articles and liturgy of the eſtabliſhed church: though they more commonly practiſed the diſſenting mode of worſhip. But conceiving a deſign of forming ſeparate communities, ſuperior in ſanctity and perfection to all other Chriſtian churches, and impelled to a very conſiderable degree by a zeal of an enthuſiaſtic and extravagant kind, they became itinerant preachers, and, being excluded from moſt of our churches, exerciſed their miniſtry in private houſes, fields, &c. not only in Great Britain and Ireland, but alſo in America: thus collecting a very conſiderable number of hearers and proſelytes, both amongſt the members of the eſtabliſhed church and the diſſenters. The theological ſyſtem of Mr. Whitefield and his followers is Calviniſtic: that of Mr. Weſley and his diſciples Arminian; and the latter maintains the poſſibility of attaining ſinleſs perfection in the preſent ſtate. The ſubordinate teachers of both theſe claſſes of *Methodiſts*, are generally men of no liberal education, and they pretend to derive their miniſterial abilities from ſpecial communications of the ſpirit. The *Methodiſts* of both parties, like other enthuſiaſts, make true religion to conſiſt principally in certain affections and inward feelings, which it is impoſſible to explain, but which, when analyſed, ſeem to be mechanical in their ſpring and operation; and they generally maintain, that Chriſtians will be moſt likely to ſucceed in the purſuit of truth, not by the dictates of reaſon, or by the aids of learning, but by laying their minds open to the direction and influence of divine illumination: and their conduct has been directed by impulſes.

METHODISTS, METHODICI, a ſect of ancient phyſicians, who reduced the whole art of healing to a few common principles or appearances. See the Hiſtory prefixed to the Syſtem of Medicine.

METONYMY, Μετωνυμια, from *μετα*, *trans*, and *ονομα*, *nomen*, *name*; a rhetorical trope, conſiſting in a tranſmutation or change of names; or a putting of the effect for the cauſe, or the ſubject for the adjunct; and *vice verſa*. The metonymy is the moſt conſiderable of all the tropes next to a metaphor, whether we conſider its force and elegancy, or the frequent uſe of it both in ſpeaking and writing. See Treatiſe on ORATORY, Part III. Sect. III.

METRE, *μετρια*, in poetry, a ſyſtem of feet of a juſt length. The different metres in poetry, are the different manners of ordering and combining the quantities, or the long and ſhort ſyllables: thus hexameter, pentameter, iambic, ſapphic verſes, &c. conſiſt of different metres, or meaſures. In Engliſh verſes, the metres are extremely various and arbitrary, every poet being at liberty to introduce any new form that he pleaſes. The moſt uſual are the heroic, generally conſiſting of five long and five ſhort ſyllables, and verſes of four feet, and of three feet, and a cæſura, or ſingle ſyllable. The ancients, by variouſly combining aud tranſpoſing their quantities, made a vaſt variety of different meaſures, by forming ſpondees, &c. of different feet.

METROPOLIS, the capital or principal city of a country or province. The term *Metropolis* is alſo applied to archiepiſcopal churches, and ſometimes to the principal or mother-church of a city. The Roman empire having been divided into 13 dioceſes and 120 provinces, each dioceſe and each province had its metropolis, or capital city, where the proconſul had his reſidence. To this civil diviſion, the eccleſiaſtical was afterwards adapted, and the biſhop of the capital city had the direction of affairs, and the pre-eminence over all the biſhops of the province. His reſidence in the metropolis gave him the title of *Metropolitan.* This erection of metropolitans is referred to the end of the third century, and was confirmed by the council of Nice. A metropolitan has the privilege of ordaining the ſuffragans; and appeals from ſentences paſſed by the ſuffragans are preferred to the metropolitan.

MEZZO-TINTO, in ſculpture, a particular manner of engraving figures on copper. It is very different from the common way of engraving. To perform it, they rake, hatch, or punch the the ſurface of the plate all over with a knife, or inſtrument made for the purpoſe, firſt one way, then the other, acroſs, &c. till the face of the plate be entirely furrowed with lines or furrows, cloſe and as it were contiguous to each other; ſo that, if an impreſſion was thus taken from it, it would be one uniform blot, or ſmut. This done, the deſign is drawn, or marked, on the ſame face; after which, they proceed with burniſhers, ſcrapers, &c. to expunge or take out the dents or furrows, in all the parts where the lights of the piece are to be; and that more or leſs, as the lights are to be ſtronger or fainter: leaving thoſe parts black, which are to repreſent the ſhadows, or deepenings of the draught. As it is much eaſier to ſcrape or burniſh away parts of a dark ground correſponding with the outline of any deſign ſketched upon it, than to form ſhades upon a light ground, by an infinite number of hatches, ſtrokes, and points, which muſt all terminate with exactneſs on the outline, as well as differ in their force and manner, the method of ſcraping, as it is called, in *Mezzo-tinto*, conſequently becomes much more eaſy and expeditious, than any other method of *engraving*. The inſtruments uſed in this kind of engravings are *cradles*, *ſcrapers*, and *burniſhers*.

MIASMA, among phyſicians, a particular kind of effluvia, by which certain fevers, particularly intermittents, are produced. See the Syſtem of MEDICINE, Genus 1, and 2.

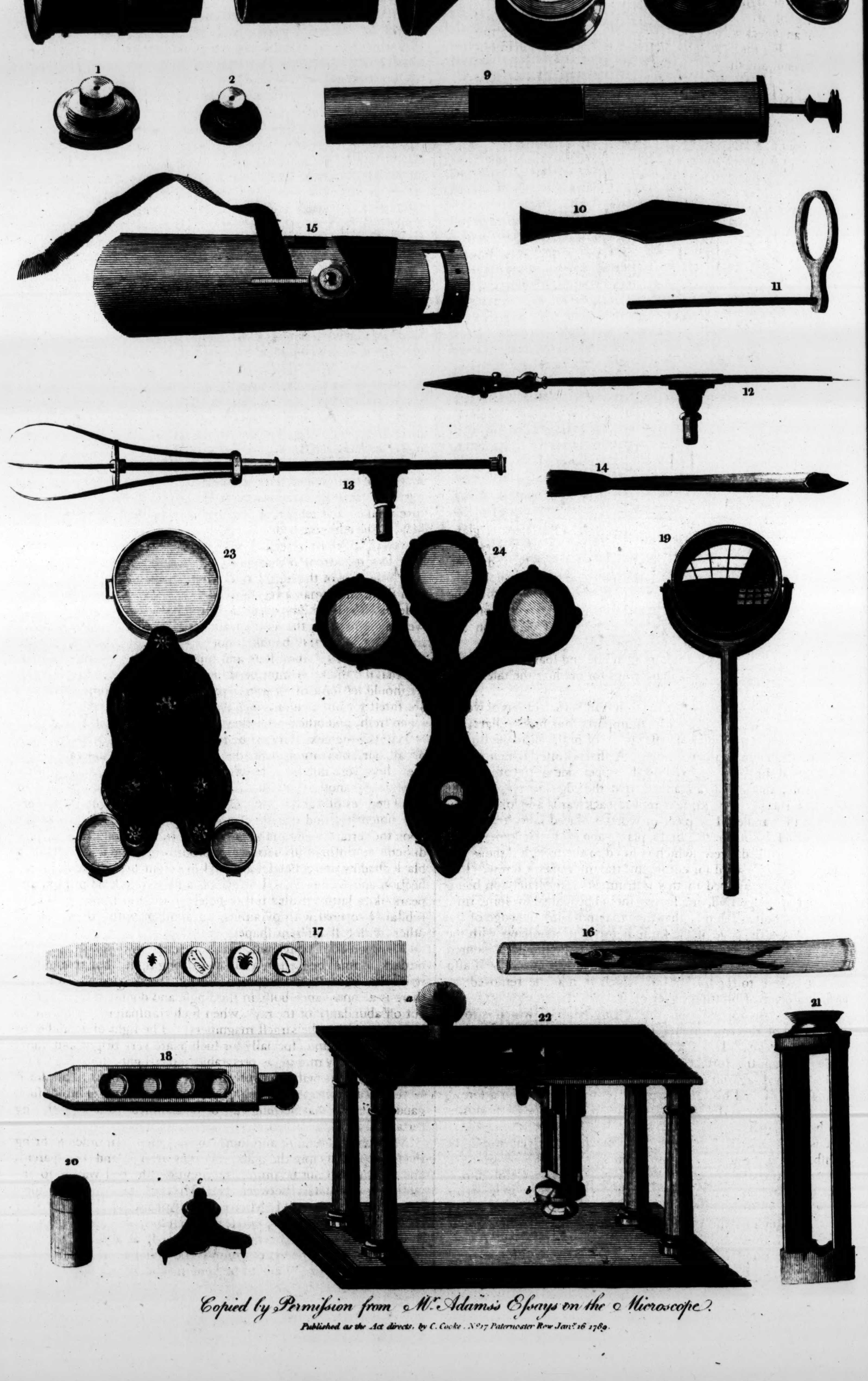
MICAH, or *The Book of* MICAH, a canonical book of the Old Teſtament, written by the prophet Micah, who is the ſeventh of the twelve leſſer prophets. He is cited by Jeremiah, and propheſied in the days of Jotham, Ahaz, and Hezekiah. He cenſures the reigning vices of Jeruſalem and Samaria, and denounces the judgments of God againſt both kingdoms. He likewiſe foretells the confuſion of the enemies of the Jews, the coming of the Meſſiah, and the glorious ſucceſs of his church.

MICROCOSM, *μικροκοσμος*; formed from *μικρος*, *little*, and *κοσμος*, *world*, a Greek term, literally ſignifying *little world*; chiefly underſtood of *Man*, who is ſo called by way of eminence, as being an epitome of all that is wonderful in the great world, or microcoſm.

MICROMETER, an aſtronomical machine, which, by means of

BRITISH 18 MR 63 MUSEUM

Microscopical Apparatus.—See System of Optics.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of a very fine ſcrew, ſerves to meaſure extremely ſmall diſtances in the heavens; as the apparent diameters of the planets, to a great degree of accuracy. The word comes from the Greek *μικρος*, *parvus*, and *μετρον*, *menſura*; in regard to a ſmall length, e. g. an inch, is hereby divided into vaſt numbers of parts, e. g. ſome 2800, and in others more. See the Syſtem of OPTICS.

MICROSCOPE, an optical inſtrument conſiſting of lenſes, or mirrors, by means of which ſmall objects appear larger than they do by the naked eye. Single microſcopes conſiſt of lenſes or mirrors; or if more lenſes or mirrors be made uſe of, they only ſerve to throw light upon the object, and not contribute to enlarge the image of it. Double microſcopes are thoſe in which the image of an object is compoſed by means of more lenſes, or mirrors than one. For the principles on which the conſtruction of microſcopes depend, and the beſt methods of making them, ſee Syſtem of OPTICS.

MICROSCOPIC APPARATUS. *See the* PLATE.

Fig. 9. A cylindrical piece, intended for the ſolar opake microſcope, by pulling back the ſpiral ſpring, ſmaller or larger objects may be confined in it.

Fig. 10. A pair of forceps to take up any occaſional object.

Fig. 11. A piece to hold the ſpeculum; this piece is generally fitted to the microſcopes which will be deſcribed in the Plates in the Syſtem of Optics.

Fig. 12. A long ſteel wire, with a ſmall pair of pliers at one end, and a ſteel point at the other; the wires ſlip backwards or forwards in a ſpring tube, which is affixed to a joint, at the bottom of which is a pin to fit one of the holes in the ſtage; this piece is uſed to confine ſmall objects.

Fig. 13. A pair of triangular nippers for taking hold and confining a large object.

Fig. 14. A camel's hair pencil to bruſh the durſt off the glaſſes; the upper part of the quill is ſcooped out, to take up a drop of any fluid, and place it on either of the glaſſes for examination.

Fig. 15. A fiſh pan, whereon a ſmall fiſh may be faſtened, in order to view the circulation of the blood: its tail is to be ſpread acroſs the oblong hole at the ſmalleſt end, and tied faſt by means of the ribbon affixed; by ſhoving the knob which is on the back of it through the ſlit made in the ſtage, the tail of the fiſh may be brought under the lens which is in uſe.

Fig. 16. A glaſs tube to receive a ſmall fiſh, &c.

Fig. 17. repreſents one of the ivory ſliders, wherein objects are placed between two pieces of talc, and confined by a braſs ring.

Fig. 18. A braſs ſlider, into which is fitted a flat piece of glaſs, and a braſs ſlider, containing one or two ſmall concave glaſſes, the others flat; it is deſigned to confine ſmall living objects, and when uſed is to be placed between the upper plates of the ſlider-hold.

Fig. 19. A convex lens, which fits the ſtage, by means of the long pin adhering to it; it is deſigned to collect the light from the ſun or a candle, and to throw them or any object placed on the ſtage: this piece is but little uſed at preſent.

Fig. 20. An ivory box, containing at one end ſpare talc, for the ivory ſliders, and at the other ſpare rings for preſſing the talcs together and confining them to the ſlider.

Fig. 22. An inſtrument for cutting thin tranſverſe ſections of wood. It conſiſts of a wooden baſe, which ſupports four braſs pillars; on the top of the pillars is placed a flat piece of braſs, near the middle of which there is a triangular hole. A ſharp knife, which moves in a diagonal direction, is fixed on the upper ſide of the aforementioned plate, and in ſuch a manner, that the edge always coincides with the ſurface. The knife is moved backwards and forwards by means of the handle. The piece of wood is placed in the triangular trough which is under the braſs plate, and is to be kept ſteady therein by a milled ſcrew, which is fitted to the trough; the wood is to be preſſed forward for cutting by the micrometer ſcrew. The pieces ſhould be applied to this inſtrument immediately on being taken out of the ground, or elſe they ſhould be ſoaked for ſome time in water, to ſoften them ſo that they may not hurt the edge of the knife. When the edge of the knife is brought in contact with the piece of wood, a ſmall quantity of ſpirits of wine ſhould be poured on the ſurface of the wood to prevent its curling up; it will alſo make it adhere to the knife from which it may be removed by preſſing a piece of blotting paper on it.

Letter *c*. An appendage to the cutting engine, which is to be uſed inſtead of the micrometer ſcrew; being preferred by ſome practitioners to it. It is placed over the triangular hole, and kept flat down upon the ſurface of the braſs plate, while the piece of wood is preſſed againſt a circular piece of braſs, which is on the under ſide of it. This circular piece of braſs is fixed to a ſcrew, by which its diſtance from the flat plate on which the knife moves may be regulated.

It is neceſſary that the curious microſcopic obſerver, ſhould be furniſhed with the following inſtruments, as the moſt convenient for inveſtigating the object of his purſuits, as it riſes before him.

In the caſe, *fig.* 23. are three lenſes of different magnifying powers, that all turn up and ſhut into the caſe.

Fig. 24, contains alſo three lenſes of different foci which are all made to turn into the caſe, and may be uſed combined or ſeparately. The three lenſes in themſelves afford three different magnifying powers; by combining two and two we make three more; the three together make a ſeventh magnifying power with three lenſes. When the three lenſes are uſed together, it is beſt to turn them into the caſe, and look through the hole; as this combined magnifying power is ſo great, that it requires to have a portion of the light which falls in the lenſes excluded, in order to attain diſtinct viſion. Further, the eye is alſo by this means made to coincide more eaſily with the axis of the glaſſes.

Thoſe who wiſh for further information reſpecting the Microſcopical Apparatus, its uſes, &c. are referred to Mr. Adams's Eſſays on the Microſcope.

MICROSCOPIC *Objects*. All things too minute to be viewed diſtinctly by the naked eye, are proper objects for the microſcope. Dr. Hooke has diſtinguiſhed them to be exceeding ſmall bodies, exceeding ſmall pores, or exceeding ſmall motions. Exceeding ſmall bodies muſt either be the parts of larger bodies, or things, the whole of which is exceedingly minute, ſuch as ſmall ſeeds, inſects, ſalts, ſands, &c. Exceeding ſmall pores are the interſtices between the ſolid parts of bodies, as in ſtones, minerals, ſhells, &c. or the mouths of minute veſſels in vegetables, or the pores in the ſkin, bones, and other parts of animals. Exceeding ſmall motions are the movements of the ſeveral parts or members of minute animals, or the motion of the fluids, contained in either animal or vegetable bodies. Under one or other of theſe three heads, almoſt every thing about us affords us matter of obſervation, and may conduce both to our amuſement and inſtruction. An examination of theſe objects, however, ſo as to diſcover truth, requires a great deal of attention, care, and patience, with ſome ſkill and dexterity, to be acquired chiefly by practice, in the preparing, managing, and applying them to the microſcope.

Whatever object offers itſelf as the ſubject of our examination, the ſize, contexture, and nature of it, are firſt to be conſidered, in order to apply it to ſuch glaſſes, and in ſuch a manner as may ſhew it beſt. The firſt ſtep ſhould always be to view the whole together, with ſuch a magnifier as can take it in all at once, and after this the ſeveral parts of it may the more fitly be examined, whether remaining on the object, or ſeparated from it. The ſmaller the parts are which are to be examined, the more powerful ſhould be the magnifiers employed; the tranſparency or opacity of the object muſt alſo be conſidered, and the glaſſes employed accordingly ſuited thereto; for a tranſparent object will bear a much greater magnifier than one which is opake, ſince the nearneſs that a glaſs muſt be placed at, unavoidably darkens an object if in its own nature opake, and renders it very difficult to be ſeen, unleſs by the help of the apparatus contrived for that purpoſe, which has a ſilver ſpeculum. Moſt objects however become tranſparent by being divided into extremely thin parts.

The nature of the object alſo, whether it be alive or dead, a ſolid or a fluid, an animal, a vegetable, or a mineral ſubſtance, muſt likewiſe be conſidered, and all the circumſtances of it attended to, that we may apply it in the moſt advantageous manner. If it be a living object, care muſt be taken not to ſqueeze or injure it, that we may ſee it in its natural ſtate and full perfection. If it be a fluid, and that too thick, it muſt be diluted with water; and if too thin, we ſhould let ſome of its watery parts evaporate. Some ſubſtances are fitteſt for obſervation when dry, others when moiſtened; ſome when freſh, and others after they have been kept ſome time.

Light is the next thing to be taken care of; for on this the truth of all our obſervations depends; and a very little obſervation will ſhew how very different objects appear in one degree of it to what they do in another; ſo that every new object ſhould be viewed in all degrees of light, from the greateſt glare of brightneſs to perfect obſcurity, and that in all poſitions to each degree, till we hit upon the certain form and figure of it. In many objects it is very difficult to diſtinguiſh between a prominency and a depreſſion, a black ſhadow and a black ſtain, and in colour between a bright reflection and whiteneſs. The eye of a fly in one kind of light appears like a lattice drilled full of holes, in the ſun-ſhine like a ſolid ſubſtance covered with pyramids, in another with cones, and in others with ſtill different ſhapes.

The degrees of light muſt always be ſuited to the object; if that be dark, it muſt be ſeen in a full and ſtrong light; but if tranſparent, the light ſhould be proportionably weak; for which reaſon there is a contrivance both in the ſingle and double microſcope to cut off abundance of the rays, when ſuch tranſparent objects are to be examined by the largeſt magnifiers. The light of a candle for many objects; and eſpecially for ſuch as are very bright and tranſparent, and very minute, is preferable to day-light: for others a ſerene day-light is beſt; but ſun-ſhine is the worſt light of all, for it is reflected from objects with ſo much glare, and exhibits ſuch gaudy colours, that nothing can be determined from it with any certainty.

Moſt objects require alſo ſome management, in order to bring them properly before the glaſs. If they are flat and tranſparent, and ſuch as will not be injured by preſſure, the beſt way is to incloſe them in ſliders between two Muſcovy talcs or iſinglaſſes, as in *Fig.* 17. Plate III. Microſcopic Apparatus. In this way the feathers of butterflies, the ſcales of fiſhes, and the farinæ of flowers, may be very conveniently preſerved, as alſo the parts of inſects, the whole bodies of minute ones, and a great number of other things. Theſe are to be kept in ſliders, each containing three, four, or more holes, and theſe muſt not be filled promiſcuouſly: but all the things preſerved in one ſlider ſhould be ſuch as require one and the ſame magnifying power to view them, that there may not be a neceſſity of changing the glaſſes for every object, and the ſliders ſhould be marked with the number of the magnifier it is proper to be viewed with. In placing the objects in the ſliders, it is always proper to have a ſmall magnifier, of about an inch focus, in your hand, to examine and adjuſt them by, before they are fixed down with the rings.

Small living objects, ſuch as lice, fleas, bugs, mites, minute ſpiders, &c. may be placed between theſe talcs without injuring them, if care be taken to lay on the braſs rings without preſſing them down, and they will remain alive many weeks in this manner; but if they are too large to be treated thus, they ſhould be either preſerved between two concave glaſſes, or elſe viewed immediately, by holding them in the pliers, or ſticking them on the point at the other end of that inſtrument. If fluids come under examination, to diſcover the animalcules in them, a ſmall drop is to be taken with a hair-pencil, as in *fig*. 14, or on the nib at the end of it, and placed on a plate of glaſs; and if they are too numerous to be thus ſeen diſtinctly, ſome water warmed, by holding it in the mouth, muſt be added to the drop, and they will then ſeparate and be ſeen diſtinctly. This is particularly neceſſary in viewing the animalcules in the *ſemen maſculinum*, of all creatures; which, though extremely minute, are always ſo numerous, that without this caution their true form can ſeldom be ſeen. But if we are to ſee the ſalts in a fluid, the contrary method muſt be obſerved, and the plate of glaſs muſt be held gently over the fire, till part of the liquor is evaporated.

The diſſection of minute animals, as lice, fleas, &c. requires patience and care; but it may be done very accurately by means of a needle and a fine lancet, placing the creature in a drop of water, for then the parts will readily unfold themſelves, and the ſtomach, guts, &c. be very diſtinctly ſeen. Theſe ſeem the beſt ways of preſerving tranſparent objects; but the opake ones, ſuch as ſeeds, woods, &c. require a very different treatment, and are beſt preſerved and viewed in the following manner:

Cut cards into ſlips about half an inch long, and a tenth of an inch broad; wet theſe half way of their length in gum-water, and with that faſten on ſeveral pieces of the object, and as the ſpots of cards are of different colours, ſuch ſhould be choſen for every object as are the moſt different from its own colours. Theſe are very convenient for viewing by the *microſcope* made for opake objects with the ſilvered ſpeculum; but they are proper for any *microſcope* that can view opake bodies.

Great caution is to be uſed in forming a judgment on what is ſeen by the microſcope, if the objects are extended or contracted by force or dryneſs. Nothing can be determined about them, without making the proper allowances; and different lights and poſitions will often ſhew the ſame object very different from itſelf. There is no advantage in any greater magnifier than ſuch is capable of ſhewing the object in view diſtinctly; and the leſs the glaſs magnifies, the more pleaſantly the object is always ſeen. The colours of objects are very little to be depended on, as ſeen by the microſcope; for the ſeveral component particles being by this means removed to great diſtances from one another, may give reflections very different from what they would, if ſeen by the naked eye.

The motions of living creatures alſo, or of the fluids contained in their bodies, are by no means to be haſtily judged of, from what we ſee by the microſcope, without due conſideration; for as the moving body, and the ſpace wherein it moves, are magnified, the motion muſt be ſo too; and therefore that rapidity with which the blood ſeems to paſs through the veſſels of ſmall animals muſt be judged of accordingly. Suppoſe, for inſtance, that a horſe and a mouſe move their limbs exactly at the ſame time, if the horſe runs a mile while the mouſe runs fifty yards; though the number of ſteps are the ſame in both, the motion of the horſe muſt notwithſtanding be allowed the ſwifteſt; and the motion of a mite, as viewed by the naked eye, or through the microſcope, is perhaps not leſs different. Baker's Microſcope, p. 52. 62.

The *frog* affords the curious in microſcopic obſervations, a very beautiful view of the circulation of the blood; but the method of examining it to advantage was never hit upon till the contrivance of the late ingenious Dr. Stuart for that purpoſe. This he did by the ſolar microſcope in the following manner. The looking-glaſs, tube, and convex lens, are the ſame in this, as in the common ſolar microſcope; but inſtead of the little pocket microſcope of Wilſon, he uſed the belly-part of the common large reflecting one, fixed horizontally on a pedeſtal, juſt at an equal height with the tube. This ſtands on a little ſhelf made to ſupport it; and to its ſnout, which lies on a level with the tube, the magnifiers are ſcrewed: the object being extended and faſtened with ſtrings and pins on a frame contrived for that purpoſe, is applied between the tube and the magnifier, whereby the ſun's rays, reflected from the looking-glaſs, through the tube, upon the object, paſs on through the magnifier, and exhibit upon the ſcreen an image of the object moſt prodigiouſly enlarged. Baker's Microſ. p. 132.

To view a *frog* with this apparatus, the ſkin of the belly is to be opened from near the anus to the throat, and then giving it a little ſnip ſide-ways both at the top and bottom, and ſticking a fiſh-hook into each corner of the ſkin, it was eaſily extended before the microſcope, and ſhewed on the ſcreen the moſt beautiful view imaginable of the veins and arteries of the ſkin, with the blood circulating through them. In the arteries thus viewed, the blood is ſeen to ſtop, and recede a little at every pulſation by the dilatation, and ruſh forcibly on again by the contraction of the heart; while in the veins it ever kept the ſame equable and uniform current, with a ſurpriſing rapidity; and when the ſcreen was removed farther back, and the object by that means more enlarged, the alternate expanſion and contraction of the ſides of the arteries were very viſible. After this, the abdomen of the *frog* being opened, and the muſcles of it being extended before the microſcope in the ſame manner as the ſkin was, the ſtructure of theſe muſcles is beautifully ſeen; being all made up of bundles of tranſparent ſtrings of fibres, all lying parallel to one another, and joined by a common membrane.

Theſe ſtrings or fibres appeared alſo through their whole length made up of roundiſh veſicles, and reſembled ruſhes divided longitudinally; but there is no certainty of any circulation being ſeen in theſe.

When this has been ſufficiently examined, part of the creature's guts being pulled out and extended with the meſentery, there is ſeen the fineſt of all views of the circulation of the blood. Words are not able to deſcribe this wonderful ſcene. The blood is ſeen paſſing through numberleſs veſſels at one and the ſame inſtant, in ſome one way, and in others directly the contrary. Several of the veſſels are thus magnified to more than an inch in diameter, and the globules of the blood rolling through them, appear near as large as pepper-corns; while in many of the minuteſt veſſels only ſingle globules were able to find their paſſage, and that too by changing their ſhape into an oblong ſpheroid. The pulſation and acceleration of the blood in the arteries are thus alſo very beautifully ſeen. As the animal under examination grows languid and near expiring, the blood in the arteries will often ſtop on a ſudden, and ſeem as if it were coagulating, and will then run back for ſome time; after which it will recover its natural courſe with a great deal of rapidity. A due conſideration of theſe particulars may poſſibly account for the intermiſſions, ſtarts, and irregularities, in the pulſe of perſons near death. Baker's Microſcope, p. 136.

EXPLANATION OF THE PLATES ON MICROSCOPIC OBJECTS. PLATE I.

Fig. 1. *The Hydra Griſea* Polype is about three-fourths of an inch when ſtretched out; ſome are found an inch and a half long. It can be made to contract itſelf either by touching, or agitating the water in which it is contained. It contracts itſelf ſo much when taken out of the water, as to appear only as a lump of jelly. It can contract or extend its arms without extending or contracting its body, or the body without making any alterations in the arms: or it can contract or dilate only ſome of the arms independent of the reſt; it can alſo bend the body and arms in all poſſible directions.

Fig. 2. The Hydra Polype repreſented in this figure, is with its arms hanging down, making different turns and returns, often directing ſome of them back again to the top of the water. It can alſo dilate the body at different places, ſometimes at one part and then again at another; ſometimes they are thick ſet with folds, which if careleſsly viewed might be taken for rings.

Fig. 3. A Polype ſuſpended in the water by a piece of packthread, a millipedes ſeized by it, and drawn towards its mouth by one of its arms, while another is employed in ſeizing a ſmall aequatic inſect.

Fig. 4. repreſents a Polype engaged with a very large worm.

Fig. 6. repreſents a Polype that has ſwallowed a ſmall fiſh, and taken the ſhape of it.

Fig. 7. is a Polype that has ſwallowed a worm, which from its tranſparency may be diſtinctly ſeen in this figure. The worm is at firſt macerated in the ſtomach of the Polype, and when the nutritious juices are ſeparated from it, the remainder is diſcharged by the mouth. It is with theſe as with other voracious animals, as they eat a great deal at once, ſo alſo they can faſt for a long time: the hiſtory of inſects furniſhes us many examples of this kind.

Fig. 8. repreſents the Hydra viridis Polype adhering to the common pond weed. The arms of this polype are ſeldom longer than their bodies.

Fig. 5. From this figure of the Hydra Polype the reader may form an idea of the promptitude with which theſe creatures increaſe and multiply; the whole groupe formed by the parent and its young was about an inch and an half long, and one inch broad, the arms of the mother and her nineteen little ones hanging down towards the bottom of the veſſel: the animal would eat about twelve monoculi per day, and the little ones about twenty among them, or rather more than thirty for the groupe.

Of the Re-production of Polypes.

A Polype cut tranſverſely or longitudinally in two or three parts, is not deſtroyed; each part becomes in a little time a perfect Polype. This ſpecies of fecundity is ſo great in theſe animals that even a ſmall portion of their ſkin will become a little Polype; a new animal riſing as it were from the ruins of the old, each ſmall fragment yielding a Polype. If the young ones are mutilated while they grow upon the parent, the mutilated parts are re-produced;

Microscopical Objects. Class 1, Animal Subjects; Hydra or Polypes

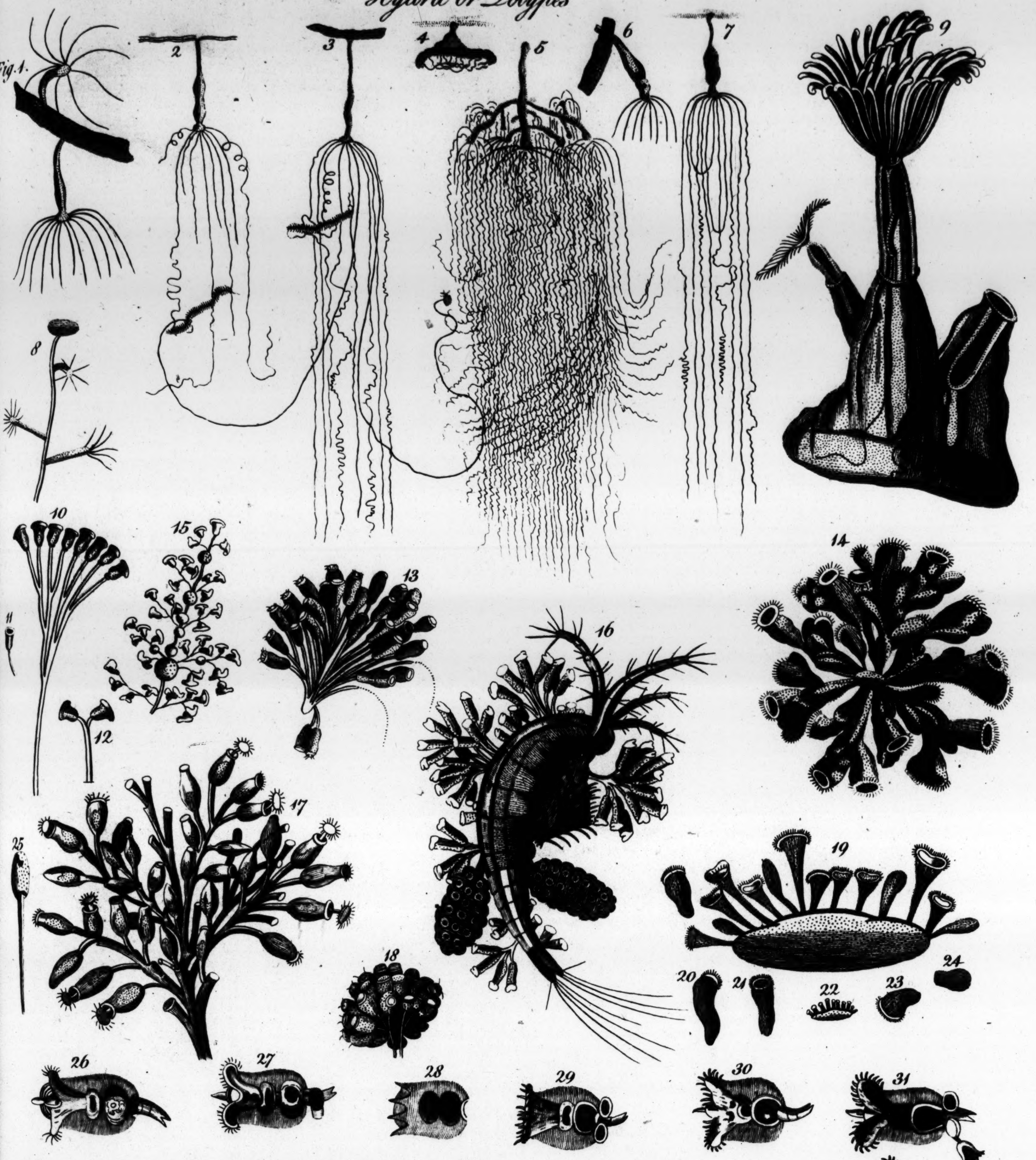
Fig. 1.
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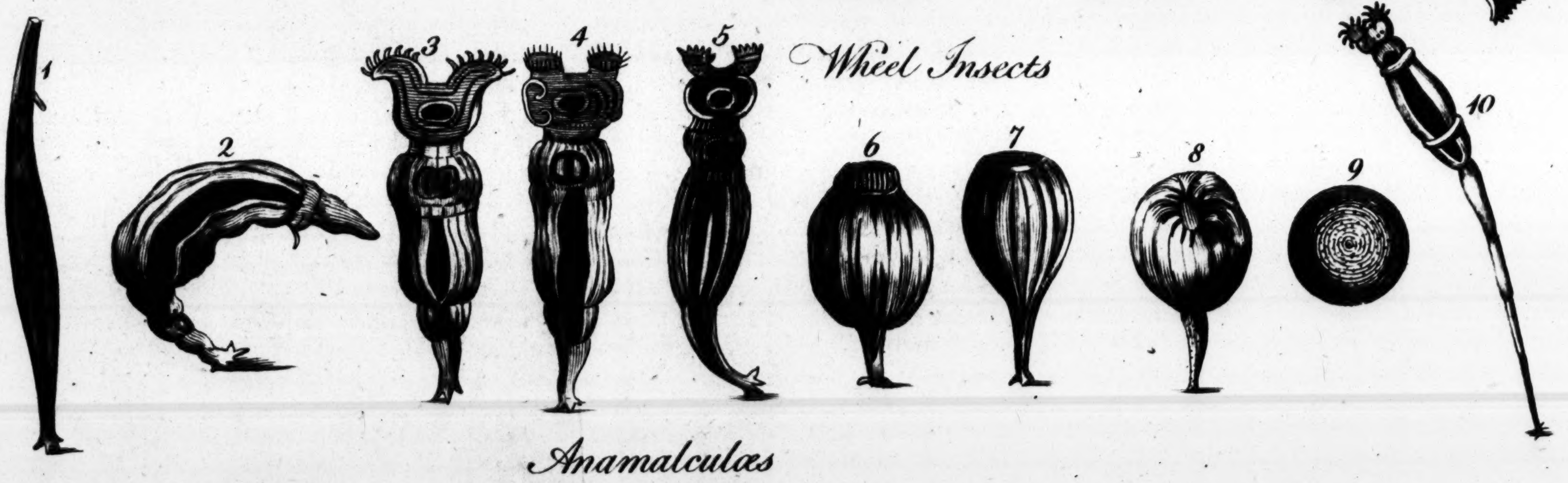
Wheel Insects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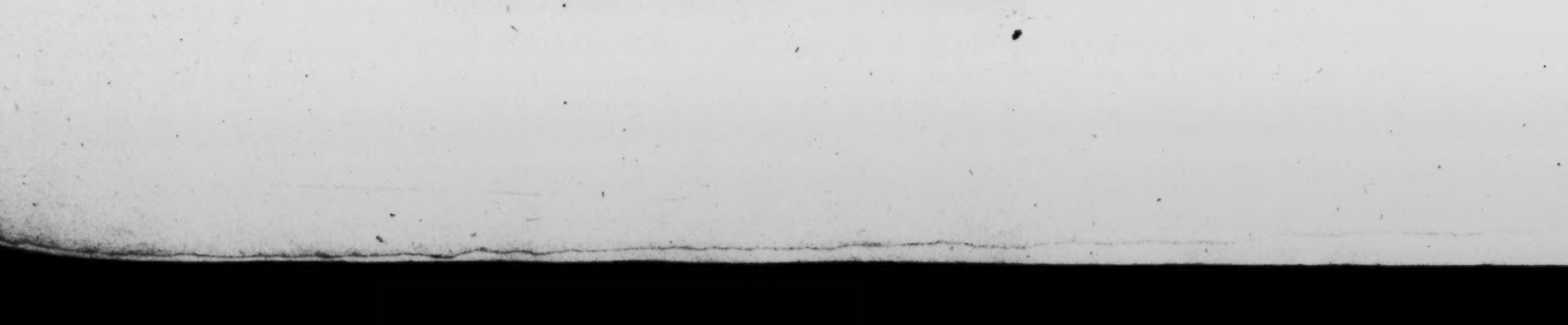
Anamalculæs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duced; the ſame changes ſucceed alſo in the parent. A truncated portion will put forth young before it is perfectly formed itſelf, or has acquired its new head and tail; ſometimes the head of the young one ſupplies the place of that which would grow out of the anterior part of the trunk.

If a Polype is ſlit, beginning at the head, and proceeding to the middle of the body, a Polype will be formed with two heads, and will eat at the ſame time with both. If the Polype is ſlit into ſix or ſeven parts, it becomes an Hydra, with ſix or ſeven heads. If theſe are again divided, we ſhall have one with fourteen; cut off theſe, and as many new ones will ſpring up in their place, and the heads thus cut off will become new Polypes, of which ſo many new Hydras may again be formed: ſo that in every reſpect it exceeds the fabulous relation of the Lernean Hydra.

As if the wonders already related of the Polype were not ſufficient to engage our attention to theſe ſingular animals; new circumſtances, as ſurprizing as the foregoing, preſent themſelves to convince us of the imperfections of our ideas of animality, and of the greatneſs of the power of the Creator, who is the ſource and origin of every degree of life, in all its immenſe gradations, as unity is the origin of number, in all its varied ſeries, multiplied proportions and combinations: now as numbers may be conſidered as being recipient of unity, in order to make manifeſt its wonderful powers; ſo the univerſe and its parts are adapted to receive life from the ſource of all life, and thus become repreſentatives of his immenſity and eternity.

The Polypes may be as it were grafted together. If the truncated portions of a Polype are to placed end to end, and then puſhed together with a gentle force, they will unite and form a ſingle one. The union is firſt made by a ſingle thread, and the portions are diſtinguiſhed by a narrow neck, which gradually fills up and diſappears, the food paſſing from one portion to another. Portions not only of the ſame, but pieces of different Polypes, may be thus united together. You may fix the head of one Polype to the trunk of another; and that which is thus produced, will grow, eat, and multiply like another.

There is ſtill another method of uniting theſe animals together, more wonderful in its nature, and leſs analogous to any known principles of animation, and more difficult to perform. It is effected by introducing one within another, forcing the body of one into the mouth of the other, and puſhing it down ſo that their heads may be brought together. In this ſtate it muſt be kept for ſome time: the two individuals are at laſt united, and grafted into each other; and the Polype, which was at firſt double, is converted into one, with a large quantity of arms, and performs all its functions like another.

The Hydra fuſca furniſhes us with another prodigy, to which we know nothing that is ſimilar, either in the animal or vegetable kingdom. They may be turned inſide out like a glove, and notwithſtanding the improbability of the circumſtance, they live and act as before. The lining or coating of the ſtomach, and the former epidermis now conſtitutes the coating of the ſtomach.

Fig. 9. *Tubularia Campanulata*, the bell-flowered, or plumed-animal. Theſe little creatures dwell in colonies together, from ten to fifteen in number, living in a kind of ſlimy mucilaginous caſe, which when expanded in the water, has ſome reſemblance to a bell with its mouth upwards. Theſe bells or colonies are to be found adhering to the large leaves of duck-weed, and other aquatic plants.

The bell or caſe, which theſe animals inhabit, being very tranſparent, all the motions of its inhabitants may be diſcerned diſtinctly through it. There are ſeveral ramifications, or ſmaller bells, proceeding from the larger ones, in each of theſe there is an inhabitant. The opening at the top of theſe bells are juſt large enough for the creature's head and a ſmall part of its body to be thruſt out from it, the reſt remaining in the caſe, into which it alſo draws the head on the leaſt alarm.

Beſides the particular and ſeparate motions which each of theſe creatures is able to exert within its caſe, and independent of the reſt, the whole colony has a power of altering the poſition of the bell, and removing it from one place to another. Theſe animalcula ſeem not to like to dwell in ſocieties whoſe number exceeds fifteen; when the colony happens to encreaſe in number, the bell may be obſerved to ſplit gradually, beginning from about the middle of the upper extremity, and proceeding downwards towards the bottom, till they at laſt ſeparate, and become two colonies independent of each other.

The arms are very near each other, ſixty may often be counted in one plume, having each the figure of an Italic *S*, one of whoſe hooked ends are faſtened to the head; and all together, when expanded, compoſe a figure ſomewhat like a horſeſhoe. When the arms are thus extended, the creature, by giving them a vibratory motion, can produce a current in the water, which brings the animalcula, and other minute bodies that are floating near it, into its mouth, ſituated between the arms. The food if agreeable to the creature, is ſwallowed, if not, it is rejected by a contrary motion. As the ſkin is tranſparent, the animal may be ſeen every way plain when it has retired within the tube.

The body is about one eighth of an inch long, without reckoning the plume. It is cylindrical, and the ſkin is very tranſparent. The plume is only a continuation of this tranſparent ſkin; it is very broad in proportion to the body, and of a remarkable figure; the baſe is of the ſhape of an horſeſhoe, from this baſe the arms project, they bend rather outwards. The plume which they form gives them a reſemblance to ſome flowers. The arms may be compared from their firmneſs and tranſparency to very fine threads of glaſs.

The plumed Polype is very voracious, devouring a great number of ſmall animals. The arms, when obſerved attentively with the microſcope, will be found to bend from moment to moment within-ſide of the plume, and then riſe up again; then another arm performs the ſame: thus by the continued motion of its arms, it puts the water into violent agitation, and brings into its mouth the food whereby it is nouriſhed.

Fig. 10. The *Vorticella Umbellaria*, with ciliated globous marked florets, and an umbellated ſtem; we often find in divers places, upon water, plants and other bodies in water, a whitiſh ſubſtance, that looks like mould; plants, pieces of wood, ſnail ſhells, &c. are often entirely covered with theſe ſubſtances, and often ſo united as to form together a ſort of branches or cluſters, from whence they have been termed cluſtering Polypes.

The length of thoſe repreſented in this figure, is about the 240th part of an inch; they are of a bell-ſhape. The anterior part, as in *fig*. 11, generally appears open; the poſterior part is fixed to a ſtem or pedicle; it is by the extremity of this pedicle that the vorticella fixes itſelf to any ſubſtance. It appears in the microſcope of a browiſh colour, excepting at the bottom where it is tranſparent, as well as the whole pedicle. When the broad part is open, a very lively motion may be perceived about its edges, and when it preſents itſelf in a particular manner, ſomething very much reſembling the little wheels of a mill, moving with great velocity, may be diſcovered on both ſides the edges of this broad part.

Fig. 12. repreſents two Vorticellæ joined by their poſterior extremity to one pedicle; ſoon after the diviſion, each vorticella begins to ſhew a pedicle of its own.

Fig. 10. repreſents a cluſter of eight Vorticellæ; by this figure we may form ſome idea in what manner the pedicles are diſpoſed as their number increaſes. There were at firſt only two that proceeded from the center of the figure; and then divided into four; and as they branched upwards, they then divided into eight.

What unforeſeen, varied, and intereſting ſcenes are preſented within ſo ſmall a compaſs! What a theatre is exhibited to a thinking mind! But our abode is ſo recluſe, that we have but a glimmering view of it: how great would our aſtoniſhment be, if the whole ſpectacle was diſcloſed to us at once, if we were enabled to penetrate into the interior ſtructure of this wonderful aſſemblage of living atoms! Our eyes ſee only the groſs part of the decorations, while the machines that execute them remain in impenetrable darkneſs! Who ſhall enlighten this profound obſcurity, or dive into an abyſs where reaſon is loſt, or draw from thence the treaſures of wiſdom concealed within it? Let us learn to be content with the ſmall portion that is communicated to us, and contemplate with gratitude the firſt traces of human underſtanding that are imparted to us in theſe diſcoveries.

Fig. 13. *Vorticella Pyraria*, is ſomewhat of a pear ſhape, the baſe is pellucid; the top truncated; the lateral arms, which are a pair on each ſide, cannot be diſtinguiſhed without ſome attention; they are ſometimes to be ſeen diſengaged from the pedicle, and rolling ſwiftly in a kind of circle.

Fig. 14. *Hydra Socialis*, this ſpecies of Hydra has been deſcribed by many writers. In this Figure, theſe animals are repreſented as conſiderably magnified; they appear like a circle, ſurrounded with crowns, or ciliated heads, tied by ſmall thin tails to a common center, from whence they advance towards the circumference, where they turn like a wheel, with a great deal of vivacity and ſwiftneſs, till they occaſion a kind of whirlpool, which brings into its ſphere the proper food for the Polype. When one of them has been in motion for a time, it ſtops, and another begins. Sometimes two or three may be perceived in motion together. They are often to be found ſeparate, with the tail ſticking in the mud. The body contracts and dilates very much, ſo as ſometimes to have the appearance of a cudgel, at others to aſſume almoſt a globular form. The young Polypes of this ſpecies have been ſometimes taken for the *Hydra Stentorea*.

Fig. 15. *Vorticella Anaſtatica*. Theſe Polypes form a groupe reſembling a cluſter, or more properly an open flower. This flower, or cluſter, is ſupported by a ſtem, which is fixed by its lower extremity to ſome of the aquatic plants, on extraneous bodies that are found in water; the upper extremity forms itſelf into eight or nine lateral branches perfectly ſimilar to each other; theſe have alſo ſubordinate branches, whoſe collective form much reſembles that of a leaf. Every one of theſe aſſemblages is compoſed of one principal branch or nerve, which makes the main ſtem of the cluſter an angle, ſomewhat greater than a right one; from both ſides of this nerve the ſmaller lateral branches proceed; theſe are ſhorter the nearer their origin is to the principal branch.

At the extremity of the principal branch, and alſo of all the lateral ones, there is a Polype or Vorticella. There are others on both ſides of the lateral twigs, but at different diſtances from their extremity. Theſe Polypes are all exceeding ſmall, and of a bell-like figure: near their mouth a quick motion may be diſcerned, though not without a ſufficient diſtinctneſs to convey an adequate idea of its cauſe, and upon the branches of theſe cluſters are round bodies, which will be hereafter mentioned. Each of theſe branches is bent a little inwards, ſo that all of them taken together form a kind of ſhallow cup. If the eye is placed right over the baſe of this cup, the appearance of the whole eight or nine branches is like unto that of a ſtar, with ſo many rays proceeding from the center; if the cluſter is ſlightly touched, all the branches inſtantly fold up, and form a ſmall round maſs. The ſtem which ſupports the cluſter contracts alſo at the ſame time, folding up, like a workman's meaſuring rule, that conſiſts of three or four joints. This extraordinary aſſemblage conſtitutes one organized whole, formed of a multitude of ſimilar and particular ones. A new ſpecies of ſociety, in which all the individuals are members of each other in the ſtricteſt ſenſe, and all participate of the ſame life.

A few days after one of theſe cluſters is formed, ſmall round bodies or bulbs, may be perceived to protrude in ſeveral places from the body of the branch; theſe grow very faſt, and arrive at their greateſt growth in two or three days. The bulbs detach themſelves from the branches out of which they ſpring, and go away, ſwimming, till they can ſettle upon ſome ſubſtance. Mr. Trembley obſerved from one round bulb, in about twenty four hours, by repeated diviſions, one hundred and ten vorticella to be formed.

Fig. 25. repreſents one of the globular bodies after it has parted from the cluſter, and has fixed itſelf to ſome other body, and after the globule itſelf and its pedicle have begun to lengthen.

Fig. 16. *Vorticella Digitalis.* This ſpecies of the Vorticella is very ſcarce, it ſeems only to have been ſeen by Roeſel, who found it on the monoculus quadricornis, till 1784, when it was diſcovered by Mr. Muller who had ſought for it ſeveral years before in vain. The body is cylindrical, and appears almoſt empty: it has three pellucid points diſpoſed lengthways; the apex is truncated in an oblique direction, the margin bent back. The upper part contracts itſelf, and the margin then aſſumes a conical ſhape, with a convex ſurface; there are in general but few branches from the principal ſtem, and theſe are ſhort and thick, it excites an undulatory motion; but no hairs, nor any rotatory motion have been diſcovered.

Fig. 17. *Vorticella Opercularia.* Theſe vorticellæ are of a lemon ſhape, and are generally found in cluſters, branching out from a ſtem, which moſtly adheres to ſome convenient ſubſtance. That ſpecies of them deſcribed by Mr. Baker had a very ſhort pedicle, and theſe animals were much longer than thoſe repreſented in this figure.

The mouths of theſe animalcula are not ciliated, but they are furniſhed with a round operculum, or cover, connected by a long ligament, or muſcle, which extends downwards through the body, and is affixed within ſide of it, near the tail. This ligament may be contracted or dilated, ſo that the cover may be removed to ſome diſtance from the mouth: in this ſituation ſeveral ſhort hairs may be found to radiate from it: theſe have a vibratory motion, by which they excite a current of water, moſt probably to draw a proper nouriſhment, after which they ſhut or pull down the cover, which they again extend at pleaſure; when the cover is pulled cloſe down, the mouth contracts, and no hairs are to be ſeen.

Fig. 18. *Vorticella Cratægaria.* The figure repreſents a parcel of theſe Vorticellæ united together. Theſe animals are to be found in the month of April, both in the head, and upon the tail of the monoculus quadricornis; they are generally heaped together in the manner they are repreſented in the figure; they are of a ſpherical form, and united to one common ſtalk. They are alſo often to be found without any pedicle; the body is rather contracted, the aperture is circular and ſurrounded with a marked margin; it has two ſmall arms; with a deep magnifier, a vehement rotatory motion may be ſeen; they ſometimes ſeparate from the community, and go forwards in a kind of ſpiral line, and then in a little time come back again to the reſt.

Among the other authorities for this animal, M. Linnæus refers to Mr. Baker's deſcription of the mulberry inſect. "Employment for the Microſcope," page 348, which as it differs a little from the preceding account, we ſhall inſert here. That from which his drawing was made, and which he has deſcribed, was found in a ditch near Norwich: he called it the mulberry inſect, from the reſemblance it bore to that fruit; though the protuberances that ſtand out round it are more globular than thoſe of a mulberry. It is to be ſeen rolling about from one place to another, and is probably a congeries of animalcula. They are to be met with in different numbers of knobs or protuberances, ſome having fifty or ſixty, others more or leſs, down to four or five. The manner of moving is the ſame in all. They are generally of a pale yellow.

Fig. 19. *Hydra Stentorea.* This ſpecies of Hydra is very common, and has been deſcribed by almoſt every writer on theſe ſubjects. They are named by Mr. Baker, and Mr. Trembley, the funnel-like Polype. There are three ſpecies of them, which are of different colours, green, blue, and white. The white ones are the moſt common. It is neceſſary to obſerve them often, and in various attitudes, in order to obtain a tolerable idea of their ſtructure. They do not form cluſters, but adhere ſingly by their tail to whatever comes in their way; their anterior end is wider than their poſterior, and being round gives the animal ſomewhat of a funnel form. The edge of this opening is furniſhed with a great number of fimbrillæ, which by their briſk and continual motions excite a current of water; the ſmall bodies that float or ſwim near the current, are forced by it into the mouth of the little animal. Mr. Trembley ſays, that he has often ſeen a number of very ſmall animalcula fall one after another into the mouth, ſome of which were afterwards let out again at another opening, which he was not able to deſcribe. They can faſhion their mouths into ſeveral different forms. If any thing touches them they ſhrink back, and contract themſelves. They live independent of each other, ſwimming freely through the water in ſearch of their prey, and fix to any thing they meet with.

From the various methods by which different ſpecies of Polypes are multiplied, we are led to form more exalted ideas of nature; and to ſee that the little we diſcover is but an exceeding ſmall part of her contents. We learn alſo to be more cautious in reaſoning from analogy, and laying down the known for a model to the unknown, becauſe we find that the operations in nature are varied, *ad infinitum*. The growth of the Hydra Fuſca is very quick, but that of the Hydra Stentocea is much more ſo. The progreſs of the fœtus is always more rapid than that of the infant and adult animal; but in theſe organized atoms, the evolution is ſo rapid, as to appear almoſt like an immediate creation.

Fig. 22. repreſents the Hydra Stentorea, or funnel Polype, fixed to the upper ſide of a piece of ſome vegetable ſubſtance; they are in this figure of their *natural* ſize.

Fig. 19. The ſame Polype magnified; the different forms they aſſume are alſo ſeen here, ſometimes ſhort and thick, as in *fig.* 23, ſometimes nearly globular, as in *fig.* 24; extended to the full ſize as in the upper part of *fig.* 19.

Vorticella Urceolaris.

Fig. 26, 27, 28, 29, 30, 31. This animal has been ſeen and deſcribed by moſt microſcopical writers; but as Mr. Baker ſeems to us to be the moſt perfect, we ſhall principally follow his account of it. He diſcovered three ſpecies of them, two of them which are included under the Vorticella Urceolaris, *fig.* 26, 27, 28, are of the firſt ſpecies; *fig.* 29, 30, 31, are of the ſecond ſpecies. The firſt ſort, when extended, is about twice as long as it is broad. It is contained in a ſhell, the fore part of this is armed with four ſharp teeth or points; the oppoſite ſide has no teeth, but is waved or bent in two places, like the form of a Turkiſh bow. At the bottom there is a hole, through which paſſes the tail. It faſtens itſelf by this tail to another convenient ſubſtance, when it intends to uſe its rotatory organs; but when it is floating in the water, and at all times when not adhering to any body, it wags the tail backwards and forwards, ſomething like a dog. We may conſider it as divided into a head, thorax, and abdomen; each of which may be extended and contracted conſiderably. The head when extended, divides itſelf into two branches, between which another part, a kind of proboſcis, is puſhed out; at the end of this are two fibres, that appear when they are at reſt like a broad point, but which can be moved to and from each other very briſkly without a vibratory motion. See *fig.* 26.

The form and ſituation of the two branches is ſometimes changed, the ends thereof becoming more round, the vibratory motion is altered to a rotatory one; this alteration is repreſented at *fig.* 27; the head alſo appears in this figure. The thorax is annexed to the lower part of the head; it is muſcular, within it there is a moving inteſtine, which has been ſuppoſed to be either the lungs or the heart of the little creature.

The tail has three joints, and is cleft or divided at the extremity, by which means it can better faſten itſelf to ſuitable objects. It is in general projected from the lower end of the ſhell, moving nimbly to and fro, ſerving the animal as a rudder, when it is ſwimming, to direct its courſe.

When the water in which this little animal is placed is nearly dried away, or when it has a deſire to compoſe itſelf to reſt, it contracts the head and fore part of the body, and brings them down into the ſhell, and pulls the tail upwards, ſo that the whole of this minute creature is contained within the ſhell. See *fig.* 28. The ſhell is ſo tranſparent that the terminations cannot be eaſily diſtinguiſhed when the animal is extended; but whatever is tranſacted within the ſhell, is as plain as if there was no ſubſtance between the eye and the interior parts.

Fig. 29. 30, 31, exhibit the appearance of another ſpecies of theſe animals which differ from the foregoing kind. This ſpecies has alſo a head, a thorax, and abdomen. Like the other ſpecies, it draws the head and tail within the ſhell, which then appears to have ſix teeth or ſpikes on one ſide, and two on the other: it very ſeldom protrudes its head ſo far out as the other; ſometimes the fimbrillæ may be ſeen within the margin of the ſhell.

Both ſpecies carry their young in an oval integument or bag, faſtened externally to the lower part of the ſhell, ſomewhere about the tail; theſe bags are ſometimes opake at one end, and ſeemingly empty at the other: ſee *fig.* 27; ſometimes the middle is opake with a tranſparent margin; ſee *fig.* 29.

It is highly entertaining to ſee a young one burſt its integument, and gradually force its way out: in performing this operation, it is much aſſiſted by the motion of the tail of the parent. The head comes out firſt; it then ſets its rotatory organ in motion, by which it is completely diſengaged, leaving the integument behind, which the vorticella freed itſelf from, by repeated ſtrokes with its tail. A young one almoſt diſengaged is ſeen at the bottom of the right ſide of *fig.* 31; another embryo is ſeen at the bottom of the left ſide of the ſame figure.

TRICHODA OR WHEEL INSECTS.

Fig. 1 and 5. *Trichoda Charon.* The body is oval. It reſembles a boat both in ſhape and motion, the upper part hollowed, the under part furrowed and convex, the ſtern round, with ſeveral hairs projecting from it. Several hairs may alſo be ſeen in one ſide. It is found in ſalt water. Near the middle of the left ſide of *fig.* 5, is a pellucid bubble that is ſometimes to be ſeen.

Fig. 2. *Trichoda Cyllidium.* Pellucid, replete with globules of different ſizes in the hind extremity, the fore part narrower, without any footſteps of an external organ. It vacillates upon the edge, commonly advancing on its flat ſide, continually drawing up water, it then gapes, opens into a very acute angle, almoſt to the middle of the body. It is difficult to be perceived, as it effects this in an inſtant.

Fig. 3. *Trichoda Pulex.* With an inciſion in the fore part; the front and the baſe hairy.

Fig. 4. *Trichoda Vermicularis.* Long cylindrical Trichoda, with a ſhort neck; the apex hairy. Gelatinous; the fore part pellucid, the hind part full of molecules. It was found in river water. It is repreſented in different apperances in the figure.

Fig. 6. *Trichoda Melitea.* Oblong ciliated Trichoda, with a dilatable neck, the apex globular, and ſurrounded with hairs; the edge is ciliated, and a kind of periſtaltic motion may be perceived. It is very rarely found, and even then in ſalt water.

Fig. 7. *Kerona Cypris.* This animalculum is compreſſed and ſomewhat in a pear ſhape; the fore part broad and blunt; the front is furniſhed with ſhort hairs; or little vibrating points inſerted under the edge, ſhorter in the hind part, partly extended ſtrait, partly bent down; the motion is retrograde. It is found in water which is covered with lemna.

Fig. 8. *Kerona Patella.* With one valve, orbicular, cryſtalline, the fore part ſomewhat notched; the fleſhy body lies in the middle of the ſhell; above and below are hairs or horns of different lengths, jutting out beyond the ſhell, and acting inſtead of feet and oars, ſome of which are bent; the ſuperior ones conſtitute a double tranſverſe row.

Fig. 9. *Kerona Vannus.* Oval and rather flat Kerona; one edge bent, the oppoſite edge ciliated.

Fig. 10. *Trichoda Muſculus*, a ſmooth animalculum, the fore part narrow and furniſhed with ſhort hairs, that are continually playing about; underneath the hind-part is a ſmall tail. It is furniſhed with molecular entrails, and moves ſlowly. It is found in infuſions of hay, which have been kept for ſome months.

ANIMALCULA.

Fig. 1. This is the ſame animalculum which was dignified by Mr. Baker, with the name of Proteus, on account of its aſſuming a great number of different ſhapes, ſo as ſcarce to be known for the ſame animal in its various transformations; and indeed unleſs it be carefully watched while paſſing from one ſhape to another, it will often become ſuddenly inviſible.

When water, wherein any ſorts of vegetables have been infuſed, or animals preſerved, has ſtood quietly for ſome days, or weeks, in any glaſs or other veſſel; a ſlimy ſubſtance will be collected about the ſides; ſome of which being taken up with the point of a penknife, placed on a ſlip of glaſs, in a drop of water, and viewed through a microſcope, will be found to harbour ſeveral kinds of little animals that are ſeldom ſeen ſwimming about at large. The inſect we are treating of is one of theſe, and was diſcovered in ſuch ſlime-like matter taken from the ſide of a glaſs jar, in which ſmall fiſhes, water ſnails and other creatures had been kept.

Fig. 2. *Enchelis Truncus.* This is the largeſt of this kind of animalcula; the body is cylindrical, mucoſe, grey, long, and rather opake; the fore-part globular, the hind-part obtuſe. Something like three teeth may be ſometimes ſeen to proceed from one of the ſides; it can alter its ſhape conſiderably. Globules of different ſizes may be ſeen within the body: it rolls about ſlowly from right to left.

FIGURES 3, 4, 5. *Vibrio Paxilifer.* This is a wonderful animalculum, or rather a congeries of animalcula. It is inviſible to the naked eye, and conſiſts of a tranſparent membrane, with yellow inteſtines, and two or three viſible points: they are generally found collected together in different parcels from ſeven to forty in number, and ranged in a variety of forms; ſometimes in a ſtrait line, as in *fig.* 5, then forming the concave *fig.* 3, at others moving in a zig-zag direction as in *fig* 4. When at reſt they are generally in a quadrangular form, and found in great plenty with the ulva latiſſima. This little animal is extremely ſlender, and not uncommonly one hundred and fifty times longer than broad. Its reſemblance to an hair induced Mr. Baker to call it the hair-like inſect. The body or middle part which is nearly ſtrait, appears in ſome compoſed of ſuch parallel rings as the wind-pipe of land animals conſiſts of; but ſeems in others ſcaled, or rather made up of rings that obliquely croſs each other. Its two ends are bent or hooked nearly in the ſame degree, but in a direction contrary to each other; and as no eyes can be diſcerned, it is difficult to judge which is the head or tail. All its motions are extremely ſlow, and require much patience and attention in the obſerver. It has neither feet, nor fins, nor hairs; but appears perfectly ſmooth and tranſparent, with the head bending one way, and the tail another, ſo as to be like a long Italic *S*, nor is any internal motion, or particular opake part, to be perceived, which may determine one to ſuppoſe it the ſtomach, or other of the inteſtines.

Theſe creatures are ſo ſmall, that millions of millions might be contained in an inch ſquare. When viewed ſingly, or ſeparated from one another, they are exceedingly tranſparent, and of a lovely green; but like all other tranſparent bodies, when numbers of them are brought together they become opake, and loſe their green colour in proportion as the quantity increaſes, till at laſt they appear entirely black. Notwithſtanding the extreme minuteneſs of theſe animalcula, they ſeem to be fond of ſociety; for on viewing for ſome time a parcel of them taken up at random, they will be ſeen to diſperſe themſelves in a kind of regular order. If a multitude of them are put into a jar of water, they will form themſelves into a regular body, and aſcend ſlowly to the top; where, after having remained ſome time expoſed to the air, their green colour changes to a beautiful ſky-blue: when they are weary of this ſituation, they form themſelves into a kind of rope: a ſmall quantity of the matter containing theſe creatures, having been put into a jar of water; it ſo happened, that one part went down immediately to the bottom, whilſt the other continued floating on the top: after ſome time, each of theſe ſwarms of animalcula began to grow weary of its ſituation, and had a mind to change its quarters. Both armies, therefore, ſet out at the ſame time, the one proceeding upwards, and the other downwards; ſo that after ſome hours journey they met in the middle. A deſire of knowing how they would behave on this occaſion, engaged the obſerver to watch them carefully; and to his ſurprize he ſaw the army that was marching upwards, open to the right and left to make room for thoſe that were deſcending. Thus, without confuſion, or intermixture, each held on its way; the army that was going up marching in two columns to the top, and the other proceeding in one column to the bottom; as if each had been under the direction of wiſe leaders.

Fig. 6. *Trichoda Sol.* This ſplendid creature conſtitutes a peculiar genus. It is a little cryſtalline round corpuſcle, the upper part convex: it is beſet with innumerable diverging rays, which are longer than the body, proceeding from every part of its ſurface: in the inſide are ſimilar molecules. The body contracts and dilates itſelf, the animalculum remaining confined to the ſame ſpot. It was found in water, which had been kept for three weeks.

Fig. 7. *Anguillula Glutinis, or Paſte Eel.* Theſe eels are in general of a large ſize, and may be ſeen with a common magnifying glaſs, being about one thirtieth of an inch in length, and one hundred and fortieth broad. This figure repreſents one of them magnified about one hundred and twenty times; they are in general of a bright cheſnut colour, the extremity is whiter and more tranſparent than the reſt of the body. One end is rather round and the other is pointed. A diſtinguiſhing mark of theſe little creatures is a row of tranſparent globules, which are placed at intervals, through the whole length of the body. They are in diameter rather leſs than one third of the body. Another peculiar mark is a ſmall lunar-tranſparent ſpace near the middle of the body. This part is tranſparent, and is free from the coloured matter of the inteſtines; there is a neck in the inteſtines near this ſpace, which confines them to one part of the body.

The principal phænomena of blighted wheat is probably owing to theſe animalcula, which prevent the regular circulation of the ſap. They increaſe in their ſize in a certain proportion to the plant, ſo that at laſt they may be obſerved with great eaſe by the naked eye, being two tenths of an inch long and nearly one tenth in diameter.

A moſt ſatisfactory view of theſe eels is obtained by examining them with the ſolar microſcope; it affords one of the moſt ſurprizing and magnificent ſpectacles: two generations may be often ſeen, one which draws near the allotted period of its exiſtence; and another which only begins to enjoy the bleſſings of life. Some arrive at their full growth, others are quite ſmall, &c. In ſome we may perceive the young animalcula in motion in the eggs, in others no ſuch motion can be obſerved; with a variety of other circumſtances too tedious to enumerate, though they afford great pleaſure to the ſpectator.

One of the moſt remarkable circumſtances in theſe animalcula is the faculty they have of receiving again the powers of life, after having loſt them for a conſiderable time; for inſtance, when ſome of theſe blighted grains, that have been preſerved for many years, have been ſoaked in water for ten or twelve hours, you will find in it living eels of this ſpecies; if the water evaporates or begins to fail, they ceaſe to move; but on a freſh application will be again revived. It may be proper to notice here, that according to the obſervations of M. Roffredi, thoſe eels which have done laying eggs are incapable of being reſuſcitated upon being moiſtened; the ſame ſeems alſo to be the caſe with thoſe that are very young; it is probable they muſt attain a certain age and degree of ſtrength before they are endowed with this wonderful faculty.

Fig. 8. *Trichoda Orbis*, is orbicular ſmooth and pellucid, a little notched in the forepart; the hairs, which are longer than uſual, occupy this inciſion; the reſt of the margin has no hairs: the whole is compoſed of veſicular molecules.

Fig. 10. *Gonium Pectorale.* Theſe ſixteen little oval bodies are nearly equal in ſize, of a greeniſh colour, pellucid, and ſet in a quadrangular membrane, like the jewels in the breaſt plate of the high-prieſt, reflecting light on both ſides. Its animality is evinced by its ſpontaneous motion, advancing alternately towards the right and left: theſe little bodies ſeem oval when in motion, round when at reſt; the four interior ones are a little larger than the reſt. Found in pure water.

Fig. 11. *Vorticella Polypina.* Compound Vorticella, truncated with a bending, branching ſtalk. When viewed with a ſmall magnifier, they appear like ſo many little trees, the upper part, or heads are egg ſhaped, the top truncated, the lower part filled with inteſtines; the branches are thick ſet with little knobs.

Fig. 12. *Kolpoda Cucullus.* It is very pellucid, with a well defined margin, filled with little bright veſicles, differing in number and ſize. The figure of the moſt part is oval, the top bent into a kind of an obtuſe beak, ſeldom an acute one, but ſometimes oblong. Its inteſtines are formed of from eight to twenty four bright little veſicles, theſe are not conſpicuous in their young ones; ſome have ſuppoſed that there were animalcula that had been ſo allowed by the Kolpoda; but Mr. Muller thinks they are of the offſpring of the Kolpoda. In ſome only one cryſtalline veſicle occupies the middle of the body. When the water is almoſt exhaled, and death nigh, it moves more ſlowly than uſual, and protrudes its offſpring with violence. It moves in general with great vivacity and in all directions. It is found in infuſions of vegetables and in fœtid hay.

Fig. 13, 14, 16. *Vorticella Polymorpha.* Many ſhaped vorticella, green, opake. To the naked eye it appears as a moſt agile green point: when viewed by the microſcope, it puts on every moment ſo many and ſuch various forms that they can neither be exhibited to the eye by drawing, nor deſcribed by words: it is truly one of the wonders of nature, aſtoniſhing the mind, fatiguing the eye, and exciting the admiration of the ſpectator. The figures repreſent it in three different forms: 13 is the forepart; 14 the hind part; and 16 the fore part turned in or doubled. The body is granulous; a ſeries of pellucid points is ſometimes to be obſerved.

Fig. 15. *Vorticella Naſuta.* This animalculum is inviſible to the naked eye, but when it is armed with microſcopic lenſes, it appears curiouſly furniſhed with a rotatory organ, which encompaſſes the middle of the body. It is pellucid, cylindrical, of an unequal ſize, the fore part truncated and ciliated, and a triangular prominency in the middle of the aperture; the hind part obtuſe, a point on each ſide of the middle of the body. This is the appearance of this little creature when in motion; but when the water is nearly exhaled, ſome further parts of its ſtructure are rendered viſible: beſides the rotatory organ in the anterior part, another is now diſcovered encompaſſing the middle of the body; the hairs of this are in vehement motion. There are other faſcicles of moving hairs to be diſcovered at the ſame time. The variegated and quick motion of this apparatus, (more particularly if the animal is big with young, and moving at the ſame time within the mother) fill the mind with amazement.

Fig. 17. *Trichoda Cometa.* Spherical, the fore-part hairy, with an appendant globule. It is a pellucid globule, replete with bright inteſtines, the fore part furniſhed with hairs, the hind part with a pellucid appendant globule.

Fig. 18. *Trichoda Cimex.* The body is oval, the back convex; the belly flat; an inciſion in the edge of the fore part; the edges of this inciſion are ſeen to move. Its inteſtines are pellucid. It both ſwims and walks. When it meets with any obſtacles, four ſmall briſtles, which are fixed underneath, come into view; theſe it uſes as feet.

Deſcription of PLATE II. *which repreſents* MICROSCOPIC OBJECTS *in their natural Size, and as they appear when magnified.*

PLATE II. FIG. I. *Leucoſpis Dorſigera, mentioned in the Plate as a nondeſcript Inſect.* This very beautiful and ſingular inſect was firſt pointed out to Mr. Adams, (from whom we are favoured with the deſcription) by Mr. Marſham, who had ſeen it in the cabinet of inſects belonging to the Queen, in the royal obſervatory at Richmond. Her Majeſty was pleaſed to permit Mr. Adams to have the drawing taken from it, from which this Figure was engraved. When Mr. Marſham firſt ſaw it at Richmond, he conſidered it as an undeſcribed inſect, and an antique in this country. But he has ſince found that it is mentioned by Fabricius in his Syſtema Entomologiæ, as a new genus, under the name of Leucoſpis Dorſigera, and there is one of the inſects in the cabinet of the celebrated Linnæus, now in the poſſeſſion of T. E. Smith, M. D. F. R. S.

It appears at firſt ſight like a waſp, to which genus the folded wings would have given it a place, had not the remarkable ſting or tube on the back removed it from thence. It is probably a ſpecies between and uniting the ſphex and waſp, in ſome degree partaking of the characters of both. The antennæ are black and cylindrical, increaſing in thickneſs towards the extremity; the joint neareſt the head is yellow; the head is black, the thorax alſo is black and encompaſſed round with a yellow line, and furniſhed with a croſs one of the ſame colour, near the head. The ſcutellum is yellow, the abdomen black with two yellow bands, and a ſpot of the ſame colour on each ſide between the bands. A deep black poliſhed groove extends down the back from the thorax to the anus, into which the ſting turns and is depoſited, leaving the anus very circular. A yellow line runs on each ſide the ſting. The anus and the whole body, when viewed with a ſhallow magnifier, appear punctuated: theſe points, when examined in the microſcope, appear hexagonal, and in the center of each hexagon a ſmall hair is to be ſeen. The feet are yellow with black ſpots. The inſect is found in Italy, Switzerland, France and Germany. The principal Figure in the Plate ſhews this beautiful Inſect very much magnified: above it is the object of its real ſize.

Fig. 2. *Chryſomela Aſparagi.* This common though elegant Inſect of the Coleoptera claſs, is repreſented as ſeen in the lucernal microſcope, and in its natural ſize, as above. It is called by Linnæus, Chryſomela Aſparagi, from the larva feeding on the leaves of that plant. Its figure is oblong, the antennæ black, compoſed of many joints nearly oval. The head is a bright but deep blue, the thorax red and cylindrical, the elytra blue, with a yellow margin, with three ſpots of the ſame colour on each, one at the baſe of an oblong form, and two united with the margin. The legs are black, but the under ſide of the belly is of the ſame colour with the elytra and head. This little animal, when viewed by the naked eye, ſcarcely appears to deſerve any notice; but when examined by the microſcope, is one of the moſt pleaſing opake objects we have. This inſect is found in June on the aſparagus, after it has run to ſeed.

Fig. 3. *Pediculus or Louſe.* Various as are the antipathies of mankind, all ſeem to unite in their diſlike to this animal, and to regard it as their natural and moſt nauſeous enemy. "Whenever wretchedneſs, diſeaſe, and hunger ſeize upon man, the louſe ſeldom fails to add itſelf to the tribe, and to increaſe in proportion to the number of his calamities."

When the human louſe is examined by the microſcope, its deformity fills us with diſguſt. In the head we may diſtinguiſh two fine black eyes, near this are the two antennæ; the fore part of the head is rather long; the hinder more obtuſe or rounder; there is a ſmall part that projects from the noſe or ſnout; this ſerves as a ſheath or caſe to the proboſcis, which the creature thruſts into the ſkin to draw out the blood and humours which are its deſtined food; for it has no mouth that opens in the common way.

This proboſcis has been eſtimated to be ſeven hundred times ſmaller than a hair, and is contained in another caſe within the firſt, and can be drawn in or thruſt out at pleaſure; the ſkin is hard and tranſparent. From the under ſide proceed ſix legs, each of which has five joints, and terminates in two unequal hooked claws, as well as all over the legs; the body finiſhes in a cloven tail, which is generally covered and partly concealed by hairs.

From the extreme tranſparency of its ſkin, many of its internal parts may be ſeen, as the various ramifications of the veins and arteries, and the periſtaltic motions of the guts. When the louſe feeds, the blood is ſeen to ruſh like a torrent into the ſtomach, and its greedineſs is ſo great, that the excrement contained in the inteſtines is ejected at the ſame time, to make room for this new ſupply. There is ſcarce any animal that multiplies ſo faſt as this unwelcome intruder; the moment it is excluded from the egg, it begins to breed. It would be endleſs to deſcribe the various creatures which go under the name of lice, and ſwarm upon every part of nature. The reader who wiſhes for a more particular account of thoſe which infeſt various animals is referred to Rhedi's Treatiſe, *De Generatione Inſectorum.*

Fig. 4. *The Lobſter Inſect.* This extraordinary little creature was found by a curious gentleman of Edmonton. He was at the New Inn, Waltham Abbey, where it was ſeen by ſome labouring men who were drinking their ale. The man who firſt perceived it thought it was of an unuſual form; this occaſioned a nicer inſpection, and it was ſuppoſed to be a louſe with unuſual long horns; others thought it was a mite. This occaſioned a debate, which drew the attention of the gentleman, who obtained the inſect from them for further obſervation. Mr. Martin has given ſome account of it in the third Volume of "The Young Gentleman and Lady's Philoſophy." Mr. Adams favoured us with the inſect, that an accurate drawing might be taken from it, which I thought would be highly pleaſing, not only to the lovers of microſcopic obſervations, but alſo the entomologiſt. It appears to be quite a diſtinct ſpecies from the phalangium cancroides of Linnæus, of which a good drawing has been given by Hook, Roeſel, Schœfer, &c. not one however of the deſcriptions agrees with the animal under conſideration. The abdomen of this is more extended, the claws are larger and much more obtuſe; the body of the other being more orbicular, the claws ſlender, and finiſhing almoſt in a point, more tranſparent and of a paler colour. It is very probable that there are ſeveral ſpecies nearly ſimilar. Mr. Marſham, ſecretary to the Linnæan Society, who favoured us with a Syſtem of Entomology, has two of theſe animals in his poſſeſſion, one like the drawings of Reaumur; the other not to be diſtinguiſhed from that repreſented in the Figure, except that it wants the beak or dent in the claws, which is ſo conſpicuous in this. Mr. Marſham found his fixed by its claws to the thighs of a large fly, which

Microscopic Objects in their natural Size, and as they appear when magnified.

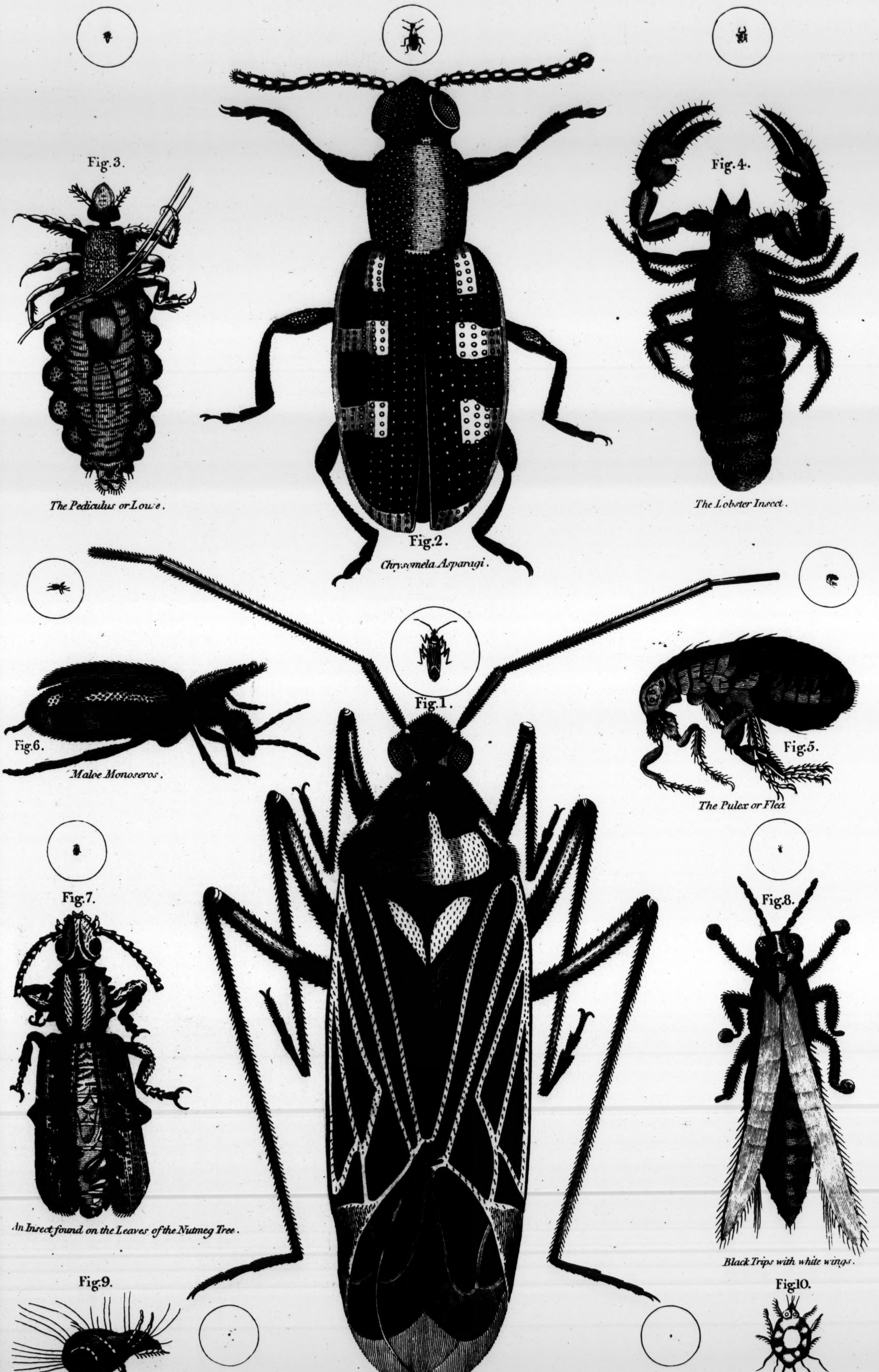

Fig.3. The Pediculus or Louse.

Fig.2. Chryſomela Asparagi.

Fig.4. The Lobster Insect.

Fig.6. Maloe Monoseros.

Fig.1. A non descript Insect of the Hemiptera Claſs. Copied by permiſsion from Mr. Adams's Eſsay on the Microscope.

Fig.5. The Pulex or Flea.

Fig.7. An Insect found on the Leaves of the Nutmeg Tree.

Fig.8. Black Trips with white wings.

Fig.9. The Acarus or Mite.

Fig.10. The Exulcerans or Itch animal.

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Microscopic Objects of the Vegetable Kingdom, as they appear when magnified, exhibiting a view of the Organization of Timber.

Copied by permiſsion from Mr. Adams's Eſsays on the Microscope.

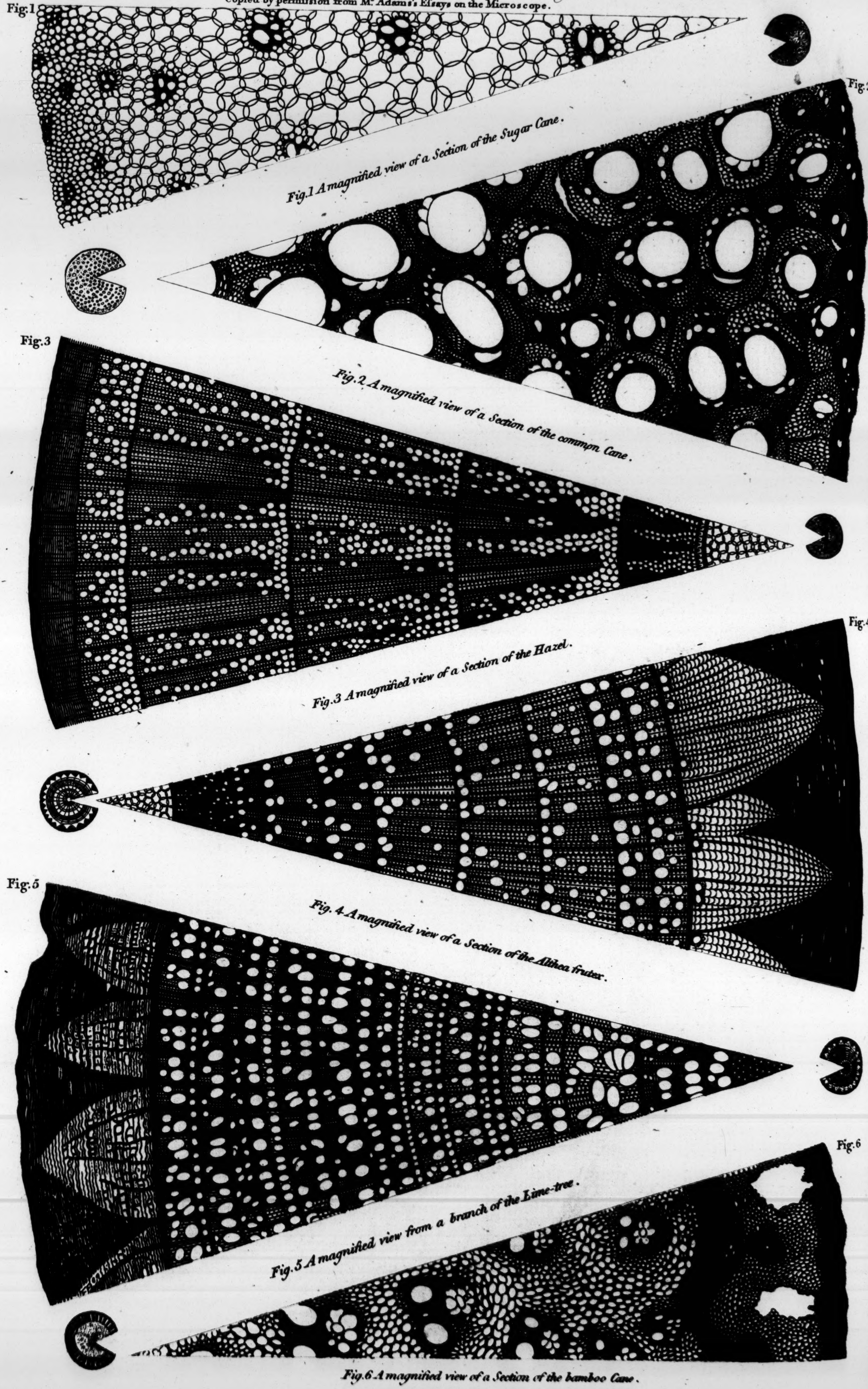

Fig. 1 A magnified view of a Section of the Sugar Cane.

Fig. 2 A magnified view of a Section of the common Cane.

Fig. 3 A magnified view of a Section of the Hazel.

Fig. 4 A magnified view of a Section of the Althea frutex.

Fig. 5 A magnified view from a branch of the Lime-tree.

Fig. 6 A magnified view of a Section of the bamboo Cane.

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which he caught on a flower in Eſſex the firſt week in Auguſt, and from which he could not diſengage it without great difficulty, and tearing off the fly's leg, which he did on a piece of writing paper, and was much ſurprized to ſee the little creature ſpring forwards full a quarter of an inch, with great impetuoſity, and again ſieze its prey from which he had great difficulty to diſengage it.

Fig. 5. *Pulex or Flea.* The Flea when examined by the microſcope is not an unpleaſing object: it is difficult however to obtain ſuch a view of it as will diſplay the mechaniſm, and apparatus belonging to the head. Theſe parts are but imperfectly repreſented in the celebrated drawing of Mr. Hook. The neck is long, finely arched, and much reſembles the tail of a lobſter. The body is covered all over with a ſuit of ſable armour, formed of a hard ſhelly ſubſtance, curiouſly joined and folded over one another, and yet yielding to all the nimble motion of the little animal. It has two ſharp eyes to look before it leaps; for which purpoſe its legs are admirably adapted, for the joints are ſo conſtructed, that it can fold them up as it were, and when it leaps ſpring them out all at once, whereby its whole ſtrength is exerted, and the body often raiſed two hundred times its own diameter. The proboſcis or ſucker with which it penetrates the ſkin, is placed at the end of the ſnout, and is not eaſily ſeen, except the two fore legs are removed. In it are included a couple of darts or lancets, which after the proboſcis has made an entrance, are thruſt further into the fleſh, and make the blood flow from the adjacent parts, and occaſion that round red ſpot with a hole in the center of it called a flea bite. Every one is acquainted with the agility and blood thirſty diſpoſition of the flea; the caution with which it comes to the attack, and the readineſs with which it avoids purſuit. This creature is produced from eggs, which they depoſit on the animals that afford them food, or affix them to the wool of blankets, rugs, &c. of theſe eggs are hatched white worms, which adhere cloſely to the body of the animal or other ſubſtance, on which they are produced. In a fortnight they come to a tolerable ſize, and are very lively and active; but if they are touched at this time, they will roll themſelves up in a ball. About eleven days from the time of their being hatched, they ſeek a place to hide in, and if viewed by a microſcope, will be found weaving a covering or bag, in which they aſſume the pupa ſtate, where they continue from nine days to a fortnight, when having acquired ſufficient ſtrength, they burſt from their confinement perfectly formed, and armed with powers to diſturb the peace of an Emperor.

Fig. 6. *Meloe Monoceros.* The inſect which now comes under our inſpection, is peculiarly adapted to ſhew the advantages of the microſcope, which alone will diſcover the peculiarities of its figure: this is ſo remarkable, that naturaliſts appear undetermined as to its genus: Even Linnæus himſelf could not determine at firſt where to place it, for in the Fauna Suecica he makes it an Attelabus; but in the late edition of the Syſtema Naturæ, he has fixed it as a meloe, calling it the Meloe Monoceros.

Geoffroy and Schœffer have given figures of it; but as they had not that kind of microſcope which would aſſiſt them, their figures are imperfect. Geoffroy ſays it is found on umbelliferous plants; the one here repreſented was found in May. The natural ſize is ſeen above that in the magnified ſtate.

Fig. 7. This flying inſect has two horns, which conſiſt of divers joints and hairs. Its eyes are furniſhed with a number of little lenſes. It has alſo ſix feet armed with talons. The hinder part of the body is jointed as it were with hollow notches. If the wing be conſidered, it will be found to conſiſt of ſeveral ſmall veſſels or nerves, that aſſiſt in the expanſion of it. The exquiſite neatneſs with which this minute wing is folded, is ſurprizingly beautiful. With what wonderful nerves muſt theſe minute wings be furniſhed, that can enable this inſect ſo readily to fold up the extremity of this filmy membrane in ſo neat a manner, and to expand it again as it were inſtantaneouſly, whenever it is inclined to fly? The extremity ſhews theſe neat foldings, which together with the ſtrength of the nerves diſcover the wiſdom of the Almighty in their contrivance. Mr. Adams, to whom we are indebted for our microſcopic obſervations, found theſe inſects in ſummer time flying about his work-ſhop, and he obſerved them to anſwer the above deſcription. They are ſo ſmall that Mr. Adams has applied them to the microſcope in the ivory ſliders; but they are better ſeen when applied in the nippers.

Fig. 8. *Black Trips*, with white wings. This inſect was originally named Phyſopus by Mr. de Geer, on account of the bladders at the feet. Linnæus terms it Trips. They live upon plants, and particularly in flowers. The figure repreſented in this plate, is the black Trips with white wings; the antennæ have ſix articulations, the body is black, the wings whitiſh, long, and hairy, the head ſmall with two large verticular eyes. The extremities of the feet are furniſhed with a membranaceous and flexible bladder, which it can throw out and draw in at pleaſure. It places and preſſes this bladder againſt the ſubſtances on which it is walking, and ſeems to fix itſelf thereby to them; the bladder ſometimes appears concave towards the bottom, the concavity diminiſhing in proportion as it is leſs preſſed. Theſe inſects are to be found in great plenty in the ſpring and ſummer, in the flowers of the dandelion, &c.

Fig. 9. *The Acarus or Mite.* This inſect has eight legs, two eyes, one on each ſide of the head, and two jointed tentacula. The female is oviparous. The ſiro or cheeſe mite, is a very minute ſpecies. To the naked eye theſe mites appear like moving particles of duſt; but the microſcope diſcovers them to be perfect animals, having as regular a figure of performing all the functions of life, as perfectly as creatures that exceed them in bulk. Theſe little creatures may be kept alive many months between two concave glaſſes, and applied to the microſcope at pleaſure. They are thus often ſeen in coitu, conjoined tail to tail; and this is performed by an incredible ſwift motion. Their eggs are ſo ſmall, that a regular computation ſhews, that ninety millions of them are not ſo large as a common pigeon's egg. They are very voracious animals, and have often been ſeen to eat one another. The mite is an animal very tenacious of life, and will live months without food. Mr. Lewenhoek had one lived eleven weeks in a ſituation he had fixed it for examining by his microſcope.

Fig. 10. *The Exulcerans or Itch Animal.* Dr. Bononio diſcovered that the diſeaſe called the itch owes its riſe to little inſects under the cuticula, whoſe continual bitings cauſe an ouſing of the ſerum from the cutis, and produce theſe puſtules whereby the diſeaſe is known. For, on obſerving people in this diſtemper pull out of the ſcabs little bladders of water with the point of a pin, and crack them like lice upon their nails from a place ſcabbed over; and where there was a grievous itching, he picked out a little puſtule, and from thence ſqueezed a thin matter; in which he could but juſt diſcern a ſmall white globule; but on applying it to his microſcope found it to be a minute animal of a whitiſh colour, in ſhape reſembling a tortoiſe, but ſomewhat dark on its back. The animal has ſeveral long hairs, ſix legs, a ſharp head, and two horns, and is very nimble. The doctor repeated this on perſons of all ages and complexions, and at all ſeaſons of the year, and found the ſame ſorts of animals in moſt of the watery puſtules. They begin to enter the furrows of the cuticula by knawing and working in their heads, till they are got quite under, where they cauſe a grievous itching, and force the infected perſon to ſcratch, which only heightens the malady. Hence follows the reaſon why this diſtemper is ſo very catching, ſince by ſimple contact theſe animals can readily paſs from one perſon to another, not only from their ſwift motion, but by their clinging to every thing they touch, and crawling as well upon the ſurface of the body as under the ſkin. A few being once lodged they multiply apace by their eggs; nor is it any wonder if this infection is propagated by the ſheets, towels, handkerchiefs, or gloves, uſed by itchy people.

THE ORGANIZATION, OR CONSTRUCTION OF TIMBER, AS VIEWED BY THE MICROSCOPE.

This ſubject opens an extenſive field of obſervation to the naturaliſt, in which the labour of a life may be employed. It is a branch where the obſerver will find the microſcope of continual uſe, and without which he will ſcarce be able to form any juſt idea of the organization of trees and plants, of the variations in the diſpoſition, the number, nature, and offices of the ſeveral parts. If we conſider the imperfection of the inſtruments uſed by ſome in thoſe anatomical reſearches, and the little attention paid by the reſt to the advantages their favourite purſuits might have derived from the uſe of the microſcope and the diſſecting knife, we have rather more to wonder at what has been done, than at what remains to be performed.

One reaſon that our knowledge of this ſubject is ſo circumſcribed is the general inattention to the ſtructure of plants. To this among other cauſes we may alſo aſcribe the inſtability and fluctuation of the different theories on the principles of vegetation. We are however ſo little acquainted with the ſteps which providence, takes to lead intellectual, but free agents, to the knowledge of truth, and the various difficulties, errors, and prejudices that muſt be removed before it can ſhine in its native colours, that it is our duty to encourage every humble effort towards the advancement of ſcience, that thus we may co-operate with our beneficent Creator in promoting that plan to which all things are now converging, the bringing all his creatures to a ſtate of truth, goodneſs, and conſequent happineſs, an end worthy the beſt and wiſeſt of beings.

As Dr. Hill is the firſt writer who has treated this part of Natural Hiſtory in an orderly and ſcientific manner; we ſhall uſe the names he has adopted for characterizing the different parts of trees, &c. which are, the rind; the bark; the blea; the wood; the corona or circle of propagation; and the pith. Theſe are placed immediately within or under one another; they are the eſſential parts upon which the ſtrength of the tree depends; in, among, and between theſe, the various veſſels are placed, which nouriſh the whole, and maintain and carry on the vegetation of the tree; and from which it obtains its peculiar qualities and virtues.

The exterior covering of all trees is a thin, dry, parched ſubſtance, which has been compared by many writers to the ſkin of animals, and called by names analogus thereto. Thus it is called the epidermis by Duhamel; the ſkin by Grew; the rind by Hill. The rind is a general covering to the young trunks of trees, to the branches, the roots, the leaves, the fruit, the flowers, &c.

Aided by the microſcope a number of luminous points may be diſcovered in the rind; theſe are ſo many minute holes for other purpoſes of tranſpiration. In the canes theſe holes are viſible to the naked eye. A few oval holes may alſo be perceived in it; theſe are however no more than a ſeparation of the parts, occaſioned by the extenſion of the interior veſſels.

The bulk lies next within the rind, and differs but little from it in conſtruction; though it holds a more important office in the ſcale of vegetation, the growth and qualities of the tree being in a great meaſure connected with it. It is therefore found to differ conſiderably in ſubſtance, quantity, and quality in various kinds. It is originally the outer membrane covering the lobes of the ſeed. Even there as in the branch of a tree, it appears in form of a kind of ſpunge, or like a cruſt of bread compoſed of flatted bladders. By the bark the tree is fed with a continual ſupply of moiſture; protected from external injuries, and defended from the exceſſes of heat and cold; for theſe purpoſes it is variouſly diſpoſed in different trees.

The blea is that part of the tree which is forming into wood, and therefore lies between it and the bark, and may be ſeparated from the bark by maceration. A longitudinal piece of the blea, when examined by the microſcope, exhibits a number of veſſels running parallel to each other, the interſtitial ſpaces being filled with a floccoſe, white, formleſs ſubſtance, of which Dr. Hill ſuſpects even the veſſels themſelves to be formed. The blea is a zone more or leſs perfect, which lies under the bark and is principally diſtinguiſhed from it by being leſs denſe. In ſome ſpecies the difference between the blea and the wood is very remarkable, in others it is leſs ſo. The ancient botaniſts ſtruck with the difference between the wood and the blea, compared this ſubſtance to the fat in animals. It is organized in a manner ſimilar to the wood and poſſeſſing the ſame veſſels diſpoſed nearly in the ſame manner.

When the bark and blea are taken away, we come to the wood, which is a ſolid ſubſtance, on which the ſtrength of the tree depends, and which has been conſidered by naturaliſts as being to the tree what bones are to the animal. It is more difficult to inveſtigate the conſtruction of the wood than that of the other parts, becauſe the texture is in general much harder, and therefore not ſo eaſily ſeparated, requiring very long macerations, and many ſubjects, before one may be found fit for maceration. A tranſverſe ſection of wood generally appears formed of a number of rays proceeding from the corona to the bark, which are interſected at different diſtances by concentric circles interſperſed with veſſels of varying magnitude. The variations in this ſtructure afford much pleaſure to the curious obſerver, and throw conſiderable light upon the nature and properties of timber, for it is by means of a variety of ſtrainers that different juices are prepared from the ſame maſs. Matter conſidered as matter has no ſhare in the qualities of bodies. It is from the arrangement of it, or the recipient forms given to it, that we have ſo many different ſubſtances. According to the modifications that theſe receive we ſhall find the ſame light, air, water, and earth, manifeſting themſelves in one by a deadly poiſon, and in another by a moſt ſalubrious food. A lemon ingrafted upon an orange ſtock, is capable of changing the ſap of the orange into its own nature, by a different arrangement of the nutritive juices. One maſs of earth will give life and vigour to the bitter aloe, to the ſweet cane, the cool houſe-leek, and the fiery muſtard, the nouriſhing grain, and the deadly night-ſhade. In a word, the life of the vegetable ſeems to reſide in the wood; from it all the other parts are produced. It ſhoots a pith inwards, and a blea and a bark outwards.

Dr. Hill gives the name of Corona to that circle which ſurrounds the pith and ſeparates it from the wood, although in his opinion it differs greatly from both, and in its compoſition has no reſemblance to either. It is according to him, the moſt important part in the whole vegetable fabric, by which the propagation and increaſe of the branches, buds, and ſhoots is carried on. The corona is not ſo uniform as the other parts, nor is it conſtituted exactly ſimilar in all trees. It is placed between the pith and wood in all vegetables forming a ring, whoſe outline is more or leſs regulated. The general circle is cellular, compoſed of blebs and veſſels, like the bark and the rind, and is perfectly ſimilar to them, only that at different diſtances oblong cluſters of different veſſels are placed amongſt it. Theſe cluſters are uſually eight or ten in number and give origin to the angles of the corona. Each cluſter is compoſed of all the eſſential parts of the ſucceeding branch, and the intermediate parts of the circle are abſolutely bark and rind. On the corona and its cluſters depends that property of vegetables that can be produced entire from every piece. Theſe cluſters follow the courſe of the other portions of the tree, they are therefore every where; they are always capable of growing, and their growth, even in a cutting of the ſmalleſt twig, cannot produce a leaf or any other part of a vegetable alone; but muſt afford the whole; for they are complete bodies, and the whole is there waiting only for the opportunity of extenſion. For the knowledge we have of this part, we are altogether indebted to Dr. Hill. It remains for future obſervers to confirm, or diſprove his obſervations.

The pith is found in the center of every young ſhoot of a tree; it is large in ſome, leſs in others, but preſent in all. It is placed cloſe within the corona. It ſeems to be nothing more than a congeries of the cellular tiſſue; it is generally found near the center of the tree, incloſed as it were within a tube; in general the cells of the pith are larger than thoſe of the cellular tiſſue, with which according to ſome naturaliſts it communicates. The bark and the wood grows thicker every year, while the pith on the contrary, grows more ſlender, ſo that in a branch of one year it is of a larger ſize than it is in the ſame branch when two years old, and ſo on. In very young branches, while in an herbaceous ſtate, the pith forms the greateſt part of the ſubſtance; but when the fibres are ſtronger, the pith becomes leſs ſucculent and ſurrounded with a tube of wood. When the branch is arrived to a certain age, it is ſo compreſſed as to be almoſt annihilated. In examining different branches that proceed from others in their firſt ſtate, a ſmall communication between the pith of the one and the other will be found; but this communication is in general entirely cloſed up in the ſecond or third year. The cells of which the pith is formed are at firſt entirely one connected body; but as the plant grows up, it is often ſo broke and ruptured as to remain no longer a fibrous ſubſtance.

This as well as other remarks on the nature of pith, corroborates the opinion of Dr. Hill, who thinks it is formed for the purpoſe of moiſtening the cluſters of the corona and regulating its extenſion. It has been ſuppoſed coeval with, or primordial to all other parts, but he thinks it poſtrate, and comes after them in the order of time as well as in its uſes; and the thickneſs of the juices cloathing the bubble gives it form and ſubſtance. The firſt ſeaſon is the time of its greateſt uſe, and immediately after it begins to decay.

To what has been ſaid we may add the following general ideas relative to the organization of trees. The moſt obvious and remarkable parts of a plant or tree, are the root, the ſtem, the branches, the leaves, the flower, and the fruit. The component parts of theſe diviſions are not complicated; they are ſimple when compared to thoſe of an animal, and this becauſe the offices of the vegetable are fewer than thoſe of the animal. The principal ſource of the phænomena of vegetation is the ſimplicity, and uniformity of their organization. The figures in Plate III. are portions of tranſverſe ſections cut by Mr. Cuſtane, who firſt brought this art to perfection, and remains unrivalled as yet in theſe performances.

Fig. 1. repreſents a magnified view of a ſection of the ſugar cane: *fig.* 2. a magnified view of a ſection of the common cane: *fig.* 3. a magnified view of a ſection of the hazel: *fig.* 4. a magnified view of a ſection of the Althea frutex: *fig.* 5. a magnified view from a branch of the lime-tree: *fig.* 6. a magnified view of a ſection of the Bamboo cane.

The exterior form, and even the internal ſtructure of the generality of vegetable ſeeds, have been ſuppoſed by ſome ſo much alike in the ſeveral kinds, and of ſo little curioſity and beauty in the whole, that they have ſcarcely been regarded by the curious; but when nearly examined by the help of microſcopes, they are found to be worthy of greater attention. Thoſe which appear moſt like to one another when viewed by the naked age, often proving as different when thus examined, in their ſeveral forms and characters, as the different genera of any other bodies of the creation. If their external forms carry all this variety and beauty about them, their internal ſtructure, when laid open by different ſections, appears yet more admirable. A number of beauties in this part of the creation are deſcribed at large by Dr. Parſons in his work entitled, "A Microſcopic Theatre of Seeds." Moſt kinds of ſeeds ſhould be prepared for a microſcopical examination by ſteeping them in warm water till their coats are ſeparated, and their ſeminal leaves may then be opened without laceration. But ſeeds while dry, and without any preparation, are of an almoſt infinite variety of ſhape, and afford a number of pleaſing objects for the microſcope. Indeed it may be truly ſaid that the whole of the animal, vegetable, and mineral kingdoms, with all their numerous ſubdiviſions, furniſh objects for the microſcope, and there is not one of them, when properly examined, but will afford inſtruction and entertainment to the rational inveſtigator of the works of creation.

Thoſe who rightly conſider natural things will find them a ſhadow of heavenly things, a ſchool in which the parent of the univerſe is the teacher, and all the objects of ſenſe in heaven and earth and under the earth, are as the letters of an univerſal language, in which all nations have a common intereſt. The creator himſelf has made this uſe of it, revealing his will by it, and referring man to it for inſtruction.

The conciſe view we have given of the wonders of nature, can be conſidered as little more than a directory, to point out to thoſe who have only begun to ſtudy this part of natural hiſtory, a few of thoſe objects which merit their attention, and which, from their beauties, may incite them to purſue the ſtudy with greater ardour.

MIDSHIP-*Men*, are officers on board a ſhip of war, whoſe ſtation, when they come on duty, is, ſome on the quarter-deck, others on the poop, &c. Their buſineſs is, to mind the braces, to look out, and to give about the word of command from the captain, and other ſuperior officers.

MIDWIFERY. The art of aſſiſting women in the birth of children. It comprehends the management of women both before and after the delivery, as well as the treatment of the child in its moſt early ſtate.

SYSTEM OF MIDWIFERY.

INTRODUCTION.

THE knowledge of midwifery ſeems not to have been improved ſo ſoon as that of phyſic. Hippocrates and other phyſicians of eminence among the ancients did not attain to a competent degree of knowledge, either in the theory or practice of this art. Mauriceau was the firſt who brought it to a ſtandard, and formed it upon principles that have ever ſince been generally adopted. The knowledge of midwifery has been ſo much encreaſed within this century, that it ſeems to have nearly attained its ultimate perfection, and its operations are reduced almoſt to a geometrical certainty. And this, ſays Aſtruc, is not ſurpriſing; for, after all, the art of midwifery is reduced to the following mechanical problem: "An extenſive cavity of a certain capacity being given, to paſs a flexible body of a given length and thickneſs through an opening dilatable to a certain degree." This might be reſolved geometrically, if the different degrees of elaſticity of the womb, and ſtrength and weakneſs of the child, the greater or leſs diſpoſition of the blood to inflammation, and the greater or leſſer degree of irritability of the nerves, did not occaſion that uncertainty which phyſical facts conſtantly produce in all phyſico-mathematical queſtions.

PART I. THEORY.

SECT. I. CONCEPTION.

The minutiæ or firſt principles of bodies being without the ſphere of human comprehenſion, all that we know is by the obſervation of their effects; ſo that the *modus* of conception is altogether uncertain, eſpecially in the human ſpecies, becauſe opportunities of opening pregnant women ſo ſeldom occur. Although the knowledge of this operation is not abſolutely neceſſary for the practice of Midwifery, an inveſtigation of it may not only gratify the curious, but alſo promote farther inquiries; in the courſe of which, many material diſcoveries may be made, in the ſame manner as many valuable compoſitions in chymiſtry were found out in the laſt century by thoſe who exerciſed themſelves in ſearch of the philoſopher's ſtone.

From the time of Hippocrates to the ſixteenth century, it was generally believed that the Embryo and Secundines were formed by the mixture of the male and female ſemen in the Uterus: but during the laſt hundred years, anatomy received great improvements by the frequent diſſection of human bodies; and in ſome female ſubjects, the Fœtus was found in one of the Fallopian tubes; in others, it was diſcovered in the Abdomen, with the Placenta adhering to the ſurface of the viſcera.

Malphigius and others, between the years 1650 and 1690, wrote expreſsly upon the incubation of eggs, their formation, and the gradual increaſe of oviparous animals. The great Harvey obſerved the progreſs of the viviparous kind, in a great number of different animals which he had opportunities of opening. De Graaf diſſected near one hundred rabbits, and is very particular and accurate in the obſervations he had made. Ruyſch, Aldes, Needham, Steno, Kerkringius, Swammerdam, Bartholine the ſon, and Drelincourt, employed themſelves in the ſame inquiries; and, in conſequence of their different remarks, a variety of theories have been erected: yet all of them have been ſubject to many objections.

When the parts in women, ſubſervient to generation, attain their acme or full growth, one or more of the Ova being brought to maturity, that part of the Peritonæum which covers the Ovarium begins to ſtretch; the nervous fibres are accordingly affected, and contract themſeves ſo as to bring the Fimbria of the Fallopian tube in cloſe contact with the ripe Ovum: by which mechaniſm, this laſt is ſqueezed out of its nidus or huſk into the cavity of the tube, through which it is conveyed into the Uterus by a vermicular or periſtaltic motion; and if it is not immediately impregnated with an Animalcule of the male ſemen, muſt be diſſolved and loſt, becauſe it is now detached from the veſſels of the Ovarium, and has no Vis Vitæ in itſelf. The external coat of the Ovum is the membrane Chorion; one fourth part of which is the Placenta, ſuppoſed to be the root by which it was formerly joined to the veſſels of the Ovarium; and the navel-ſtring is no other than a continuation of the veſſels belonging to this cake. The Chorion is on the inſide lined with another membrane called *Amnion*; and both are kept diſtended in a globular form by a clear ſerous fluid, or thin lymph.

As for the male ſemen, according to the obſervation of the celebrated Leeuwenhoek, it abounds with Animalcula, that ſwim about in it like ſo many tadpoles; and theſe are larger and more vigorous the longer the ſemen hath remained in the Veſiculæ Seminales. The parts of both male and female being thus brought to maturity, the following circumſtances are ſuppoſed to happen in coition, eſpecially in thoſe embraces which immediately follow the evacuation of the Menſes. In the woman the friction of the Penis in the contracted Vagina, the repeated preſſure and ſhocks againſt the external parts, the alternate motion upwards and downwards of the Uterus, with its appendages, the Ovaria, Fallopian tubes, and round ligaments, produce a general titillation and turgency; in conſequence of which, the nevous fibrils are convulſed, and a fluid ejected from the proſtate or analogous glands, as well as from thoſe of the Uterus and Fallopian tubes. The Fimbria belonging to one of which, now firmly graſps the ripened Ovum, which at the ſame inſtant is impregnated with the male ſeed that in the orgaſm of coition had been thrown into the Uterus, and thence conveyed into the cavity of the tube by ſome abſorbing or convulſive power. When the two matured principles are thus mingled, one of the Animalcula inſinuates itſelf into the Ovum, and is joined with its belly to that ruptured part of it from which the navel-ſtring is produced; or, entering one of the veſſels, is protruded to the end of the Funis, by which a circulation is carried on from the embryo to the placenta and membranes. The ovum being impregnated is ſqueezed from its nidus or huſk into the tube, by the contraction of the fimbria; and thus diſengaged from its attachments to the ovarium, is endowed with a circulating force by the animalculum, which has a vis vitæ in itſelf: the veſſels on the ſurface of the ovum being opened in conſequence of its detachments from the ovarium, abſorb the ſurrounding fluid which is ſecerned by the glands in the cavity of the tube and uterus, or forced into them by motion, heat, and rarefaction, and carried along the umbilical vein for the nouriſhment and increaſe of the impregnated maſs.

Of the ſemen that is injected or abſorbed into the uterus, part is mixed with the fluid ſecreted by the glands in the canal of the neck, which is blocked up with a ſort of gluten formed by this mixture; ſo that the Ovum is thereby prevented from ſinking too far down, and being diſcharged.

This theory of conception, though very ingenious, and of all others the beſt ſupported with corroborating conſiderations, ſuch as, that Fœtuſes and Embryos have been actually found in the cavity of the tube and abdomen, without any marks of excluſion from the Uterus; beſides other preſumptions that will be mentioned when we come to treat of the nutrition of the fœtus; we ſay, notwithſtanding the plauſibility of the ſcheme, it is attended with circumſtances which are hitherto inexplicable; namely, the manner in which the Animalculum gains admiſſion into the Ovum, either while it remains in the ovarium, ſojourns in the tube, or is depoſited in the Fundus uteri; and the method by which the veſſels of the navel-ſtring are inoſculated with thoſe of the Animalculum. Indeed, theſe points are ſo intricate, that every different theoriſt has ſtarted different opinions concerning them, ſome of which are rather jocular than inſtructive.

SECT. II. *External and internal Parts of Generation in Women.*

The Mons Veneris is ſituated at the upper part of the Pubes, from which alſo begin the Labia Pudendi, ſtretching down as far as the lower edge, where the Frænum Labiorum or Fourchette is formed.

The Clitoris with its Præputium is found between the Labia, on the middle and forepart of the Pubes; and from the lower part of the Clitoris, the Nymphæ riſing, ſpread outwards and downwards to the ſides of the Os Externum, forming a kind of ſulcus or furrow, called the *Foſſa Magna* or *Navicularis*, for the direction of the Penis in coition, or the finger in touching, into the Vagina.

The Meatus Urinarius is immediately below the under edge of the Symphyſis of the Oſſa Pubis, and at the upper part of the Os Externum, which is the orifice of the Vagina, ſituated immediately below the ſaid bones of the Pubes: the lower edge of which bones is equal to the lower edge of the frænum or fourchette, which bounds the inferior part of the Foſſa Magna and Os Externum, reſtraining it as if with a bridle.

The Perinæum extends from this border to the Anus, being about one inch or one and an half in length: the wrinkled part of the Anus is about three quarters of an inch in diameter; from thence to the Coccyx the diſtance is about two inches: ſo that the whole extent from the fourchette to this bone amounts to about four inches, or four and a quarter.

What remains of the lower part of the Pelvis is covered and filled up with the integuments, adipoſe membrane, and the muſcles called *Levatores Ani*; while within theſe are contained the muſcles belonging to the Clitoris, mouth of the bladder, Os Externum, and Anus. See *fig.* 12.

In young children, there is a thin membrane called the *Hymen*, extended over the lower part of the Os Externum, repreſenting the figure of a creſcent; the concave and open ſide being turned towards the Meatus Urinarius. In ſome, the middle of this concave is attached to the lower part of the Meatus, forming two ſmall openings; nay, in ſome adults this membrane has entirely ſhut up the entrance of the Vagina, ſo that they have been altogether imperforated; but, when broke, it recedes, and forms the Carunculæ myrtiformes.

On each ſide of the Meatus Urinarius are two ſmall lacunæ or openings, the tubes of which, ending in a kind of ſacculus, come from the proſtrate gland: from theſe a thin fluid is ejected in time of copulation, and that from ſome women with conſiderable force: and ſometimes, though ſeldom, to the quantity of ſeveral drachms.

The Urethra in women is about one inch and an half in length. The vagina is formed of a ſtrong thick membrane, of a ſpongy texture, more contracted in virgins than in married women. When ſtretched to its full extent, it may be about five, ſix, or ſeven inches long, and two in width, according to the difference of ſtature in different women: but, when the Uterus hangs down in the Vagina, the length will not be more than two or three inches; and it may be ſtretched with the finger to the wideneſs of three or four. The inſide of it, in young women, is full of rugæ, folds or wrinkles, which are partly obliterated in thoſe who have borne children. The upper end of the Vagina is joined to the circumference of the lips of the Os Uteri, which reſemble the mouth of a puppy or tench; and a thin expanſion of this membrane, being reflected inwards, covers the exterior part of theſe lips, which in virgins are ſmooth and of an oval form. It is alſo continued along the inſide of the Uterus, conſtituting the internal membrane of the neck and Fundus, which is likewiſe full of plicæ, eſpecially in young ſubjects. See *fig.* 4, 5, 6, 7, 8.

As to the different names of thoſe parts, the book of Schurigius, publiſhed at Dreſden, may be conſulted. The entry of the Vagina is commonly called the *Sphincter Vaginæ*, and the mouth of the womb is often diſtinguiſhed by the appellation of *Os Tincæ*: but, as the mention of theſe parts will frequently occur in the courſe of this Syſtem, we ſhall, in order to avoid confuſion or miſtake, call the firſt Os Externum, and the other Os Internum, through the whole of it.

The Uterus is about three inches long from the Os Internum to the upper part of the Fundus, and one inch in thickneſs from the fore to the back part. It is divided into the Neck and Fundus; the length of the neck being an inch and three quarters, while that of the fundus is one inch and one quarter. The width of the Uterus at the neck is about one inch, but at the fundus twice as much. The Uterus is ſmaller in young women.

The outſide-ſhape of the Uterus in ſome meaſure reſembles a flattened cucurbit, or that kind of ſpear which hath a long neck.

The canal or entrance from the Os Internum to the cavity of the Fundus Uteri, will admit a common director; being a little wider in the middle, and more contracted at the upper end.

The cavity of the Fundus, is in point of figure ſomething between an oval and triangle: one of the angles commencing at the upper end of the foreſaid canal, and the other two expanding the ſides of the Fundus, from which ariſe the Fallopian tubes. Theſe tubes are about three inches long; and ſo narrow at their entrance from the Uterus, as ſcarcely to admit an hog's briſtle; but the cavity of each turns gradually wider, and ends in an open mouth or ſphincter, from the brim of which is expanded the Fimbria or Morſus Diaboli, that generally bears the likeneſs of jagged leaves, and in ſome reſembles an hand with membranous fingers, which is ſuppoſed to graſp the Ovum when ripe and ready to drop from the Ovarium.

The Uterus is formed firſt of the inſide membrane that riſes from the Vagina, and lines all the interior part of the womb: immediately above this coat is the thick ſubſtance of the uterus, compoſed of a plexus of arteries, lymphatics, veins, and nerves; and the veſſels on its ſurface, when injected, ſeem to run in contorted lines. It appears to be of the ſame glandular texture (though not ſo compact) as that of the breaſts, without any muſcular fibres, except ſuch as compoſe the coats of the veſſels. When this part is minutely injected, it ſeems to be almoſt nothing but a maſs of veſſels; a circumſtance common to it with other parts of the body: And anatomiſts are agreed, that the greater number of veſſels viſible in ſuch nice injections, are thoſe through which the ſerum or lymph of the blood circulates in the living body; whence the *error loci* in an Ophthalmia is imitated by ſubtile injections of coloured matter into the arteries of the dead ſubject. See *fig.* 4, 5, 6.

When the Uterus ſtretches in time of geſtation, the veſſels are proportionably dilated by an increaſe of the fluid they contain: ſo that, at the time of delivery, ſome of them are capacious enough to admit the end of the little finger. Yet the ſubſtance of the womb, for the moſt part, inſtead of growing thinner, as Mauriceau alleges, or thicker, according to Daventer, continues of its natural thickneſs during the whole term of pregnancy; and this equality is maintained by the gradual diſtenſion of the veſſels that enter into its compoſition. In time of labour, indeed, as the waters are diſcharged, the uterus contracts itſelf and grows thicker; and the reſiſtance ceaſing at the delivery of the child and after-birth, it becomes ſmaller and ſmaller, until it has nearly reſumed its natural dimenſions. See *fig.* 14 and 16.

The Vagina on its outſide is covered with a thick adipoſe membrane: by means of which it is on the fore-part attached to the lower part of the bladder, and on the back-part to the lower end of the Rectum and Anus; and by the ſame means all theſe parts are connected with the Peritonæum, or internal ſurface of the Pelvis.

The Uterus is contained in a duplicature of the Peritonæum, which covers it every where above, and is connected with its ſubſtance by a very thin cellular membrane; as for the Peritonæum in itſelf, it is a ſmooth membranous expanſion, that covers all the inſide of the Abdomen, and gives external coats to all the Viſcera contained in that cavity. On the fore-part it lines the muſcles of the Abdomen and Diaphragma; backwards, it covers the abdominal Viſcera in general, the Aorta and Vena Cava Deſcendens, the kidneys, ureters, and ſpermatic veſſels, the external and internal Iliacs, the Pſoas and muſcles that cover the inſide of the Ilium, whence it riſes double, and forms the Ligamenta Lata, in which are contained the Ovaria and Fallopian tubes. This duplicature, where it meets in the middle, invelops all the Uterus, as before obſerved, and gives a covering to the round ligaments that riſe from each ſide of the Fundus Uteri, and are inſerted or loſt about the upper and external part of the pubes and groin. The Peritonæum is alſo reflected from the fore-part of the Uterus over the upper part of the bladder: and upon the back-part of the Uterus it deſcends even upon the Vagina, from which it is again reflected upwards over the Rectum.

In coition, the Uterus yields three or four inches to the preſſure of the Penis, having a free motion upwards and downwards, ſo that the reciprocal oſcillation, which is permitted by this contrivance, increaſes the mutual titillation and pleaſure. See *fig.* 5.

SECT. III. *Of the* OVARIA, *Veſſels, Ligaments, and Fallopian Tubes.*

The Ovaria are two ſmall oval bodies, one of which is placed behind each Fallopian tube; ſuppoſed to be little more than a cluſter of Ova, whence they derive their preſent name: for, by ancienr authors, they are mentioned by the appellation of the *female teſticles*. Each Ovarium is about one inch in length, half as broad, and one quarter of an inch in thickneſs; more convex on the fore than on the back-part, of a ſmooth ſurface, covered with the Peritonæum. See *fig.* 5.

The blood-veſſels are, firſt, the Spermatic Arteries and Veins, which have nearly the ſame origin as thoſe in men, are moſtly diſtributed upon the Ovaria and tubes, and at the upper part of the uterus communicate with the hypogaſtrics; from the branches of which the body of the womb is furniſhed. All theſe arteries anaſtomoſe, and are ſuppoſed to detach ſmall ramifications that open into the cavity of the Uterus. The veins are large, communicate one with another, with the Hæmorrhoidals and Vena Portarum, and have no valves. The Ligamenta Rotunda are two vaſcular ropes compoſed of veins and arteries incloſed in the duplicature of the Ligamenta Lata; ſeemingly ariſing from the crural artery and vein, from whence they are extended to the ſides of the Fundus Uteri. The nerves come from the Intercoſtals, Lumbares, and Sacri, as deſcribed in Boerhaave's Inſtitutes and Winſlow's Anatomy.

SECT. IV. *Of the Increaſe of the* UTERUS *after Conception.*

It is ſuppoſed that the Ovum ſwims in a fluid, which it abſorbs ſo as to increaſe gradually in magnitude till it comes in contact with all the inner ſurface of the Fundus; and this being diſtended in proportion to the augmentation of its contents, the upper part of the neck begins alſo to be ſtretched.

About the third month of geſtation, the ovum in bigneſs equals a gooſe-egg; and then nearly one fourth of the neck at its upper part is diſtended equal with the fundus. At the fifth month, the fundus is increaſed to a much greater magnitude, and riſes upwards to the middle ſpace betwixt the upper part of the pubes and the navel; and at that period one half of the neck is extended. At the ſeventh month, the fundus reaches as high as the navel; at the eighth month, it is advanced midway between the navel and ſcrobiculus cordis; and in the ninth month, is raiſed quite up to this laſt mentioned part, the neck of the womb being then altogether diſtended. See *fig.* 4, 5, 6, 7, 8, 9, 10.

Now that the whole ſubſtance of the uterus is ſtretched, the neck and os internum, which were at firſt the ſtrongeſt, become the weakeſt part of the womb, and the ſtretching force being ſtill continued by the increaſe of the fœtus and ſecundines, which are extended by the incloſed waters in a globular form, the os uteri begins gradually to give way. In the beginning of its dilatation, the nervous fibres in this place being more ſenſible than any other part of the uterus, are irritated and yield an uneaſy ſenſation; to alleviate which, the woman ſqueezes her uterus by contracting the abdominal muſcles, and at the ſame time filling the lungs with air, by which the diaphragm is kept down; the pain being rather increaſed than abated by this ſtraining, is communicated to all the neighbouring parts to which the ligaments and veſſels are attached, ſuch as the back, loins, and inſide of the thighs; and by this compreſſion of the uterus the waters and membranes are ſqueezed againſt the os uteri, which is of conſequence a little more opened. See *fig.* 11, 14, 15, 16.

The woman being unable to continue this effort for any length of time, from the violence of the pain it occaſions, and the ſtrength of the muſcles being thereby a little exhauſted and impaired, the contracting force abates; the tenſion of the os tincæ being taken off, it becomes more ſoft, and contracts a little; ſo that the nervous fibres are relaxed. This remiſſion of pain the patient enjoys for ſome time, until the ſame increaſing force renews the ſtretching pains, irritation, and ſomething like a teneſmus at the os uteri; the compreſſion of the womb again takes place, and the internal mouth is a little more dilated, either by the preſſure of the waters and membranes, or, when the fluid is in ſmall quantity, by the child's head forced down by the contraction of the uterus, which in that caſe is in contact with the body of the fœtus. See *fig.* 16, 17, 18.

In this manner the labour-pains begin, and continue to return periodically, growing ſtronger and more frequent until the os uteri is fully dilated, and the membranes are depreſſed and broke; ſo that the waters are diſcharged, the uterus contracts, and, with the aſſiſtance of the muſcles, the child is forced along and delivered.

SECT. V. *Of the Magnitude, Weight, and different Appellations given to the* OVUM *and* CHILD.

When the ovum deſcends into the uterus, it is ſuppoſed to be about the ſize of a poppy-ſeed, and in the third month augmented to the bigneſs of a gooſe egg. Ten days after conception, the child (according to ſome authors) weighs half a grain; at thirty days, is increaſed to the weight of twenty-two grains; at three months, weighs betwixt two and three ounces; and at nine months, from ten to twelve, and ſometimes ſixteen, pounds: by which calculation it would appear that the progreſs of the Fœtus is quickeſt in the beginning of its growth; for from the tenth to the thirtieth day (according to this ſuppoſition) it increaſes to three and forty times its weight. All theſe calculations are uncertain.

The conception is called an *Embryo*, until all the parts are diſtinctly formed, generally in the third month; and from that period to delivery, is diſtinguiſhed by the appellation of Fœtus.

SECT. VI. *Of the* PLACENTA *and Membranes.*

We have already obſerved that the Ovum is formed of the Placenta with the Chorion and Amnion, which are globularly diſtended by the incloſed waters that ſurround the child. The Placenta is commonly of a round figure, ſomewhat reſembling an oat-cake, about ſix inches in diameter, and one inch thick in the middle, growing a little thinner towards the circumference; it is compoſed of veins and arteries, which are divided into an infinite number of ſmall branches, the venous parts of which unite in one large tube, called the ***umbilical vein***, which brings back the blood, and is ſuppoſed to carry along the nutritive fluid from the veſſels of the Chorion and Placenta, to the child, whoſe belly it perforates at the navel; from thence paſſing into the liver, where it communicates with the vena portarum and cava. It is furniſhed with two arteries, which ariſe from the internal iliacs of the child, and running upon each ſide of the bladder perforates the belly where the umbilical vein entered; then they proceed to the Placenta, in a ſpiral line, twining around the vein, in conjunction with which, they form the Funiculus umbilicalis, which is commonly four or five hand breadths in length, ſometimes only two or three, and ſometimes it extends to the length of eight or ten. The two arteries, on their arrival at the inner ſurface of the Placenta, are divided and ſubdivided into minute branches, which at laſt end in ſmall capillaries that inoſculate with the veins of the ſame order. Theſe arteries, together with the umbilical vein, are ſuppoſed to do the ſame office in the Placenta which is afterwards performed in the lungs by the pulmonary artery and vein, until the child is delivered and begins to breathe: and this opinion ſeems to be confirmed by the following experiments. If the child and Placenta are both delivered ſuddenly, or the laſt immediately after the firſt; and if the child, though alive, does not yet breathe, the blood may be felt circulating ſometimes ſlowly, at other times with great force, through the arteries of the Funis to the Placenta, and from thence back again to the child, along the umbilical vein. When the veſſels are ſlightly preſſed, the arteries ſwell between the preſſure and the child, while the vein grows turgid between that and the Placenta, from the ſurface of which no blood is obſerved to flow, altho' it be lying in a baſon among warm water. As the child begins to breathe, the circulation, though it was weak before, immediately grows ſtronger and ſtronger; and then in a few minutes the pulſation in the navel-ſtring becomes more languid, and at laſt entirely ſtops. If after the child is delivered, and the navel-ſtring cut, provided the Placenta adheres firmly to the Uterus, which is thereby kept extended; or, if the womb is ſtill diſtended by another child; no more blood flows from the umbilical veſſels than what ſeemed to be contained in them at the inſtant of cutting; and this, in common caſes, does not exceed the quantity of two or three ounces: and finally, when, in conſequence of violent floodings, the mother expires either in time of delivery or ſoon after it, the child is ſometimes found alive and vigorous, eſpecially if the Placenta is found; but if tore, then the child will loſe blood as well as the mother.

The external ſurface of the Placenta is divided into ſeveral lobes, that it may yield and conform itſelf more commodiouſly to the inner ſurface of the Uterus, to which it adheres, ſo as to prevent its being ſeparated by any ſhock or blows upon the abdomen, unleſs when violent. Thoſe groups of veins and arteries which enter into the compoſition of the Placenta, receive external coats from the Chorion, which is the outward membrane of the Ovum, thick and ſtrong, and forms three-fourths of the external globe that contains the waters and the child; the remaining part being covered by the Placenta; ſo that theſe two in conjunction conſtitute the whole external ſurface of the Ovum. Some indeed allege, that theſe are inveloped with a cribriform or cellular ſubſtance, by which they ſeem to adhere by contact only, to the Uterus: and that the inner membrane of the womb is full of little glands, whoſe excretory ducts, opening into the fundus and neck, ſecrete a ſoft thin mucus (as formerly obſerved) to lubricate the whole cavity of the Uterus, which beginning to ſtretch in time of geſtation, the veſſels that compoſe theſe glands are alſo diſtended; conſequently a greater quantity of this mucus is ſeparated and retained in this ſuppoſed cribriform and cellular ſubſtance, the abſorbing veſſels of which take it in and convey it along the veins for the nouriſhmen of the child. The womb being therefore diſtended in proportion to the increaſe of the child, thoſe glands are alſo proportionably enlarged; by which means a larger quantity of the fluid is ſeparated, becauſe the nutriment of the child muſt be augmented in proportion to the progreſs of its growth; and this liquor undergoes an alteration in quality as well as in quantity, being changed from a clear thin fluid into the more viſcous conſiſtence of milk. In ſome caſes, this mucus hath been diſcharged from the uterus in time of pregnancy, and both mother and child weakened by the evacuation; which may be occaſioned by the chorion's adhering too looſely, or being in one part actually ſeparated from the womb.

Formerly, it was taken for granted by many, that the Placenta always adhered to the fundus uteri. But this notion is refuted by certain obſervations: in conſequence of which we find it as often ſticking to the ſides, back, and fore parts, and ſometimes as far down as the inſide of the os uteri. See *fig*. 4,5,6,7,8,9,11,14,15,17.

When the Placenta is delivered, and no other part of the membrane tore except that through which the child paſſed, the opening is generally near the edge or ſide of the placenta, and ſeldom in the middle of the membranes; and a hog's bladder being introduced at this opening, and inflated, when lying in water, will ſhew the ſhape and ſize of the inner ſurface of the womb, and plainly diſcover the part to which the placenta adhered.

The Chorion is, on the inſide, lined with the Amnion, which is a thin tranſparent membrane, without any veſſels ſo large as to admit the red globules of blood: it adheres to the chorion by contact, and ſeems to form the external coat of the funis umbilicalis.

This membrane contains the ſerum, in which the child ſwims; which fluid is ſuppoſed to be furniſhed by lymphatic veſſels that open into the inner ſurface of the amnion. If this liquid is neither abſorbed into the body of the fœtus, nor taken into the ſtomach by ſuction at the mouth, there muſt be abſorbing veſſels in this membrane, in the ſame manner as in the abdomen and other cavities of the body, where there is a conſtant renovation of humidity.

From the foregoing obſervations upon nutrition, it ſeems probable, that the fœtus is rather nouriſhed by the abſorption of the nutritive fluid into the veſſels of the placenta and chorion, than from the red blood circulated in full ſtream from the arteries of the uterus to the veins of the placenta, and returned by the arteries of the laſt to the veins of the firſt, in order to be renewed, refined, and made arterial blood in the lungs of the mother.

SECT. VII. *Of the Child's Situation in the Uterus.*

The embryo or fœtus, as it lies in the uterus, is nearly of a circular or rather oval figure, which is calculated to take up as little ſpace as poſſible. The chin reſts upon the breaſt; the thighs are preſſed along the belly; the heels applied to the breech; the face being placed between the knees; while the arms croſs each other round the legs. The head for the moſt part is down to the lower part of the uterus; and, the child being contracted into an oval form, the greateſt length is from head to breech: but the diſtance from one ſide to the other is very much leſs than that from the fore to the back part; becauſe the thighs and legs are doubled along the belly and ſtomach, and the head bended forwards on the breaſt.

In the firſt month, according to ſome writers, the embryo exhibits the figure of a tadpole, with a large head and ſmall body or tail, which gradually increaſes in magnitude, till the arms and thighs begin to bud or ſtrut out, like ſmall nipples, from the ſhoulders and breech; two black ſpecks appear on each ſide of the head, with a little hole or opening between them, which, in the ſecond month, are eaſily diſtinguiſhed to be the eyes and mouth. (See *fig*. 6.) The legs and arms are gradually formed, while the body turns larger, but the fingers are not ſeparated or diſtinct, till the latter end of the ſecond or beginning of the third month. (See *fig*. 7.) This is commonly the caſe; but ſometimes the bulk and appearance differ conſiderably in different embryos of the ſame age. The younger the embryo, the larger and heavier is the head in proportion to the reſt of the body; and this is the caſe in all the different gradations of the fœtus; ſo that, when dropt or ſuſpended by the navel-ſtring in water, the head muſt ſink lowermoſt of courſe. Beſides, when women miſcarry, in the fourth, fifth, ſixth, and ſeventh months, the head, for the moſt part, preſents itſelf, and is firſt delivered. (See *fig*. 7, 8, and 9. By the touch in the vagina, the head is frequently felt in the ſeventh, ſometimes in the ſixth, but more frequently in the eighth month; and if the ſame women are thus examined from time to time till the labour begins, the head will always be felt of a round firm ſubſtance at the fore-part of the brim of the pelvis, betwixt the os internum and pubes, through the ſubſtance of the vagina and uterus. (See *fig*. 9.) But all theſe opinions are liable to objections, yet as it lies as eaſy in one poſture as in another till the birth, this diſpute is of leſs conſequence in the practice of Midwifery. It may be uſeful to ſuggeſt, that the wrong poſture of the child in the uterus may proceed from circumvolutions of the funis umbilicalis, (ſee *fig*. 32.) Or when there is little or no water ſurrounding the child, it may move into a wrong poſition, and be confined there by the ſtricture of the uterus; (ſee *fig*. 33, 34, 35, 36. Or laſtly, it may be the effect of a pendulous belly or narrow pelvis, when the head lies forward over the pubis. See *fig*. 16, 30, and 37.

SECT. VIII. *The Pelvis.*

It is neceſſary that all Practitioners in Midwifery ſhould be acquainted with the ſtructure and form of the Pelvis; of which we have treated in the Syſtem of Anatomy, Part II. Section II. And in order to afford a more perfect knowledge of the bones which compoſe the Pelvis, we have given three views of it, that will be deſcribed at the end of the Syſtem. The firſt Figure repreſents the bones of a well formed Pelvis. The ſecond Figure exhibits a front view of a diſtorted Pelvis. The third repreſents a lateral and internal view of the Pelvis, the ſame being divided longitudinally, in order more clearly to ſhew and deſcribe the reſpective parts. As a diſtorted Pelvis ſometimes occurs in the courſe of practice, it will be proper to attend to *fig.* 2. in the deſcription of the Plates, at the end of the Syſtem.

PART II.

Of the Diſeaſes incident to pregnant Women; being either ſuch as immediately proceed from Pregnancy, or ſuch as may happen at any other Time; and, if not carefully prevented or removed, may be of dangerous Conſequence both to Mother and Child.

SECT. I. *Of* NAUSEA *and* VOMITING.

The firſt complaint attending pregnancy, is the nauſea and vomiting, which in ſome women begins ſoon after conception, and frequently continues till the end of the fourth month. Moſt women are troubled with this ſymptom more or leſs, particularly vomiting in the morning: ſome who have no ſuch complaint in one pregnancy, ſhall be violently attacked with it in another; and in a few it prevails during the whole time of uterine geſtation.

The vomiting, if not very violent, is ſeldom of dangerous conſequence: but, on the contrary, is ſuppoſed to be ſerviceable to the patient, by unloading the ſtomach of ſuperfluous nouriſhment, thereby carrying off or preventing too great a turgency in the veſſels of the viſcera and uterus; and by creating a kind of ſtraining or niſus in the parts, which will aſſiſt the fundus and neck of the womb in ſtretching. Nevertheleſs, if the ſtraining is too great, it may endanger a miſcarriage.

Perhaps this complaint is chiefly occaſioned by a fulneſs of the veſſels of the uterus, owing to obſtructed catamenia, the whole quantity of which cannot as yet be employed in the nutrition of the embryo: over and above this cauſe, it has been ſuppoſed that the uterus being ſtretched by the increaſe of the ovum, a tenſion of that part enſues, affecting the nerves of that viſcus, eſpecially thoſe that ariſe from the ſympathetici maximi, and communicate with the plexus at the mouth of the ſtomach. Whatever be the cauſe, the complaint is beſt relieved by bleeding, more or leſs, according to the plethora and ſtrength of the patient; and if ſhe is coſtive, by emollient glyſters and opening medicines, that will evacuate the hardened contents of the colon and rectum; ſo that the viſcera will be rendered light and eaſy, and the ſtretching fulneſs of the veſſels taken off. A light, nutritive, and ſpare diet, with moderate exerciſe, and a free open air, will conduce to the removal of this complaint.

SECT. II. *Of the Difficulty in making Water; Coſtiveneſs; Swelling of the Hæmorrhoids, Legs, and Labia Pudendi; and the Dyſpnœa and Vomiting at the latter End of Pregnancy.*

Towards the end of the fourth month, or beginning of the fifth, the uterus is ſo much diſtended as to fill all the upper part of the pelvis, and then begins to riſe upwards into the abdomen; about the ſame time the os internum is likewiſe raiſed and turned backwards towards the ſacrum, becauſe the fundus is inclined forwards in its riſe. The uterus, according to the different directions in which it extends, produces various complaints by its weight and preſſure upon the adjacent parts, whether in the pelvis, or higher in the abdomen. In the fourth or fifth month, it preſſes againſt the ſphincter of the bladder in the pelvis, and produces a difficulty in making water, and ſometimes, (though ſeldom) a total ſuppreſſion. This complaint will happen, if the womb is ſunk too low in the vagina; or if the ovum, inſtead of adhering to the fundus, deſcends into the wide part in the middle of the neck, which accordingly firſt undergoes diſtention. This diſpoſition of the ovum is frequently the cauſe of abortion, becauſe the mouth and neck being in this caſe, from the ſtretching, the weakeſt parts of the uterus, the os internum begins to be opened too ſoon: yet ſometimes this will continue ſtrong and rigid; and after the neck is enlarged, the fundus will be, laſt of all, ſtretched till the end of geſtation, and the woman be happily delivered. This is one probable reaſon to account for the Placenta's ſometimes adhering over the inſide of the mouth of the womb, and helps to ſupport the theory of the neck's turning ſhorter and ſhorter, as the full time approaches.

But, as the ſtretching begins lower down in this than in a common caſe, the uterus muſt conſequently preſs againſt all parts of the pelvis before it can riſe above the brim; and this preſſure ſometimes produces an obſtruction of urine and difficulty in going to ſtool: the general compreſſion of all theſe parts will be attended with a degree of inflammation in the ſubſtance of the uterus, the vagina, mouth of the bladder, and rectum; from whence violent pains and a fever will enſue. In order to remove or alleviate theſe ſymptoms, recourſe muſt be had to bleeding and glyſters, the urine muſt be drawn off by the catheter, fomentations and warm baths be uſed, and this method occaſionally repeated until the complaints abate; and they commonly vaniſh in conſequence of the womb's riſing higher, ſo as to be ſupported on the brim of the pelvis. See *fig.* 7.

By the preſſure of the uterus upon the upper part of the rectum and lower part of the colon, where it makes ſemicircular turns to the right and left, the fæces are hindered to paſs, and by remaining too long in the guts are indurated, the fluid parts being abſorbed. Hence ariſe violent ſtraining at ſtool, and a compreſſion of the womb, which threatens abortion. When the patient, therefore, has laboured under this ſymptom for ſeveral days, let emollient, laxative, and gently ſtimulating glyſters be injected. But if the rectum be ſo obſtructed as that the injection cannot paſs, ſuppoſitories are firſt to be introduced: for frequently, when the colon and rectum are compreſſed by the uterus, the periſtaltic motion is weakened and impeded, ſo that the guts cannot expel their contents; in which caſe, the ſuppoſitory, by irritation, quickens this faculty, and in diſſolving lubricates the parts, thereby facilitating the diſcharge of the hardened fæces. This previous meaſure being taken, a glyſter ought to be injected, in order to diſſolve the collected and indurated contents of the colon, as well as to lubricate and ſtimulate the inſide of that inteſtine, ſo as to effect a general evacuation; and for this purpoſe, a ſyringe ſhould be uſed inſtead of a bladder, that the injection may be thrown up with greater efficacy and force.

Theſe glyſters ought to be repeated until the hardened fæces are altogether brought away, and the laſt diſcharge appear to be of a ſoft conſiſtence: neither ought the preſcriber to truſt to the reports of the patients or nurſe, but to his own ſenſes, in examining the effects of theſe injections; for, if the complaint hath continued ſeveral days, a large quantity of indurated fæces ought to be diſcharged. To avoid ſuch inconvenience for the future, an emollient glyſter muſt be injected every ſecond night; or, if the patient will not ſubmit to this method, which is certainly the eaſieſt and beſt, recourſe muſt be had to thoſe lenients mentioned at the latter end of this ſection: for when the fæces are long retained, the air rarifies, expands, and ſtretches the colon, producing ſevere colic pains; this being the method followed by nature, with a view to diſburthen herſelf when ſhe is thus encumbered. See *fig.* 7.

The preſſure of the uterus upon the hæmorrhoidal and internal Iliac veins, produces a turgency and tumefaction of all the parts below, ſuch as the pudenda, vagina, anus, and even the os internum, and neck of the womb. This tumefaction of the hæmorrhoidal veins, appears in thoſe ſwellings at the inſide and outſide of the anus, which are known by external and internal hæmorrhoids, or piles. This is a complaint to which women are naturally more ſubject than the other ſex: but it is always more violent in time of pregnancy, when the ſame method of cure may be adminiſtered as recommended in the Syſtem of Medicine, Genus 31, though greater caution muſt be uſed in applying leeches to the parts; becauſe, in this caſe, a great quantity of blood may be loſt before the diſcharge can be reſtrained.

About the latter end of the 5th or in the beginning of the ſixth month, the uterus being ſtretched above the brim, and the fundus raiſed to the middle ſpace betwixt the os pubis and navel, is conſiderably increaſed in weight; and even then (though much more ſo near the full time) lies heavy upon the upper part of the brim, preſſes upon the vertebræ of the loins and oſſa ilia, and, riſing ſtill higher with an augmented force, gradually ſtretches the parietes of the abdomen, puſhing the inteſtines upwards and to each ſide.

The weight and preſſure on the external iliac veins are attended with a ſurcharge or fulneſs in the returning veſſels that come from the feet, legs, and thighs; and this tumefaction produces œdematous and inflammatory ſwellings in theſe parts, together with various tumours in the veins, that ſometimes come to ſuppuration.

The ſame weight and preſſure occaſion pains in the back, belly, and loins, eſpecially towards the end of the eighth or in the ninth month: if the uterus riſes too high, a diſpnœa or difficulty of breathing, and frequent vomitings enſue: the firſt proceeds from the confinement of the lungs and diaphragm in reſpiration, the liver and viſcera of the abdomen being forced up into the thorax; and the laſt is occaſioned by the extraordinary preſſure upon the ſtomach.

All the complaints above deſcribed, namely, ſwelling of the legs, thighs, and labia pudendi, pains in the back, loins, and belly, with dyſpnœa and vomiting, are removed or palliated by the following method. The patient, if ſhe can bear ſuch evacuations, is generally relieved by bleeding at the arm or ankle, to the amount of eight or ten ounces; but the quantity muſt be proportioned to the emergency of the caſe: the belly muſt be kept open and eaſy with emollient glyſters and laxative medicines, ſuch as a ſpoonful or two of a mixture compoſed of equal parts of *Ol. Amygd. d.* and *Syr. Violar.* taken every night; or from two drachms to half an ounce of manna, or the ſame quantity of lenitive electuary; a ſmall doſe of rheubarb, or five grains of any opening pill, unleſs the patient be troubled with the hæmorrhoids, in which caſe all aloetic medicines ought to be avoided: the patient muſt not walk much, or undergo hard exerciſe; but frequently reſt upon the bed, and lie longer than uſual in the morning. When the ſwelling of the legs is moderate, and only returns at night, rollers or the laced ſtocking may be ſerviceable; but when it extends in a great degree to the thighs, labia pudendi, and lower part of the belly, in a woman of a full habit of body, venæſection is neceſſary, becauſe this cedeœdematous ſwelling proceeds from a compreſſion of the returning veins, and not from laxity, as in the anaſarca and leucophlegmatic conſtitutions: here moderate exerciſe, and (as we have already obſerved) frequent reſting on a bed or couch, is beneficial; or if the ſkin of the leg and pudenda is exceſſively ſtretched, ſo as to be violently pained, the patient will be greatly relieved by puncturing the parts occaſionally: but theſe complaints cannot be totally removed till delivery, after which they commonly vaniſh of themſelves.

The bellies of thoſe that are indolent and uſe no exerciſe ought to be moderately compreſſed, ſo that the uterus may not riſe too high, and occaſion difficulty in breathing, and vomiting, in the laſt months; but they muſt not be too ſtraitly ſwathed leſt the womb ſhould be determined, in ſtretching over the pubes, and produce a pendulous belly, which is often the cauſe of difficult labours. A medium ought, therefore, to be preſerved in this article of compreſſing, and no woman lace her jumps or ſtays ſo as to make herſelf uneaſy; while the diet, air, and exerciſe, ought to be regulated according to the conſtitution, cuſtom, and complaints of the patient.

SECT. III. *Of Incontinence of Urine and Difficulty in making Water, at the latter End of Pregnancy, and in Time of Labour.*

The veſica urinaria, in pregnant women near their full time, is often ſo much preſſed by the uterus, that it will contain but a very ſmall quantity of water: a circumſtance, though not dangerous, extremely troubleſome, eſpecially when attended with a vomiting or cough; in which caſe, the ſtraining forces out the water involuntarily, with great violence. The cough may be alleviated by proper remedies, but the vomiting can ſeldom be removed. Sometimes a bandage applied round the lower part of the belly, and ſupported with the ſcapular, is of ſingular ſervice, particularly when the uterus lies pendulous over the os pubis, thereby compreſſing the urinary bladder.

But this complaint is not of ſuch dangerous conſequence, as a difficulty in making water, or a total ſuppreſſion which happens, though very ſeldom, in the fourth or in the beginning of the fifth month of pregnancy; but moſt frequently occurs in the time of labour, and after delivery. In the beginning of labour, before the membranes are broke, and the head of the child ſunk into the paſſage, the woman commonly labours under an incontinence of urine from the preſſure upon the bladder: but the membranes being broken, and the waters diſcharged, the uterus contracts, and the child's head is forced down into the pelvis, where, if it continues for any length of time, the urethra and ſphincter veſicæ are ſo compreſſed that the urine cannot paſs: while the preſſure on the other parts of the bladder being removed in conſequence of the diminiſhed ſize of the uterus and the laxity of the parietes of the abdomen, the veſica urinaria is the more eaſily ſtretched by the increaſing quantity of urine, which diſtends it to ſuch a degree, that the fibres are overſtrained: and after delivery, when the preſſure is removed from the ſphincter and meatus urinarius, it cannot contract ſo as to diſcharge its contents, eſpecially if any ſwelling or inflammation remains from the preſſure upon the neck and urethra; in which caſe, the patient is afflicted with violent ſtretching pains in the loins, back, groin, and particularly above the os pubis.

This complaint is immediately removed by drawing off the urine with a catheter: and indeed this expedient ought to be tried before delivery, as it muſt infallibly promote labour, becauſe one pain interferes with the other. If the inflammation continues or increaſes, and the obſtruction of urine recurs after delivery, the external parts ought to be fomented with warm ſtupes; bladders half filled with warm water or emollient decoctions may be applied, as hot as the patient can bear them, to all the lower part of the belly; and the catheter be uſed twice a-day, or as often as neceſſity requires, until the bladder ſhall have recovered its tone, ſo as to perform its office without aſſiſtance.

PART III. MISCARRIAGES.

Moſt of the complaints above deſcribed, if violent and neglected, may occaſion a miſcarriage; and it would be almoſt an endleſs taſk to enumerate every accident from which this misfortune may proceed. We ſhall therefore content ourſelves with deſcribing in what manner abortion happens: firſt, in the death of the child; ſecondly, in the ſeparation of the placenta; and laſtly, in whatever may occaſion too great extenſion of the neck and of the os internum.

SECT. I. *Of the* CHILD's *Death.*

This may proceed from diſeaſes peculiar to itſelf not to be accounted for, as well as from divers accidents that befal it in the womb. If, for example, the navel-ſtring be long, and the quantity of ſurrounding waters great, the fœtus, while young, may in ſwimming form a nooſe of the funis; through which if the head only paſſes, a circumvolution will happen round the neck or body; but ſhould the whole fœtus paſs or thread this nooſe, a knot will be formed on the navel-ſtring, which, if tight drawn, will abſolutely obſtruct the circulation. This may likewiſe be the caſe when the waters are in very ſmall quantity, and the funis umbilicalis falls down before the head, by which it is violently compreſſed. In ſhort, the death of the fœtus will be effected by all circumvolutions, knots, or preſſure upon the navel-ſtring, which deſtroy the circulation betwixt the placenta and the child.

The fœtus may ſuffer death from diſeaſes and accidents that happen to the mother; from violent paſſions of joy, fear, or anger, ſuddenly raiſed to ſuch tranſports as occaſion tremors, fainting, or convulſions; and from a plethora, and all acute diſtempers in which the circulating force of the fluids is too violent.

The child being dead, and the circulation in the ſecundines conſequently deſtroyed, the uterus is no longer ſtretched; the fœtus, if large, is no longer felt to move or ſtir; all the contained parts run gradually into a ſtate of putrefaction; the reſiſtance of the membranes becomes weaker than the contracting force of the uterus, joined with the preſſure of the contents and parietes of the abdomen; the contained waters of conſequence burſt through their mortified incloſure; and the uterus is contracted cloſe to its contents, which are therefore preſſed down lower and lower; the neck and mouth of the womb being gradually ſtretched, labour comes on, and a miſcarriage enſues.

At other times, gripings, looſeneſs, and labour-pains, even before the membranes break, are occaſioned by obſtruction or reſiſtance of the veſſels of the uterus. In theſe caſes, if no flooding happens, the woman is ſeldom in danger; and, though the child is known to be dead, the progreſs of nature is to be waited for with patience. If the woman is weak, exhauſted, or timorous, ſhe muſt be encouraged and fortified with nouriſhing diet; if plethoric, ſhe muſt undergo evacuation by bleeding and laxative medicines; and when labour begins, be aſſiſted according to the directions ſpecified in the ſequel.

SECT. II. *Of the Separation of the* PLACENTA *from the* UTERUS.

This ſeparation may proceed from all the foregoing diſeaſes and accidents that happen to the mother: from violent ſhocks, ſtrains, over-reachings, falls, and bruiſes on the abdomen; as alſo from vehement coughs, vomitings, or ſtrainings at ſtool when the body is coſtive. The ſeparation of the placenta is always accompanied with a diſcharge of blood from the veſſels of the uterus, more or leſs, according to the term of pregnancy, or as the placenta is more or leſs detached.

This diſcharge is diſtinguiſhed from the menſes by the irregularity of its period, by its flowing in a larger quantity, and, after a ſmall intermiſſion, its return upon the leaſt motion of the patient.

The younger the woman is with child, the danger is the leſs; becauſe, though a conſiderable quantity of blood be loſt, it does not flow with ſuch violence as to exhauſt her immediately; and therefore ſhe may be ſupported and her ſpirits kept up with proper cordials and nutritive diet. But when ſuch an hæmorrhage happens in any of the three or four laſt months of pregnancy, the danger is much more imminent, eſpecially towards the full time; becauſe the veſſels of the uterus being then largely diſtended, a much greater quantity of blood is loſt in a ſhorter time: yet in both caſes, the floodings will be more or leſs, as there is more or leſs of the placenta ſeparated from the womb; and when this happens in a very ſmall degree, the diſcharge may, by right management, be ſometimes ſtopped, and every thing will happily proceed to the full time. But if this purpoſe cannot be effected in a woman young with child, the principal intention ought to be a mitigation of the hæmorrhage, leaving the reſt to time and patience, as a miſcarriage in the firſt five months is ſeldom attended with hazard. On the contrary, nothing can be more dangerous than ſuch an effuſion in any of the four laſt months, provided it can be immediately reſtrained. In this caſe we are often deceived by a ſhort intermiſſion, occaſioned by coagulated blood that locks up the mouth of the womb, which being puſhed off, the flooding returns: and hence we account for its returning ſo commonly upon motion, a fit of coughing, ſtraining at ſtool, or any effort whatever.

It is happy for the woman in this caſe when ſhe is ſo near the full time that ſhe may be ſuſtained till labour is brought on; and this may be promoted, if the head preſents, by gently ſtretching the mouth of the womb, which being ſufficiently opened, the membranes muſt be broke: ſo that the waters being evacuated, the uterus contracts, the flooding is reſtrained, and the patient ſafely delivered: at any rate, if the hæmorrhage returns again with great violence, there is no other remedy than that of delivering with all expedition.

Although the great danger is from floodings when near the full time, yet, if labour can be brought on, the os uteri is eaſily dilated with the labour or the hand; but in the ſixth or ſeventh month, it takes longer time, and is ſtretched with greater difficulty, which is ſometimes the occaſion of the danger at that period.

In all caſes and at all times of pregnancy, if the woman receives any extraordinary ſhock either in mind or body; if ſhe is attacked by a violent fever, or any complaints attending a plethora; bleeding ought always to be preſcribed by way of prevention or precaution, unleſs a low, weak, lax habit of body renders ſuch evacuation unadviſable; but theſe are not ſo ſubject to fevers from fulneſs.

On the firſt appearance of flooding, ſhe ought to be confined to her bed, and be rather cool than warm. If coſtive, an emollient glyſter muſt be injected in order to diſſolve the hardened fæces, that they may be expelled eaſily without ſtraining: internally, mulſion with nitre muſt be uſed, and mixtures of the *Tinct. Roſar. Rub.* acidulated with ſpirits of vitriol, as the cooling or reſtringent method ſhall ſeem to be indicated; but above all things, opiates muſt be adminiſtered to procure reſt, and quiet the uneaſy apprehenſions of the mind: For diet, let her uſe panada, weak broth, and rice-gruel; ſhe may drink water in which a red-hot iron has been ſeveral times quenched, mixed with a ſmall proportion of red burnt wine; ſhe muſt abſtain from all the high-ſeaſoned foods, and even fleſh-meat or ſtrong broths, that will inrich the blood too faſt, and quicken the circulation. But if, notwithſtanding this regimen, the flooding ſhall continue and increaſe, ſo that the patient becomes faint and low with loſs of blood, we muſt without further delay attempt to deliver her, though this is ſeldom practicable, except in the laſt months of pregnancy, and then will be the eaſier performed the nearer ſhe is to her full time, unleſs labour-pains ſhall have aſſiſted or begun a dilatation of the os internum.

PART IV.

RULES TO BE OBSERVED PREVIOUS TO LABOUR.

SECT. I. Touching.

Touching is performed by introducing the fore-finger lubricated with pomatum into the vagina, in order to feel the os internum and neck of the uterus; and ſometimes into the rectum, to diſcover the ſtretching of the fundus. By ſome, we are adviſed to touch with the middle finger, as being the longeſt; and by others, to employ both that and the firſt: but the middle is too much encumbered by that on each ſide, to anſwer the purpoſe fully; and when two are introduced together, the patient never fails to complain. The deſign of touching is to be informed whether the woman is or is not with child; to know how far ſhe is advanced in her pregnancy; if ſhe is in danger of a miſcarriage; if the os uteri be dilated; and, in time of labour, to form a right judgment of the caſe from the opening of the os internum, and the preſſing down of the membranes with their waters; and laſtly, to diſtinguiſh what part of the child is preſented.

It is generally impracticable to diſcover by a touch in the vagina, whether or not the uterus is impregnated, till after the fourth month: when the beſt time for examination is the morning, when the woman is faſting, after the contents of the bladder and rectum have been diſcharged: and ſhe ought, if neceſſary, to ſubmit to the inquiry in a ſtanding poſture; becauſe, in that caſe, the uterus hangs lower down in the vagina, and the weight is more ſenſible to the touch than when ſhe lies reclined. One principal reaſon of our uncertainty is, when we try to feel the neck, the womb riſes up on our preſſing againſt the vagina, at the ſide of the os internum, (ſee *fig.* 7.); and in ſome, the vagina feels very tenſe: but, when the fundus uteri is advanced near the navel, the preſſure from above keeps down the os internum ſo much, that you can generally feel both the neck, and, above that, the ſtretching of the under part of the uterus. See *fig.* 6, 7, 8, 9.

There is no conſiderable variation to be felt in the figure of the os internum, except in the latter end of pregnancy, when it ſometimes grows larger and ſofter, (ſee *fig.* 14); nor do the lips ſeem to be more cloſed in a woman with child than in another, eſpecially in the beginning of pregnancy; but, in both caſes, the os uteri is felt like the mouth of a young puppy or tench. In ſome, the lips are very ſmall; in others, large; and ſometimes, though ſeldom, ſmoothed over or pointed. In many women, who have formerly had children and difficult labours, the lips are large, and ſo much ſeparated as to admit the tip of an ordinary finger; but, a little higher up, the neck ſeems to be quite cloſed.

In the firſt four months, the neck of the womb may be felt hanging down in the vagina, by puſhing up the finger by the ſide of the os internum: but the ſtretching of the uterus and upper part of the neck cannot be perceived till the fifth, and ſometimes the ſixth month; and even then the uterus muſt be kept down, by a ſtrong preſſure upon the belly. The ſtretching of the fundus is ſometimes felt by the finger introduced into the rectum, before it can be perceived in the vagina; becauſe, in this laſt method, the uterus recedes from the touch, and riſes too high to be accurately diſtinguiſhed; whereas the finger, being introduced into the rectum, paſſes along the back of the womb almoſt to the upper part of the fundus, which, in an unimpregnated ſtate is felt flat on the backpart, and jetting out at the ſides; but the impregnated uterus is perceived like a large round tumour.

About the fifth or ſixth month, the upper part of the uterus is ſo much ſtretched, as to riſe three or four inches above the os pubis, or to the middle ſpace between that and the navel; ſo that, by preſſing the hand on the belly, eſpecially of lean women, it is frequently perceived: (ſee *fig.* 10,) and if, at the ſame time, the index of the other hand be introduced in the vagina, the neck will ſeem ſhortened, particularly at the fore-part and ſides; and, as we have already obſerved, the weight will be ſenſibly felt: but if the parietes of the abdomen are ſtretched after eating, we may be deceived by the preſſure of the ſtomach, becauſe weight and preſſure are the ſame. But all theſe ſigns are more perceptible towards the latter end of pregnancy: and in ſome women the os internum is felt a little open ſome weeks before the full time, though generally it is not opened till a few days before labour begins.

From the fifth to the ninth month, the neck of the uterus becomes ſhorter and ſhorter, and the ſtretching of the womb grows more and more perceptible. In the ſeventh month, the fundus riſes as high as the navel; in the eighth month, to the middle ſpace betwixt the navel and ſcrobiculus cordis; and in the ninth, even to the ſcrobiculus, except in pendulous bellies: (ſee *fig.* 9, 10, 14.) But all theſe marks may vary in different women; for when the belly is pendulous, the parts below the navel are much more ſtretched than thoſe above, and hang over the os pubis: the fundus will then be only equal to, or a little higher than, the navel; at other times, the uterus will riſe in the latter end of the ſeventh or eighth month to the ſcrobiculus cordis. The neck of the womb will, in ſome, be felt as long in the eighth, as in others in the ſixth or ſeventh month. This variation ſometimes makes the examination of the abdomen more certain than the touch of the vagina; and ſo *vice verſa*. At other times, we muſt judge by both. See *fig.* 16.

SECT. II. *Of the Signs of* Conception, *and the equivocal Signs of pregnant and obſtructed Women.*

The ſigns of pregnancy are to be diſtinguiſhed from thoſe that belong to obſtructions, by the touch in the vagina, and motion of the child, in the fifth or ſixth month: ſometimes, by the touch in the rectum, before and after the fifth month, when the tumour of the abdomen is plainly perceived.

The fundus uteri, in the obſtructed patient, is not ſtretched, nor is the diſorder in her ſtomach ſo violent as in a pregnant woman, and ſeldom accompained with retchings; while the woman with child is afflicted with a retching every morning, and ſubject to longings beſides. The firſt labours under a fullneſs of the veſſels; the laſt, over and above this complaint, ſuffers an additional one from the diſtention of the uterus by the impregnated ovum. Obſtructions and pregnancy are both accompanied by a ſtretching fullneſs of the breaſts: but in the laſt only may be perceived the areola, or brown ring, round the nipples, from which, in the laſt months, a thin ſerum diſtils; but this circle is not always ſo diſcernible as in the firſt pregnancy, and even then is uncertain as well as the others.

About the fifth or ſixth month, the circumſcribed tumour, or ſtretching of the uterus, is felt above the os pubis; and by this circumſcription and conſiſtence, eaſily diſtinguiſhed from the aſcites or dropſy of the abdomen: it is alſo rounder and firmer than thoſe ſwellings that accompany obſtructions which proceed from a general fullneſs of the veſſels belonging to the ligaments and neighbouring viſcera. On the whole, the difficulty of diſtinguiſhing between obſtruction and pregnancy, in the firſt months, is ſo great, that we ought to be cautious in giving our opinion; and never preſcribe ſuch remedies as may endanger the fruit of the womb, but rather endeavour to palliate the complaints until time ſhall diſcover the nature of the caſe; and always judge on the charitable ſide, when life or reputation is at ſtake.

In the fifth or ſixth month of uterine geſtation, by the touch in the vagina, we perceive the neck of the womb conſiderably ſhortened; and the ſtretching of the lower part of the uterus is then ſenſibly felt between the mouth of the womb and the pubes, and on each ſide of the neck. See *fig.* 7, 8, 9.

In the ſeventh month, the head of the child is frequently felt reſting againſt the lower part of the uterus, between the pubes and os internum; and, being puſhed upward towards the fundus, ſinks down again by its own gravity. All theſe diagnoſtics are more plain and certain, the nearer the patient approaches to the time of delivery. Sometimes, the head is not felt till the eighth or ninth month; and in ſome few caſes not till after the membranes are broke, when it is forced down by the contraction of the uterus and ſtrong labour-pains. This circumſtance may be owing to the head's reſting above the baſin, eſpecially in a narrow pelvis; or to the diſtention of its belly with air after death, by which the fœtus being rendered ſpecifically lighter than the ſurrounding waters, the body floats up to the fundus, if there is a large quantity of fluid in the membranes: nor is the body always felt when the child lies acroſs the uterus.

SECT. III. *How to diſtinguiſh the* false Labour *from the* true, *and the Means to be uſed on that Occaſion.*

If the os uteri remains cloſe ſhut, it may be taken for granted that the woman is not yet in labour, notwithſtanding the pains ſhe may ſuffer. With regard to theſe, an accurate inquiry is to be made; and if her complaints proceed from an overſtretching fullneſs of the uterus, or veſſels belonging to the neighbouring parts, bleeding in the arm or ankle, to the quantity of ſix or eight ounces, ought to be preſcribed, and repeated occaſionally. If the pains are occaſioned by a looſeneſs or diarrhœa, it muſt be immediately reſtrained with opiates. Colic pains are diſtinguiſhed from thoſe of labour, by being chiefly confined to the belly, without going off and returning by diſtinct intervals: they are for the moſt part produced by fæces too long retained in the colon, or by ſuch ingeſta as occaſion a rarefaction or expanſion of air in the inteſtines, by which they are violently ſtretched and vellicated. This complaint muſt be removed by opening glyſters, to empty the guts of their noxious contents: and this evacuation being performed, opiates may be adminiſtered to aſſuage the pains; either to be injected by the anus, taken by the mouth, or applied externally in the form of epithem or embrocation.

Sometimes the os internum may be a little dilated, and yet it may be difficult to judge whether or not the patient be in labour. The caſe, however, may be aſcertained after ſome attendance, by theſe conſiderations: if the woman is not arrived at her full time: if no ſoft or glary mucus hath been diſcharged from the vagina: if the pains are limited to the region of the belly, without extending to the back and inſide of the thighs: if they are ſlight, and continue without intermiſſion or increaſe, nay, if they have long intervals, and recur without force ſufficient to puſh down the waters and membranes, or child's head, to open the os internum: if this part be felt thick and rigid, inſtead of being ſoft, thin, and yielding, we may ſafely pronounce, that labour is not yet begun; and thoſe alarms are to be removed as we have directed in the caſe of falſe or colic pains. Beſides, if the pulſe be quick and ſtrong, and the patient attacked by ſtitches in the ſides, back, or head, bleeding will be likewiſe neceſſary. See *fig.* 9, 14, 15.

PART V. NATURAL LABOURS.

In order to render this Syſtem as diſtinct as poſſible, for the ſake of the reader's memory, as well as the dependence and connection of the different labours, they are divided in the following manner: That is accounted *natural*, in which the head preſents, and the woman is delivered without extraordinary help; thoſe births are called *laborious* or *nonnatural*, when the head comes along with difficulty, and muſt be aſſiſted either with the hand in opening the parts, or with a fillet or forceps, or even when there is a neceſſity for opening and extracting it with the crotchet; and thoſe in which the child is brought by the breech or feet, are denominated *preternatural*, becauſe the delivery is performed in a preternatural way.

SECT. I. *The different Poſitions of Women in Labour.*

In almoſt all countries, the woman is allowed either to ſit, walk about, or reſt upon a bed, until the os uteri is pretty much dilated by the gravitation of the waters; or (when they are in ſmall quantity) by the head of the fœtus, ſo that delivery is ſoon expected; when ſhe is put in ſuch poſition as is judged more ſafe, eaſy, and convenient for that purpoſe: but the patient may be put upon labour too prematurely; and bad conſequences will attend ſuch miſtakes. Among the Egyptians, Grecians, and Romans, the woman was placed upon a high ſtool: in Germany and Holland, they uſe the chair which is deſcribed by Daventer and Heiſter: and for hot climates the ſtool is perfectly well adapted; but in northern countries, and cold weather, ſuch a poſition muſt endanger the patient's health. In the Weſt Indies, and ſome parts of Britain, the woman is ſeated on a ſtool made in form of a ſemicircle; in other places, ſhe is placed on a woman's lap; and ſome, kneeling on a large cuſhion, are delivered backwards. In France, the poſition is chiefly half-ſitting, half-lying, on the ſide or end of a bed; or the woman being naked in bed, is raiſed up with pillows or a bed-chair. The London method is very convenient in natural and eaſy labours: the patient lies in bed upon one ſide, the knees being contracted to the belly, and a pillow put between them to keep them aſunder. But the moſt commodious method is to prepare a bed and a couch in the ſame room: a piece of oiled cloth or dreſſed ſheep-ſkin is laid acroſs the middle of each, over the under-ſheet; and above this are ſpread ſeveral folds of linen pinned or tied with tape to each ſide of the bed and couch. Theſe are deſigned to ſponge up the moiſture in time of labour and after delivery; while the oiled cloths or ſheep-ſkins below preſerve the feather-bed from being wetted or ſpoiled: for this purpoſe, ſome people lay beſides upon the bed ſeveral under-ſheets over one another, ſo that by ſliding out the uppermoſt every day, they can keep the bed dry and comfortable.

The couch muſt be no more than three feet wide, and provided with caſters; and the woman, without any other dreſs than that of a ſhort or half ſhift, a linen ſkirt or petticoat open before, and a bed-gown, ought to lie down upon it, and be covered with cloaths according to the ſeaſon of the year. She is commonly laid on the left ſide, but in this particular ſhe is to conſult her own eaſe; and a large ſheet being doubled four times or more, one end muſt be ſlipt in below her breach, while the other hangs over the ſide of the couch, to be ſpread on the knee of the accoucheur or midwife, who ſits behind her on a low ſeat. As ſoon as ſhe is delivered, this ſheet muſt be removed, a ſoft warm cloth applied to the os externum, and the pillow taken from betwixt her knees: ſhe then muſt be ſhifted with a clean warm half-ſhift, linen ſkirt, and bed-gown, and the belly kept firm with the broad head-band of the ſkirt, the ends of which are to be pinned acroſs each other. Theſe meaſures being taken, the couch muſt be run cloſe to the bed-ſide, and the patient gently moved from one to another; but if there is no couch, the bed muſt be furniſhed with ſome apparatus. Some, again, are laid acroſs the foot of the bed, to the head of which the cloaths are previouſly turned up till after delivery, when the woman's poſture is adapted, and then they are rolled down again to cover and keep her warm. By this expedient the place of a couch is ſupplied, and the upper part of the bed preſerved ſoft and clean: whereas thoſe who are laid above the cloaths, muſt be taken up and ſhifted while the bed is put to rights, in which caſe they are ſubject to fainting; and to ſuch as are very much enfeebled, this fatigue is often fatal.

Women are moſt eaſily touched, leaſt fatigued, and kept warmeſt, when they lie on one ſide. But if the labour ſhould prove tedious, the Pariſian method ſeems moſt eligible; becauſe, when the patient half ſits, half lies, the brim of the pelvis is horizontal; a perpendicular line falling from the middle ſpace between the ſcrobiculus cordis and navel, would paſs exactly through the middle of the baſin. In this poſition, therefore, the weight of the waters, and, after the membranes are broke, that of the child's head, will gravitate downwards, and aſſiſt in opening the parts, while the contracting force of the abdominal muſcles and uterus is more free, ſtrong, and equal, in this than in any other attitude. Wherefore, in all natural caſes, when the labour is lingering or tedious, this or any other poſition, ſuch as ſtanding or kneeling, ought to be tried, which, by an additional force, may help to puſh along the head and alter its direction when it does not advance in the right way. Nevertheleſs, the patient muſt by no means be too much fatigued.

When the woman lies on the left ſide, the right-hand muſt be uſed in touching, and *vice verſa*, unleſs ſhe is laid acroſs on the bed; in which caſe, either hand will equally anſwer the ſame purpoſe: but if ſhe lies athwart with the breech towards the bed's foot, it will be moſt convenient to touch with the left-hand when ſhe is upon the left ſide, and with the right when in the oppoſite poſition. And here it will not be amiſs to obſerve, that in the deſcription of all the laborious and preternatural deliveries treated of in this Syſtem, the reader muſt ſuppoſe the woman lying on her back, as directed, except when another poſture is preſcribed; and that in natural and laborious labours, whether ſhe be upon her ſide or back, the head and ſhoulders are a little raiſed into a reclining poſture, ſo that ſhe may breathe eaſily, and aſſiſt the pains. But in preternatural labours, when there is a neceſſity for uſing great force in turning the child, the head and ſhoulders muſt lie lower than the breech, which, being cloſe to the ſide or foot of the bed, ought to be raiſed higher than either; becauſe, when the pelvis is in this ſituation, the hand and arm are eaſily puſhed up in a right line along the back-part of the uterus, even to its fundus. Sometimes, however, when the feet of the child are towards the belly of the mother, they are more eaſily felt and managed when ſhe lies on her ſide. At other times, placing the woman on her knees and elbows on a low couch, according to Daventer's method, will ſucceed better by diminiſhing in part the ſtrong reſiſtance from the preſſure and weight of the uterus and child, by which the feet will ſometimes be eaſier found and delivered: but then it is ſafer to the child, and eaſier for the operator and mother, to turn her back before you deliver the body and head.

SECT. II. *Of the Management of Women in a Natural Labour.*

In a woman come to full time, labour commonly begins and proceeds in the following manner. The os uteri is felt ſoft and a little opened, the circumference being ſometimes thick, but chiefly thin; from this aperture is diſcharged a thick mucus which lubricates the parts, and prepares them for ſtretching. This diſcharge uſually begins ſome days before; and is accounted the forerunner of real labour: at the ſame time the woman is ſeized at intervals with ſlight pains that gradually ſtretch the os uteri, fitting it for a larger dilatation; and when labour actually begins, the pains become more frequent, ſtrong, and laſting. At every pain the uterus is ſtrongly compreſſed by the ſame effort which expels the contents of the rectum at ſtool; namely, the inflation of the lungs, and the contraction of the abdominal muſcles.

If the child be ſurrounded with a large quantity of waters, (ſee *fig.* 11, 14, 15.) the uterus cannot come in contact with the body of it; but at every pain the membranes are puſhed down by the fluids they contain, and the mouth of the womb being ſufficiently opened by this gradual and repeated diſtention, they are forced into the middle of the vagina; then the uterus contracts and comes in contact with the body of the child, and, if it be ſmall, the head is propelled with the waters. Here the membranes uſually break; but if that is not the caſe, they are puſhed along towards the os externum, which they alſo gradually open, and appear on the outſide in the form of a large round bag: mean while, the head advances, and the os externum being by this time fully dilated, is alſo protruded; when, if the membranes, inſtead of burſting in the middle of the protuberance, are tore all round at the os externum, the child's head is covered with ſome part of them, which goes under the name of the *caul*, or *king's hood*. If the placenta is at the ſame time ſeparated from the uterus, and the membranes remain unbroken, the ſecundines, waters, and child, are delivered together; but if the placenta adheres, they muſt of courſe give way: and ſhould they be tore all around from the placenta, the greateſt part of the body, as well as the head of the child, will be enveloped by them, from which it muſt be immediately diſengaged, that the air may have a free paſſage into the lungs.

When the head is large, ſo that it does not deſcend immediately into the pelvis, the membranes are forced down by themſelves, and being ſtretched thinner and thinner give way; when all the waters which are further advanced than the head run out: then, the uterus coming in contact with the body of the child, the head is ſqueezed down into the mouth of the womb, which it plugs up ſo as to detain the reſt of the waters. (See *fig.* 16, 17.)

Sometimes when the quantity of waters is very ſmall, and the uterus embraces the body of the child, the head, covered with the membranes, is forced downwards, and gradually opens the os internum; but at its arrival in the middle of the pelvis and vagina, part of the waters will be puſhed down before it, ſometimes in a large and ſometimes in a ſmall proportion, towards the back-part of the pelvis. At other times, when the waters are in ſmall quantity, no part of them are to be diſtinguiſhed farther than the head, which deſcending lower and lower, the attenuated membranes are ſplit upon it; while at the ſame time it fills up the mouth of the womb and upper part of the vagina in ſuch a manner as hinders the few remaining waters from being diſcharged at once; though in every pain a ſmall quantity diſtils on each ſide of the head, for lubricating the parts, ſo as that the child may ſlip along the more eaſily. See *fig.* 17.

The uterus contracts; the pains become quicker and ſtronger; the crown of the head is puſhed down to the lower part of the pelvis, againſt one of the iſchia, at its lower extremity; the forehead, being at the upper part of the oppoſite iſchium, is forced into the hollow of the under part of the ſacrum, while the vertex and hind-head is preſſed below the os pubis, (*fig.* 18.) from whence it riſes in a quarter-turn, gradually opening the os externum; the frænum labiorum, or fourchette, perinæum, fundament, and the parts that intervene betwixt that and the extremity of the ſacrum, are all ſtretched outwards in form of a large tumour. The perinæum, which is commonly but one inch, from the os externum to the anus, is now ſtretched to three, the anus to two, and the parts between that and the coccyx are ſtretched from two inches to about three or more. The broad ſacro-ſciatic ligaments, reaching from each ſide of the lower part of the ſacrum, to the under part of each iſchium, are alſo outwardly extended, and the coccyx is forced backward; while the crown of the head, where the lambdoidal croſſes the end of the ſagittal ſuture, continues to be puſhed along, and dilates the os externum more and more. See *fig.* 13, 20.

When the head is ſo far advanced that the back part of the neck is come below the under part of the os pubis, the forehead forces the coccyx, fundament, and perinæum, backwards and downwards; then the hind part of the head riſes about two or three inches from under the pubes, making an half-round turn in its aſcent, by which the forehead is equally raiſed from the parts upon which it preſſed, and the perinæum eſcapes without being ſplit or torn; (ſee *fig.* 22.) at the ſame time, the ſhoulders advance into the ſides of the pelvis at its brim where it is wideſt, and, with the body, are forced along and delivered: meanwhile, by the contraction of the uterus, the placenta and chorion are looſened from the inner ſurface to which they adhered, and forced through the vagina, out at the os externum. When the head reſts as firſt above the brim of the pelvis, and is not far advanced, the fontanel may be plainly felt with the finger, commonly towards the ſide of the pelvis: this is the place where the coronal croſſes the ſaggital ſuture, and the bones are a little ſeparated from each other, yielding a ſoftneſs to the touch, by which may be diſtinguiſhed four ſutures, or rather one croſſing another. Theſe may be plainly perceived, even before the membranes are broke: yet the examination muſt not be made during a pain, when the membranes are ſtretched down and filled with waters; but only when the pain begins to remit, and the membranes to be relaxed; otherwiſe they may be broke too ſoon, before the os internum be ſufficiently dilated, and the head properly advanced.

When the vertex is come lower down, the ſagittal ſuture only is to be felt; becauſe, as the hind-head deſcends in the pelvis, the fontanel is turned more backwards to the ſide, or towards the concavity of the ſacrum: but, after it has arrived below the under part of the oſſa pubis, the lambdoidal may be felt croſſing the end of the ſagittal ſuture, the occiput making a more obtuſe angle than that of the parietal bones, at the place where the three are joined together. But all theſe circumſtances are more eaſily diſtinguiſhed after the membranes are broke, or when the head is ſo compreſſed that the bones ride over one another, provided the hairy ſcalp be not exceſſively ſwelled. See FIG. 13, 17, 18, 20, 21.

SECT. III. *How and when to break the Membranes.*

We have already obſerved, that if the child be ſurrounded with a large quantity of waters, the uterus cannot come in contact with the body, ſo as to preſs down the head, until the membranes are puſhed a conſiderable way before it into the vagina: nor even then until they are broke, and the fluid diminiſhed in ſuch a manner as will allow the womb to contract, and, with the aſſiſtance of the pains, force along the child. When the membranes, therefore, are ſtrong or unadvanced, and continue ſo long unbroke that the delivery is retarded, provided the os internum be ſufficiently dilated, they ought to be broke without further delay, eſpecially if the woman hath been much fatigued or exhauſted with labour, or is ſeized with a violent flooding: in which caſe, the rupture of the membranes haſten delivery, and the hæmorrhage is diminiſhed by the contraction of the uterus, which leſſens the mouth of the veſſels that are alſo compreſſed by the body of the child.

The common method of breaking the membranes, is by thruſting the fingers againſt them when they are protruded with the waters during the pain, or by pinching them with the finger and thumb; but if they are detained too high to be managed in either of theſe methods, the hand may be introduced into the vagina, if the os externum is ſo lax as to admit it eaſily: and if this cannot be done without giving much pain, the fore and middle fingers being puſhed into the vagina with the other hand, let a probe or pair of pointed ſciſſars be directed along and between them, and thruſt through the membranes when they are puſhed with the waters below the head. This operation muſt be cautiouſly performed, leſt the head ſhould be wounded in the attempt; and as for the membranes, let the opening be ever ſo ſmall, the waters are diſcharged with force ſufficient to tear them aſunder.

SECT. IV. *When little or no Waters are protruded.*

If the vertex, inſtead of reſting at the ſide of the brim of the pelvis, or at the os pubis, is forced farther down to the os internum, and the waters happen to be in ſmall quantity, the head is puſhed forwards, and gradually opens the mouth of the womb without any ſenſible interpoſition of the waters: then it advances by degrees into the vagina, and the membranes being ſplit or tore, little or nothing is diſcharged until the body of the child be delivered: and in this caſe, the hair of the head being plainly felt, will be a ſufficient indication that the membranes are broke. If no hair is to be felt, but a ſmooth body preſents itſelf to the touch, and the woman has undergone many ſtrong pains even after the mouth of the womb hath been largely dilated, and the head forced into the middle of the pelvis, you may conclude that delivery is retarded by the rigidity of the membranes, that there is but a ſmall quantity of waters, and that if the containing ſacs were broke, the head would come along without farther heſitation.

Sometimes no waters can be felt while the head is no farther advanced than the upper part of the pelvis, becauſe it plugs up the paſſage and keeps them from deſcending; but as it advances downwards, the uterus contracts, and they are forced down in a ſmall quantity towards the back-part; from thence, as the head deſcends, or even though it ſhould ſtick in that ſituation, they are puſhed farther down, and the membranes may be eaſily broke; but the taſk is more difficult when no waters come down, and the membranes are contiguous to the head. In this caſe, they muſt be ſcratched a little, during every pain, with the nail of a finger, which, though ſhort and ſmooth, will by degrees wear them thinner and thinner, until they ſplit upon the head by the force of labour. Yet this expedient ought never to be uſed until you are certain that delivery is retarded by their rigidity; for, if that be not the hindrance, the difficulty muſt proceed from the weakneſs of the woman, a large head, or narrow pelvis: in which caſe, the delivery is a work of time, and will be obſtructed by the premature diſcharge of the waters, which, by gradually paſſing by the head, ought to keep the parts moiſt and ſlippery, in order to facilitate the birth: for, when the membranes are not broke, until the head is forced into the middle of the pelvis, the largeſt part of it being then paſt the upper part of the ſacrum, is commonly ſqueezed along, opens the os externum, and is delivered before all the waters are diſcharged from the uterus; ſo that what remains, by moiſtening and lubricating the parts, helps the ſhoulders and body to paſs with more eaſe. When the membranes are too ſoon broke, the under part of the uterus contracts ſometimes ſo ſtrongly before the ſhoulders, that it makes the reſiſtance ſtill greater.

SECT. V. *How to manage when the Head comes down into the* PELVIS.

In moſt natural labours, the ſpace betwixt the fore and back fontanels, viz. the vertex, preſents to the os internum, and the forehead is turned to the ſide of the pelvis; becauſe the baſin at the brim is wideſt from ſide to ſide; and frequently, before the head is puſhed in and faſt wedged among the bones, the child (after a pain) is felt to move and turn it to that ſide or ſituation in which it is leaſt preſſed and hurt, if it was not preſenting in that poſition before. But this poſition of the head may alter, viz. in thoſe where it is as wide, or wider, from the back-part to the fore-part of the brim, than from ſide to ſide, the forehead may be turned backwards or forwards. But this form of the pelvis ſeldom happens.

This poſture is always obſerved in a narrow pelvis, when the upper part of the ſacrum jets forward to the pubes; but as the child is forced lower down, the forehead turns into the hollow at the interior part of the ſacrum, becauſe the vertex and occiput find leſs reſiſtance at the lower part of the oſſa pubis than at the iſchium, to which it was before turned, the pelvis being at the pubes, no more than two inches in depth, whereas at the iſchium it amounts to four. If, therefore, the forehead ſticks in its former ſituation, without turning into the hollow, it may be aſſiſted by introducing ſome fingers, or the whole hand, into the vagina, during a pain, and moving in the right poſition. See Part VI. Sect. IV. Caſe V.

When the head of the fœtus preſents, and is forced along in any of thoſe poſitions, the labour is accounted natural, and little elſe is to be done, but to encourage the woman to bear down with all her ſtrength in every pain, and to reſt quietly during each interval: if the parts are rigid, dry, or inflamed, they ought to be lubricated with pomatum, hog's-lard, butter, or ung. altheæ; the two firſt are moſt proper for the external parts, and the two laſt (as being harder and not ſo eaſily melted) ought to be put up into the vagina to lubricate that and the os internum.

SECT. VI. *How to aſſiſt in* LINGERING LABOURS *when the Parts are rigid.*

The mouth of the womb and os externum, for the moſt part, open with greater difficulty in the firſt than in the ſucceeding labours, more eſpecially in women turned of thirty. In theſe caſes, the os externum muſt be gradually dilated in every pain, by introducing the fingers in form of a cone, and turning them round, ſo as to ſtretch the parts by gentle degrees; and the whole hand being admitted into the vagina, it will be ſometimes found neceſſary to inſinuate the fingers with the flat of the hand between the head and os internum: for when this precaution is not taken in time, the os uteri is frequently puſhed before the head (eſpecially that part of it next the pubes), even through the os externum; or if the head paſſes the mouth of the womb, it will protrude the parts of the os externum, and will endanger a laceration in the perinæum. This dilatation, however, ought to be cautiouſly performed, and never attempted except when it is abſolutely neceſſary; even then it muſt be affected ſlowly, and in time of a pain, when the woman is leaſt ſenſible of the dilating force.

When the labour happens to be lingering, though every thing be in a right poſture, if the aſſiſtants are clamorous, and the woman herſelf too anxious and impatient to wait the requiſite time without complaining, the labour will be actually retarded by her uneaſineſs, which we muſt endeavour to ſurmount by arguments and gentle perſuaſion: but if ſhe is not to be ſatisfied, and ſtrongly impreſſed with an opinion that certain medicines might be adminiſtered to haſten delivery, it will be convenient to preſcribe ſome innocent medicine that ſhe may take between whiles, to beguile the time and pleaſe her imagination; but if ſhe is actually weak and exhauſted, it will be neceſſary to order ſomething that will quicken the circulating fluids, ſuch as preparations of amber, caſtor, myrrh, volatile ſpirits, the *pulv. myrrh. compoſit.* of the London, or *pulv. ad partum* of the Edinburgh Pharmacopœia, with every thing in point of diet and drink that nouriſhes and ſtrengthens the body. If the patient is of a plethoric habit, with a quick, ſtrong pulſe, the contrary method is to be uſed, ſuch as venæſection, antiphlogiſtic medicines, and plentiful draughts of weak, diluting fluids.

SECT. VII. *How to manage when the Birth is obſtructed by the Navel-ſtring of the Child, or a narrow* PELVIS.

Although the head is puſhed down into the pelvis, and the vertex employed in opening the os externum, the forehead being lodged in the concavity formed by the coccyx and lower part of the ſacrum; yet frequently, after the labour-pain is abated, the head is again withdrawn, by the navel-ſtring happening to be twiſted round the neck; or when the ſhoulders, inſtead of advancing, are retarded at the brim of the pelvis, one reſting over the oſſa pubis, while the other is fixed at the ſacrum; or when (the waters having been long evacuated) the under-part of the uterus contracts round the neck and before the ſhoulders, keeping up the body of the child.

When the head is therefore drawn back by any of theſe obſtacles, and the delivery hath been retarded during ſeveral pains, one or two fingers being introduced into the rectum before the pain goes off, ought to preſs upon the forehead of the child at the root of the noſe, great care being taken to avoid the eyes: this preſſure detains the head till the return of another pain, which will ſqueeze it further down, while the fingers puſhing ſlowly and gradually turn the forehead half round outwards and half round upwards. By this aſſiſtance, and the help of ſtrong pains, the child will be forced along, although the neck be entangled in the navel-ſtring: for as the child advances the uterus contracts, and conſequently the placenta is moved lower; the funis umbilicalis will alſo ſtretch a little, without obſtructing the circulation. The head being thus kept down, the ſhoulders too are preſſed in every ſucceeding pain until they are forced into the pelvis, when the whole comes along, without further difficulty. And this expedient will, moreover, anſwer the purpoſe, when the under-part of the uterus or the os internum is contracted round the neck of the child, and before the ſhoulders: alſo, when the head is very low, preſſing a finger on each ſide of the coccyx externally, will frequently aſſiſt in the ſame manner; alſo, in lingering caſes, when the woman is weak, the head large, or the pelvis narrow, you may aſſiſt the delivery by gently ſtretching both the os externum and internum with your fingers, in time of the pains, which will increaſe the ſame, as well as dilate; but this is only to be done when abſolutely neceſſary, and with caution and at intervals, for fear of inflaming or lacerating the parts. Over and above theſe obſtacles, the head may be actually delivered, and the body retained by the contraction of the os externum round the neck, even after the face appears externally. In this caſe it was generally alleged that the neck was cloſe embraced by the os internum: but this ſeldom happens when the head is delivered, becauſe then the os internum is kept dilated on the back part and ſides by the breaſt and arms of the fœtus, unleſs it be forced low down with or before the head.

When the head is delivered, and the reſt of the body retained from the largeneſs or wrong preſenting of the ſhoulders, or by the navel-ſtring's being twiſted round the body or neck of the child, the head muſt be graſped on each ſide, the thumbs being applied to the occiput, the fore and middle fingers extended along each ſide of the neck, while the third and fourth of each hand ſupport each ſide of the upper jaw: thus embraced, the head muſt be pulled ſtraight forwards; and if it will not move eaſily along, the force muſt be increaſed, and the direction varied from ſide to ſide, or or rather from ſhoulder to ſhoulder, not by ſudden jerks, but with a ſlow, firm, and equal motion. If the body cannot be moved in this manner, though you have exerted as much force as poſſible without running the riſk of over-ſtraining the neck, you muſt endeavour to ſlip the turns of the navel-ſtring over the head. But ſhould this be found impracticable, you ought not to trifle in tying the ſtring at two places, and cutting betwixt the ligatures, as ſome people have adviſed: ſuch an operation would engroſs too much time; beſides, the child is in no danger of ſuffocation from the ſtricture of the funis, becauſe it ſeldom or never breathes before the breaſt is delivered.

The better method is, immediately to ſlide along one or two fingers, either above or below, to one of the arm-pits, by which you try to bring along the body, while with the other hand you pull the neck at the ſame time: if it ſtill continues unmoved, ſhift hands, and let the other arm-pit ſuſtain the force; but if this fail, cut the navel-ſtring, and tie it afterwards. If the ſhoulders lie ſo high that the fingers cannot reach far enough to cut or take ſufficient hold, let the flat of the hand be run along the back of the child: or ſhould the os externum be ſtrongly contracted round the neck, puſh up your hand along the breaſt, and pull as before; and ſhould this method fail, you muſt have recourſe to the blunt hook introduced and fixed in the arm-pit: but this expedient mnſt be uſed with caution, leſt the child ſhould be injured or the parts lacerated. The child being born, the funis umbilicalis muſt be divided, and the placenta delivered, according to the directions that will occur in the ſequel.

PART VI.

LABORIOUS LABOURS.

SECT. I. *How* LABORIOUS LABOURS *are occaſioned.*

A general outcry hath been raiſed againſt gentlemen of the profeſſion, as if they delighted in uſing inſtruments and violent methods in the courſe of their practice; and this clamour hath proceeded from the ignorance of ſuch as do not know that inſtruments are ſometimes abſolutely neceſſary, or from the intereſted views of ſome low, obſcure, and illiterate practitioners, both male and female, who think they find their account in decrying the practice of their neighbours. It is not to be denied, that miſchief has been done by inſtruments in the hands of the unſkilful and unwary; but we are perſuaded that every judicious practitioner will do every thing for the ſafety of patients before he has recourſe to any violent method either with the hand or inſtrument, though caſes will occur in which gentle methods will abſolutely fail. It is therefore neceſſary to explain thoſe reinforcements which muſt be uſed in dangerous labours; though they ought by no means to be called in, except when the life of the mother or child, or both, is evidently at ſtake; and even then managed with the utmoſt caution.

All thoſe caſes in which the head of the child preſents, and cannot be delivered in the natural way, are accounted more or leſs laborious, according to the different circumſtances from which the difficulty ariſes: and theſe commonly are, firſt, great weakneſs, proceeding from the loſs of appetite and bad digeſtion; frequent vomitings, diarrhœas or dyſenteries, floodings, or any other diſeaſe that may exhauſt the patient; as alſo the fatigue ſhe may have undergone by unſkilful treatment in the beginning of labour. Secondly, From exceſſive grief and anxiety of mind, occaſioned by the unſeaſonable news of ſudden misfortune in time of labour; which often affect her ſo as to carry off the pains, and endanger her ſinking under the ſhock. Thirdly, From the rigidity of the os uteri, vagina, and external parts, which commonly happens to women in the firſt birth, eſpecially to thoſe who are about the age of forty: though it may be alſo owing to large calloſities, produced from laceration or ulceration of the parts; or to glands and ſcirrhous tumours that block up the vagina. Fourthly, When the under part of the uterus is contracted before the ſhoulders, or the body entangled in the navel-ſtring. Fifthly, From the wrong preſentation of the child's head: that is, when the forehead is towards the groin or middle of the os pubis; when the face preſents with the chin to the os pubis, iſchium, or ſacrum; when the crown of the head reſts above the os pubis, and the forehead or face is preſſed into the hollow of the ſacrum; and laſtly, when one of the ears preſents. Sixthly, From the extraordinary oſſification of the child's head, by which the bones of the ſkull are hindered from yielding as they are forced into the pelvis; and from a hydrocephalus or dropſy, diſtending the head to ſuch a degree, that it cannot paſs along until the water is diſcharged. Seventhly, From a too ſmall or diſtorted pelvis, which often occurs in very little women, or ſuch as have been ricketty in their childhood. See *fig.* 31.

In all theſe caſes, except when the pelvis is too narrow and the head too large, provided the head lies at the upper part of the brim, or (though preſſed into the pelvis) can be eaſily puſhed back into the uterus, the beſt method is to turn the child and deliver by the feet, according to the directions which ſhall be given in the ſequel: but if the head is preſſed into the middle or lower part of the pelvis, and the uterus ſtrongly contracted round the child, delivery ought to be performed with the forceps; and in all theſe ſeven caſes, if the woman is in danger, and if you can neither turn nor deliver with the forceps, the head muſt be opened and delivered with the crotchets. Laborious caſes, from ſome of the above recited cauſes, happen much oftener than thoſe we call preternatural; but thoſe which proceed from a narrow pelvis or a large head, are of the worſt conſequence. Theſe caſes demand greater judgment in the operator than thoſe in which the child's head does not preſent; becauſe in theſe laſt we know that the beſt and ſafeſt method is to deliver by the feet; whereas, in laborious births, we muſt maturely conſider the cauſe that retards the head from coming along, together with the neceſſary aſſiſtance required; we muſt determine when we ought to wait patiently for the efforts of nature, and when it is abſolutely neceſſary to come to her aid. If we attempt

tempt to ſuccour her too ſoon, and uſe much force in the operation, ſo that the child and mother, or one of the two, are loſt, we ſhall be apt to reproach ourſelves for having acted prematurely, upon the ſuppoſition that if we had waited a little longer the pains might have by degrees delivered the child, or at leaſt forced the head ſo low as that we might have extracted it with more ſafety by the aſſiſtance of the forceps. On the other hand, when we leave it to nature, perhaps, by the ſtrong preſſure upon the head and brain, the child is dead when delivered, and the woman ſo exhauſted with tedious labour, that her life is in imminent danger: in this caſe we blame ourſelves for delaying our help ſo long, reflecting, that had we delivered the patient ſooner, without paying ſuch ſcrupulous regard to the life of the child, the woman might have recovered without having run ſuch a dangerous riſk. Doubtleſs it is our duty to ſave both mother and child if poſſible; but, if that is impracticable, to pay our chief regard to the parent; and, in all dubious caſes, to act cautiouſly and circumſpectly, to the beſt of our judgment and ſkill.

If the head is advanced into the pelvis, and the uterus ſtrongly contracted round the child, great force is required to puſh it back into the womb, becauſe the effort muſt be ſufficient to ſtretch the uterus, ſo as to re-admit the head, together with your hand and arm; and even then the child will be turned with great difficulty. Should you turn when the head is too large, you may bring down the body of the child, but the head will ſtick faſt above, and cannot be extracted without the help of the forceps or crotchets, ſee *fig.* 38, 39. yet the caſe is ſtill worſe in a narrow pelvis, even though the head be of an ordinary ſize. When things are ſo ſituated, you ſhould not attempt to turn, becauſe in ſo doing you may give the woman a great deal of pain, and yourſelf much unneceſſary fatigue: you ought, therefore, to try the forceps; and if they do not ſucceed, diminiſh the ſize of the head, and extract it as ſhall be afterwards ſhown.

SECT. II. *Of the* FILLETS *and* FORCEPS.

We have already obſerved, that the greateſt number of difficult and lingering labours proceed from the head's ſticking faſt in the pelvis, which ſituation is occaſioned by one of the ſeven cauſes recited before. When formerly this was the caſe, the child was generally loſt, unleſs it could be turned and delivered by the feet; or if it could be extracted alive, either died ſoon after delivery, or recovered with great difficulty from the long and ſevere compreſſion of the head, while the life of the mother was endangered from the ſame cauſe as above deſcribed: for the preſſure being reciprocal, the fibres and veſſels of the ſoft parts contained in the pelvis are bruiſed by the child's head, and the circulation of the fluids obſtructed; ſo that a violent inflammation, and ſometimes a ſudden mortification, enſues. If the child could not be turned, the method practiſed in theſe caſes was to open the head and extract with the crotchet; and this expedient produced a general clamour among the women, who obſerved, that when recourſe was had to the aſſiſtance of a man-midwife, either the mother or child, or both, were loſt. This cenſure, which could not fail of being a great diſcouragement to male practitioners, ſtimulated the ingenuity of ſeveral gentlemen of the profeſſion, in order to contrive ſome gentler method of bringing along the head, ſo as to ſave the child, without any prejudice to the mother.

Their endeavours have not been without ſucceſs: a more ſafe and certain expedient for this purpoſe hath been invented, and of late brought to greater perfection in this than in any other kingdom; ſo that if we are called in before the child is dead, or the parts of the woman in danger of mortification, both the fœtus and mother may frequently be happily ſaved. This fortunate contrivance is no other than the *forceps,* which was, as is alleged, firſt uſed here by the Chamberlains, by whom it was kept as a noſtrum, and after their deceaſe ſo imperfectly known as to be ſeldom applied with ſucceſs: ſo that different practitioners had recourſe to different kinds of fillets or lacks. Blunt hooks alſo of various make were invented in England, France, and other parts. The forceps, ſince the time of Dr. Chamberlain, have undergone ſeveral alterations, particularly in the joining, handles, form, and compoſition.

The common way of uſing them formerly was by introducing each blade at random, taking hold of the head any how, pulling it ſtraight along, and delivering with downright force and violence: by which means both os internum and externum were often tore, and the child's head much bruiſed. On account of theſe bad conſequences, they had been altogether diſuſed by many practitioners, ſome of whom endeavoured in lieu of them to introduce divers kinds of fillets over the child's head; but none of them can be ſo eaſily uſed, or have near ſo many advantages, as the forceps, when rightly applied and conducted, according to the directions that ſhall be laid down in the next ſection.

The lacks or fillets are of different kinds, of which the moſt ſimple is a nooſe made on the end of a fillet or limber garter; but this can only be applied before the head is faſt jammed in the pelvis, or when it can be puſhed up and raiſed above the brim. The os externum and internum having been gradually dilated, this nooſe muſt be conveyed on the ends of the fingers, and ſlipped over the fore and hind-head. There are alſo other kinds differently introduced upon various blunt inſtruments, too tedious either to deſcribe or uſe: but the moſt uſeful of all theſe contrivances is a fillet, made in form of a ſheath, mounted upon a piece of ſlender whalebone about two feet in length, which is eaſier applied than any other expedient of the ſame kind. See the Plate of inſtruments, *fig.* 5.

When the head is high up in the pelvis, if the woman has been long in labour, and the waters diſcharged for a conſiderable time, the uterus being ſtrongly contracted ſo as that the head and ſhoulders cannot be raiſed, or the child turned to be delivered by the feet, while the mother is enfeebled and the pains ſo weak, that, unleſs aſſiſted, ſhe is in danger of her life; alſo when the os internum, vagina, and labia pudendi, are inflamed and tumefied; or when there is a violent diſcharge of blood from the uterus, provided the pelvis is not too narrow, nor the head too large, this fillet may be ſucceſsfully uſed; in which caſe, if the os externum and internum are not already ſufficiently open, they muſt be gradually dilated as much as poſſible by the hand, which at the ſame time muſt be introduced, and paſſed along the ſide of the head, in order to aſcertain the poſition thereof. This being known, let the other hand introduce the double of the whalebone, and fillet over the face and chin, where you can have the beſt purchaſe, and where it will be leaſt apt to ſlip and loſe its hold. This application being effected, let the hand be brought down, and the whalebone drawn from the ſheath of the fillet, which (after the ends of it are tied together) muſt be pulled during every pain, preſſing at the ſame time with the other hand upon the oppoſite part of the head, and uſing more or leſs force according to the reſiſtance.

The diſadvantage attending all fillets, is the difficulty in introducing and fixing them: and though this laſt is eaſier applied than the others, yet when the vertex preſents, the child's chin is ſo preſſed to the breaſt, that it is often impracticable to inſinuate the fillet between them, and if it is fixed upon the face or hind-head it frequently ſlips off in pulling. But, granting it commodiouſly fixed, when the head is large or the pelvis narrow, ſo that we are obliged to pull with great force, the fillet will gall and even cut the ſoft parts to the very bone; and if the child comes out of a ſudden in conſequence of violent pulling, the external parts of the woman are in great danger of ſudden laceration: but if the head is ſmall, and comes along with a moderate force, the child may be delivered by this contrivance, without any bad conſequence; though in this caſe, we find by experience, that unleſs the woman has ſome very dangerous ſymptom, the head will in time ſlide gradually down into the pelvis, even when it is too large to be extracted with the fillet or forceps, and the child be ſafely delivered by the labour-pains, although ſlow and lingering, and the mother ſeems weak and exhauſted, provided ſhe be ſupported with nouriſhing and ſtrengthening cordials.

From what we have ſaid, the reader ought not to imagine that we are more bigotted to any one contrivance than to another. As our chief ſtudy hath been to improve the art of Midwifery, we have conſidered a great many different methods, with a view of fixing upon that which ſhould beſt ſucceed in practice: we have tried ſeveral kinds of lacks, which have been from time to time recommended to us; and in particular, the laſt mentioned fillet, which was communicated by an eminent profeſſor. As this fillet could, in all appearance, be more eaſily introduced than any other, we generally found the fixing of this, as well as all other lacks, ſo uncertain, that we have had recourſe to the forceps, which being introduced with greater eaſe, and fixed with more certainty, ſeldom fail to anſwer the purpoſe better than any other method hitherto found out. Dr. Smellie reprobates the uſe of this fillet; but let not this aſſertion prevent people of ingenuity from employing their talents in improving theſe or any other methods that may be ſafe and uſeful; for daily experience proves that we are ſtill imperfect, and very far from the *ne plus ultra* of diſcovery in arts and ſciences; though we hope every gentleman will deſpiſe and avoid the character of a ſelfiſh ſecret-monger.

As the head in the 6th and 7th caſes, recited in Sect. I, is forced along the pelvis, commonly in theſe laborious caſes the bones of the cranium are ſo compreſſed, that they ride over one another, ſo that the bulk of the whole is diminiſhed, and the head, as it is puſhed forward, is, from a round, altered into an oblong figure: when therefore it is advanced into the pelvis, where it ſticks faſt for a conſiderable time, and cannot be delivered by the labour-pains, the forceps may be introduced with great eaſe and ſafety, like a pair of artificial hands, by which the head is very little (if at all) marked, and the woman very ſeldom tore. But if the head is detained above the brim of the pelvis, or a ſmall portion of it only farther advanced, and it appears that the one being too narrow, or the other too large, the woman cannot be delivered by the ſtrongeſt labour-pains: in that caſe the child cannot be ſaved, either by turning and bringing it by the feet, or delivered by the application of fillet or forceps; but the operator muſt unavoidably uſe the diſagreeable method of extracting with the crotchet. Nevertheleſs, in all theſe caſes, the forceps ought firſt to be tried; and ſometimes they will ſucceed beyond expectation, provided the birth is retarded by the weakneſs of the woman, and the ſecond, third, fourth, or fifth obſtructions, mentioned in Sect. I. But they cannot be depended upon, even when the vertex preſents, with the forehead to the ſide or back part of the pelvis, and (though the woman has had ſtrong pains for many hours after the membranes are broke) the head is not forced down into the pelvis, or at leaſt but an inconſiderable part of it reſembling the ſmall end of a ſugar loaf, as in *fig.* 19 and 22. For, from theſe circumſtances, you may conclude, that the largeſt part of it is ſtill above the brim, and that either the head is too large or the pelvis too narrow. Even in theſe caſes, indeed, the laſt fillet, or a long pair of forceps, may take ſuch firm hold, that with great force and the ſtrong purchaſe the head will be delivered: but ſuch violence is commonly fatal to the woman, by cauſing ſuch an inflammation, and perhaps laceration, of the parts, as is attended with mortification. In order to diſable young practitioners from running ſuch riſks and uſing too great a force, Dr. Smellie recommends the forceps ſo ſhort in the handles, that they cannot be uſed with ſuch violence as will endanger the woman's life; though the purchaſe of them is ſufficient to extract the head when one half or two-thirds of it are equal to or paſt the upper or narrow part of the pelvis.

When the head is high the forceps may be locked in the middle of the pelvis; but in that caſe great care muſt be taken in feeling with the fingers all round, that no part of the vagina be included in locking. Sometimes, when the head reſts, or is preſſed too much on the fore-part or ſide of the pelvis, either at the brim or lower down, by introducing one blade it may be moved farther down, provided the labour-pains are ſtrong, and the operation aſſiſted by the fingers of the other hand applied to the oppoſite ſide of the head; but if the fingers cannot reach high enough, the beſt method is to turn or move the blade towards the ear of the child, and introduce the other along the oppoſite ſide.

In a narrow pelvis we have ſometimes found the head of the child thrown ſo much forward over the os pubis, by the jetting in of the ſacrum and lower vertebra of the loins, that we could not puſh the handles of the forceps far enough back to include within the blades the bulky part of the head which lay over the pubes. To remedy this inconvenience, Dr. Smellie contrived a longer pair, curved on one ſide, and convex on the other; but theſe ought never to be uſed except when the head is ſmall; for, as we have already obſerved, when the head is large, and the greateſt part of it remains above the brim, the parts of the woman may be inflamed and contuſed by the exertion of too much force. Nevertheleſs, this kind of forceps may be advantageouſly uſed when the face preſents and is low down, and the chin turned to the ſacrum; becauſe, in that caſe, the occiput is towards the pubes, ſo that the ends of the blades can take firmer hold of the head; but then the chin cannot be turned below the pubes ſo eaſily with theſe as with the other kind, nor the hind-head be brought below theſe laſt bones. See *fig.* 29.

SECT. III. *General Rules for uſing the* FORCEPS.

The farther the head is advanced in the pelvis, the eaſier it is delivered with the forceps; becauſe then, as in the 6th or 7th caſe, in Sect. I. it is changed from a round to an oblong figure, by being forced along by the labour pains; on the contrary, when the head remains high up, reſting upon the brim of the pelvis, the forceps are uſed with greater difficulty and uncertainty.

The os externum muſt be gradually opened by introducing the fingers one after another in form of a cone, after they have been lubricated with pomatum, moving and turning them in a ſemicircular motion, as they are puſhed up. If the head is ſo low down that the hand cannot be introduced high up in this form, let the parts be dilated by the fingers turned in the direction of the coccyx, the back of the hand being upwards, next to the child's head: the external parts being ſufficiently opened to admit all the fingers, let the back of the hand be turned to the perinæum, while the fingers and thumb, being flattened, will ſlide along betwixt the head and the os ſacrum. If the right-hand be uſed, let it be turned a little to the left ſide of the pelvis, becauſe the broad ligament and membrane that fill up the ſpace between the ſacrum and iſchia, will yield and allow more room for the fingers to advance; for the ſame reaſon, when the left hand is introduced, it muſt be turned a little to the right ſide. Having gained your point ſo far, continue to puſh up, until your fingers paſs the os internum; at the ſame time, with the palm of your hand, raiſe or ſcoop up the head, by which means you will be more at liberty to reach higher, dilate the internal parts, and diſtinguiſh the ſituation and ſize of the head, together with the dimenſions of the pelvis: from which inveſtigation you will be able to judge whether the child ought to be turned and brought by the feet, or delivered with the forceps; or, if the labour-pains are ſtrong, and the head preſents tolerably fair, without being jammed in the pelvis, you will reſolve to wait ſome time, in hope of ſeeing the child delivered by the labour-pains, eſpecially when the woman is in no immediate danger, and the chief obſtacle is the rigidity of the parts.

The poſition of the head is diſtinguiſhed by feeling for one of the ears, the fore or ſmooth part of which is towards the face of the child; if it cannot be aſcertained by this mark, the hands and fingers muſt be puſhed farther up, to feel for the face or back part of the neck; but if the head cannot be traced, the obſervation muſt be taken from the fontanel or that part of the cranium where the lambdoidal croſſes the end of the ſagittal future. When the ears of the child are towards the ſides of the pelvis, or diagonal, the forehead being either to the ſacrum or pubes, the patient muſt lie on her back, with her breach a little over the bed, her legs and thighs being ſupported as directed. If one ear is to the ſacrum, and the other to the pubes, ſhe muſt be laid on one ſide, with her breach over the bed, as before, her knees being pulled up to her belly, and a pillow placed between them; except when the upper part of the ſacrum jets too much forward, in which caſe ſhe muſt lie upon her back, as before deſcribed.

The blades of the forceps ought always, if poſſible, to be introduced along the ears; by which means they approach nearer to each other, gain a firmer hold, and hurt the head leſs than in any other direction: frequently, indeed, not the leaſt mark of their application is to be perceived; whereas, if the blades are applied along the forehead and occiput, they are at a great diſtance from each other, require more room, frequently at their points preſs in the bones of the ſkull, and endanger a laceration in the os externum of the woman. See *fig.* 19.

The woman being laid in a right poſition for the application of the forceps, the blades ought to be privately conveyed between the feather-bed and the cloaths, at a ſmall diſtance from one another, or on each ſide of the patient: that this conveyance may be the more eaſily effected, the legs of the inſtrument ought to be kept in the operator's ſide-pockets. Thus provided, when he ſits down to deliver, let him ſpread the ſheet that hangs over the bed, upon his lap, and, under that cover, take out and diſpoſe the blades on each ſide of the patient; by which means he will often be able to deliver with the forceps, without their being perceived by the woman herſelf or any other of the aſſiſtants. Some people pin a ſheet to each ſhoulder, and throw the other end over the bed, that they may be the more effectually concealed from the view of thoſe who are preſent: but this method is apt to confine and embarraſs the operator. At any rate, as women are commonly frightened at the very name of an inſtrument, it is adviſable to conceal them as much as poſſible, until the character of the operator is fully eſtabliſhed.

The ſum of all that has been ſaid on this head, may be comprehended in the following general maxims. Young practitioners are often at a loſs to know and judge by the touch in the vagina, when the head is far enough down in the baſin for uſing the forceps. If we were to take our obſervations from what we feel of the head at the os pubis, we ſhould be frequently deceived, becauſe in that place the pelvis is only two inches in depth, and the head will ſeem lower down than it really is: but if, in examining backwards, we find little or no part of it towards the ſacrum, we may be certain that all the head is above the brim: if we find it down as far as the middle of the ſacrum, one third of it is advanced; if as far down as the lower part, one half; and in this caſe, the largeſt part is equal with the brim. When it is in this ſituation, we may be almoſt certain of ſucceeding with the forceps; and when the head is ſo low as to protrude the external parts, they never fail. But theſe things will differ according to different circumſtances, that may occaſion a tedious delivery.

Let the operator acquire an accurate knowledge of the figure, ſhape, and dimenſions of the pelvis, together with the ſhape, ſize, and poſition of the child's head. Let the breech of the woman be always brought forwards a little over the bed, and her thighs pulled up to her belly, whether ſhe lies on her ſide or back, to give room to apply and to move the forceps up or down or from ſide to ſide. Let the parts be opened and the fingers paſs the os internum; in order to which, if it cannot be otherwiſe accompliſhed, let the head be raiſed two or three inches, that the fingers may have more room: if the head can be raiſed above the brim, your hands is not confined by the bones; for, as we have already obſerved, the pelvis is wider from ſide to ſide at the brim than at the lower part: if the fingers are not paſt the os uteri, it is in danger of being included betwixt the forceps and the child's hea

The forceps, if poſſible, ſhould paſs along the ears, becauſe in that caſe they ſeldom or never hurt or mark the head. They ought to be puſhed up in an imaginary line, towards the middle ſpace between the navel and ſcrobiculus cordis, otherwiſe the ends will run againſt the ſacrum. The forehead ought always to be turned into the hollow of the ſacrum, when it is not already in that ſituation. When the face preſents, the chin muſt be turned to below the os pubis, and the hind-head into the hollow of the ſacrum. When the ſhoulders reſt at the pubes, where they are detained, the head muſt be turned a large quarter to the oppoſite ſide, ſo as that they may lie towards the ſides of the pelvis. The head muſt be always brought out with an half round turn, over the outſide of the os pubis, for the preſervation of the perinæum, which muſt at the ſame time be ſupported with the flat of the other hand, and ſlide gently backwards over the head.

When the head is ſo low as to protrude the parts in form of a large tumour, and the vertex hath begun to dilate the os externum, but, inſtead of advancing, is long detained in that ſituation, from any of the forementioned cauſes of laborious caſes, and the operator cannot exactly diſtinguiſh the poſition of the head, let him introduce a finger between the os pubis and the head, and he will frequently find the back-part of the neck, or one ear, at the fore-part or towards the ſide of the pelvis. When the ſituation is known, he needs not ſtretch the os externum, and raiſe the head, as formerly directed; but he may introduce the forceps, and, they being properly joined and their handles tied, pull gently during every pain, or, if the pains are gone, at the interval of four or five minutes, that the parts may be ſlowly dilated, as they are in the natural labour: but when the ſituation cannot be known, the head ought to be raiſed. The ſame method may alſo be taken when the face preſents, and is low in the pelvis, except when the chin is toward the back-part: in this caſe the head ought to be raiſed likewiſe. Almoſt all theſe directions are to be followed, except when the head is ſmall; in which caſe it may be brought along by the force of pulling: but this only happens when the woman is reduced, and the labour-pains are not ſufficient to deliver the child; for the lower part of the uterus may be ſo ſtrongly contracted before the ſhoulders, and ſo cloſe to the neck of the child, as to prevent its advancing, even when the head is ſo looſe in the pelvis, that we can ſometimes puſh our fingers all round it: and this is ofteneſt the occaſion of preventing the head's being delivered when low in the pelvis. The difficulty, when high up, is from the reſtraint at the brim; and when it paſſes that, the head is ſeldom retained in the lower part, unleſs the patient is weak. In this caſe we need not wait, becauſe we are commonly certain of relieving the woman immediately with the forceps, by which you prevent the danger that may happen, both to the mother and child, by the head's continuing to lodge there too long. This caſe ſhould be a caution againſt breaking the membranes too ſoon, becauſe the uterus may contract too forcibly and too long before the ſhoulders: when the head in this caſe is advanced one-third or half way on the os externum, if the pains are ſtrong, this laſt inconvenience is frequently remedied by introducing your two fingers into the rectum, as formerly directed. By theſe rules, delivery may (for the moſt part) be performed with eaſe and ſafety. Nevertheleſs the head is ſometimes ſo ſqueezed and locked in the pelvis, and the hairy ſcalp ſo much ſwelled, that it is impracticable to raiſe up the head ſo as to come at the ears or os internum, or to diſtinguiſh the ſutures of the ſkull ſo as to know how the head preſents. In this caſe the forceps muſt be introduced at random, and the uncertainty of the poſition generally removed by remembering, that in thoſe caſes where the head is ſqueezed down with great difficulty, the ears are for the moſt part towards the os pubis and ſacrum; and that the forehead ſeldom turns into the hollow of the ſacrum, before the occiput is come down to the lower part of the iſchium; and then riſes gradually towards the under part of the os pubis, and the perinæum and anus are forced down before it in form of a large tumour.

On ſuch occaſions, the woman being laid on her ſide, if one ear is to the ſacrum and the other to the os pubis, the blades of the forceps are to be introduced; and if they meet with any reſiſtance at the points, they muſt not be forcibly thruſt up, leſt they paſs on the outſide of the os uteri and tear the vagina, which together with the womb would be included in the inſtrument and pulled along with the head: for this reaſon, if the blade does not eaſily paſs, let it be withdrawn a little downwards, as before directed, and puſhed up again, moving the point cloſe to the head; if the ear obſtructs its paſſage, let the point be brought a little outwards: and by theſe cautious eſſays it will at length paſs without further reſiſtance, and ought to be advanced a conſiderable way, in order to certify the operator that he is not on the outſide of the os internum.

When the forceps are fixed, and the operator uncertain which way the forehead lies, let him pull ſlowly, and move the head with a quarter-turn, firſt to one ſide and then to the other, until he ſhall have found the direction in which it comes moſt eaſily along. If at any time we find the forceps begin to ſlip, we muſt reſt and puſh them up again gently: but if they are like to ſlide off at a ſide, untie the handles, and move them ſo as to take a firmer hold, fix as before, and deliver. If we are obliged to hold with both hands, the parts may be ſupported by the firm application of an aſſiſtant's hand: for without ſuch cautious management they will run a great riſk of being lacerated; a misfortune which rarely happens when the perinæum is properly preſſed back, and the head leiſurely delivered. Sometimes, when the head is brought low down, you may take off the forceps, and help along with your fingers on each ſide of the coccyx, or in the rectum, as directed in the natural labour.

If the head is low down, the ears are commonly diagonal, or to the ſides; and when the head is brought down one third or one half through the os externum, the operator can then certify himſelf whether the forehead is turned to the coccyx or os pubis, by feeling with his finger for the back-part of the neck or ear, betwixt the os pubis and the head; and then move the head as above directed. Let him try to alter with his hand every bad poſition of the head; and if it be detained high up in the pelvis, in conſequence of the woman's weakneſs, the rigidity of the parts, the circumvolutions or ſhortneſs of the funis, or the contraction of the uterus over the ſhoulders of the child, the forceps will frequently ſucceed when the fœtus cannot be turned; but if the head is large or the pelvis narrow, the child is ſeldom ſaved either by turning or uſing the forceps, until the head ſhall be farther advanced. And here it will not be amiſs to obſerve, that the blades of the forceps ought to be new-covered with ſtripes of waſhed leather after they ſhall have been uſed, eſpecially in delivering a woman ſuſpected of having an infectious diſtemper.

SECT. IV. *The Signs of a dead Child.*

When the head preſents, and cannot be delivered by the labour-pains; when all the common methods have been uſed without ſucceſs, the woman being exhauſted, and all her efforts vain; and when the child cannot be delivered without ſuch force as will endanger the life of the mother, becauſe the head is too large or the pelvis too narrow; it then becomes abſolutely neceſſary to open the head and extract with the hand, forceps, or crotchet. Indeed, this laſt method formerly was the common practice when the child could not be eaſily turned, and is ſtill in uſe with thoſe who do not know how to ſave the child by delivering with the forceps: for this reaſon their chief care and ſtudy was to diſtinguiſh whether the fœtus was dead or alive; and as the ſigns were uncertain, the operation was often delayed until the woman was in imminent danger; or, when it was performed ſooner, the operator was frequently accuſed of raſhneſs, on the ſuppoſition that the child might in time have been delivered alive by the labour-pains. Perhaps he was ſometimes conſcious to himſelf of the juſtice of this imputation, although what he had done was with an upright intention.

The ſigns of a dead fœtus are, firſt, The child's ceaſing to move and ſtir in the uterus. Secondly, The evacuation of meconium, though the breech is not preſſed into the pelvis. Thirdly, No perceivable pulſation at the fontanel and temporal arteries. Fourthly, A large ſwelling or tumour of the hairy ſcalp. Fifthly, An uncommon laxity of the bones of the cranium. Sixthly, The diſcharge of a fœtid ichor from the vagina, the effluvia of which ſurrounding the woman, gave riſe to the opinion that her breath conveyed a mortified ſmell. Seventhly, Want of motion in the tongue when the face preſents. Eighthly, No perceivable pulſation in the arteries of the funis umbilicalis, when it falls down below the head; nor at the wriſt, when the arm preſents; and no motion of the fingers. Ninthly, The pale and livid countenance of the woman. Tenthly, A collapſing and flaccidity of the breaſts. Eleventhly, A coldneſs felt in the abdomen, and weight, from the child's falling, like a heavy ball, to the ſide on which ſhe lies. Twelfthly, a ſeparation of the hairy ſcalp on the ſlighteſt touch, and a diſtinct perception of the bare bones. All or moſt of theſe ſigns are dubious and uncertain, except the laſt, which can only be obſerved after the fœtus hath been dead ſeveral days. One may alſo certainly pronounce the child's death, if no pulſation hath been felt in the navel-ſtring for the ſpace of twenty or thirty minutes; but the ſame certainty is not to be acquired from the arm, unleſs the ſkin can be ſtripped off with eaſe.

SECT. V. *When the* CROTCHET *is to be uſed.*

MIDWIFERY is now ſo much improved, that the neceſſity of deſtroying the child does not occur ſo often as formerly. Indeed it never ſhould be done, except when it is impoſſible to turn or to deliver with the forceps; and this is ſeldom the caſe but when the pelvis is too narrow, or the head too large to paſs, and therefore reſts above the brim. For this reaſon, it is not ſo neceſſary for the operator to puzzle himſelf about dubious ſigns; becauſe, in theſe two caſes, there is no room for heſitation: for if the woman cannot poſſibly be delivered in any other way, and is in imminent danger of her life, the beſt practice is undoubtedly to have recourſe to that method which alone can be uſed for her preſervation, namely, to diminiſh the bulk of the head. In this caſe, inſtead of deſtroying you are really ſaving a life; for, if the operation be delayed, both mother and child are loſt.

SECT. VI. *Method of extracting the Head.*

Various have been the contrivances intended for this purpoſe. Some practitioners, when the head did not advance in the pelvis, introduced the *ſpeculum matricis*, in order to ſtretch the bones aſunder, and thereby increaſe the capacity of the baſin: if, after this operation, the woman could not be delivered with her pains, they fixed a large ſcrew in the head, by which they pulled with great force. Others opened the head with a large biſtory, or a ſhort broad-bladed knife in form of a myrtle leaf, or with a crooked biſtory with a long handle: then a ſmall pair of forceps with teeth were introduced; and one blade being inſinuated into the opening, they laid hold on the ſkull, and pulled the head along: they likewiſe made uſe of different kinds of crotchets both ſharp and blunt; and when the head was lower down, they practiſed the ſame expedient. Albucaſis has alſo given the draught of an inſtrument, which is both for opening and extracting the head; the point and wings are forced through the cranium, and when turned the contrary way, the two wings are forced to take hold of the inſide.

There are other later contrivances uſed and recommended by different gentlemen of the profeſſion, ſuch as Mauriceau's *tire-tête*, Simpſon's ſcalp-ring, and Old's *terebra occulta*, with the improvement made in it by Dr. Burton of York: and all theſe inſtruments may be uſed with ſucceſs, if cautiouſly managed, ſo as not to injure the woman; except the *ſpeculum matricis*, which, far from anſwering the ſuppoſed intention of it, namely, to extend the bones of the pelvis, can ſerve no other purpoſe than that of bruiſing or inflaming the parts of the woman.

The following method, if exactly followed according to the circumſtances of the caſe, ſeems, of all others hitherto invented, the eaſieſt, ſafeſt, and moſt certain, eſpecially when it requires great force to extract the head.

SECT. VII. *The Method of uſing the* Scissars, *Blunt* Hook, *and* Crotchet.

When the head preſents, and ſuch is the caſe that the child can neither be delivered by turning nor extracted with the forceps, and it is abſolutely neceſſary to deliver the woman to ſave her life; this operation muſt then be performed in the following manner. The operator muſt be provided with a pair of curved crotchets, made according to the improvements upon thoſe propoſed by Meſnard, together with a pair of ſciſſars about nine inches long, with reſts near the middle of the blades, and the blunt hook.

Of the Woman's Poſture.

The patient ought to be laid on her back or ſide, in the ſame poſition directed in the uſe of the forceps; the operator muſt be ſeated on a low chair, and the inſtruments concealed and diſpoſed in the ſame manner and for the ſame reaſon mentioned in treating of the forceps. The parts of the woman have already, in all likelihood, been ſufficiently dilated by his endeavours to turn or deliver with the forceps: or if no efforts of that kind have been uſed, becauſe by the touch he had learned that no ſuch endeavours would ſucceed, as in the caſe of a large hydrocephalus, when the bones of the cranium are often ſeparated at a great diſtance from each other, or upon perceiving that the pelvis was extremely narrow; if, upon theſe conſiderations, he hath made no trials in which the parts were opened, let him gradually dilate the os externum and internum, as formerly directed.

The head is commonly kept down pretty firm, by the ſtrong contraction of the uterus round the child; but ſhould it yield to one ſide, let it be kept ſteady by the hand of an aſſiſtant, preſſing upon the belly of the woman: let him introduce his hand, and preſs two fingers againſt one of the ſutures of the cranium; then take out his ſciſſars from the place in which they were depoſited, and guiding them by the hand and fingers till they reach the hairy ſcalp, puſh them gradually into it, until their progreſs is ſtopped by the reſts.

If the head ſlips aſide, in ſuch a manner as that they cannot be puſhed into the ſkull at the ſuture, they will make their way through the ſolid bones, if they are moved in a ſemicircular turn, like the motion of boring, and this method continued till you find the point firmly fixed; for if this is not obſerved, the points ſlide along the bones.

The ſciſſars ought to be ſo ſharp at the points, as to penetrate the integuments and bones when puſhed with a moderate force; but not ſo keen as to cut the operator's fingers, or the vagina, in introducing them.

The ſciſſars being thus forced into the brain, as far as the reſts at the middle of the blades, let them be kept firm in that ſituation; and the hand that was in the vagina being withdrawn, the operator muſt take hold of the handles with each hand, and pull them aſunder, that the blades may dilate and make a large opening in the ſkull; then they muſt be ſhut, turned, and again pulled aſunder, ſo as to make the inciſion crucial; by which means the opening will be enlarged, and ſufficient room made for the introduction of the fingers: let them afterwards be cloſed, and introduced even beyond the reſts, when they muſt again be opened, and turned half round from ſide to ſide, until the ſtructure of the brain is ſo effectually deſtroyed, that it can be evacuated with eaſe. This operation being performed, let the ſciſſars be ſhut and withdrawn; but, if this inſtrument will not anſwer the laſt purpoſe, the buſineſs may be done by introducing the crotchet within the opening of the ſkull. The brain being thus deſtroyed, and the inſtrument withdrawn, let him introduce his right hand into the vagina, and two fingers into the opening which hath been made, that if any ſharp ſplinters of the bones remain, they may be broken off and taken out, leſt they ſhould injure the woman's vagina, or the operator's own fingers.

If the caſe be an hydrocephalus, let him fix his fingers on the inſide and his thumb on the outſide of the opening, and endeavour to pull along the ſkull in time of a pain: but, if labour is weak, he muſt deſire the woman to aſſiſt his endeavours by forcing down: and thus the child is frequently delivered; becauſe, the water being evacuated, the head collapſes of courſe.

But when the pelvis is narrow, the head requires much greater force to be brought along; unleſs the labour-pains are ſtrong enough to preſs it down and diminiſh it by ſqueezing out the cerebrum: in this caſe, let the operator withdraw his fingers from the opening, and ſliding them along the head, paſs the os uteri; then, with his left-hand, taking one of the crotchets from the place of its concealment, introduce it along his right-hand, with the point towards the child's head, and fix it above the chin in the mouth, back part of the neck, or above the ears, or in any place where it will take firm hold; having fixed the inſtrument, let him withdraw his right-hand, and with it take hold on the end or handle of the crotchet, then introduce his left to ſeize the bones at the opening of the ſkull (as above directed), that the head may be kept ſteady, and pull along with both hands.

If the head is ſtill retained by the uncommon narrowneſs of the pelvis, let him introduce his left-hand along the oppoſite ſide, in order to guide the other crotchet; which being alſo applied, and locked or joined with its fellow in the manner of the forceps, he muſt pull with ſufficient force, moving from ſide to ſide, and as it advances: turn the forehead into the hollow of the ſacrum, and extract it with the forceps, humouring the ſhape of the head and pelvis during the operation, which ought to be performed ſlowly, with great judgment and caution: and from hence it appears abſolutely neceſſary to know how the head preſents, in order to judge how the crotchet muſt be fixed, and the head brought along to the beſt advantage. Sometimes, in theſe caſes, when we find that we cannot ſucceed by pulling at the opening with the fingers, and if the woman has not had ſtrong pains, we introduce the ſmall end of the blunt hook into the opening, and placing the fingers againſt the point on the outſide of the ſkull, pull with greater and greater force: but, as we can ſeldom take a firm hold in this manner, if it does not ſoon anſwer the purpoſe, we introduce the fingers, as above, farther, and ſlide the point up along the outſide above the under jaw; and have ſucceeded ſeveral times with this inſtrument, except when the pelvis was ſo narrow as to require a greater force; when we muſt uſe the others. No doubt, it is better firſt to try the blunt hook; becauſe the managing the point gives leſs trouble, and it can be eaſier introduced with the point to one ſide. When the inſtrument is far enough advanced, this point may be turned to the head; and as a very narrow pelvis ſeldom occurs, the blunt hook will commonly ſucceed.

Dr. Smellie mentions in his laſt treatiſe a ſheath to cover the ſharp point of the curved crotchets, which may be introduced and uſed in the ſame manner as the blunt hook; the ſheath may be taken off or kept on as there is occaſion.

If, when the head is delivered in this manner, the body cannot be extracted, on account of its being much ſwelled, of a monſtrous ſize, or (which is moſt commonly the caſe) the narrowneſs of the pelvis; let the operator deſiſt from pulling, leſt the head ſhould be ſeparated from the body, and, introducing one hand ſo as to reach with his fingers to the ſhoulder-blades or breaſt, conduct along it one of the crotchets, with the point towards the fœtus, and fix it with a firm application; then withdrawing his hand, employ it in pulling the crotchet, while the other is exerted in the ſame manner upon the head and neck of the child: if the inſtrument begins to loſe its hold, he muſt puſh it farther up, and fixing it again, repeat his efforts, applying it ſtill higher and higher, until the body is extracted.

Some writers direct us to introduce the crotchet within the ſkull, and preſſing one hand againſt the point in the outſide, pull along. But this a trifling expedient; and if a good deal of force is uſed, the inſtrument tears through the thin bones, and hurts the operator's hand or the woman's vagina, if not both. Whereas, in the other method, there is much more certainty, and a better purchaſe to force along the head, which collapſes and is diminiſhed as the brain is diſcharged, and never comes down in a broad flattened form, according to the allegations of ſome people, whoſe ideas of theſe things are imperfect and confuſed: for if this were the caſe, the ſame would happen when the head is forced down from behind with labour-pains into a narrow pelvis, becauſe the preſſure, in both caſes, acts in the ſame direction; whereas we always find, both in the one and the other, that the vertex is protruded in a narrow point, and the whole head ſqueezed into a longiſh form. Dr. Smellie obſerves in his treatiſe that though many people have exclaimed againſt the crotchets as dangerous inſtruments, from ignorance, want of experience, or a worſe principle, as formerly obſerved; yet Dr. Smellie again obſerves, that they either tore or hurt the parts of a woman with that inſtrument. He has indeed ſeveral times hurt the inſide of his hand by their giving way; till he had recourſe to the curve kind, which in many reſpects have the advantage of the ſtraight; and he is perſuaded, if managed as above directed, will never injure the patient.

Indeed, young practitioners, till they are better informed by cuſtom and practice, may, after the head is opened, try to extract it with the ſmall or large forceps; and if it is not very large, or the pelvis very narrow, they may deliver by ſqueezing and leſſening the head; but, in his courſe of practice, he has been concerned in many caſes, where the pelvis was ſo diſtorted and narrow, that, even after opening the head largely, he has pulled at the bones in time of ſtrong pains, but all to no purpoſe, although ſome of them actually came away. Nay, after fixing a crotchet firmly above and near the chin or baſis of the ſkull, and uſing a good deal of force, he had not been able to move the head lower, till at laſt he was obliged to introduce the other, and by intervals increaſe the force of pulling to the utmoſt of his ſtrength; and before we had the curve crotchet, he had been ſo fatigued from the ſtraight kind ſlipping their ſmall hold ſo often, that he had ſcarcely been able to move his fingers or arms for many hours after; and if this force had not been uſed, the mother muſt have been loſt as well as the child. See *fig.* 31, 32.

PART VII.

Preternatural Labours.

Preternatural labour happens when, inſtead of the head, ſome other part of the body preſents to the os uteri. It has been thought by ſome, that all labours in which the forceps and crotchet are uſed ought to be ranked in this claſs, becauſe the head is certainly delivered by preternatural means; and that, when the feet or breech preſent, and the woman is delivered without any other aſſiſtance than that of labour-pains, the caſe ought to be accounted natural. However, this diviſion would embarraſs and confuſe the young beginners more than the other which we have choſen to follow, namely, that of reckoning by the manner in which the child is delivered, and calling all thoſe births *preternatural* in which the body is delivered before the head. Preternatural labours are more or leſs difficult according to the preſentation of the child, and the contraction of the uterus round its body. The nearer the head and ſhoulders are to the os internum or lower part of the uterus, the more difficult is the caſe; whereas when the head is towards the fundus, and the feet or breech near the os internum, it is more eaſy to turn and deliver.

To begin with the eaſieſt of theſe it may be proper to divide them into three diviſions. Firſt, how to manage when the feet, breech, or lower parts preſent. Secondly, how to behave in violent floodings; and, when the child preſents wrong before the membranes are broke, how to ſave the waters in the uterus, that the fœtus may be the more eaſily turned; and what method to follow even after the membranes are broke, when all the waters are not evacuated. Thirdly, how to deliver when the uterus is ſtrongly contracted, and the child preſenting either with the fore or back parts, and lying in a circular form; or with the ſhoulders, breaſt, neck, face, ear, or vertex, and lying in a longiſh form, with the feet and breech towards the fundus of the womb, which is contracted like a long ſheath, cloſe to the body of the fœtus; and when the fore-parts of the child lie towards the ſide, fundus, fore or back-part of the uterus.

We ſometimes meet with pendulous bellies, in which the os uteri is farther back than uſual; but even in theſe caſes, when the head is not very large, nor the pelvis narrow, and the patient is vigorous and the labour-pains ſtrong, the woman, with a little patience, is for the moſt part ſafely delivered without any other than common aſſiſtance: or ſhould the caſe prove tedious, ſhe may be aſſiſted in time of a pain by introducing one or two fingers into the os uteri, and gradually bringing it more forwards. When the belly is very pendulous, change of poſition from time to time is of ſervice, eſpecially lying upon her back, with the ſhoulders low and the breech raiſed. In women that are diſtorted, when one ilium is much lower than the other, the fundus uteri will be turned to the low ſide; but there the chief difficulty will proceed from the narrowneſs of the pelvis.

SECT. I. *Firſt Diviſion of* PRETERNATURAL LABOURS. *When the Feet, Breech, or lower Parts of the Fœtus preſent, and the Head, Shoulders, and upper Parts are towards the Fundus Uteri.*

Theſe, for the moſt part, are accounted the eaſieſt, even although the uterus ſhould be ſtrongly contracted round the body of the child, and all the waters diſcharged. If the knees or feet of the child preſent to the os internum, which is not yet ſufficiently dilated to allow them and the body to come farther down; or, if the woman is weak, wore out with long labour, or endangered by a flooding; let the operator introduce his hand into the vagina, puſh up and ſtretch the os uteri, and bring along the feet; which being extracted, let him wrap a linen cloth round them, and pull until the breech appears on the outſide of the os internum. If the face or fore part is already towards the back of the uterus, let him perſiſt in pulling in the ſame direction: but if they are towards the os pubis or one ſide, they muſt be turned to the back-part of the uterus; and as the head does not move round equal with the body, he muſt make allowance for the difference in turning, by bringing the laſt quarter farther than the place at which the head is to be placed; ſo that the face or forehead which was towards one of the groins, will be forced to the ſide of the ſacrum, where it joins with the iſchium. This quarter-turn of the body muſt be again undone, without affecting the poſition of the head; a cloth may be wrapped round the breech, for the convenience of holding it more firmly; then placing a thumb along each ſide of the ſpine, and with his fingers graſping the belly, let him pull along the body from ſide to ſide, with more or leſs force according to the reſiſtance. When the child is delivered as far as the ſhoulders, let him ſlide his hand, flattened (ſuppoſe the right if ſhe lies on her back) between its breaſt and the perinæum, coccyx, and ſacrum, of the woman, and introduce the fore or middle finger (or both, if neceſſary) into the mouth of the fœtus; by which means the chin will be pulled to the breaſt, and the forehead into the hollow of the ſacrum. And this expedient will alſo raiſe upward the hindhead, which reſts at the os pubis.

When the forehead is come ſo low as to protrude the perinæum, if the woman lies on her back, let the operator ſtand up and pull the body and head of the child upwards, bringing the forehead with a half-round turn from the under part of the os externum, which will thus be defended from laceration. The application of the fingers in the child's mouth will contribute to bring the head out in this manner, prevent the os externum from hitching on the chin, help along the head, and guard the neck from being overſtrained; a misfortune which would infallibly happen if the forehead ſhould be detained at the upper part of the ſacrum. Nor is there any great force required to obviate this inconvenience, or the leaſt danger of hurting the mouth, if the head is not large: for if the head cannot be brought along with moderate force, and the operator is afraid of injuring or overſtraining the lower jaw, let him puſh his fingers farther up, and preſs on each ſide of the noſe, or on the inferior edges of the ſockets of the eyes. If the legs are come out, and the breech pulled into the vagina, there is no occaſion for puſhing up to open, but only to pull along and manage as before directed: ſtill remembering to raiſe the forehead ſlowly from the perinæum, which may be preſſed back with the fingers of his other hand.

In the caſe of a narrow pelvis, or large head, which cannot be brought along without the riſk of overſtraining the neck, let him ſlide up his fingers and hand into the vagina, and bring down one of the child's arms, at the ſame time pulling the body to the contrary ſide, by which means the ſhoulder will be brought lower down: let him run his fingers along the arm, until they reach the elbow, which muſt be pulled downwards with an half-round turn to the other ſide, below the breaſt. This muſt not be done with a jerk, but ſlowly and cautiouſly, in order to prevent the diſlocation, bending, or breaking, of the child's arm.

Let him again guide his fingers into the child's mouth, and try if the head will come along: if this will not ſucceed, let the body be pulled to the other ſide, ſo as to bring down the other ſhoulder; then ſlide up his left-hand, and, extracting the other arm, endeavour to deliver the head. If one finger of his right-hand be fixed in the child's mouth, let the body reſt on that arm; let him place the left-hand above the ſhoulders, and put a finger on each ſide of the neck: if the forehead is towards one ſide at the upper part of the pelvis, let him pull it lower down, and gradually turn it into the hollow of the ſacrum; then ſtand up, and in pulling raiſe the body ſo as to bring out the head in an half-round turn, as above directed.

Daventer and others, from a miſtaken notion that the chief reſiſtance is at the coccyx or lower part of the pelvis, have directed us to preſs the ſhoulders of the child downwards, ſo as to bring the hindhead firſt from below the os pubis: not conſidering that the reſiſtance is occaſioned by the thickeſt part of the head being detained at the upper part of the pelvis, where the loweſt vertebra of the loins and the upper part of the ſacrum jet inwards; and that, until the forehead hath paſſed into the hollow of the ſacrum, this method cannot ſucceed. The buſineſs, therefore, is to pull upwards at the back-part of the neck, which reſts againſt the under-part of the os pubis; and by this exertion, the forehead, which is high up, will be brought down with a circular turn; after which the head ſeldom ſtops, and the ſame circular motion is ſtill the moſt proper, though now we can bring out the head the other way, but not before. Sometimes, indeed, we have found Daventer's method ſucceed better than the other, when the head is low down, and the chief reſiſtance is in the lower parts; but this is very ſeldom the caſe: however, when the forehead is hindered from coming down into the lower part of the ſacrum by an uncommon ſhape of the head or pelvis, and we cannot extract it by bringing it out with an half-round turn at the os pubis, we muſt try to make this turn in the contrary direction; and inſtead of introducing our fingers into the child's mouth, let the breaſt of it reſt on the palm of your left-hand, (the woman being on her back) and placing the right on its ſhoulders, with the fingers on each ſide of the neck, preſs it downwards to the perinæum. In conſequence of this preſſure, the face and chin being within the perinæum, will move more upwards, and the head come out with an half-round turn from below the os pubis: for the centre of motion is now where the fore-part of the neck preſſes at the perinæum; whereas, in the other method, the back-part of the neck is againſt the lower part of the os pubis, on which the head turns.

If the forehead is not turned to one ſide, but ſticks at the upper part of the ſacrum, eſpecially when the pelvis is narrow; let him endeavour, with his finger in the mouth, to turn it one ſide of the jetting-in of the ſacrum, becauſe the pelvis is wider at the ſides of the brim, and bring it along as before.

If one of the child's arms, inſtead of being placed along the ſide of the head, is turned in between the face and ſacrum, or between the hindhead and os pubis, the ſame difficulty of extracting occurs as in a large head or narrow pelvis; and this poſition frequently enſues when the fore-parts of the child's body are turned from the os pubis down to the ſacrum. If they are turned to the left ſide of the woman, the left-hand and arm are commonly brought in before the face, and *vice verſa*; but in theſe caſes the elbow is for the moſt part eaſily come at, becauſe it is low down in the vagina, and then there is a neceſſity for bringing down one or both arms before the head can be delivered: from whence we may conclude, that thoſe authors are ſometimes in the wrong who expreſsly forbid us to pull down the arms. Indeed, if the pelvis is not narrow, nor the head very large, and the arms lie along the ſides of the head, there is ſeldom occaſion to pull them down; becauſe the pelvis is wideſt at the ſides, and the membranes and ligaments that fill up the ſpace betwixt the ſacrum and iſchia yield to the preſſure, and make room for the paſſage of the head: but when they are ſqueezed between the head and the ſacrum, iſchia, or oſſa pubis, and the head ſticks in the pelvis, they certainly ought to be brought down; or even when the head comes along with difficulty. Neither is the alleged contraction of the os internum round the neck of the child ſo frequent as hath been imagined; becauſe for the moſt part the contraction embraces the head and not the neck: but ſhould the neck alone ſuffer, that inconvenience may be removed by introducing the hand into the vagina, and a finger or two into the child's mouth, or on each ſide of the noſe; by which means alſo a ſufficient dilatation will be preſerved in the os externum, which frequently contracts on the neck as ſoon as the arms are brought out.

The diameter from the face or forehead to the vertex, being greater than that from the forehead to the back-part of the hindhead or neck, when the hindhead reſts at the os pubis, and the forehead at the upper part of the ſacrum, the head can ſeldom be brought down until the operator, by introducing a finger into the mouth, moves the ſame to the ſide, brings the chin to the breaſt, and the forehead into the hollow of the ſacrum: by which means the hindhead is raiſed and allowed to come along with greater eaſe; and in pulling, half the force only is applied to the neck, the other half being exerted upon the head, by the finger which is fixed in the mouth; ſo that the forehead is more eaſily brought out, by pulling upwards with the half round turn from the perinæum. When the operator with his fingers in the child's mouth cannot pull down the forehead into the hollow of the ſacrum, let him puſh the fore-finger of his left hand betwixt the neck and the os pubis, in order to raiſe the hindhead upwards; which being done, the forehead will come down with leſs difficulty, eſpecially if he puſhes up and pulls down at the ſame time, or alternately.

If it be diſcovered by the touch, that the breech preſents, that the membranes are not yet broke, the woman is in no danger, the os internum not yet ſufficiently dilated, and the labour-pains ſtrong; the midwife ought to wait until the membranes, with the waters, are puſhed farther down, as in the natural labour: for, as they come down through the os uteri into the vagina, they ſtretch open the parts contained in the pelvis; and the bulk within the uterus being diminiſhed, it contracts and comes in contact with the body of the child; ſo that the breech is puſhed along by the mechanical force of the abdominal muſcles operating upon the womb. The ſame conſequences will follow even although the membranes are broke; for the waters lubricate the parts as they flow off, and the breech, if not too large, or the pelvis narrow, is puſhed down: in this caſe, when the nates preſent equal and fair to the os uteri, and one ſide of the fœtus was towards the fore-part, the other to the back-part of the uterus; and when the breach preſents, it lies in the ſame manner, only that the fore-parts of the child are rather turned backwards to one ſide of the vertebræ of the loins: in this poſition, one hip will preſent, and the other reſt on the os pubis; but when forced along with pains, the laſt will be gradually moved more and more to the groin of that ſide, and from thence ſlip down at the ſide of the baſin: the lower at the ſame time will be forced to the other, and the hollow betwixt the thighs will reſt upon the jetting in of the os ſacrum, and come down in that manner; the thighs on each ſide, and the back and round part of the breech, paſſing in below the arch of the os pubis, which is the beſt poſition: but if the back of the child is tilted backwards, then it will be forced down in the contrary direction, and come along with more difficulty, viz. the thighs to the os-pubis, and back to the ſacrum. When it is come down to the middle or lower part of the pelvis, let the operator introduce the fore-finger of each hand, along the outſide, to the groins; and taking hold, pull gently along during a ſtrong pain.

If the os externum is ſo contracted that he cannot take ſufficient hold, let it be opened ſlowly, ſo as to allow his hands to be puſhed up with eaſe: when he has inſinuated a finger or two in each groin, let him place his thumbs on the thighs, if they are towards the oſſa pubis, ſo as to obtain a full hold; then pull along from ſide to ſide, and, if the back of the child is to the os pubis, continue to aſſiſt in this manner until the body and head are delivered. The legs being commonly ſtretched up along the belly and breaſt, when the child is extracted as far as the ſhoulders, they come out of themſelves, or are eaſily brought down; but if the belly of the child is turned to one ſide, or to the os pubis, in that caſe, when the breech is delivered, he ought to turn the belly down to the ſacrum and the back to the os pubis; and that the face may be alſo turned to the back of the mother, let him remember the quarter extraordinary, which muſt be again reverſed, and then he may pull along and deliver.

If the body cannot be turned until the thighs and legs are brought down, either on account of the bulk, or becauſe the hold on the breech is not ſufficient, let him continue to pull along, until the hams appear on the outſide of the os externum; then ſeize one of the knees with his finger and thumb, and extract that leg; and let the other be brought down in the ſame manner. If he attempts to pull out the legs before the hams arrive at this place, the thighs are always in danger of being bent or broken. When the legs are delivered, let him wrap a cloth round the breech of the child: and as the body was pulled down almoſt as far as the breaſt, before the legs could be brought out, it muſt be puſhed up again to the navel, or above it; becauſe, without this precaution, the ſhoulders would be ſo much engaged in the pelvis, that it would be impracticable to make the motions formerly directed, ſo as to turn the face to the back of the mother: whereas, when the body is puſhed up, thoſe turns can be effected with greater eaſe, becauſe the belly being in the pelvis, it yields eaſier to the form of the baſin. When the face is turned properly down, let him proceed to deliver as above directed.

If the breech is detained above the pelvis, either by its uncommon magnitude or the narrowneſs of the baſin; or if one of the nates is puſhed in, while the other reſts above the os pubis, ſacrum, or to either ſide; if the woman is low and weak, the pains lingering and inſufficient to force the child along; or if ſhe is in danger from a violent flooding: in any of theſe caſes, let him (during every pain) gradually open firſt the os externum, and then the os internum, with his fingers and hand. Having thus gained admiſſion, let him puſh up the breech to the fore or back part, or to one ſide of the uterus, that his hand and arm may have room to ſlide along the fore-parts or belly of the child, ſo as to feel the thighs, that will direct him to the legs, which muſt be brought down with his fingers, while at the ſame time he puſhes up the hams with his thumb, that in caſe the legs lie ſtraight up they may be extracted with more eaſe by the flection of the knee, and run the leſs riſk of being bent, broken, or overſtrained; for if they are folded downward, they are the more eaſily brought out.

If the breech be ſtrongly preſſed into the upper part of the pelvis, let him alſo puſh it upwards and to one ſide, that his hand and arm may have free paſſage; for the higher the breech is raiſed out of his way, he will be at more freedom to extract the legs. If both legs cannot be eaſily brought down, he may ſafely deliver with one, of which taking hold with a linen cloth wrapped round it, let him ſlide up his other hand into the vagina, and a finger or two into the outſide of the groin which is bent: by theſe means, the hip will come down the eaſier, and the leg which is already extracted, will not be overſtrained by ſuſtaining the whole force of pulling the body along.

If the legs lie towards the left ſide of the woman, who is laid on her back, the right-hand muſt be introduced into the uterus; if they lie to her right ſide, the left-hand will better anſwer the purpoſe; and if they are towards her back or belly, either hand may be indifferently uſed. In all caſes where the breech preſents, the ſafeſt practice is always to puſh up and bring down the legs, provided the os uteri is ſufficiently dilated, and the waters not wholly diſcharged. If the waters are evacuated, the uterus ſtrongly contracted around the child, the breech ſo low as that it cannot be returned, or ſo ſmall as to come eaſily along, we ought then to deliver it accordingly: but if ſo large as neither to be puſhed up nor brought along with the aſſiſtance of the fingers, let the operator introduce the curved handle of the blunt crotchet into one of the groins, his fingers into the other, and pull very cautiouſly in order to prevent a fracture or diſlocation of the thigh-bone, which might otherwiſe happen from the uſe of this inſtrument, the blunt point of which muſt be ſufficiently paſt the groin. A fillet may alſo be uſed for the ſame purpoſe.

We have, in the foregoing caſes of this ſection, ſuppoſed the woman laid on her back, her legs ſupported, and breech to the bedſide; this being generally the beſt poſition for delivering the body and head. Indeed, when the child is ſmall, ſhe may lie on her ſide, and the ſame methods be uſed in delivering, provided the operator ſtill remembers, that in this poſition the ilium and iſchium of one ſide are down, and the others up. Beſides, when the breech is puſhed up, in order to bring down the legs, if they lie forwards towards the fore-part of the uterus, and the belly is pendulous, he can reach them with the greateſt eaſe when ſhe lies on one ſide; or, if the reſiſtance is very great, turn her to her knees and elbows, according to Daventer's method: but, when the legs are delivered, if the child is large or the pelvis narrow, ſhe ought to be turned upon her back, becauſe the body and head can be better and more ſafely delivered by pulling up and down; and in that poſture ſhe is alſo kept more firm, and her thighs leſs in the operator's way, than when ſhe lies upon her ſide. See *fig.* 32, 33, 35, and 37.

SECT. III. *The ſecond Diviſion of* PRETERNATURAL LABOURS.

Firſt caſe. When the membranes are broke, but the face, ſhoulder, or ſome other part of the child, being puſhed into the pelvis, locks up the os internum, ſo as that a ſmall quantity of the waters hath been diſcharged, the uterus is kept from contracting ſtrongly round the child, which is therefore more eaſily turned than it poſſibly can be when they are all gone.

Second caſe. When, before the membranes are broke, the child is felt through them, preſenting wrong; and at the ſame time the pains puſh them down ſo as to dilate the os internum, more or leſs.

Third caſe. When the woman at any time in the four laſt months is ſeized with a violent flooding that cannot be reſtrained, and unleſs ſpeedily delivered muſt loſe her life: if labour-pains cannot be brought on by ſtretching the parts, delivery muſt be forced: but if ſhe is in labour, and the membranes have been puſhed down with the waters, they may be broke; by which means the flooding is frequently diminiſhed, and the child delivered by the labour pains. In theſe three different caſes, if we can prevent the ſtrong contraction of the uterus, by keeping up the waters, we can alſo, for the moſt part, turn the child with great eaſe, even in the very worſt poſitions.

CASE I.

In the firſt caſe, let the operator ſlowly introduce his hand into the vagina, and his fingers between that part of the child which is puſhed down and the os internum; if in ſo doing, he perceives ſome of the waters coming along, he muſt run up his hand as quick as poſſible into the uterus, betwixt the inſide of the membranes and the child's body; the lower part of his arm will then fill up the os externum like a plug, ſo that no more of the waters can paſs: let him turn the child with its head and ſhoulders up to the fundus, the breech down to the lower part of the uterus, and the fore-parts towards the mother's back: let the hand be puſhed no farther up than the middle of the child's body; becauſe if it is advanced as high as the fundus, it muſt be withdrawn lower before the child can be turned; and by theſe means the waters will be diſcharged, and the uterus of conſequence contract ſo as to render the turning more difficult.

CASE II.

In the ſecond caſe, when the membranes are not broke, and we are certain that the child does not preſent fair, if the os internum is not ſufficiently dilated, and the woman is in no danger, we may let the labour go on until the parts are more ſtretched; lubricating and extending the os internum, by degrees, during every pain. Then introducing one hand into the vagina, we inſinuate it in a flattened form, within the os internum, and puſh up between the membranes and the uterus, as far as the middle of the womb. Having thus obtained admiſſion, we break the membranes, by graſping and ſqueezing them with our fingers; ſlide our hand within them, without moving the arm lower down; then turn and deliver as before directed: but if in any of theſe caſes you find the head is large, or the pelvis narrow, bring down the head into the natural poſition, and aſſiſt as directed in lingering or laborious caſes.

CASE III.

In the third caſe, if the woman is attacked with a violent flooding, occaſioned by a ſeparation of all or any part of the placenta from the uterus during the laſt four months of pregnancy, and every method has in vain been tried to leſſen and reſtrain the diſcharge, the operator ought to pronounce the caſe dangerous, and prudently declare to the relations of the patient, that unleſs ſhe is ſpeedily delivered both ſhe and the child muſt periſh; obſerving at the ſame time, that by immediate delivery they may both be ſaved; let him alſo deſire the aſſiſtance and advice of ſome perſon eminent in the profeſſion, for the ſatisfaction of her friends and the ſupport of his own reputation. When there are no labour-pains, and the mouth of the womb is not dilated, it is ſometimes very difficult to deliver, more eſpecially if the os internum is not a little lax, but feels rigid.

If the os uteri is ſo much contracted that the finger cannot be introduced, ſome authors have recommended a dilator, by which it may be gradually opened ſo as to admit a finger or two. Doubtleſs, ſome caſes may happen in which this may be neceſſary; though in all thoſe we know of in which there was a neceſſity for forcing delivery, the mouth of the womb was open enough to receive the tip of a finger, ſo that by gradual efforts we could effect a ſufficient dilatation: and it is certainly a ſafer method to dilate with the fingers and hand, than with an inſtrument. If in ſtretching the os internum labour-pains are brought on, let the operator ſlowly proceed and encourage them: when the mouth of the womb is opened, if the head preſents and the pains are ſtrong, by breaking the membranes the flooding will be diminiſhed: but if ſhe floods to ſuch a degree as to be in danger of her life, and the dilatation does not bring on labour, at leaſt not enough for the occaſion, ſhe muſt be immediately delivered in the following manner. But in the firſt place let her friends be appriſed of the danger, and the operator beware of promiſing to ſave either mother or child: for we have known the woman die in a few minutes after delivery, although to all appearance ſhe ſeemed able to undergo the operation, and the child loſt from the head ſticking in the pelvis: others, again, who were apparently much more weak and exhauſted, have recovered, and the child hath been ſaved.

The operator having performed his duty in making the friends acquainted with the ſituation of the caſe, muſt gently open the os externum, by introducing his fingers gradually, turning them half-round and puſhing upward; then forming them with the thumb into the figure of a wedge or cone, continue to dilate ſlowly and by intervals, until his hand is admitted into the vagina: having thus far gained his point, let him inſinuate, in the ſame ſlow cautious manner, firſt one, then two fingers into the os internum, which may be dilated ſo as to admit the other two and the thumb, in the ſame conical form, which will gradually make way for ſliding the hand along between the outſide of the membranes and inſide of the uterus; then he muſt manage as directed in the ſecond caſe. If upon ſliding up his hand upon the outſide of the membranes, he feels the placenta adhering to that ſide of the womb, he muſt either withdraw that hand and introduce the other on the oppoſite ſide, or break through the membranes at the lower edge of the placenta. The greateſt danger in this caſe frequently proceeds from the ſudden emptying of the uterus and belly: for when labour comes on of itſelf, or is brought on in a regular manner, and the membranes are broke, the flooding is gradually diminiſhed; and firſt the child, then the placenta, is delivered by the pains; ſo that the preſſure or reſiſtance is not all at once removed from the belly and uterus of the woman, which have time to contract by degrees; conſequently thoſe faint-fits and convulſions are prevented which often proceed from a ſudden removal of that compreſſion under which the circulation was performed.

In order to anticipate theſe fatal ſymptoms, Dr. Smellie (ſometimes ſucceſsfully) ordered an aſſiſtant to preſs upon the woman's belly while the uterus was emptying; or, after having broken the membranes, turned up the head to the fundus, and brought down the legs and breech, he withdrew his arm a little to let the waters come off, and kept his hand in the uterus for a few minutes, he did not extract the legs until he felt the womb cloſe contracted to the child; nay, if the flooding was ſtopped, or diminiſhed, he let the child remain in the uterus perhaps ten or fifteen minutes longer, then delivered; and, if the hæmorrhage was ſtayed, he left the placenta to be expelled by nature. In all theſe ſtages, however, when the flooding is violent, we muſt deliver without loſs of time, remembering ſtill the preſſure upon the abdomen; for the woman is frequently ſo very weak, that although labour could be brought on, ſhe would not have ſtrength ſufficient to undergo it. The younger the woman is with child, the greater is the difficulty in opening the os internum; and more ſo in the firſt child, eſpecially if ſhe is paſt the age of thirty-five.

We ſhould never refuſe to deliver in theſe dangerous caſes, even although the patient ſeems expiring; for immediately after delivery the uterus contracts, the mouths of the veſſels are ſhut up, ſo that the flooding ceaſes, and if ſhe lives five or ſix hours after the operation, and can be ſupported by frequent draughts of broth, jelly, caudle, weak cordial, and anodyne medicines, which maintain the circulation and gradually fill the empty veſſels, ſhe may recover.

If, in time of flooding, ſhe is ſeized with labour-pains, or if, by every now and then ſtretching with your fingers the os internum, you bring on labour, by which either the membranes or head of the child is puſhed down and opens the os internum, the membranes ought to be broken; ſo that, ſome of the waters being diſcharged, the uterus may contract and ſqueeze down the fœtus. This may be done ſooner in thoſe women who have had children formerly, than in ſuch as have not been in labour before. If, notwithſtanding this expedient, the flooding ſtill continues, and the child is not like to be ſoon delivered, it muſt be turned immediately; or, if the head is in the pelvis, delivered with the forceps: but, if neither of theſe two methods will ſucceed, on account of the narrowneſs of the pelvis or the bigneſs of the head, this laſt muſt be opened and delivered with the crotchet. In all theſe caſes let the parts be dilated ſlowly and by intervals, in order to prevent laceration. See *fig.* 11, 14, 15, 16, 37.

SECT. IV. *Third Diviſion of* PRETERNATURAL LABOURS.

We have already obſerved, that the principal difficulties in turning children and bringing them by the feet, proceeded from the contraction of the uterus and bad poſition of the fœtus. If the child lies in a round form, whether the fore-parts are towards the os internum, or up to the fundus uteri, we can for the moſt part move it with the hand, ſo as to turn the head and ſhoulders to the upper part, and the breech and legs downwards: but if the child lies lengthwiſe, the womb being contracted around it like a long ſheath, the taſk is more difficult; eſpecially if the head and ſhoulders of the child are down at the loweſt part of the uterus, with the breech and feet turned up to the fundus.

Before we proceed to the method of delivery in the following caſes, it will not be improper to premiſe, that the woman ought to be laid on her back, her breech upon the ſide or foot of the bed, a bolſter or pillows being laid below the feather-bed or matraſs, in order to raiſe it ſo as that the breech may be higher than the ſhoulders: while an aſſiſtant ſits on each ſide, to ſupport her legs and thighs, and one or two more aſſiſtants ought to ſit behind, or on each ſide of her ſhoulders, to keep her firm in that poſition. The operator ought to avoid all formality in point of dreſs, and never walk about the room with ſleeves and apron; for although ſuch apparatus may be neceſſary in hoſpitals, in private practice it conveys a frightful idea to the patient and female ſpectators: the more genteel and commodious dreſs is a looſe waſhing night-gown, which he may always have in readineſs to put on when he is going to deliver; his waiſtcoat ought to be without ſleeves, that his arms may have more freedom to ſlide up and down under cover of the wrapper; and the ſleeves of his ſhirt may be rolled up and pined to the breaſt of his waiſtcoat. In natural labours, the ſheet that hangs over the bed-ſide is ſufficient to keep him clean and dry, by being laid in his lap; but in thoſe caſes where he is obliged to alter his poſition, a ſheet ought to be tucked round him, or an apron put on, but not before he is about to begin his work. If the patient is laid on a low bed, and he intends to introduce his right-hand, his beſt and firmeſt poſition is to kneel with his left knee on a cuſhion, keeping up the right to ſupport his arm; if the left-hand is introduced, the reverſe of this diſpoſition muſt take place: if the bed or couch is high, he ought to ſtand, but ſtill remember to ſupport the elbow on the knee. Theſe directions, howſoever trivial they may ſeem to old practitioners, may be ſerviceable to young beginners, and give our readers a better idea of the operation.

The hand of the accoucheur or operator being introduced into the uterus, if he finds the breech below the head and ſhoulders, let him ſearch for the legs and bring them down: but if the breech be higher than the upper parts of the child, or equal with them, he muſt try to turn the head and ſhoulders to the fundus, and the breech downwards, by puſhing up the firſt and pulling down at laſt; then proceed with delivery as before directed. This is commonly executed with eaſe, provided ſome part of the waters ſtill remain in the uterus; but, if the woman has been long in labour, and the waters diſcharged, the contraction of the womb is ſo ſtrong, that the child cannot be turned without the exertion of great force frequently repeated. In this caſe, the eaſieſt method, both for the patient and operator, is to puſh up the hand gradually on that ſide to which the legs and thighs are turned; and even after he has reached them, if they are not very high up, let him advance his hand as far as the fundus uteri; he will thus remove the greateſt obſtacle, by enlarging the cavity of the womb, ſo as more eaſily to feel and bring down the legs; then he may puſh up and pull down, as we have preſcribed before. But if the head and ſhoulders ſtill continue to hinder the breech and body from coming along, and the feet cannot be brought ſo low as the outſide of the os externum, while they are yet in the vagina he may apply a nooſe upon one or both: for, unleſs the child is ſo ſmall that he can turn it round by graſping the body when the head and ſhoulders are puſhed up, and he endeavours to bring down the other parts, they will again return to the ſame place, and retard delivery; whereas, if he gains a firm hold of the feet, either without the os externum or in the vagina, by means of the nooſe fixed upon the ankles, he can with the other hand puſh up the head and ſhoulders, and be able in that manner to bring down the breech. He muſt continue this method of puſhing up and pulling down, until the head and ſhoulders are raiſed to the fundus uteri: for, ſhould he leave off too ſoon, and withdraw his hand, although the child is extracted as far as the breech, the head is ſometimes ſo preſſed down and engaged with the body in the paſſage, that it cannot be brought farther down without being tore along with the crotchet; for the breech and part of the body may block up the paſſage in ſuch a manner, as that the hand cannot be introduced to raiſe the head.

In all caſes, where the accoucheur foreſees that great force will be requiſite, he ought to ſave his ſtrength as much as poſſible, beginning ſlowly, and reſting his hand between whiles during the operation of puſhing and turning the child in the uterus: for if he begins to work in a hurry, and exerts his utmoſt ſtrength at firſt, his hands will be ſo cramped and enervated, that he will be obliged to deſiſt, and give them ſome reſpite; ſo that it may be a long time before he recovers the uſe of them, and even then they will be ſo much weakened as to be ſcarce able to effect delivery, which is thus impeded and delayed.

Thoſe caſes are commonly the eaſieſt in which the fore-parts preſent, and the child lies in a round oval form, acroſs the uterus, or diagonally, when the head or breach is above and over the os pubis, with the legs, arms, and navel-ſtring, or one or all of them, at the upper or lower part of the vagina, or on the outſide of the os externum. Thoſe are moſt difficult in which, though the child lies in the ſame round or contracted form, the back, ſhoulders, belly, or breaſt, are over the os internum; becauſe, if we cannot move the child round, ſo as to place the head to the fundus, the legs are brought down with much more difficulty than in the other caſe; but if the ſhoulder, breaſt, neck, ear, face, or crown of the head preſents, and the legs and breech are up to the fundus uteri, the caſe is ſtill more difficult; becauſe, in the other two, the uterus is contracted in a round form, ſo that the wrong poſition of the child is more eaſily altered than this, when the womb is contracted in a long ſhape, and ſometimes requires vaſt force to ſtretch it ſo as that the head may be raiſed to the fundus, and the legs and breech brought down.

CASE I.

When the fore-parts of the child preſent, if the feet, hands, and navel-ſtring are not detained above the os uteri, ſome or all of them deſcend into the vagina, or appear on the outſide of the os externum. If one or more of them come down, and the child at the ſame time lies in a round form acroſs the uterus, let the accoucheur introduce his hand between them and the os ſacrum, as directed in Part 7. § 3. When it is paſt the os internum, let it reſt a little, while he feels with his fingers the poſition of the fœtus: if the head and ſhoulders lie higher than the breech, he muſt take hold of the legs and bring them down withoutſide the os internum: if the breech is detained above the brim of the pelvis, let him ſlide up the flat of his hand along the buttocks, and pull down the legs with the other hand; by which method the breech is diſengaged and forced into the middle of the pelvis. See *fig.* 34.

In moſt of thoſe caſes where the child is preſſed in an oval form, if neither the head nor breech preſent, the head is to one ſide of the uterus, and the breech to the other; becauſe, as was formerly obſerved, it is wider from ſide to ſide, than from the back to the fore part; and if either the head or breech is over the os pubis, the other is turned off to the ſide: in moving the head or ſhoulders to the fundus, they are raiſed with greater eaſe along the ſides than at the back or fore parts, for the ſame reaſons.

If the head and ſhoulders lie lower down, ſo as to hinder the breech from coming along, and the legs from being extracted, let him puſh up the head and ſhoulders to the fundus, and pull out the legs; then try, as above directed, to bring in the breech; and if it ſtill ſticks above, becauſe the head and ſhoulders are again forced down by the contraction of the uterus, he muſt with one hand take hold of the legs that are now without the os externum, and, ſliding the other into the uterus, puſh the head and ſhoulders again up to the fundus, while at the ſame time he pulls the legs and breech along with the feet. If the legs cannot be brought farther down than the vagina, becauſe the breech is high up, let him ſlip a nooſe over the feet round the ancles, as before obſerved; by which he may pull down the lower parts with one hand, while the other is employed in puſhing it up, as before. By this double purchaſe the child may be turned even in the moſt difficult caſes: but the operator, in pulling, muſt beware of overſtraining the ligaments of the joints.

If the legs can be extracted through the os externum, let a ſingle cloth, warmed, be wrapped round them, in order to yield a firmer hold to the accoucheur; but when they can be brought no lower than the neck of the uterus and vagina, he may uſe one of theſe following nooſes. Let him take a ſtrong limber fillet or ſoft garter, half worn, about one yard and an half in length, and moderately broad and thick; if thick, an eye may be made at one end of it, by doubling about two inches and ſewing it, ſtrongly, and the other end paſſing through this doubling in order to make the nooſe, which being mounted upon the thumb and fingers of his hand muſt be introduced and gently ſlipped over the toes and feet of the child ſo as to embracethe ankles, and thus applied it muſt be drawn tight with his other hand.

If the foot or feet ſhould be ſo ſlippery that his fingers cannot hold them and work over the nooſe at the ſame time, it muſt be withdrawn and mounted round his hand or wriſt; with which hand when introduced he may take firm hold on both feet, if they are as far down as the vagina; then with the fingers of his other hand he may ſlide the nooſe along the hand and fingers that hold the feet, and fix it round the ankle. But if one foot remains within the uterus, the fingers of his other hand cannot puſh up the nooſe far enough to ſlide it over the ankle; ſo that he muſt have recourſe to a director like that for polypuſes, mounted with the nooſe, which will puſh it along the hand and fingers that hold the foot. The nooſe being thus ſlipped over the fingers upon the ankle, he muſt pull the extremity of the fillet, which hath paſſed the eye at the upper end of the director; and after it is cloſe drawn, bring down the inſtrument. Some uſe a ſmall ſlender pair of forceps to graſp the ankles and ſlide the nooſe along them; others make uſe of a fillet with a nooſe upon one end of it, fixed on a hollow tube that carries it up to be ſlipt over the ankles; and this being done, it is drawn cloſe by pulling the other end of the fillet down through the cavity of the tube: but there is ſeldom occaſion for any of theſe inſtruments, becauſe we can for the moſt part bring the feet down into the vagina.

CASE II.

When the belly preſents, and the head, ſhoulders, breech, thighs, and legs, are turned up over the back to the fundus uteri; when the back preſents, and all theſe parts are upwards; when the ſide preſents with the head, ſhoulders, breech, thighs, and legs turned to the ſide, back, or fore part of the uterus: in all theſe caſes, when the child is preſſed into a round or (more properly) an oval figure, it may be for the moſt part moved round, with one hand introduced into the uterus, the head and ſhoulders puſhed to the fundus, and the legs and breech to the os internum; which being effected, the legs are eaſily brought down. See *fig.* 35, 36. But theſe caſes are more or leſs difficult as the feet are farther up or lower down, becauſe the buſineſs is to bring them downwards.

When the breaſt, ſhoulders, neck, ear, or face preſents to the os internum, the breech, thighs, and legs being towards the fundus, with the fore-parts of the fœtus turned either to the ſide, back, or fore part of the woman's belly, and the whole lying in a longiſh form, the uterus being cloſely contracted around its body like a ſheath (See *fig.* 37.) let the accoucher introduce his hand into the vagina, and open the os internum, by puſhing up the fingers and hand flattened between the parts that preſent and the inſide of the membranes; and reſt his hand in that ſituation, until he can diſtinguiſh how the child lies, and form a right judgment how to turn and deliver: for if theſe circumſtances are not maturely conſidered, he will begin to work in a confuſed manner, fatigue himſelf and the patient, and find great difficulty in turning and extracting the child.

If the feet and legs of the fœtus lie towards the back, ſides, or fundus uteri, the woman ought to be laid on her back, with her breech raiſed and brought a little over the bed, as formerly obſerved; becauſe in that poſition he can more eaſily reach the feet than in any other.

If they lie towards the fore-part of the uterus, eſpecially when the belly is pendulous, ſhe ought to lie upon her ſide; becauſe in the other poſture it is often difficult to turn the hand up to the fore-part of the womb: whereas, if ſhe is laid on the left ſide, the right hand may be introduced at the upper part and left ſide of the brim of the pelvis, where it is wideſt, and then along the fore part of the uterus; by which means the feet are more eaſily come at. If it is more convenient for the accoucheur to uſe his left-hand, the patient may be turned on her right ſide. The only inconvenience attending theſe poſitions, is, that the woman cannot be kept ſo firm and ſteady, but will be apt to toſs about and ſhrink from the operator; and, beſides, there may be a neceſſity for turning her upon her back, after the body is delivered, before he can extract the head, eſpecially if it be large, or the pelvis narrow.

The ſituation of the child being known, and the poſition of the mother adjuſted, let the proper hand be introduced, and the firſt effort always made in puſhing the preſenting part up towards the fundus, either along the ſides, back, or fore part of the uterus, as is moſt convenient. If this endeavour ſucceeds, and the breech, thighs, or legs come down, the body may be delivered with eaſe: but if the head, ſhoulder, breaſt, or neck, preſent, the other parts of the body being ſtretched up lengthwiſe, and the uterus ſo ſtrongly contracted around the child that the preſenting part cannot be raiſed up, or, though puſhed upwards, immediately returns before the legs can be properly ſeized or brought down; the operator ought, in that caſe, to force up his hand ſlowly and gradually between the uterus and the child. If the reſiſtance is great, let him reſt a little between whiles, in order to ſave the ſtrength of his hand and arm, as formerly directed; and then proceed with his efforts until he ſhall advance his hand as far as the feet: for the higher his hand is puſhed, the more will the uterus be ſtretched, and the more room granted for bringing the legs along; and if, in puſhing up his hand, the fingers ſhould be entangled in the navel-ſtring or one of the arms, let him bring it a little lower, and paſs it up again on the outſide of ſuch encumbrance.

If one leg can be brought down, the child being turned, and that member extracted through the os externum, let the accoucheur ſlide his hand up to fetch the other; but if this cannot be done, he muſt fix a finger on the outſide of the groin of that thigh which is folded up along the belly, and bring along that buttock, as in the breech caſe, while he pulls with his other hand at the other leg; and, the body being thus advanced, deliver as before directed.

When the ſhoulder preſents, and the arm lies double in the vagina, let him puſh them both up: but, if this cannot be done, and the hand is prevented from paſſing along, he muſt bring down the arm, and hold it with one hand, while the other is introduced; then let go and puſh up the ſhoulder, and as the child is turned, and the feet brought down, the arm will for the moſt part return into the uterus: but, if the arm that is come down be ſo much ſwelled, that it is impracticable to introduce the hand ſo as to turn and deliver the child, he muſt ſeparate it at the joint of the ſhoulder, if it be ſo low down; or at the elbow, if he cannot reach the ſhoulder. If the limb be much mortified, it may be twiſted off; otherwiſe it may be ſnipt and ſeparated with the ſciſſars.

If the ſhoulder, by the imprudence and ignorance of the unſkilful, who pull in expectation of delivering in that way, is forced into the vagina, and part of it appears on the outſide of the os externum, a vaſt force is required to return it into the uterus; becauſe in this caſe, the ſhoulder, part of the ribs, breaſt, and ſide, are already pulled out of the uterus, which muſt be extended ſo as not only to receive them again, but alſo the hand and arm of the accoucheur. If this diſtention cannot poſſibly be effected, he muſt fix a crotchet above the ſternum, and turn the child by puſhing up the ſhoulder and pulling down with the crotchet; or ſlide his fingers to the neck of the child, and with the ſciſſars divide the head from the body; then deliver firſt the ſeparated head, or bring along the body by pulling at the arm, or, if need be, with the aſſiſtance of the crotchet: after the body is delivered, the head muſt be extracted according to the rules that will be laid down in Caſe 6.

When the forehead, face, or ear preſents, and cannot be altered with the hand into the natural poſition; or is not advanced to the os externum, ſo that we can aſſiſt with the forceps; the head muſt be returned, and the child delivered by the feet: but if this cannot be done, and the woman is in imminent danger, recourſe muſt be had to the crotchet.

CASE IV.

If the navel-ſtring comes down by the child's head, and the pulſation is felt in the arteries, there is a neceſſity for turning without loſs of time: for, unleſs the head advances faſt and the delivery is quick, the circulation in the veſſels will be entirely obſtructed, and the child conſequently periſh. If the head is low in the pelvis, the forceps may be ſucceſsfully uſed.

No doubt, if the pelvis is very narrow, or the head too large, it would be wrong to turn: in that caſe, we ought to try if we can poſſibly raiſe the head, ſo as to reduce the funis above it, and after that let the labour go on. But if the waters are all gone, and a large portion of the funis falls down, it is impoſſible to raiſe it, ſo as to keep it up, even although we could eaſily raiſe the head: becauſe as one part of the funis is puſhed up with the fingers, another part falls down, and evades the reduction; and to raiſe it up to the ſide, and not above the head, will be to no purpoſe: when a little jets down at the ſide of the head, our endeavours will for the moſt part be ſucceſsful.

CASE V.

The antients, as well as ſome of the moderns, adviſe, in all caſes when the upper parts, ſuch as the ſhoulders, breaſt, neck, face, or ear of the child, preſent, to puſh them upwards, and bring in the head as in its natural way; obſerving, that the fœtus ought never to be delivered by the feet, except in the preſentation of the lower parts, ſuch as the ſmall of the back, belly, ſide, breech, or legs. Were it practicable at all times to bring the head into the right poſition, a great deal of fatigue would be ſaved to the operator, much pain to the woman, and imminent danger to the child: he therefore ought to attempt this method, and may ſucceed when he is called before the membranes are broken, and feels, by the touch, that the face, ear, or any of the upper parts, preſents. In that caſe, let him open the os externum ſlowly during every pain; and when the os internum is ſufficiently dilated by the deſcent of the waters and membranes, let him introduce his hand into the uterus, as directed in Part 2. § 3. betwixt the womb and the membranes, which muſt be broke: and if he finds the head ſo large, or the pelvis ſo narrow, that it will be difficult to ſave the child, provided the woman is vigorous and has ſtrong pains, he may with little difficulty bring in the crown of the head, then withdraw his hand; and, if the pains return and continue, the child has a good chance to be delivered alive. See Part 2. § 3. Even after the membranes are broke, if the preſenting part hath ſo locked up the os internum as to detain ſome portion in the waters, (a circumſtance eaſily known in puſhing up the part that preſents), he may eaſily run up his hand ſpeedily to keep them from being diſcharged, and act in the ſame manner: but if the child is not large, nor the pelvis narrow, it were pity, while his hand is in the uterus, to deſiſt from turning the child and bringing it by the feet; becauſe in that caſe, we may be pretty certain of it. Beſides, after the head is brought into the right poſition, ſhould the pains go off entirely (and this frequently happens), or a flooding comes on, in conſequence of the force which hath been exerted, he will find great difficulty in turning after the waters have been diſcharged; for it is harder to turn when the vertex preſents, than in any other poſition; whereas, in the caſe of a large head or narrow pelvis, when the head is forced down by the labour-pains, and will not farther advance, the child may be ſaved by the forceps; nay, though the pains do not act ſo as to force it down to be delivered either by the forceps or in the natural way, the head may be opened and extracted with the crotchet, which is the laſt reſource.

But this neceſſity ſeldom occurs, becauſe the caſes in which we are moſt commonly called, are after the membranes have been long broken, the waters diſcharged, and the uterus ſtrongly contracted around the body of the child, which it confines, as it were, in a mould: ſo that we have frequently tried in vain to bring the head into the natural poſition; for this cannot be effected without firſt puſhing up the part that preſents, for which purpoſe great force is required: and as one hand only can be introduced, when the operator endeavours to bring in the head, the puſhing force is abated, to allow the pulling force to act; and the parts that hindered the head from preſenting are again forced down; beſides the head is ſo large and ſlippery, that he can obtain no firm hold. He might, indeed, by introducing a finger into the mouth, lay hold of the under jaw, and bring in the face, provided the ſhoulder preſents; but inſtead of amending, this would make the caſe worſe, unleſs the child be very ſmall: yet, granting the head could be brought into the natural poſition, the force neceſſarily exerted for this purpoſe would produce a flooding, which commonly weakens the patient and carries off the pains; and after all, he muſt turn with leſs advantage; and if that cannot be performed when the head is brought in, he muſt have recourſe to the laſt and moſt diſagreeable method; whereas, when any other part preſents, we can always turn the child, and deliver it by the feet. This we cannot promiſe after the head is brought in; and when once the operator's hand is in the uterus, he ought not to run ſuch riſks.

When Dr. Smellie firſt began to practiſe, he frequently endeavoured to adjuſt the poſition of the head in this manner; but meeting with thoſe inſuperable difficulties above-mentioned, he adhered to that method which he always found certain and ſafe. He likewiſe uſed the *impellens* of Albucaſis, in order to keep up the ſhoulders or body until he could bring in the head: but the contraction was always ſo great, that the inſtrument ſlipt, and was in danger of hurting the uterus. Indeed, when the ear, forehead, or the fontanel, preſented, he has, by puſhing up, found the head come into the right poſition: he has likewiſe, when the forehead was towards the groin or ſide of the pelvis, moved it more backwards, by which means the forceps were fixed with more eaſe; but he has much oftener failed, by the head's returning to its former ſituation.

The child is often in danger, and ſometimes loſt, when the breech preſents and is low down in the pelvis, provided the thighs are ſo ſtrongly preſſed againſt the funis and belly as to ſtop the circulation in the rope; as alſo when the child is detained by the head after the body is delivered: in both caſes the danger muſt be obviated by an expeditious delivery; and if the body is entangled in the navel ſtring, it muſt be diſengaged as well as poſſible, eſpecially when the funis happens to be between the thighs. As we have before obſerved, many of theſe minute directions, in laborious and preternatural caſes, may be thought idle and trifling by thoſe practitioners who, without minding any ſtated rules, introduce the forceps, and taking hold on the head at random, deliver with force and violence; and who, in preternatural deliveries, thruſt up their hands into the uterus, and, without conſidering the poſition, ſearch for the feet, pull them down and deliver in a hurry. Such practice may ſometimes ſucceed; but will often deſtroy the child, and bruiſe and injure the parts of the mother, even to the hazard of her life.

CASE VI.

The legs and breech of the child being brought down, and the body properly turned with the fore-parts to the mother's back, let the accoucheur endeavour to bring it along: but if it is detained by the ſize of the belly, diſtended with air or water, (a caſe that frequently happens when the child has been dead for ſeveral days), let the belly be opened, by forcing into it the points of his ſciſſars; or he may tear it open with the ſharp crotchet.

The body of the child being delivered, the arms brought down, and every method hitherto directed unſucceſsfully uſed for the extraction of the head, which is detained by being naturally too large, over-oſſified, or dropſical, or from narrowneſs and diſtortion of the pelvis; if the belly was not opened, and the child is found to be alive by the motion of the heart, or pulſation of the arteries in the funis, the forceps ought to be tried, (ſee *fig.* 38.) but if he finds it impracticable to deliver the head ſo as to ſave the life of the child, he muſt, according to ſome, force the points of the ſciſſars through the lower part of the occipital bone, or through the foramen magnum; then dilate the blades ſo as to enlarge the opening, and introduce a blunt or ſharp hook. This operation rarely ſucceeds when the head is over-oſſified: but may anſwer the purpoſe when the bones are ſoft and yielding, or in the caſe of an hydrocephalus; becauſe in the firſt the aperture may ſometimes be enlarged, and in the other the water will be evacuated ſo as to diminiſh the bulk of the head, which will of conſequence come along with more eaſe. Some recommend an inſtrument to perforate the ſkull, with double points curved and joined together; which, when puſhed into the foramen, are ſeparated, and take hold on the inſide; but as the opening with the ſciſſars and introducing the blunt hook as above, will anſwer the ſame end, it is needleſs to multiply inſtruments, eſpecially as this method is not ſo certain as the following.

If, notwithſtanding theſe endeavours, the head cannot be extracted, let the operator introduce his hand along the head, and his fingers through the os uteri; then ſlide up one of the curved crotchets along the ear, betwixt his hand and the child's head, upon the upper part of which it muſt be fixed: this being done, let him withdraw his hand, take hold of the inſtrument with one hand, turning the curve of it over the forehead, and with the other graſp the neck and ſhoulders, then pull along. The crotchet being thus fixed on the upper part, where the bones are thin and yielding, makes a large opening, through which the contents of the ſkull are emptied; the head collapſing, is with more certainty extracted, and the inſtrument hath a firm hold to the laſt, at the forehead, os petroſum, and baſis of the ſkull.

In introducing the crotchet, let the operator obſerve the greateſt degree of caution poſſible. He muſt not begin to pull until he is certain that the point of the inſtrument is properly fixed near the vertex; and he muſt keep the handle back to the perinæum. The excellency of Meſnard's contrivance is more conſpicuous here than when the head preſents: becauſe the curvature of the crotchet allows the point to be fixed on the upper part of the ſkull, which is to be tore open; and in pulling, the contents are evacuated, and the head is leſſened. By theſe means the principal obſtruction is removed; whereas the ſtraight crotchets take ſo ſlight a hold, and ſlip ſo often, that ſeveral times we have been very much fatigued before we could effect the delivery; but have always ſucceeded to our ſatisfaction ſince we adopted the other kind. See the plate of inſtruments, *fig.* 10, 11, 12, 13.

If one crotchet be found inſufficient, let him introduce the other in the ſame manner along the oppoſite ſide, lock and join them together, and pull along, moving and turning the head ſo as to humour the ſhape of the pelvis. This method ſeldom fails to accompliſh his aim, though ſometimes very great force is required; in which caſe he muſt pull with leiſure and caution.

CASE VII.

But if all the expedients ſhould fail, by reaſon of the extraordinary oſſification or ſize of the head, or the narrowneſs and diſtortion of the pelvis, after having uſed the crotchet without ſucceſs, he muſt ſeparate the body from the head with a biſtory or pair of ſciſſars; then puſhing up the head into the uterus, turn the face to the fundus, and the vertex down to the os internum and brim of the pelvis; let him direct an aſſiſtant to preſs upon the woman's belly with both hands, in order to keep the uterus and head firm in that poſition; then open the ſkull with the ſciſſars, deſtroy the ſtructure of the brain, and extract with the crotchets, as directed above.

The head is ſometimes left in the uterus by thoſe practitioners who, not knowing how to turn the fore parts and face of the child towards the back-part of the uterus, or how to bring it along although it preſented in that poſition, pull at random with all their ſtrength, ſo that the neck is ſtretched and ſeparated, and the head left behind. This may alſo happen to an expert accoucheur, when the child hath been dead for many days, and the body is much mortified, even though he hath uſed all the neceſſary precautions. In ſuch a caſe, provided the head is not very large, nor the pelvis narrow, and the forehead is towards the ſacrum, let him ſlide up his hand along the back-part of the pelvis, and, introducing two fingers into the mouth with the thumb below the chin, try to pull the forehead into the hollow of the ſacrum: if it ſticks at the jetting-in of that bone, he muſt endeavour to move it firſt to one ſide and then to the other. If the head is ſmall, it will come along; if any fragment of the neck remains, or any part of the looſe ſkin, he may lay hold on it, and aſſiſt delivery by pulling at it with his other hand; if the head is low down, it may be extracted with the forceps.

Should all theſe methods fail, let him puſh up his hand along the ſide of the head, until it ſhall have paſſed the os internum; with the other hand let him introduce one of the curved crotchets, and fix it upon the upper part of the head; then withdrawing the hand which was introduced, take hold on the inſtrument, and ſliding the fingers of the other hand into the mouth, he muſt pull down with both as above directed. If the head is not over-oſſified, the crotchet will tear open the ſkull; and the bulk being of conſequence diminiſhed, the whole may be brought along, even in a narrow pelvis: but if it cannot be moved even by this expedient, he muſt introduce the other crotchet along the other ſide of the head, and fixing it upon the ſkull, lock them together; then, in pulling, turn the forehead down into the hollow of the ſacrum, and extract with an half-round turn upwards, as when delivering with the forceps.

If the forehead is towards the os pubis, and cannot be brought into the right poſition, let him, with his hand puſh up the head into the uterus, turn the forehead from the anterior to the ſide or back-part of it, and try to extract as before. If the child hath been dead ſome time, and is much mortified, he muſt pull cautiouſly at the under jaw, becauſe, ſhould that give way, he will have no other hold for pulling or keeping the head ſteady, when he attempts to extract with one crotchet.

As great difficulties may occur from inflammations of the pudenda, contraction of the uterus, ſlipperineſs or largeneſs of the head, and the narrowneſs of the pelvis, it will not be improper to inform the reader of other methods that appear to us uſeful, particularly when the parts are much contracted and ſwelled. Let the hand be introduced into the vagina; and if it cannot be admitted within the uterus, the fingers being inſinuated, may move the head ſo as to raiſe the face and chin to the fundus, the vertex being turned to the os internum, and the forehead towards the ſide of the ſacrum. This being effected, let the operator ſlide up along one ear a blade of the long forceps, which are curved to the ſide, (ſee *fig.* 20, 38.) then change hands, and ſend up the other blade along the oppoſite ear: when they are locked and the handles ſecured by a fillet, he muſt pull the head as low as it will come; then putting them into the hands of an aſſiſtant, who will keep them in that poſition, let him make a large opening with the ſciſſars, ſqueeze the head with great force, and extract ſlowly and by degrees.

There is an old inſtrument with two ſides which turn on a pivot, formerly recommended in this caſe, and ſince improved, with the addition of another ſide, by Mr. Leveret, who gives it the denomination of *tire tête:* but as Dr. Smellie thought the contrivance was too complex, and the blades too much confined to a circular motion, he altered the form of it in a manner that renders it more ſimple, convenient and leſs expenſive. Having turned down the vertex as above directed, let this inſtrument, with the three ſides joined together, be introduced along the accoucheur's hand to the upper part of the head; then let the ſides or blades be opened with the other hand, ſo as to incloſe the head, moving them circularly and lengthwiſe in a light and eaſy manner, that they may paſs over the inequalities of the ſcalp, and avoid the reſiſtance of the head and uterus: when they are exactly placed at equal diſtances from one another, let him join the handles, withdraw his hand, and, tying them together with a fillet, pull down, open, and extract, as above directed; and let it be remembered, that the farther the hand can be introduced into the uterus, the more eaſily will both inſtruments be managed.

When the pelvis is large, or the head ſmall, (in which caſes this misfortune ſeldom happens), without doubt we might ſucceed with Mauriceau's broad fillet or ſling, provided it could be properly applied: but, upon trial, Dr. Smellie found his hand ſo much cramped by the contraction of the uterus, and was ſo much incommoded by the ſlipperineſs of the head, that he could not fix it ſo as to have ſufficient hold, and that after many fruitleſs efforts he was obliged to have recourſe to the ſciſſars and crotchets.

Amand's net is attended with the ſame difficulties; and rather more troubleſome, as it is more compounded: for, when it is mounted on the operator's hand, it will be found ſcarce practicable to bring over the head the narrow fillet by which it is pulled along, becauſe it commonly ſlides off from one ſide or the other. If the placenta adheres to the uterus, let him firſt extract the head; if the cake is ſeparated and in his way, let him deliver it before he begins to deliver the head. When the head is ſmall, or the pelvis large, dilating the foramen magnum with the ſciſſars, and introducing the blunt hook, may be of uſe either to pull the head along or keep it down, until we can fix the forceps, curve-crotchet, or Leveret's *tire tête*.

SECT. V. *The* Cæsarian Operation.

When a woman cannot be delivered by any of the methods hitherto deſcribed and recommended in laborious and preternatural labours, on account of the narrowneſs or diſtortion of the pelvis, into which it is ſometimes impoſſible to introduce the hand; or from large excreſcences and glandular ſwellings, that fill up the vagina, and cannot be removed; or from large cicatrices and adheſions in that part and at the os uteri, which cannot be ſeparated; in ſuch emergencies, if the woman is ſtrong and of a good habit of body the Cæſarian operation is certainly adviſeable, and ought to be performed; becauſe the mother and child have no other chance to be ſaved, and it is better to have recourſe to an operation which hath ſometimes ſucceeded, than leave them both to inevitable death. Nevertheleſs, if the woman is weak, exhauſted with fruitleſs labour, violent floodings, or any other evacuation which renders her recovery doubtful, even if ſhe were delivered in the natural way; in theſe circumſtances it would be raſhneſs and preſumption to attempt an operation of this kind, which ought to be delayed until the woman expires, and then immediately performed with a view to ſave the child.

The operation hath been performed both in this and the laſt century, and ſometimes with ſuch ſucceſs, that the mother has recovered, and the child ſurvived. The previous ſteps to be taken are, to ſtrengthen the patient, if weak, with nouriſhing broths and cordials; to evacuate the indurated fæces with repeated glyſters; and if the bladder is diſtended with urine, to draw it off with a catheter. Theſe precautions being taken, ſhe muſt be laid on her back, on a couch or bed, her ſide on which the inciſion is to be made being raiſed up by pillows placed below the oppoſite ſide: the operation may be performed on either ſide; though the left is commonly preferred to the right, becauſe in this laſt the liver extends lower. The apparatus conſiſts of a biſtory, probe-ſciſſars, large needles threaded, ſponges, warm water, pledgets, a large tent or doſſil, compreſſes, and a bandage for the belly.

If the weather is cold, the patient muſt be kept warm, and no part of the belly uncovered except that on which the inciſion is to be made; if the operator be a young practitioner, the place may be marked by drawing a line along the middle ſpace between the navel and the os ilium, about ſix or ſeven inches in length, ſlanting forwards towards the left groin, and beginning as high as the navel. According to this direction, let him hold the ſkin of the abdomen tenſe between the finger and thumb of one hand, and with the biſtory in the other make a longitudinal inciſion through the cutis to the membrana adipoſa, which, with the muſcles, muſt be ſlowly diſſected and ſeparated, until he reaches the peritonæum, which muſt be divided very cautiouſly, for fear of wounding the inteſtines that frequently ſtart up at the ſides, eſpecially if the membranes are broken, the waters diſcharged, and the uterus contracted.

The peritonæum being laid bare, it may be either pinched up by the fingers, or ſlowly diſſected with the biſtory, until an opening is made ſufficient to admit the fore-finger, which muſt be introduced as a director for the biſtory or ſciſſars in making an effectual dilatation. If the inteſtines puſh out, let them be preſſed downwards ſo as that the uterus may come in contact with the opening. If the womb is ſtill diſtended with the waters, and at ſome diſtance from the child, the operator may make upon it a longitudinal inciſion at once; but if it is contracted cloſe round the body of the fœtus, he muſt pinch it up, and dilate in the ſame cautious manner practiſed upon the peritonæum, taking care to avoid wounding the Fallopian tubes, ligaments, and bladder: then introducing his hand he may take out the child and ſecundines. If the woman is ſtrong, the uterus immediately contracts, ſo as that the opening, which at firſt extended to about ſix or ſeven inches, is reduced to two, or leſs; and in conſequence of this contraction, the veſſels being ſhrunk up, a great effuſion of blood is prevented. The coagulated blood being removed, and what is ſtill fluid ſponged up, the inciſion in the abdomen muſt be ſtitched with the interrupted ſuture, and ſufficient room left between the laſt ſtitch and the lower end of the opening, for the diſcharge of the moiſture and extravaſated fluid. The wound may be dreſſed with dry pledgits or doſſils dipped in ſome liquid balſam, covered with compreſſes moiſtened with wine, and a bandage to keep on the dreſſings and ſuſtain the belly. Some authors obſerve, that the cutis and muſcles only ſhould be taken up in the ſuture, leſt bad ſymptoms ſhould ariſe from ſtitching the peritonæum.

The woman muſt be kept in bed, as quiet as poſſible, and every thing adminiſtered to promote the lochia, perſpiration, and ſleep; which will prevent a fever and other dangerous ſymptoms. If ſhe hath loſt a great quantity of blood from the wounds in the uterus and abdomen ſo as to be in danger from inanition; broths, caudles, and wine, ought to be given in ſmall quantities, and frequently repeated; and the *Cort. Peruvian.* adminiſtered in powder, decoction, or extract, may be of great ſervice in this caſe. For farther information on this ſubject, the reader may conſult Ruſſetus, the Memoirs of the academy of ſurgeons at Paris, and Heiſter's Surgery.

PART VIII. TWINS, MONSTERS, AND METHOD OF DELIVERING THE PLACENTA.

SECT. I. TWINS.

Twins are ſuppoſed to be the effect of a double conception in one coition, when two or more ova are impregnated with as many animalcula; which deſcending from the ovarium, through the Fallopian tube, into the fundus uteri, as they increaſe, come in contact with that part, and with one another, and are ſo preſſed as to form one globular figure, and ſtretch the womb into the ſame form which it aſſumes when diſtended by one ovum only; and that, during the whole term of uterine geſtation, it is impoſſible to diſtinguiſh twins, either by the figure or magnitude of the uterus, or by the motion of the different fœtuſes; for one child, when it is large and ſurrounded with a great quantity of waters, will ſometimes produce as large a prominence (or even larger) in the woman's belly, than is commonly obſerved when ſhe is big with twins. One child will alſo, by moving its legs, arms, and other parts of its body againſt different parts of the uterus, at the ſame inſtant or by intervals, yield the ſame ſenſation to the mother as may be obſerved in two or more children; for part of the motion in twins is employed on each other, as well as upon the uterus.

There is therefore no certain method of diſtinguiſhing in theſe caſes, until the firſt child is delivered, and the accoucheur has examined if the placenta is coming along. If this comes of itſelf, and after its extraction the mouth of the womb be felt contracted, and the operator is unwilling to give unneceſſary pain by introducing his hand into the uterus; let him lay his hand upon the woman's abdomen, and if nothing is left in the womb, he will generally feel it, juſt above the os pubis, contracted into a firm round ball of the ſize of a child's head or leſs: whereas, if there is another child left, the ſize will be found much larger. If the placenta does not come down before the ſecond child, which is frequently the caſe; upon examining, he will commonly feel the membranes with the waters puſhed down through the os uteri; or, if they are broken, the head or ſome part of the body will be felt. If, therefore, the woman has ſtrong pains, and is in no danger from floodings or weakneſs, provided the head preſents fair, and ſeems to come along, ſhe will be delivered of this alſo in the natural way. If the membranes are not broken, if the head does not immediately follow, or if the child preſents wrong, he ought to turn and bring it immediately by the feet, in order to ſave the patient the fatigue of a ſecond labour, that may prove tedious and even dangerous by enfeebling her too much. Beſides, as the parts are fully opened by the firſt delivery, he can introduce his hand with eaſe; and as the membranes are for the moſt part whole, the waters may be kept up, and the fœtus eaſily turned, as in Part VI. Sect. II. but if the pelvis is narrow, the woman ſtrong, and the head preſents, he ought to leave it to the efforts of nature.

If the firſt child preſents wrong, and in turning that he feels another, he muſt beware of breaking the membranes of one while he is at work upon the other: but ſhould they chance to be broke, and the legs of both entangled together, (though this is ſeldom the caſe, becauſe they are commonly divided by two ſets of membranes), let the operator, when he has got hold on two legs, run up his fingers to the breech, and feel if they belong to the ſame body; and one child being delivered, let the other be turned and brought out in the ſame manner. If there are more than two, the ſame method muſt take place, in extracting one after another.

In caſe of twins, the placenta of the firſt ſeldom comes along until the ſecond child is delivered: but as this does not always happen, he ought, as formerly directed, to certify himſelf that there is nothing left in the uterus, when the cake comes of itſelf. Both children being delivered, let him extract both placentas, if they come not of themſelves; and if they form diſtinct cakes, ſeparate firſt one, then the other; but if they are joined together, forming but one maſs, they may be delivered at once, as in Part V. Sect. VII. Twins for the moſt part lie diagonally in the uterus, one below the other; ſo that they ſeldom obſtruct one another at the os internum. See *fig.* 15.

SECT. II. MONSTERS.

Two children joined together by their bellies (which is the moſt common caſe of monſtrous births) or by the ſides, or when the belly of the one adheres to the back of the other, having commonly but one funis, are comprehended in this claſs, and ſuppoſed to be the effect of two animalcula impregnating the ſame ovum, in which they grow together, and are nouriſhed by one navel-ſtring, originally belonging to the ſecundines; becauſe the veſſels pertaining to the coats of the veins and arteries do not anaſtomoſe with the veſſels belonging to the fœtus.

In ſuch a caſe, where the children were ſmall, the adheſion hath been known to ſtretch in pulling at the feet of one, ſo as to be delivered; and the other hath been afterwards brought along in the ſame manner, without the neceſſity of a ſeparation. When the accoucheur is called to a caſe of this kind, if the children are large, and the woman come to her full time, let him firſt attempt to deliver them by that method: but if, after the legs and part of the body of the firſt are brought down, the reſt will not follow, let him ſlide up his hand, and with his fingers examine the adheſion; then introducing the ſciſſars between his hand and the body of the fœtus, endeavour to ſeparate them by ſnipping through the juncture. Should this attempt fail, he muſt diminiſh the bulk in the beſt manner he can think of, and bring the body of the firſt, in different pieces, by pulling or cutting them aſunder, as he extracts with the help of the crotchet.

No certain rules can be laid down in theſe caſes, which ſeldom happen; and therefore a great deal muſt be left to the judgment and ſagacity of the operator, who muſt regulate his conduct according to the circumſtances of the caſe, and according to the directions given for delivering when the pelvis is narrow and the children extraordinary large. Formerly, practitioners uſed ſtraight and crooked knives with long handles, which were introduced into the uterus along the hand, in order to cut and divide the bodies of children, that they might be extracted piecemeal: and this cruel practice obtained even in ſome caſes which we can now manage with eaſe and ſafety by turning and delivering the fœtus by the feet. But, no doubt, ſome will happen in which it is impoſſible to preſerve or deliver the children without the help of inſtruments;

and in ſuch an emergency the ſciſſars are much ſafer than knives, with which the operator runs the riſk of cutting the uterus or himſelf; whereas he is expoſed to no ſuch hazard from the other, which cut only betwixt the points.

SECT. III. *Delivering the* PLACENTA.

The funis being ſeparated, and the child committed to the nurſe, the next care is to deliver the placenta and membranes, if they are not forced down by the labour-pains. We have already obſerved, that if there is no danger from a flooding, the woman may be allowed to reſt a little, in order to recover from the fatigue ſhe has undergone; and that the uterus may in contracting have time to ſqueeze and ſeparate the placenta from its inner ſurface: during which pauſe alſo, about one, two, or three cups full of blood are diſcharged through the funis from the veſſels of the placenta, which is thus diminiſhed in bulk, ſo that the womb may be more contracted; and this is the reaſon for applying one ligature only upon the cord. In order to deliver the placenta, take hold of the navel-ſtring with the left hand, turning it round the fore and middle fingers, or wrapping it in a cloth, that it may not ſlip from your graſp; then pull gently from ſide to ſide, and deſire the woman to aſſiſt your endeavour by ſtraining as if ſhe were at ſtool, blowing forcibly into her hand, or provoking herſelf to reach by thruſting her finger into her throat. If by theſe methods the placenta cannot be brought away, introduce your hand ſlowly into the vagina, and feel for the edge of the cake, which when you have found pull it gradually along; as it comes out at the os externum, take hold of it with both hands and deliver it, bringing away at the ſame time all the membranes, which, if they adhere, muſt be pulled along with leiſure and caution.

When the funis takes its origin towards the edge of the placenta, which is frequently the caſe, the cake comes eaſier off by pulling than when the navel-ſtring is inſerted in the middle, unleſs it be uncommonly retained by its adheſion to the womb, or by the ſtrong contraction of the os internum. If the funis is attached to the middle of the placenta, and that part preſents to the os internum or externum, the whole maſs will be too bulky to come along in that poſition: in this caſe you muſt introduce two fingers within the os externum, and bring it down with its edge foremoſt.

If inſtead of finding the edge or middle of the placenta preſenting to the os externum or internum, you feel the mouth of the womb cloſely contracted, you muſt take hold of the navel-ſtring as before-directed, and ſlide your other hand along the funis into the vagina; then ſlowly puſh your fingers and thumb, joined in form of a cone, through the os uteri, along the ſame cord, to the place of its inſertion in the placenta: here let your hand reſt, and feel with your fingers to what part of the uterus the cake adheres; if it be looſe at the lower edge, try to bring it along; but if it adheres, begin and ſeparate it ſlowly, the back of your hand being turned to the uterus, and the fore-part of your fingers towards the placenta: and for this operation the nails ought to be cut ſhort and ſmooth. In ſeparating, preſs the ends of your fingers more againſt the placenta than the uterus; and if you cannot diſtinguiſh which is which, becauſe both feel ſoft, (though the uterus is firmer than the placenta, and this laſt more ſolid than coagulated blood); in this caſe, ſlide down your fingers to its edge, and conduct them by the ſeparated part, preſſing it gently from the uterus, until the whole is diſengaged. Sometimes, when part of it is ſeparated, the reſt will looſen and come along if you pull gently at the detached portion; but if this is not effected with eaſe, let the whole of it be ſeparated in the moſt cautious manner: ſometimes alſo, by graſping the inſide of the placenta with your hand, the whole will be looſened without further trouble. As the placenta comes along, ſlide down your hand and take hold of the lower edge, by which it muſt be extracted, becauſe it is too bulky to be brought away altogether in a heap; and let it be delivered as whole as poſſible, keeping your thumb or fingers fixed upon the navel-ſtring, by which means laceration is often prevented.

When the woman lies on her back, and the placenta adheres to the left ſide of the uterus, it will be moſt commodious to ſeparate the cake with the right-hand; whereas the left-hand is moſt conveniently uſed when the placenta adheres to the right ſide of the womb; but when it is attached to the fore-part, back, or fundus, either hand will anſwer the purpoſe.

When therefore the placenta adheres to the fundus, and all the lower part of the womb is ſtrongly contracted, the hand muſt be forced up in form of a cone into the vagina, and then gradually dilate the os internum and inferior part of the uterus. If great force is required, exert it ſlowly, reſting between whiles that the hand may not be cramped, nor the vagina in danger of being tore from the womb; for in this caſe the vagina will lengthen conſiderably upwards.

While you are thus employed, let an aſſiſtant preſs with both hands on the woman's belly, or while you puſh with one hand, preſs with the other in order to keep down the uterus, elſe it will riſe high up, and roll about like a large ball, below the lax parietes of the abdomen, ſo as to hinder you from effecting the neceſſary dilatation.

When you have overcome this contraction, and introduced your hand into the fundus, ſeparate and bring the placenta along, as above directed; and ſhould the uterus be contracted in the middle like an hour-glaſs, a circumſtance that ſometimes, though rarely happens, the ſame method muſt be practiſed. In every caſe, and eſpecially when the placenta hath been delivered with difficulty, introduce your hand after its extraction, in order to examine if any part of the uterus be pulled down and inverted; and if that be the caſe, puſh it up and reduce it without loſs of time; then clear it of the coagulated blood, which otherwiſe may occaſion violent after-pains.

For the moſt part, in ten, fifteen, or twenty minutes, more or leſs, the placenta will come away of itſelf; and though ſome portion of it, or of the membranes, be left in the uterus, provided no great flooding enſues, it is commonly diſcharged in a day or two, without any detriment to the woman: but at any rate, if poſſible, all the ſecundines ought to be extracted at once, and before you leave your patient, in order to avoid reflections.

We find that, both amongſt the ancients and moderns, there have been different opinions and directions about delivering the placenta; ſome alleging, that it ſhould be delivered ſlowly, or left to come of itſelf: others, that the hand ſhould be immediately introduced into the uterus, to ſeparate and bring it away. Before we run into extremes of either ſide, it ſhould be conſidered how nature of herſelf acts in theſe caſes. We find, in the common courſe of labours, that not once in fifty or an hundred times there is any thing more to be done than to receive the child. Some of the ancients have alleged, that no danger happens, on this account, oftener than once in one thouſand labours: and as nature is, for the moſt part, ſufficient of itſelf in ſuch caſes, it is very rare, perhaps not once in twenty or thirty times, that we have occaſion to ſeparate, as it generally comes down by the common aſſiſtance of pulling gently at the funis, and the efforts of the woman. We alſo find, that the mouth of the womb is as eaſily dilated ſome hours after delivery, as at any other time; ſo in our opinion, we ought to go in the middle way, never to aſſiſt but when we find it neceſſary; on the one hand, not to torture nature, when it is ſelf-ſufficient; nor delay it too long, becauſe it is poſſible, that the placenta may ſometimes, though ſeldom, be retained ſeveral days; for if the uterus ſhould be inflamed from any accident, and the woman be loſt, the operator will be blamed for leaving the after-birth behind.

PART IX.

MANAGEMENT OF NEW BORN CHILDREN, WITH THE DISEASES TO WHICH THEY ARE SUBJECT.

SECT. I. *How to tie the* FUNIS UMBILICALIS, *or* NAVEL STRING.

If the air does not immediately ruſh into the lungs, and the circulation continues between it and the placenta, the operation of tying and cutting muſt be delayed, and every thing tried to ſtimulate, and ſometimes to give pain. If the circulation is languid, reſpiration begins with difficulty, and proceeds with long intervals; and if it be entirely ſtopped in the funis, the child, if alive, is not eaſily recovered: ſometimes many minutes are elapſed before it begins to breathe. Whatever augments the circulating force, promotes reſpiration; and as this increaſes, the circulation grows ſtronger, ſo that they mutually aſſiſt each other. In order to promote the one and the other, the child is kept warm, moved, ſhaken, whipt; the head, temples, and breaſt rubbed with ſpirits, garlic, onion, or muſtard, applied to the mouth and noſe; and the child has been ſometimes recovered by blowing into the mouth with a ſilver canula, ſo as to expand the lungs.

When the placenta is itſelf delivered, immediately or ſoon after the child, by the continuance of the labour-pains, or hath been extracted by the operator, that the uterus may contract ſo as to reſtrain too great a flooding; in this caſe, if the child has not yet breathed, and a pulſation is felt in the veſſels, ſome people (with good reaſon) order the placenta, and as much as poſſible of the navel-ſtring, to be thrown into a baſin of warm wine or water, in order to promote the circulation between them and the child; others adviſe us to lay the placenta on the child's belly, covered with a warm cloth; and a third ſet order it to be thrown upon hot aſhes: but of theſe the warm water ſeems the moſt innocent and effectual expedient. Nevertheleſs, if the placenta is ſtill retained in the uterus, and no dangerous flooding enſues, it cannot be in a place of more equal warmth while the operator endeavours, by the methods before deſcribed, to bring the child to life.

Different practitioners have uſed different methods of performing this operation: ſome propoſing to tie and ſeparate the funis before the placenta is delivered; to apply one ligature cloſe to the belly of the child, with a view to prevent a rupture of the navel; and making another two inches above the former, to divide the rope between the two tyings; by the ſecond ligature they mean to prevent a dangerous hæmorrhage from the woman, provided the placenta adheres to the uterus. But all theſe precautions are founded upon miſtaken notions; and the following is that which is eaſieſt and beſt. If the placenta is not immediately delivered by the pains, and no flooding obliges you to haſten the extraction, the woman may be allowed to reſt a little and the child to recover. If the child does not breathe, or the reſpiration is weak, let the methods before preſcribed be put in practice, with a view to ſtimulate the circulation; but if the child is lively, and cries with vigour, the funis may be immediately tied in this manner: having provided a ligature or two compoſed of ſundry threads waxed together,

gether, ſo as to equal the diameter of a packthread, being ſeven inches in length and knotted at each end, tie the navel-ſtring about two fingers breadth from the belly of the child, by making at firſt one turn if the funis be ſmall, ſecuring it with two knots; but if the cord be thick, make two more turns, and another double knot: then cut the funis with a pair of ſharp ſciſſars one finger's breadth from the ligature towards the placenta; and in cutting run the ſciſſars as near as poſſible to the root of the blades, elſe the funis will be apt to ſlip from the edge, and you will be obliged to make ſeveral ſnips before you can effect a ſeparation: at the ſame time, guard the point of the ſciſſars with your other hand. The child being waſhed, a linen rag is wrapped round the tied funis; which being doubled up along the belly a ſquare compreſs is laid over it, and kept firm or moderately tight with what the nurſes call a *belly-band* or *roller* round the body.

This portion of the funis ſoon ſhrinks, turns firſt livid, then black, and about the fifth day falls off cloſe to the belly: it will always drop off at the ſame place: ſo that ruptures in the navel ſeldom or never depend upon the tying of the funis, but may happen when the compreſs and belly-band are not kept ſufficiently firm and continued ſome time after the ſeparation of the withered portion, eſpecially in thoſe children that cry much: the bandage ought always to be applied ſo ſlight as not to affect reſpiration. The ligature upon the funis muſt always be drawn ſo tight as to ſhut up the mouths of the veſſels; therefore, if they continue to pour out their contents, another ligature muſt be applied below the former; for if this precaution be neglected, the child will ſoon bleed to death: yet if the navel-ſtring is cut or tore aſunder at two or three handbreadths from the belly, and expoſed to the cold without any ligature, the arteries will contract themſelves, ſo that little or no blood ſhall be loſt; nay, ſometimes, if the funis hath been tied and cut at the diſtance of three finger-breadths from the child's belly, ſo that it hath been kept from blooding for an hour or two, although the ligature be then untied, and the navel-ſtring and belly chaffed, and ſoaked in warm water, no more blood will be diſcharged.

SECT. II. *Waſhing and Dreſſing the Child.*

The child being delivered, the navel-ſtring tied and cut, a warm cloth or flannel cap put on its head, and its body wrapped in a warm receiver, it may be given to the nurſe or an aſſiſtant, in order to be waſhed clean from that ſcurf which ſometimes covers the whole ſcarf-ſkin, and is particularly found upon the hairy ſcalp under the arm-pits, and in the groins. This ablution is commonly performed with warm water, mixed with a ſmall quantity of Hungary water, wine, or ale, in which a little pomatum or freſh butter hath been diſſolved. This compoſition cleans all the ſurface, and the oily part, by mixing with and attenuating the mucus, prepares it for the linen cloth, which dries and wipes off the whole: nevertheleſs milk and water, or ſoap and water, is preferable to this mixture. In laborious or preternatural caſes, when conſiderable force hath been uſed in delivering the child, the whole body ought to be examined; and if there is any mark or contuſion on the head, it will diſappear, if anointed with pomatum, and gently rubbed or chafed with the accoucheur's hand: if any limb is diſlocated or broken, it ought to be reduced immediately: luxations, though they ſeldom happen, are more incident to the ſhoulder than to any other part, the humerus being eaſily diſlocated, and as eaſily reduced. The bones of the arm and thigh are more ſubject to fracture, than any other of the extremities: the firſt is eaſily cured, becauſe the arm can be kept from being moved; but a fracture in the thigh-bone is a much more troubleſome caſe, becauſe, over and above the difficulty of keeping the bones in a proper ſituation, the part is often neceſſarily moved in cleaning the child. In this caſe, the beſt method is to keep the child lying on one ſide, after the thigh hath been ſecured by proper bandage, ſo that the nurſe may change the cloth without moving the part; and to lay it upon bolſters or pillows raiſed above the wet-nurſe, that it may ſuck with greater freedom: if any of the bones are bent, they may be brought into their proper form by a ſlow, gentle, and proper extenſion.

During the time of waſhing and dreſſing the child, it ought to be kept moderately warm, eſpecially in the head and breaſt, that the cold air may not obſtruct perſpiration; the head and body ought to be kept moderately tight with the cloaths, for the convenience of handling, and to prevent its catching cold, eſpecially if the child be weakly; but if it be vigorous and full grown, it cannot be too looſely cloathed, becauſe the brain, thorax, and abdomen, ſuffer by too great compreſſion. The cloathing of new-born children ought alſo to be ſuitable to the ſeaſon of the year and the nature of the weather; the extremes of cold and heat being avoided, as equally hurtful and dangerous. Inſtead of the many ſuperfluous inventions of nurſes, and thoſe who make cloaths for children, with a view to make an expenſive and pompous appearance, the dreſs ought to be contrived with all imaginary ſimplicity: the child being waſhed, the navel-ſtring ſecured, and the head covered with a linen or woollen cap, as already directed, a ſhirt and waiſtcoat may be put upon the body, and over it a flannel ſkirt or petticoat, open before, with a broad head-band, as commonly uſed, or rather a waiſtcoat joined to it, ſo as that they can be put on at once: this ought to be rather tied than pinned before; and, inſtead of two or more blankets, may be covered with a flannel or fuſtian gown; while the head is accommodated with another cap, adorned with as much finery as the tire-woman ſhall think proper to beſtow.

In ſhort, the principal aim of this point is, to keep the child's head and body neither too tight nor too ſlovenly, too hot nor too cold; that it may be warm, though not over-heated; and eaſy, though not too looſe; that reſpiration may be full and large; that the brain may ſuffer no compreſſion; and that, while the child is awake, the legs may be at liberty; to reject all unneceſſary rollers, croſs-cloths, neck-cloths, and blankets; and to uſe as few pins as poſſible, and thoſe that are abſolutely neceſſary with the utmoſt caution.

SECT. III. *How to manage when any of the common Paſſages are locked up, or the Tongue tied.*

When the child cannot make water, becauſe the paſſage is filled up with mucus; after having unſucceſsfully practiſed the common methods of holding the belly near the fire, and rubbing the parts with *Ol. Rutæ*, &c. we muſt introduce a probe, or very ſmall catheter, along the urethra into the bladder; an operation much more eaſily performed in female than in male children.

In boys, the prepuce alone is ſometimes imperforated; in which caſe, an opening is eaſily made. But if there is no paſſage in the urethra, or even through the whole length of the glans, all that can be done is to make an opening with a lancet or biſtory, near the mouth or ſphincter of the bladder, in the lower part of the urethra, where the urine being obſtructed, puſhes out the parts in form of a tumour; or, if no ſuch tumefaction appears, to perforate the bladder above the pubes with a trocar: this, however, is a wretched and ineffectual expedient, and the other can but at beſt lengthen out a miſerable life. If the anus is imperforated, and the fæces protrude the parts; or if it be covered with a thin membrane, and a bluiſh or livid ſpot appears; the puncture and inciſion commonly ſucceed. But when the rectum is altogether wanting, or impervious for a conſiderable way, the ſucceſs of the operation is very uncertain: nevertheleſs it ought to be tried, by making an artificial anus with a biſtory, remembering the courſe of the rectum, and the entry in both ſexes. For further information on this ſubject, Mauriceau's and Saviard's Obſervations, and the Memoirs of the Academy of Surgeons, may be conſulted.

In female children there is a thin membrane, in form of a creſcent, called the *hymen*, that covers the lower part of the orifice of the vagina, and is rent in the firſt coition. The middle of it is ſometimes attached to the lower part of the meatus urinarius, and on each ſide of the bridge is a ſmall opening that will only admit the end of a probe, though it is ſufficient for the diſcharge of the menſes. This obſtruction is commonly unknown till marriage, and hath often proved fatal to the unfortunate woman, who had concealed it through exceſs of modeſty, and afterwards ſunk into a deep melancholy which coſt her her life, rather than ſubmit to inſpection, and the eaſy cure of having the attachment ſnipt with a pair of ſciſſars. On this conſideration, Saviard adviſes all accoucheurs to inſpect this part in every female child they deliver; and if there ſhould be ſuch a defect, to remedy it during her childhood: or, if the entry is wholly covered with the membrane, let a ſufficient perforation be made, which will prevent great pain and tenſion in their riper years, when the menſes, being denied paſſage, would accumulate every month, and at laſt puſh out this and the neighbouring parts, in form of a large tumour, the cauſe of which is generally unknown until it be opened.

Sometimes a thin membrane, riſing from the under part of the mouth, ſtretches almoſt to the tip of the tongue, bracing it down, ſo as to hinder the child from taking hold of the nipple and ſucking. This diſorder, which is called *tongue-tying*, is eaſily remedied by introducing the fore-finger into the child's mouth, raiſing up the tongue, and ſnipping the bridle with a pair of ſciſſars. If, inſtead of a thin membrane, the tongue is confined by a thick fleſhy ſubſtance, the ſafeſt method is to direct the nurſe to ſtretch it frequently and gently with her finger; or, if it appears like a ſoft fungus, to touch it frequently and cautiouſly with lunar cauſtic or Roman vitriol: but we ought to take care that we are not deceived by an inflammation that ſometimes happens in the birth, from the accoucheur's helping the head along with his finger in the child's mouth.

SECT. IV. *Mould-ſhot Heads, Contuſions, and Excoriations.*

In laborious and lingering labours, the child's head is often long confined, and ſo compreſſed in the pelvis, that the bones of the upper part of the cranium are ſqueezed together, and ride over one another in different manners, according as the head preſented. If the oſſa parietalia riſe over the os frontis, the caſe is called the *mould-ſhot*; if over the occiput, it goes by the name of the *horſe-ſhoe mould*. When the fontanel preſents, (though this is ſeldom the caſe) and is puſhed down, the form of the head is raiſed up in the ſhape of a hog's back; whereas, in the former caſe, the vertex or crown of the head preſented, and the whole was turned from a round to a very long figure. If the head is kept long in the pelvis, and the child not deſtroyed by the compreſſion of the brain, either before or ſoon after delivery, it commonly retains more or leſs of the ſhape acquired in that ſituation, according to the ſtrength or weakneſs of the child. When the bones begin to ride over one another in this manner, the hairy ſcalp is felt lax and wrinkled;

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Plate I

Anatomical Tables illustrative of the Theory and Practice of Midwifery. See the System.

Fig. 1.

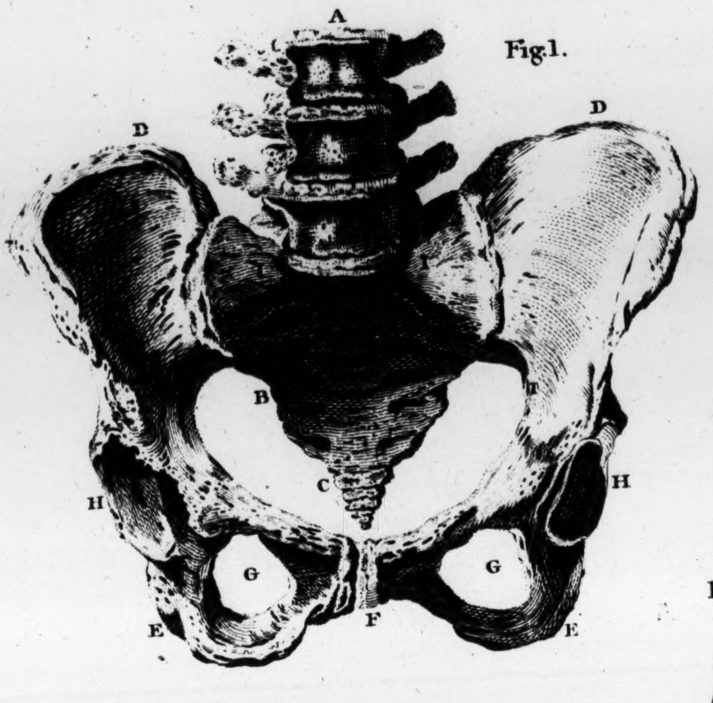
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Fig. 2.

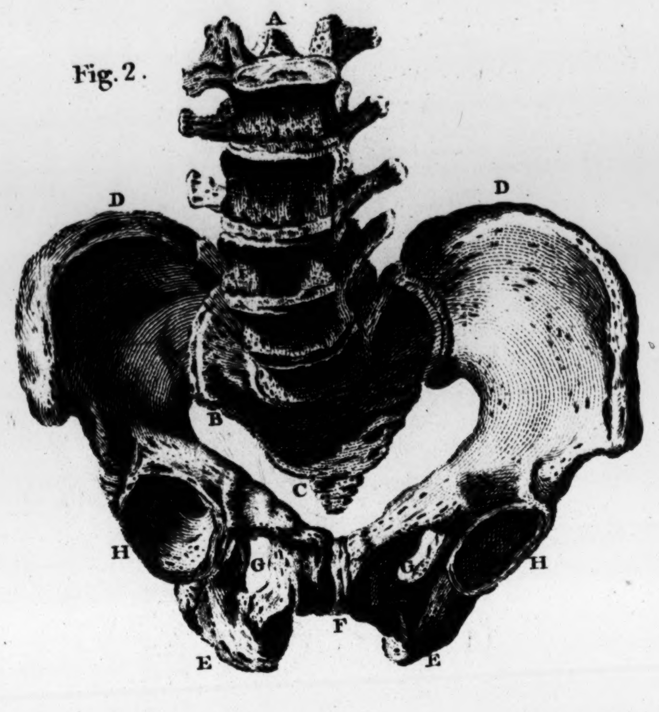
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Fig. 6.

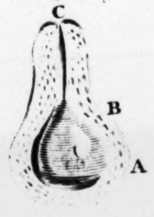

Fig. 3.

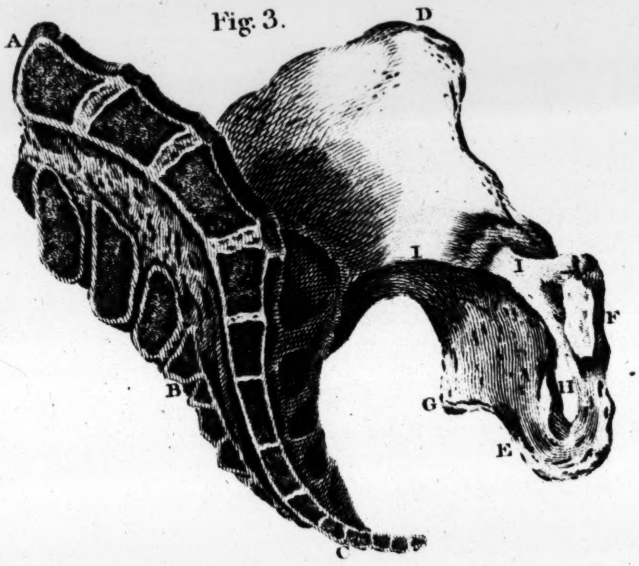
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Fig. 5.

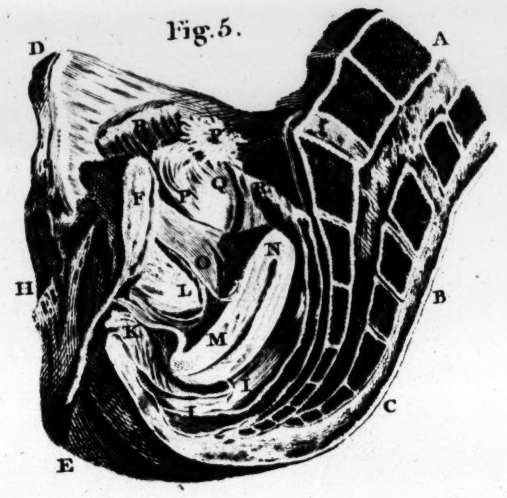
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Fig. 7.

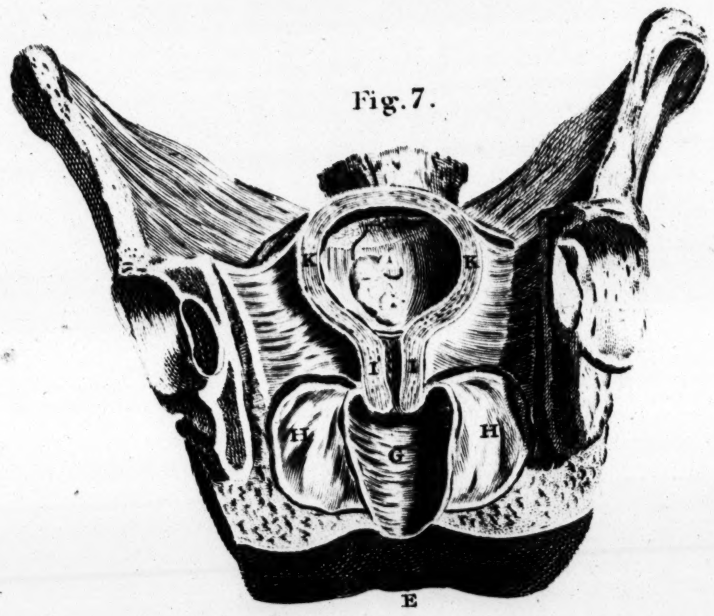

Fig. 4.

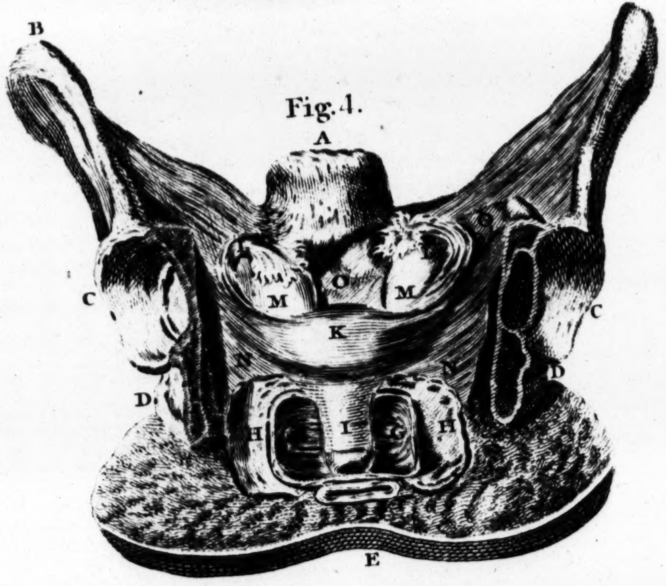
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Fig. 8.

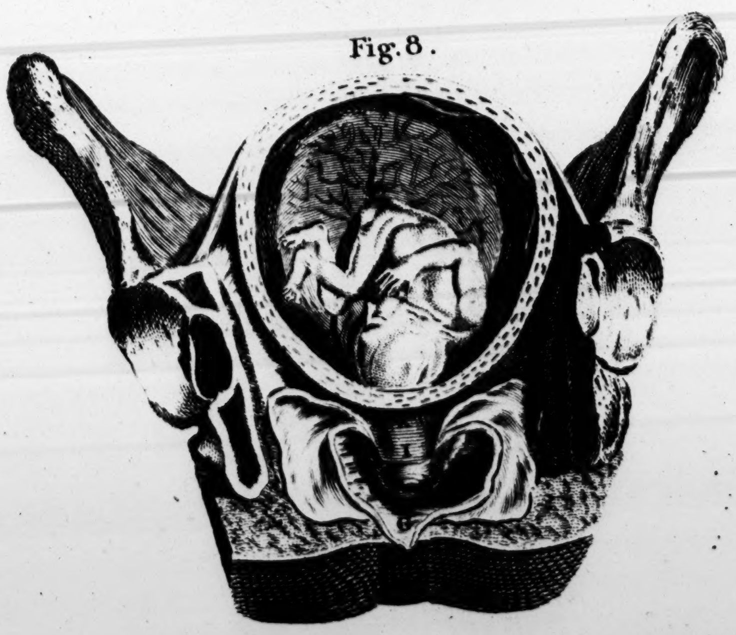
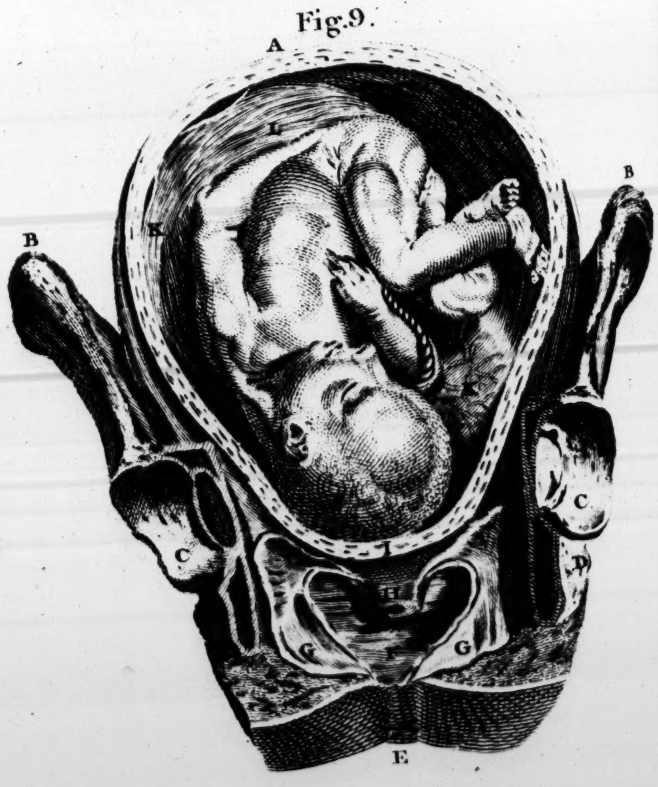


Fig. 9.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but, by the long preſſure and obſtructions of the circulating fluids, it gradually ſwells and forms a large tumour.

In theſe caſes, when the child is delivered, we ought to allow the navel-ſtring, at cutting, to bleed from one to two or three ſpoonfuls, eſpecially if the infant be vigorous and full grown; and to provoke it by whipping and ſtimulating; for the more it cries, the ſooner and better are the bones of the cranium forced outwards into their natural ſituation: or, if the head hath not been long compreſſed, and is not much inflamed, we can ſometimes with our hands reduce it into its pristine ſhape. The meconium ought alſo to be purged off as ſoon as poſſible, to give freer ſcope to the circulating fluids in the abdomen, and make a revulſion from the ſurcharged and compreſſed brain. This may be effected with ſuppoſitaries, glyſters, repeated doſes of *Ol. Amygdal. d.* mixed with *Pulv. Rhabarb.* or *De Althæa*, or *Syr. de Gichoreo, cum Rheo.*

If the child is ſeized with convulſions ſoon after delivery, in conſequence of this compreſſion, and the veſſels of the navel-ſtring have not been allowed to bleed, the jugular vein ought immediately to be opened, and from one to two ounces of blood taken away; an operation eaſily performed in young children: the urine and meconium muſt be diſcharged, and a ſmall bliſter applied between the ſcapulæ. When the ſcalp is bruiſed, inflamed, or ſwelled, let it be anointed or embrocated with a mixture of *Ol. Chamomel. Acet.* and *Spt. Vin. camphorat.* and cerates and poultices applied to the parts.

If the tumefaction is large, and we feel a conſiderable fluctuation of extravaſated fluids, which cannot be taken up by the abſorbent veſſels, aſſiſted with thoſe applications, the tumour muſt be opened; though generally there is no occaſion for a large inciſion, becauſe, after the fluid is once diſcharged, the hollow ſcalp, by gentle preſſure, is more eaſily joined in children than in older ſubjects. When the head is miſhapen, it ſhould not be bound or preſſed, but left lax and eaſy; leſt, the brain being compreſſed, convulſions ſhould enſue.

The body of the child is ſometimes covered all over with little red ſpots, called the ***red gum***, and commonly proceeding from the coſtiveneſs of the child, when the meconium hath not been ſufficiently purged off at firſt. And here it will not be improper to obſerve, that as the whole tract of the colon is filled with this viſcid excrement, which hath been gradually accumulated for a conſiderable time; and as the ſmall inteſtines, ſtomach, and gullet, are lined with a glary fluid or mucus; the child ought to take no other nouriſhment than pap as thin as whey, to dilute this fluid, for the firſt two days; or indeed, till it ſucks the mother's milk, which begins to be ſecreted about the third day, and is at firſt ſufficiently purgative to diſcharge theſe humours, and better adapted for the purpoſe than any artificial purge.

If the mother's milk cannot be had, a nurſe lately delivered is to be found; and if the purgative quality of her milk is decreaſed, ſhe muſt be ordered to take repeated ſmall doſes of manna or lenitive electuary, by which it will recover its former virtue, and the child be ſufficiently purged. If the child is brought up by hand, the food ought to imitate as near as poſſible the mother's milk: let it conſiſt of loaf-bread and water boiled up together, in form of panada, and mixed with the ſame quantity of new cow's milk; and ſometimes with the broth of fowl or mutton. When the child is coſtive, two drachms of manna, or from two to four grains of rhubarb, may be given: and when the ſtools are green and curdled, it will be proper to abſorb the prevailing acid with the teſtaceous powders, ſuch as the *Chel. Cancror, ſimp.* or *Teſt. Oſtrear.* given from the quantity of ten grains to a ſcruple: and for this purpoſe the *Magneſia alba* is recommended, from one to two drachms a-day, as being both opening and abſorbent. The red gum may likewiſe proceed from the officiouſneſs of the nurſe, by which the ſcarf ſkin hath been abraded or rubbed off; in which caſe the child muſt be bathed in warm milk, and the parts ſoftened with pomatum: the ſame bath may be alſo uſed daily in the other kind, and the belly kept open with the aforementioned medicines; with which ſome ſyrup, tincture, or powder of rhubarb, may be mixed, or given by itſelf, if the ſtools are of a greeniſh hue.

Excoriations behind the ears, in the neck and groin of the child, are ſometimes indeed unavoidable in fat and groſs habits; but moſt commonly proceed from the careleſſneſs of the nurſe, who neglects to waſh and keep the parts clean; they are, however, eaſily dried up and healed, with *Unguent. Alb. Pulv. e Ceruſſa*, or fullers earth. Yet we ought to be cautious in applying drying medicines behind the ears, becauſe a diſcharge in that part frequently prevents worſe diſeaſes.

SECT. V. *The* Aptha, *or* Thrush.

The aptha, or thruſh, is a diſeaſe to which new born children are frequently ſubject, and is often dangerous when neglected at the beginning. This diſeaſe proceeds from weakneſs and laxity of the contracting force of the ſtomach and inteſtines, by which the aceſcent food is not digeſted; and from a defect in the neceſſary ſecretion of bile, with which it ought to be mixed. This prevailing acid in the primæ viæ produces gripings and looſe green ſtools, that weaken the child more and more, deprives it of proper nouriſhment and reſt, and occaſion a fever from inanition and irritation. The ſmalleſt veſſels at the mouths of the excretory ducts in the mouth, gullet, ſtomach, and inteſtines, are obſtructed and ulcerated in conſequence of the child's weakneſs, and acrimonious vomitings, belchings, and ſtools, and little foul ulcers are formed. Theſe firſt appear in ſmall white ſpecks on the lips, mouth, tongue, and at the fundament: they gradually increaſe in thickneſs and extent; adopt a yellow colour, which in the progreſs of the diſtemper becomes duſkiſh, and the watery ſtools (called the *watery gripes*) become more frequent. The whole inner ſurface of the inteſtines being thus ulcerated and obſtructed, no nouriſhment enters the lacteal veſſels; ſo that the weakneſs and diſeaſe are increaſed, the milk and pap which are taken in at the mouth paſſes off curdled and green, the child is more and more enfeebled, and the brown colour of the aptha declares a mortification and death at hand. Sometimes, however, the apthæ are unattended by the watery ſtools; and ſometimes theſe laſt are unaccompanied with the aptha.

In order to prevent this fatal cataſtrophe, at the firſt appearance of the diſorder we ought to preſcribe repeated doſes of teſtaceous powders to abſorb and ſweeten the predominant acid in the ſtomach, giving them from ten to twenty grains in the pap, twice or three times a day; and on every third night, from three to five grains of the *Pulv. Rhei, Julap. e Creta*; oily and anodyne glyſters, with epithems to the ſtomach, may alſo be adminiſtered. When theſe and every other preſcription fail, the child, if not much weakened, is ſometimes cured by a gentle vomit, conſiſting of *Pulv. Ipecacuan.* gr. 1. given in a ſpoonful of barley-water, and repeated two or three times at the interval of half an hour between each. When the child is much enfeebled, the *Oleo-Saccharum Cinnamomi* or *Aniſi*, mixed with the pap, is ſometimes ſerviceable. If the milk is either too purgative or binding, the nurſe ſhould be changed, or take proper medicines to alter its quality; or, if the child has been brought up by hand, woman's milk may be given on this occaſion, together with weak broths; but if the child cannot ſuck, the milk of cows, mares, or aſſes, may be ſubſtituted in its room, diluted with barley water.

SECT. VI. Teething.

Children commonly begin to breed their fore-teeth about the ſeventh, and ſometimes not before the ninth month; nay, in ſome the period is ſtill later. Thoſe who are healthy and lax in their bellies, undergo dentition eaſier than ſuch as are of a contrary conſtitution. When the teeth ſhoot from their ſockets, and their ſharp points begin to work their way through the perioſteum and gums, they frequently produce great pain and inflammation, which, if they continue violent, bring on feveriſh ſymptoms and convulſions, that often prove fatal. In order to prevent theſe misfortunes, the ſwelled gum may at firſt be cut down to the tooth, with a biſtory or fleam; by which means the patient is often relieved immediately: but if the child is ſtrong, the pulſe quick, the ſkin hot and dry, bleeding at the jugular will be alſo neceſſary, and the belly muſt be kept open with repeated glyſters. On the other hand, if the child is low, ſunk, and emaciated, repeated doſes of *Spt. C. C. Tinct. Fuligin.* and the like, may be preſcribed; and bliſters applied to the back, or behind the ears.

PART X.

Of the Management *of Women from the Time of their Delivery to the End of the Month, with the ſeveral* Diseases *to which they are ſubject during that Period.*

SECT. I. *The* External Application.

The woman being delivered of the child and placenta, let a ſoft linen cloth, warmed, be applied to the external parts; and if ſhe complains much of a ſmarting ſoreneſs, ſome pomatum may be ſpread upon it. The linen that was laid below her, to ſpunge up the diſcharges, muſt be removed, and replaced with others that are clean, dry, and warm. Let her lie on her back, with her legs extended cloſe to each other; or upon her ſide, if ſhe thinks ſhe can lie eaſier in that poſition, until ſhe recovers from the fatigue: if ſhe is ſpent and exhauſted, let her take a little warm wine or caudle, or, according to the common cuſtom, ſome nutmeg and ſugar grated together in a ſpoon: the principal deſign of adminiſtering this powder, which among the good women is ſeldom neglected, is to ſupply the want of ſome cordial draught, when the patient is too weak to be raiſed, or ſuppoſed to be in danger of retchings from her ſtomach's being overloaded. When ſhe hath in ſome meaſure recovered her ſtrength and ſpirits, let the cloths be removed from the parts, and others applied in their room; and if there is a large diſcharge from the uterus, let the wet linen below her be alſo ſhifted, that ſhe may not run the riſk of catching cold.

When the patient is either weak or faintiſh, ſhe ought not to be taken out of bed, or even raiſed up to have her head and body ſhifted, until ſhe is a little recruited; otherwiſe ſhe will be in danger of repeated faintings, attended with convulſions, which ſometimes end in death. To prevent theſe bad conſequences, her ſkirt and petticoats ought to be looſened and pulled down over the legs, and replaced by another, well warmed, with a broad head band to be ſlipt in below, and brought up over her thighs and hips: a warm double cloth muſt be laid on the belly, which is to be ſurrounded by the head-band of the ſkirt pinned moderately tight over the cloth, in order to compreſs the viſcera and the relaxed parietes of the abdomen, more or leſs, as the woman can eaſily bear it; by which means the uterus is kept firm in the lower part of the abdomen and prevented from rolling from ſide to ſide when the patient is turned; but the principal end of this compreſſion is to hinder too great a quantity of blood from ruſhing into the relaxed veſſels of the abdominal contents; eſpecially when the uterus is emptied all of a ſudden by a quick delivery. The preſſure being thus ſuddenly removed, the head is all at once robbed of its proportion of blood, and the immediate revulſion precipitates the patient into dangerous lypothemia.

For this reaſon the belly ought to be firmly compreſſed by the hands of an aſſiſtant, until the bandage is applied; or, in lieu of it, a long towel, ſheet, or roller, to make a ſuitable compreſſion: but for this purpoſe different methods are uſed in different countries, or according to the different circumſtances of the patients. The head-cloaths and ſhift ought alſo to be changed, becauſe, with ſweating in time of labour, they are rendered wet and diſagreeable. Several other applications are neceſſary when the external and internal parts are rent or inflamed, misfortunes that ſometimes happen in laborious and preternatural caſes.

The directions for ordering the bed in time of labour, and of the applications after delivery, are abſolutely neceſſary to be known by young practitioners; becauſe all theſe precautions are for the eaſe and ſafety of the patient when attended by unexperienced nurſes.

CASE I.

Inflammations of the labia pudendi, rectum, urethra, vagina, and uterus, chiefly happen when the head, ſhoulder, breech, or any other part of the fœtus, hath been forced into the pelvis, and long detained in that ſituation; ſo that, by many ſtrong pains, the delivery was effected, or great force and violence were required to turn or extract the child. Theſe inflammations, if ſlight, are commonly relieved, or altogether reſolved, by a plentiful diſcharge of the lochia, reſt, and profuſe ſweating; but if violent, blooding, warm fomentations, cataplaſms, and emollient glyſters, may be neceſſary; though the firſt and laſt muſt be uſed with caution. If the preſſure hath been ſo great as totally to obſtruct the circulating fluids in thoſe parts, a mortification enſues; either total, by which the woman is ſoon deſtroyed; or partial, when the mortified parts ſeparate and caſt off in thick ſloughs, then digeſt, and are healed as a common ſore.

CASE II.

If, in conſequence of the long preſſure of the child's head at that part of the vagina where its outward ſurface is attached to the back and under part of the bladder, the mortification affects the coats of the veſica urinaria, as well as thoſe of the vagina, when the ſloughs fall off, the urine will paſs that way, and hinder the opening (if large) from being cloſed; this is an inexpreſſible inconvenience and misfortune to the poor woman, both from the ſmell and continual wetting her cloaths. The vagina and bladder may alſo be lacerated by the forceps, crotchet, or any other inſtrument imprudently forced up: but, in that caſe, the urine is immediately diſcharged through the wound; whereas, in a mortification, it comes off in a natural way, until the ſlough begins to ſeparate and fall off. As ſoon as this misfortune is known, the cure ought to be attempted; this (according to ſome) conſiſts in keeping a flexible catheter always in the bladder, that the urine may be continually ſolicited to come through the urethra rather than through the vagina: but if this precaution hath been neglected, and the lips of the ulcer are turned callous, we are directed to pare them off with a curved knife, buttoned at the point, or conſume them with lunar cauſtic; and, if the opening is large, to cloſe it with a double ſtitch, keeping the flexible catheter in the bladder until it is entirely filled up: but we wiſh this operation may not be found impracticable.

CASE III.

The os externum is frequently tore, particularly at the perinæum; and ſometimes the laceration reaches to the anus. At other times, (but more ſeldom,) both vagina and rectum are tore for the ſpace of two or three inches upwards, and the two form but one cavity at the lower part. This laceration is frequently occaſioned from the exceſſive largeneſs of the child's head; from the rigidity of the fibres in women who are near the borders of forty when their firſt children are born: from the accoucheur's neglecting to ſlide the perinæum over the head when it is forcibly propelled by the pains, or from his omitting to keep up the head with the flat of his hand that it may not come too ſuddenly along; from too great violence uſed in laborious or preternatural labours; and from the operator's incautious manner of thruſting in his hand. If the laceration be ſmall, the part ſoon heals up, and the only inconvenience attending the wound is a ſmarting after making water; and when the laceration is large, extending to the edge of the ſphincter ani, or even farther, this pain is ſtill more troubleſome, and increaſed upon the leaſt motion, by the friction of the lips againſt each other.

In the third caſe, it is ſuppoſed that there is an abſolute neceſſity to make, as ſoon as poſſible, two, three, or ſometimes four, deep ſtitches through the tore vagina and rectum, the knots being tied in the vagina, and two more ſtitches in the perinæum, to aſſiſt the re-union of the parts; for if the ſphincter ani is entirely ſeparated, and continues in that condition, the patient can ſeldom retain her excrements for any length of time. If this misfortune ſhould remain unknown, or the operation unperformed, on account of the woman's weakneſs, until the lips of the wound are grown callous, theſe callous edges muſt be pared off with ſciſſars; or, if that ſhould be found impracticable, ſcarified with the point of a lancet or biſtory, and then ſtitched as before directed; and the ſtitches muſt be made very deep, otherwiſe they will not hold; becauſe there is but little muſcular fleſh in the vagina and rectum: but the colon ought firſt to be emptied with glyſters, and the patient take little or no ſolid food, that the ſtitches may not be overſtrained when ſhe goes to ſtool. When the laceration reaches ſo high as to endanger the woman's retentive faculty, this method, doubtleſs, ought to be tried; but not otherwiſe, becauſe the operation very rarely ſucceeds.

SECT. II. *Air, Diet, Sleeping and Watching, Motion and Reſt, Retention and Excretion, and the Paſſions of the Mind.*

Although we cannot remove the patient immediately after delivery into another climate, we can qualify the air, ſo as to keep it in a moderate and ſalutary temper, by rendering it warm or cold, moiſt or dry, according to the circumſtances of the occaſion. With regard to diet, women in time of labour, and even till the ninth day after delivery, ought to eat little ſolid food, and none at all during the firſt ſeven days: let them drink plentifully of warm diluting fluids, ſuch as barley-water, gruel, chicken-water, and teas; caudles are alſo commonly uſed, compoſed of water-gruel boiled up with mace and cinnamon, to which, when ſtrained, is added a third or fourth part of white-wine or leſs, if the patient drinks plentifully, ſweetened with ſugar to their taſte: this compoſition is termed *white caudle*; whereas, if ale is uſed inſtead of wine, it goes under the name of *brown caudle*. In ſome countries, eggs are added to both kinds; but in that caſe, the woman is not permitted to eat meat or broths till after the fifth or ſeventh day: in this country, however, as eggs are no part of the ingredients, the patient is indulged with weak broth ſooner, and ſometimes allowed to eat a little boiled chicken. But all theſe different preparations are to be preſcribed weaker or ſtronger, with regard to the ſpices, wine, or ale, according to the different conſtitutions and ſituations of different patients: for example, if ſhe is low and weak, in conſequence of an extraordinary diſcharge of any kind either before or after delivery, or if the weather is cold, the caudles and broths may be made the ſtronger; but if ſhe is of a full habit of body, and has the leaſt tendency to a fever, or if the ſeaſon is exceſſive hot, theſe drinks ought to be of a very weak conſiſtence, or the patient reſtricted to gruel, tea, barley, and chicken-water, and theſe varied according to the emergency of the caſe.

Her food muſt be light and eaſy of digeſtion, ſuch as panada, biſcuit, and ſago: about the ſixth or ſeventh day, ſhe may eat a little boiled chicken, or the lighteſt kind of young meat; but theſe laſt may be given ſooner or later, according to the circumſtances of the caſe and the appetite of the patient. In the regimen as to eating and drinking, we ſhould rather err on the abſtemious ſide, than indulge the woman with meat and ſtrong fermented liquors, even if theſe laſt ſhould be moſt agreeable to her palate; for we find by experience that they are apt to increaſe or bring on fevers, and that the moſt nouriſhing and ſalutary diet is that which we have above preſcribed. Every thing that is difficult of digeſtion, or quickens the circulating fluids, muſt of neceſſity promote a fever; by which the neceſſary diſcharges are obſtructed, and the patient's life endangered.

As to the article of ſleeping and watching, the patient muſt be kept as free from noiſe as poſſible, by covering the floors and ſtairs with carpets and cloths, oiling the hinges of the doors, ſilencing the bells, tying up the knockers, and, in noiſy ſtreets, ſtrowing the pavement with ſtraw: if, notwithſtanding theſe precautions, ſhe is diſturbed, her ears muſt be ſtuffed with cotton, and opiates adminiſtered to procure ſleep; becauſe watching makes her reſtleſs, prevents preſpiration, and promotes a fever. Motion and reſt are another part of the non-naturals to which we ought to pay particular regard. By toſſing about, getting out of bed, or ſitting up too long, the perſpiration is diſcouraged and interrupted; and in this laſt attitude the uterus, not yet fully contracted, hangs down, ſtretching the ligaments, occaſioning pain, cold ſhiverings, and a fever: for the prevention of theſe bad ſymptoms, the patient muſt be kept quiet in bed till after the fourth or fifth day; and then be gently lifted up in the bed-cloaths, in a lying poſture, until the bed can be adjuſted, into which ſhe muſt be immediately reconveyed, there to continue, for the moſt part, till the ninth day; after which period women are not ſo ſubject to fevers as immediately after delivery. Some there are who, from the nature of their conſtitutions or other accidents, recover more ſlowly; and ſuch are to be treated with the ſame caution after as before the ninth day, as the caſe ſeems to indicate. Others get up, walk about, and recover, in a much ſhorter time; but theſe may, ſome time or other, pay dearly for their fool-hardineſs, by encouraging dangerous fevers: ſo that we ought rather to err on the ſafe ſide, than run any riſk whatſoever.

What next comes under conſideration, is the circumſtance of retention and excretion. We have formerly obſerved, that in time of labour, before the head of the child is locked into the pelvis, if the woman has not had eaſy paſſage in her belly that ſame day, the rectum and colon ought to be emptied by a glyſter, which will aſſiſt the labour, prevent the diſagreeable excretion of the fæces before the child's head, and enable the patient to remain two or three days after without the neceſſity of going to ſtool. However, ſhould this precaution be neglected, and the patient very coſtive after delivery, we muſt beware of throwing up ſtimulating glyſters, or adminiſtering ſtrong cathartics, leſt they ſhould bring on too many looſe ſtools, which, if they cannot be ſtopt, ſometimes produce fatal conſequences, by obſtructing the perſpiration and lochia, and exhauſting the woman, ſo as that ſhe will die all of a ſudden; a cataſtrophe which hath frequently happened from this practice. Wherefore, if it be neceſſary to empty the inteſtines, we ought to preſcribe nothing but emollient glyſters, or ſome very gentle opener, ſuch as manna, or *Elect. Lenitivum*.

But no excretion is of more conſequence to the patient's recovery than a free perſpiration; which is ſo abſolutely neceſſary, that unleſs ſhe has a moiſture continually on the ſurface of her body for ſome days after the birth, ſhe ſeldom recovers to advantage: her health, therefore, in a great meaſure depends upon her enjoying undiſturbed repoſe, and a conſtant breathing ſweat, which prevents a fever, by carrying off the tenſion, and aſſiſts the equal diſcharge of the lochia; and when theſe are obſtructed, and a fever enſues with pain and reſtleſſneſs, nothing relieves the patient ſo effectually as reſt and profuſe ſweating, procured by opiates and ſudorifics at the beginning of the complaints; yet theſe laſt muſt be more cautiouſly preſcribed in exceſſive hot, than in cool weather.

The laſt of the non-naturals to be conſidered, are the paſſions of the mind, which alſo require particular attention. The patient's imagination muſt not be diſturbed by the news of any extraordinary accident which may have happened to her family or friends; for ſuch information hath been known to carry off the labour-pains entirely, after they were begun, and the woman has ſunk under dejection of ſpirits: and, even after delivery, theſe unſeaſonable communications have produced ſuch an anxiety as obſtructed all the neceſſary excretions, and brought on a violent fever and convulſions, that ended in death.

SECT. III. *Violent* FLOODINGS.

All women, when the placenta ſeparates, and after it is delivered, loſe more or leſs red blood, from the quantity of half a pound to that of one pound or even two; but ſhould it exceed this proportion, and continue to flow without diminution, the patient is in great danger of her life. This hazardous hæmorrhage is known by the violence of the diſcharge, wetting freſh cloths as faſt as they can be applied; from the pulſe becoming low and weak, and the countenance turning pale: then the extremities grow cold; ſhe ſinks into faintings; and, if the diſcharge is not ſpeedily ſtopped or diminiſhed, is ſeized with convulſions, which often terminate in death.

This dangerous efflux is occaſioned by every thing that hinders the emptied uterus from contracting; ſuch as, great weakneſs and laſſitude, in conſequence of repeated floodings before delivery; the ſudden evacuation of the uterus; ſometimes, though ſeldom, it proceeds from part of the placenta's being left in the womb: it may happen when there is another child or more ſtill undelivered; when the womb is kept diſtended with a large quantity of coagulated blood; or when it is inverted by pulling too forcibly at the placenta.

In this caſe, as there is no time to be loſt, and internal medicines cannot act ſo ſuddenly as to anſwer the purpoſe, we muſt have immediate recourſe to external application. If the diſorder be owing to weakneſs, by which the uterus is diſabled from contracting itſelf, ſo that the mouths of the veſſels are left open; or though contracted a little, yet not enough to reſtrain the hæmorrhage of the thin blood; or if, in ſeparating the placenta, the accoucheur has ſcratced or tore the inner ſurface or membrane of the womb; in theſe caſes, ſuch things muſt be uſed as will aſſiſt the contractile power of the uterus, and hinder the blood from flowing ſo faſt into it and the neighbouring veſſels: for this purpoſe, cloths dipped in any cold aſtringent fluid, ſuch as oxycrate, or red tart wine, may be applied to the back and belly. Some preſcribe venæſection in the arm, to the amount of five or ſix ounces, with a view of making revulſion: if the pulſe is ſtrong, this may be proper; otherwiſe, it will do more harm than good. Others order ligatures, for compreſſing the returning veins at the hams, arms, and neck, to retain as much blood as poſſible in the extremities and head. Beſides theſe applications, the vagina may be filled with tow or linen rags dipped in the abovementioned liquids, in which a little alum or ſaccharum ſaturni hath been diſſolved: nay, ſome practitioners inject proof-ſpirits warmed, or, ſoaking them up in a rag or ſponge, introduce and ſqueeze them into the uterus, in order to conſtringe the veſſels.

If the floodings proceed from another child, the retention of the placenta, or coagulated blood, theſe ought immediately to be extracted; and if there is an inverſion of the uterus, it muſt be ſpeedily reduced. Should the hæmorrhage, by theſe methods, abate a little, but ſtill continue to flow, though not in ſuch a quantity as to bring on ſudden death, ſome red wine and jelly ought to be preſcribed for the patient, who ſhould take it frequently, and a little at a time; but above all things, chicken or mutton broths, adminiſtered in the ſame manner, for fear of overloading the weakened ſtomach, and occaſioning retchings: theſe, repeated in ſmall quantities, will gradually fill the exhauſted veſſels and keep up the circulation. If the pulſe continues ſtrong, it will be proper to order repeated draughts of barley-water, acidulated with elixir of vitriol: but if the circulation be weak and languid, extract of the bark, diſſolved in *Aq. Cinnamoni tenuis*, and given in ſmall draughts or exhibited in any other form, will be ſerviceable; at the ſame time, lulling the patient to reſt with opiates. Theſe, indeed, when the firſt violence of the flooding is abated, if properly and cautiouſly uſed, are generally more effectual than any other medicine.

SECT. IV. *The* AFTER-PAINS.

After-pains commonly happen when the fibrous part of the blood is retained in the uterus or vagina, and formed into large clots, which are detained by the ſudden contraction of the os internum and externum, after the placenta is delivered: or, if theſe ſhould be extracted, others will ſometimes be formed, though not ſo large as the firſt, becauſe the cavity of the womb is continually diminiſhing after the birth. The uterus, in contracting, preſſes down theſe coagulums to the os internum; which being again gradually ſtretched, produces a degree of labour-pains, owing to the irritation of its nerves: in conſequence of this uneaſineſs, the woman ſqueezes the womb as in real-labour; the force being increaſed, the clots are puſhed along, and when they are delivered ſhe grows eaſy. The larger the quantity is of the coagulated blood, the ſeverer are the pains, and the longer they continue.

Women in the firſt child, ſeldom have after-pains; becauſe, after delivery, the womb is ſuppoſed to contract, and puſh off the clots with greater force in the firſt than in the following labours: after-pains may alſo proceed from obſtructions in the veſſels, and irritations at the os internum. In order to prevent or remove theſe pains, as ſoon as the placenta is ſeparated and delivered, the hand being introduced into the uterus, may clear off all the coagula. When the womb is felt, through the parietes of the abdomen, larger than uſual, it may be taken for granted that there is either another child, or a large quantity of this clotted blood; and whichſoever it may be, there is a neceſſity for its being extracted. If the placenta comes away of itſelf, and the after-pains are violent, they may be alleviated and carried off by an opiate: for, by ſleeping and ſweating plentifully, the irritation is removed, the evacuations are increaſed, the os uteri is inſenſibly relaxed, and the coagula ſlide eaſily along. When the diſcharge of the lochia is ſmall, the after-pains, if moderate, ought not to be reſtrained; becauſe the ſqueezing which they occaſion, promotes the other evacuation, which is neceſſary for the recovery of the patient. After-pains may alſo proceed from an obſtruction in ſome of the veſſels, occaſioning a ſmall inflammation of the os internum and ligaments; and the ſqueezing thereby occaſioned may not only help to propel the obſtructing fluid, but alſo (if not too violent) contribute to the natural diſcharges.

SECT. V. *Of the* LOCHIA.

When the large veſſels of the uterus are emptied immediately after delivery, the diſcharge frequently ceaſes for ſeveral hours, until the fluids in the ſmaller veſſels are propelled into the larger, and then begins to flow again of a paler colour.

The red colour of the lochia commonly continues till the fifth day, though it is always turning more and more ſerous from the beginning; but, about the fifth day, it flows off a clear, or ſometimes (though ſeldom) of a greeniſh tint; for the mouths of the veſſels, growing gradually narrower by the contraction of the uterus, at laſt allow the ſerous part only to paſs. As for the greeniſh hue, it is ſuppoſed to proceed from a diſſolution of the cellular or cribriform membrane or mucus that ſurrounded the ſurface of the placenta and chorion; part of which, being left in the uterus, becomes livid, decays, and diſſolving, mixes with and tinctures the diſcharge as it paſſes along.

Though the lochia commonly continue to the eighteenth or twentieth day, they are every day diminiſhing in quantity, and ſooneſt ceaſe in thoſe woman who ſuckle their children, or have had an extraordinary diſcharge at firſt; but the colour, quantity, and duration, differ in different women: in ſome patients, the red colour diſappears on the firſt or ſecond day; and in others, though rarely, it continues more or leſs to the end of the month: the evacuation in ſome is very ſmall, in others exceſſive: in one woman it ceaſes very ſoon; in another, flows during the whole month: yet all of theſe patients ſhall do well.

The ſpace that is occupied before delivery, from being ſix inches in diameter, or eighteen inches in circumference, will, ſoon after the birth, be contracted to one third or fourth of theſe dimenſions.

The diſcharge of the lochia being ſo different in women of different conſtitutions, and beſides in ſome meaſure depending upon the method of management and the way of life peculiar to the patient, we are not to judge of her ſituation from the colour, quantity, and duration of them, but from the other ſymptoms that attend the diſcharge: and if the woman ſeems hearty, and in a fair way of recovery, nothing ought to be done with a view to augment or diminiſh the evacuation. If the diſcharge be greater than ſhe can bear, it will be attended with all the ſymptoms of inanition; but as the lochia ſeldom flow ſo violently, as to deſtroy the patient of a ſudden, ſhe may be ſupported by a proper, nouriſhing diet, aſſiſted with cordial and reſtorative medicines. Let her, for example, uſe broths, jellies, and aſſes milk; if the pulſe is languid and ſunk, ſhe may take repeated doſes of the *Confec. Cardiac.* with mixtures compoſed of the cordial waters and volatile ſpirits. Subaſtringents and opiates frequently adminiſtered, with the *Cort. Peruv.* in different forms, and auſtere wines, are of great ſervice. On the other hand, when the diſcharge is too ſmall, or hath ceaſed altogether, the ſymptoms are more dangerous, and require the contrary method of cure; for now the buſineſs is to remove a too great plenitude of the veſſels in and about the uterus, occaſioning tenſion, pain, and labour, in the circulating fluids; from whence proceed great heat in the part, reſtleſſneſs, fever, a full hard quick pulſe, pains in the head and back, nauſea, and difficulty in breathing. Theſe complaints, if not at firſt prevented, or removed by reſt and plentiful ſweating, muſt be treated with venæſection and the antiphlogiſtic method.

When the obſtruction is recent, let the patient lie quiet and encourage a plentiful diaphoreſis, by drinking frequently of warm, weak, diluting fluids; ſuch as water-gruel, barley-water, tea, or chicken-broth: ſhe may likewiſe take opiates and ſudorifics in different forms as may be agreeable to her ſtomach. *Theriaca Androm.* from ʒſs to ʒi. *Laud. liquid.* from gut. x. to gut. xx. *Pilul. ſaponac.* from gr. v. to gr. x. or *Syr. de Meconio.* from ℥ſs. to ℥i. Theſe may be repeated occaſionally, with other forms of opiates; and if they fail to procure reſt and ſweating, the following diaphoretics, without opium, ought to be adminiſtered.

℞ *Pulv. Contrayerv. Cam.* ʒſs. *Pulv. Caſtor. Ruſſ. Sal. Succin.* āā. gr. v. *Syr. Croci.* q. ſ. f. *Bolus ſtatim ſumendus cum hauſt. ſequent. et repetat. quarta vel ſexta quaque hora ad tres vices vel ut opus fuerit.*

℞ *Aq. Cinnamon. ten.* ℥iſs. *cum Spiritu. Syr. Croci.* āā ℥ij. *Adde Sal. Vol. C. C* gr. iv. m.

Should theſe methods be uſed without ſucceſs, and the patient, far from being relieved by reſt, plentiful ſweating, or a ſufficient diſcharge of the obſtructed lochia, labour under an hot dry ſkin, anxiety, and a quick hard and full pulſe, the warm diaphoretics muſt be laid aſide; becauſe if they fail of having the deſired effect, they muſt neceſſarily increaſe the fever and obſtruction, and recourſe be had to bleeding at the arm or ankle, to more or leſs quantity, according to the degree of fever and obſtruction; and this evacuation muſt be repeated as there is occaſion. When the obſtruction is not total, it is ſuppoſed more proper to bleed at the ankle than at the arm; and at this laſt, when the diſcharge is altogether ſtopped. Her ordinary drink ought to be impregnated with nitre, and the following draughts or others of the ſame kind preſcribed.

℞ *Sal. Abſynth.* ℈i. *Succ. Limon.* ℥ſs. *Aq. Cinnamon. ſimp.* ℥iſs. *Pul. Contrayerv. Comp.* ℈i. *Sacch. Alb.* q. ſ. f. *Hauſtus ſtatim ſumendus, et quarta vel ſexta quaque hora repetendus.*

SECT. VI. *The* MILK-FEVER.

About the fourth day, the breaſts generally begin to grow turgid and painful. We have formerly obſerved, that during the time of uterine geſtation the breaſts in moſt women gradually increaſe till the delivery, growing ſofter as they are enlarged by the veſſels being more and more filled with fluids; and by this gradual diſtention they are prepared for ſecreting the milk from the blood after delivery. During the two or three firſt days after parturition, eſpecially when the woman has undergone a large diſcharge, the breaſts have been ſometimes obſerved to ſubſide and grow flaccid; and about the third or fourth day, when the lochia begin to decreaſe, the breaſts ſwell again to their former ſize, and ſtretch more and more, until the milk, being ſecreted, is either ſucked by the child, or frequently of itſelf runs out at the nipples.

Moſt of the complaints incident to women after delivery, proceed either from the obſtruction of the lochia in the uterus, or of the milk in the breaſts, occaſioned by any thing that will produce a fever; ſuch as catching cold, long and ſevere labour, eating food that is hard of digeſtion, and drinking fluids that quicken the circulation of the blood in the large veſſels; by which means the ſmaller, with all the ſecretory and excretory ducts, are obſtructed.

If ſhe is coſtive, emollient and gently opening glyſters may be occaſionally injected; and her breaſts muſt be fomented, and ſucked either by the mouth or pipe-glaſſes. If by theſe means the fever is abated, and the neceſſary diſcharges return, the patient commonly recovers; but if the complaints continue, the antiphlogiſtic method muſt ſtill be purſued. If notwithſtanding theſe efforts the fever is not diminiſhed or removed by a plentiful diſcharge of the lochia from the uterus, the milk from the breaſts, or by a critical evacuation by ſweat, urine, or ſtool, and the woman is every now and then attacked with cold ſhiverings, an abſceſs or abſceſſes will probably be formed in the uterus or neighbouring parts, or in the breaſts; and ſometimes the matter will be tranſlated to other ſituations, and the ſeat of it foretold from the parts being affected with violent pains: theſe abſceſſes are more or leſs dangerous, according to the place in which they happen, the largeneſs of the ſuppuration, and the good or bad conſtitution of the patient.

If, when the pains in the epigaſtric region are violent and the fever increaſed to a very high degree, the patient ſhould all of a ſudden enjoy a ceſſation from pain without any previous diſcharge or critical eruption, the phyſician may pronounce that a mortification is begun; eſpecially if at the ſame time the pulſe becomes low, quick, wavering, and intermitting: if the woman's countenance, from being florid, turns duſky and pale while ſhe herſelf and all the attendants conceive her much mended; in that caſe, ſhe will grow delirious, and die in a very ſhort time.

What we have ſaid on this ſubject, regards that fever which proceeds from the obſtructed lochia, and in which the breaſts may likewiſe be affected: but the milk-fever is that in which the breaſts are originally concerned, and which may happen though the lochia continue to flow in ſufficient quantity: nevertheleſs they mutually promote each other, and both are to be treated in the manner already explained in the former ſection; namely, by opiates, diluents, and diaphoretics in the beginning; and theſe preſcriptions failing, the obſtructions muſt be reſolved by the antiphlogiſtic method deſcribed before. The milk-fever alone, when the uterus is not concerned, is not ſo dangerous, and much more eaſily relieved. Women of an healthy conſtitution, who ſuckle their own children, have good nipples, and whoſe milk comes freely, are ſeldom or never ſubject to this diſorder, which is more incident to thoſe who do not give ſuck, and neglect to prevent the ſecretion in time, or, when the milk is ſecreted, take no meaſures for emptying their breaſts. This fever likewiſe happens to women who try too ſoon to ſuckle, and continue their efforts too long at one time; by which means the nipples, and conſequently the breaſts, are often inflamed, ſwelled, and obſtructed.

In order to prevent too great a turgeſcency in the veſſels of the breaſts, and the ſecretion of milk, in thoſe women who do not chooſe to ſuckle, it will be proper to make external application of thoſe things which, by their preſſure and repercuſſive force, will hinder the blood from flowing in too great quantity to this part, which is now more yielding than at any other time: for this purpoſe, let the breaſts be covered with ***Emp. de minio, Diapalma***, or ***Emp. ſimp.*** ſpread upon linen, or cloths dipped in camphorated ſpirits, be frequently applied to theſe parts and the arm-pits; while the patient's diet and drink are of the lighteſt kind, and given in ſmall quantities. Notwithſtanding theſe precautions, a turgeſcency commonly begins about the third day; but by reſt, moderate ſweating, and the uſe of theſe applications, the tenſion and pain will ſubſide about the fifth or ſixth day, eſpecially if the milk runs out at the nipples: but if the woman catches cold, or is of a full habit of body, and not very abſtemious, the tenſion and pain increaſing, will bring on a cold ſhivering, ſucceeded by a fever; which may obſtruct the other excretions, as well as thoſe of the breaſt.

In this caſe, the ſudorifics recommended in the former ſection muſt be preſcribed; and if a plentiful ſweat enſues, the patient will be relieved; at the ſame time the milk muſt be extracted from her breaſts by ſucking with the mouth or glaſſes. Should theſe methods fail, and the fever increaſe, ſhe ought to be blooded in the arm; and, inſtead of the external applications hitherto uſed, emollient liniments and cataplaſms muſt be ſubſtituted, in order to ſoften and relax. If in ſpite of theſe endeavours the fever proceeds for ſome days, the patient is frequently relieved by critical ſweats, a large diſcharge from the uterus, miliary eruptions, or looſe ſtools mixed with milk, which is curdled in the inteſtines. But ſhould none of theſe evacuations happen, and the inflammation continue with increaſing violence, there is danger of an impoſthume, which is to be brought to maturity, and managed like other inflammatory tumours; and no aſtringents ought to be applied, leſt they ſhould produce ſcirrhous ſwellings in the glands.

As the criſis of this fever, as well as of that laſt deſcribed, often conſiſts in miliary eruptions over the whole ſurface of the body, but particularly on the neck and breaſts, by which the fever is carried off, nothing ought to be given which will either greatly increaſe or diminiſh the circulating force, but ſuch only as will keep out the eruptions. But if, notwithſtanding the eruptions, the fever, inſtead of abating, is augmented, it will be neceſſary to diminiſh its force, and prevent its increaſe by thoſe evacuations before mentioned. On the contrary, ſhould the pulſe ſink, the eruptions begin to retreat inwardly, and the morbific matter be in danger of falling upon the viſcera, we muſt endeavour to keep them out, by ſuch opiates and ſudorific medicines as we have already preſcribed in obſtructions of the lochia; and here bliſters may be applied with ſucceſs. On this ſubject Sir David Hamilton and Hoffman may be conſulted.

SECT. VII. *The* PROLAPSUS VAGINA, RECUM *and* UTERUS.

When the head of the child is long retained about the middle of the vagina, the lower part of that ſheath ſometimes ſwells; and, as the head comes farther down, is puſhed out at the os externum, occaſioning great difficulty in delivering the woman: ſometimes alſo the lower part of the rectum is protruded through the ſphincter ani, eſpecially if the patient is troubled with the inward piles. The cure of both theſe complaints conſiſts in reducing the prolapſus: if this cannot be done immediately in the laſt on account of the ſwelling of the protruded part, emollient fomentations and poultices muſt be uſed in order to remove the inflammation. When it is reduced, the woman muſt be confined more than uſual to her bed; and if the part falls down again in conſequence of her ſtraining at ſtool or in making water, it muſt be reduced occaſionally, and as ſhe recovers ſtrength the complaint will in all probability vaniſh; otherwiſe aſtringent fumigations or fomentations muſt be uſed. If the diſorder be of long duration, peſſaries, adapted to the part, whether vagina or rectum, muſt be applied.

A prolapſus uterus may happen from the ſame cauſes, or from any thing that will too much relax the ligament and peritonæum, by which the womb is ſuſpended; ſuch as an inveterate fluor albus, that, by its long continuance and great diſcharge, weakens the womb and all the parts. This misfortune, when it proceeds from labour, does not appear till after delivery, when the uterus is contracted to its ſmalleſt ſize; nay, not for ſeveral weeks or months after that period, until by its weight the os externum is gradually ſtretched wider and wider, ſo as to allow the womb to ſlip through it; and in this caſe it deſcends covered with the vagina, that comes down along with it, and hangs between the thighs: though the os tincæ only can be perceived on account of this covering, the ſhape and ſubſtance of the uterus may be eaſily diſtinguiſhed.

As this prolapſus comes on gradually, the woman of herſelf can (for the moſt part) reduce and keep it up while in bed; but when ſhe riſes and walks, it will fall down again. When the complaint is not of long ſtanding, and the womb does not come altogether through the os externum, the patient may be cured by aſtringent injections: and in the next pregnancy, when the upper part of the uterus is diſtended ſo as to fill the pelvis and riſe above its brim, the os internum will be raiſed higher in the vagina; and after delivery, if the woman is confined to her bed for twenty or thirty days, the ligaments generally contract ſo as to keep up the womb and prevent any future prolapſus. But when the complaint is of long continuance; when the uterus and vagina deſcend quite through the os externum, and by the friction in walking, occaſioned by the vagina's rubbing againſt the thighs and the os uteri upon the cloths that are uſed for ſupporting it, an inflammation, excoriation, and ulceration, are produced, inviting a greater flux of fluids to the part: theſe ſymptoms, joined with a fluor albus from the inſide of the uterus, deſtroy the hope of a ſecond impregnation, or cure by injections; and we can only promiſe to palliate the diſeaſe, by reducing the uterus and keeping it up with a peſſary; by which means, uſed for a length of time, the parts will recover their tone, and the diſeaſe be radically cured.

If the uterus be ſo much inflamed, that it cannot be reduced, generally evacuations muſt be preſcribed, and fomentations and poultices applied in order to diminiſh its bulk, ſo as that it may b replaced. For this complaint, different kinds of peſſaries have been uſed; ſome of a globular form; others that open with a ſpring, as deſcribed in the Medical Eſſays of Edinburgh. But thoſe moſt in uſe are of a flat form, with a little hole in the middle, and made of cork waxed over, ivory, box, ebony, lignum vitæ, of a triangular, quadrangular, oval, or circular ſhape. Thoſe that are circular ſeem beſt to anſwer the intention, becauſe we can more eaſily introduce a large one of that than of any other figure; it lies more commodiouſly in the vagina; and, as it always tilts a little upwards and downwards, never hinders the paſſage of the urine or fæces: theſe inſtruments, however, ought to be larger or ſmaller, according to the laxity or rigidity of the os externum.

There is a peſſary lately invented at Paris, which hath an advantage over all others; becauſe the woman can introduce it in the morning, and take it out at night: it is ſupported and kept in the vagina by a ſmall ſtalk, the lower end of which forms a little ball that moves in a ſocket; this ſocket is furniſhed with ſtraps, which are tied to a belt that ſurrounds the patient's body. The peſſary is extremely well calculated for thoſe who are in an eaſy way of life; but the other kind is beſt adapted to hard-working women, who have not time or conveniency to fix or mend the bandange when it wants repair.

SECT. VIII. *The Evacuations neceſſary at the End of the Month after Delivery.*

Thoſe who have had a ſufficient diſcharge of the lochia, plenty of milk, and ſuckle their own children, commonly recover with eaſe; and, as the ſuperfluous fluids of the body are drained off at the nipples, ſeldom require evacuations at the end of the month: but, if there are any complaints from fulneſs, ſuch as pains and ſtitches, after the twentieth day, ſome blood ought to be taken from the arm, and the belly gently opened by frequent glyſters, or repeated doſes of laxative medicines.

If the patient has tolerably recovered, the milk having been at firſt ſucked or diſcharged from the nipples, and afterwards diſcuſſed, no evacuations are neceſſary before the third or fourth week; and ſometimes not till after the firſt flowing of the menſes, which commonly happens about the fifth week; if they do not appear within that time, gentle evacuations muſt be preſcribed, to carry off the plethora and bring down the catamenia.

PART XI.

The requiſite Qualifications *of Accoucheurs, and Midwives,*

SECT. I. *Of the* Accoucheur.

Thoſe who intend to practiſe Midwifery ought firſt of all to make themſelves maſters of anatomy, and acquire a competent knowledge in ſurgery and phyſic; becauſe of their connection with the obſtetric art, if not always, at leaſt in many caſes. He ought to take the beſt opportunities he can find of being well inſtructed; and of practiſing under a maſter, before he attempts to deliver by himſelf.

In order to acquire a more perfect idea of the art, he ought to perform with his own hands upon proper machines, contrived to convey a juſt notion of all the difficulties to be met with in every kind of labour: by which means he will learn how to uſe the forceps and crotchets with more dexterity, be accuſtomed to the turning of children, and conſequently be more capable of acquitting himſelf in troubleſome caſes, that may happen to him when he comes to practiſe among women: he ſhould alſo embrace every occaſion of being preſent at real labours; and indeed of acquiring every qualification that may be neceſſary or convenient for him in the future exerciſe of his profeſſion. But, over and above the advantages of education, he ought to be endowed with a natural ſagacity, reſolution, and prudence; together with that humanity which adorns the owner, and never fails of being agreeable to the diſtreſſed patient: in conſequence of this virtue, he will aſſiſt the poor as well as the rich, behaving always with charity and compaſſion. He ought to act and ſpeak with the utmoſt delicacy of decorum, and never violate the truth repoſed to him, ſo as to harbour the leaſt immoral or indecent deſign; but demean himſelf in all reſpects ſuitable to the dignity of his profeſſion.

SECT. II. *Of the* Midwife.

A Midwife, though ſhe can hardly be ſuppoſed miſtreſs of all theſe qualifications, ought to be a decent ſenſible woman, of a middle age, able to bear fatigue: ſhe ought to be perfectly well inſtructed with regard to the bones of the pelvis, with all the contained parts, comprehending thoſe that are ſubſervient to generation: ſhe ought to be well ſkilled in the method of touching pregnant women, and know in what manner the womb ſtretches, together with the ſituation of all the abdominal viſcera: ſhe ought to be perfectly miſtreſs of the art of examination in time of labour, together with all the different kinds of labour, whether natural or preternatural, and the methods of delivering the placenta: ſhe ought to live in friendſhip with other women of the ſame profeſſion, contending with them in nothing but in knowledge, ſobriety, diligence, and patience; ſhe ought to avoid all reflections upon men-practitioners; and when ſhe finds herſelf at a loſs, candidly have recourſe to their aſſiſtance: on the other hand, this confidence ought to be encouraged by the man, who, when called, inſtead of openly condemning her method of practice, (even though it ſhould be erroneous), ought to make allowance for the weakneſs of the ſex, and rectify what is amiſs, without expoſing her miſtakes. This conduct will as effectually conduce to the welfare of the patient, and operate as a ſilent rebuke upon the conviction of the midwife; who, finding herſelf treated ſo tenderly, will be more apt to call for neceſſary aſſiſtance on future occaſions, and to conſider the accoucheur as a man of honour and a real friend. Theſe gentle methods will prevent that mutual calumny and abuſe which too often prevail among the male and female practitioners; and redound to the advantage of both: for no accoucheur is ſo perfect, but that he may err ſometimes; and on ſuch occaſions he muſt expect to meet with retaliation from thoſe midwives whom he may have roughly uſed.

EXPLANATION of the PLATES.

With an Abridgment of the Practice of Midwifery, *intended to illuſtrate the Syſtem and Caſes before recited.*

FIGURE I. repreſents, in a front view, the bones of a well formed Pelvis. A, the five *vertebræ* of the loins. B, the *os ſacrum*. C, the *os coccygis*. D, D, the *oſſa ilium*. E, E, the *oſſa iſchium*. F, the *oſſa pubis*. G, the *foramina magna*. H, H, the *acetabula*. I, I, I, I, I, I, the brim of the *pelvis*, or that circumference of its cavity which is deſcribed at the ſides by the inferior parts of the *oſſa ilium*, and at the back and fore parts by the ſuperior parts of the *oſſa pubis* and *ſacrum*.

In this Plate, beſides the general ſtructure and figure of the ſeveral bones, the dimenſions of the brim of the pelvis, and the diſtance between the under parts of the oſſa iſchium, are particularly to be attended to; from which it will appear, that the cavity of the brim is commonly wider from ſide to ſide, than from the back to the fore part, but that the ſides below are in the contrary proportion. The reader, however, ought not from this to conclude, that every pelvis is ſimilar in figure and dimenſions, ſince even well-formed ones differ in ſome degree from each other. In general, the brim of the pelvis meaſures about five inches and a quarter from ſide to ſide, four inches and a quarter from the back to the fore part; there being likewiſe the ſame diſtance between the inferior parts of the oſſa iſchium. All theſe meaſures, however, muſt be underſtood as taken from the ſkeleton; for in the ſubject, the cavity of the pelvis is conſiderably diminiſhed by its teguments and contents. Correſpondent alſo to this diminution, the uſual dimenſions of the head of the full-grown fœtus are but three inches and a half from ear to ear, and four inches and a quarter from the the fore to the hind head. *Vide* Fig. 19; 20, 21.

FIGURE II. exhibits a front-view of a diſtorted Pelvis. A, the five *vertebræ* of the loins. B, the *os ſacrum*. C, the *os coccygis*. D, D, the *oſſa ilium*. E, E, the *oſſa iſchium*. F, the *oſſa pubis*. G, G, the *foramina magna*. H, H, the *acetabula*.

From this Plate may appear the great danger incident to both mother and child when the pelvis is diſtorted in this manner; it being only two inches and an half at the brim from the poſterior to the anterior part, and the ſame diſtance between the inferior parts of each os iſchium. *Vide* Fig. 30, where the pelvis is one quarter of an inch narrower at the brim than this, but ſufficiently wide below. Various are the forms of diſtorted baſins, but the laſt mentioned is the moſt common. It is a great happineſs, however, in practice, that they are ſeldom ſo narrow, though there are inſtances where they have been much more ſo. The danger in all ſuch caſes muſt increaſe or diminiſh according to the degree of diſtortion of the pelvis and ſize of the child's head.

FIGURE III. gives a lateral and internal view of the Pelvis, the ſame being divided longitudinally. A, the three lower vertebræ of the loins. B, the *os ſacrum*. C, the *os coccygis*. D, the left *os ilium* E, the left *os iſchium*. F, the *os pubis* of the ſame ſide. G, the acute proceſs of the *os iſchium*. H, the *foramen magnum*. I, I, I, the brim of the *pelvis*.

This Plate ſhows the diſtance from the ſuperior part of the os ſacrum to the oſſa pubis, as well as from the laſt mentioned bones to the coccyx, which in each amounts to about four inches and a quarter. The depth likewiſe is ſhown of the poſterior, lateral and anterior parts of the pelvis, not in the line of the body, but in that of the pelvis from its brim downward, which is three times deeper on the poſterior than anterior part, and twice the depth of the laſt at the ſides.

From this view appears alſo the angle which is formed by the laſt vertebra of the loins and the ſuperior part of the os ſacrum, as likewiſe the concavity or hollow ſpace in the poſterior internal part of the pelvis, ariſing from the poſterior curvature of the laſt-mentioned bone and coccyx; finally, the diſtance from which to the poſterior parts of the oſſa iſchium is here expreſſed. *Vide* FIG. 19, 20, 21, 22.

FIGURE IV. gives a front view of the *Uterus in ſitu* ſuſpended in the *vagina*; the anterior parts of the *oſſa iſchium*, with the *oſſa pubis*, *pudenda*, *perinæum*, and *anus*, being removed, in order to ſhow the internal parts. A, the laſt *vertebra* of the *loins*. B,B, the *oſſa ilium*. C, C, the *acetabula*. D, D, the inferior and poſterior parts of the *oſſa iſchium*. *Vide* FIG. 32, where the *oſſa pubis* and the anterior parts of the *oſſa iſchium* are repreſented by dotted lines. E, the part covering the extremity of the *coccyx*. F, the inferior part of the *rectum*. G, G, the *vagina* cut open longitudinally, and ſtretched on each ſide of the *collum uteri*, to ſhow in what manner the *uterus* is ſuſpended in the ſame. H, H, part of the *veſica urinaria* ſtretched on each ſide of the *vagina* and inferior part of the *fundus uteri*. I, the *collum uteri*. K, the *fundus uteri*. L,L, the *tubæ Fallopianæ* and *fimbriæ*. M, M, the *ovaria*. N, N, the *ligamenta lata* and *rotunda*. O, O, the ſuperior part of the *rectum*.

FIGURE V. gives a view of the internal parts, as ſeen from the right *groin*, the *pelvis* being divided longitudinally. A, the loweſt *vertebra* of the *loins*. BC, the *os ſacrum* and *coccyx*, with the integuments. D, the left *os ilium*. E, the inferior part of the left *os iſchium*. F, the *os pubis* of the ſame ſide. G, the *foramen magnum*. H, the *acetabulum*. I, I, I, the inferior part of the *rectum* and *anus*. K, the *os externum* and *vagina*; the *os uteri* lying looſely in the ſame. L, the *veſica urinaria*. M, N, the *collum* and *fundus uteri*, with a view of the cavity of both. The attachment of the *vagina* round the outſide of the lips of the mouth of the *womb* is here likewiſe ſhown, as alſo the ſituation of the *uterus*, as it is preſſed downwards and backwards by the *inteſtines* and *urinary bladder* into the concave and inferior part of the *os ſacrum*. O, the *ligamenta lata* and *rotunda* of the left ſide. P, P, the *Fallopian* tube, with the *fimbriæ*. Q, the *ovarium* of the ſame ſide. R,R, the ſuperior part of the *rectum* and inferior part of the *colon*.

FIGURE VI. gives a front view of the *Uterus* in the beginning of the firſt month of pregnancy; the anterior part being removed, that the *Embryo* might appear through the *amnios*, the *chorion* being diſſected off. A, the *fundus uteri*. B, the *collum uteri*, with a view of the rugous canal that leads to the cavity of the *fundus*. C, the *os uteri*.

FIGURE VII. is the ſame view and ſection of the parts as in *Fig*. 6; it ſhows the *Uterus* as it appears in the ſecond or third month of pregnancy, its anterior part being here likewiſe removed. F, the *anus*. G, the *vagina*, with its *plicæ*. H, H, the poſterior and inferior part of the *urinary bladder* extended on each ſide, the anterior and ſuperior part being removed. I,I, the mouth and neck of the *womb*, as raiſed up when examining the ſame by the touch, with one of the fingers in the *vagina*. K, K, the *uterus* as ſtretched in the ſecond or third month, containing the *embryo*, with the *placenta* adhering to the *fundus*.

It appears from this and the former Figure, that at this time nothing can be known, with reſpect to pregnancy, from the touch in the vagina, as the reſiſtance of the uterus is ſo inconſiderable that it cannot prevent its being raiſed up before the finger. Women at this period miſcarry oftener than at any other. It is a great happineſs, however, in practice, that although they are frequently much weakened by large diſcharges, yet they rarely ſink under the ſame, but are ſooner or later relieved by labour coming on, which gradually ſtretches the neck and mouth of the womb, by the membranes being forced down with the waters.

From the ſtructure, of the parts, as repreſented in this and the former Figure, it may appear, that it is much ſafer to reſtrain the flooding, and ſupport the patient, waiting with patience the efforts of nature, than to endeavour to ſtretch the os uteri, and deliver either with the hand or inſtruments, which might endanger a laceration and inflammation of the parts.

FIGURE VIII. repreſents the *Uterus* in the fourth or fifth month of pregnancy, in the ſame view and ſection of the parts with the former figure, excepting that in this the anterior part of the *collum uteri* is not removed.

In the natural ſituation, the mouth and lips of the womb are covered with the vagina, and theſe parts are contiguous to each other; but here the vagina G, is a little ſtretched from the neck and lips of the former, in order to ſhow the parts more diſtinctly. I, the neck of the womb, which appears in this figure thicker, ſhorter, and ſofter, than in the former. K, the inferior part of the fundus uteri; the ſtretching of which can ſometimes be felt through the vagina, by puſhing up a finger on the anterior or lateral part of the ſame.

The uterus now is ſo largely ſtretched as to fill all the upper part of the pelvis, and begins alſo to increaſe ſo much as to reſt on the brim, and to be ſupported by the ſame, the fundus at the ſame time being raiſed conſiderably above the pubes. The ſize or bulk of the fœtus is finally here to be obſerved, with the placenta adhering to the poſterior part of the uterus.

FIGURE IX. in the ſame view and ſection of the parts as in *Fig*. 8. in order to ſhow its contents, and the internal parts as they appear in the ſixth or ſeventh month of pregnancy. A, the *uterus* ſtretched up to the *umbilical* region. B, B, the ſuperior part of the *oſſa ilium*. C, C, the *acetabula*. D, D, the remaining poſterior parts of the *oſſa iſchium*. E, the *anus*. F, the *vagina*. G, the bladder of *urine*. H, the neck of the *womb* ſhorter than in *Fig*. 8, and raiſed higher by the ſtretching of the *uterus* above the brim of the *pelvis*. I, the veſſels of the *uterus* larger than in the unimpregnated ſtate. K, K, the *placenta* adhering to the inferior and poſterior part of the *uterus*. L, L, the *membranes* that ſurround the *fœtus*, the head of which is here repreſented (as well as of thoſe in *Fig*. 8.) ſituated downwards at the inferior part of the *uterus*, which is the uſual ſituation of the *fœtus* when at reſt, and ſurrounded with a great quantity of waters, as the head is heavier than any other part. With reſpect to the ſituation of the body of the *fœtus*, though the fore parts are often turned towards the ſides and poſterior parts of the *uterus*, they are here repreſented at the anterior part or forwards, in order to ſhow them in a more diſtinct and pictureſque manner.

From this *Figure* may appear the difficulty of ſtretching the os uteri in flooding caſes, even at this period, from the length and thickneſs of the neck of the womb, eſpecially in a firſt pregnancy: much the ſame method, however, is to be followed here as was directed in *Fig*. 8. till labour comes on to dilate the os uteri. If the flooding is then conſiderable, the membranes ſhould be broken, that the uterus may contract, and thereby leſſen the diſcharge. The labour likewiſe, if it is neceſſary, may be aſſiſted by dilating the os uteri in time of the pains; which alſo, if wanting, may be provoked by the ſame method, when the patient is in danger. If this danger is imminent, and the woman ſeems ready to expire, the uterus, as appears from this *Figure*, is at this time ſufficiently ſtretched to receive the operator's hand to extract the fœtus, if the os internum can be ſafely dilated.

Laſtly, It may be obſerved that women are in greater danger in this period and afterwards, than in the former months.

FIGURE X. repreſents the abdomen of a woman opened in the ſixth or ſeventh month of pregnancy. A,A,A,A, the parietes of the *abdomen* opened, and turned back to ſhow. B, the *uterus*. C, C, C, the *inteſtines* raiſed upwards. D, the *labia pudendi*, which are ſometimes affected in pregnancy with œdematous ſwellings, occaſioned by the preſſure of the uterus upon the returning veins and lymphatics. If the labia are ſo tumefied as to obſtruct the patient's walking, the complaint is removed by puncturing the parts affected. By which means the ſerous fluid is diſcharged for the preſent, but commonly recurs; and the ſame operation muſt be repeated ſeveral times, perhaps, before delivery; after which, however, the tumefaction entirely ſubſides. From this figure it appears, that the ſtretching of the uterus can eaſily be felt at this period in lean ſubjects, through the parietes of the abdomen, eſpecially if the inteſtines do not lie before it. In general indeed, as the uterus ſtretches, it riſes higher; by which means the inteſtines are likewiſe raiſed higher, and are alſo preſſed to each ſide. Hence the nearer the woman is to her full time, the ſtretching is the more eaſily felt.

FIGURE XI. exhibits a front internal view of the *Gravid Uterus* in the beginning of labour; the anterior parts being removed, as in *Fig*. 15, but in this the *membranes* not being broken, form a large bag containing the Waters and *Fœtus*. A, the ſubſtance of the *uterus*. B, B, C, C, D, D, the bones of the *pelvis*. E, the *coccyx*. F, the inferior part of the *rectum*. G, G, G, G, the *vagina*. H, H, the mouth of the *womb* largely ſtretched in time of a pain; with I, the *membranes* and waters. This circumſtance makes it uſually certain that labour is begun; whereas, from the degree of dilatation repreſented in *Fig*. 15, there is little to be aſcertained unleſs the pains are regular and ſtrong, the *os uteri* being often found more open ſeveral days, and even weeks, before labour commences. K, the *chorion*. L, the ſame diſſected off at the inferior part of the *uterus*, in order to ſhow the head of the *fœtus* through the *amnios*. *N. B.* This hint is taken from one of Dr. Albinus's Tables of the *gravid uterus*. M, the *placenta*; the external convex ſurface of which, divided into a number of *lobes*, is here repreſented, its concave internal parts being covered by the

chorion

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Anatomical Tables, illustrative of the Theory and Practice of Midwifery. See the System.

Fig. 12.

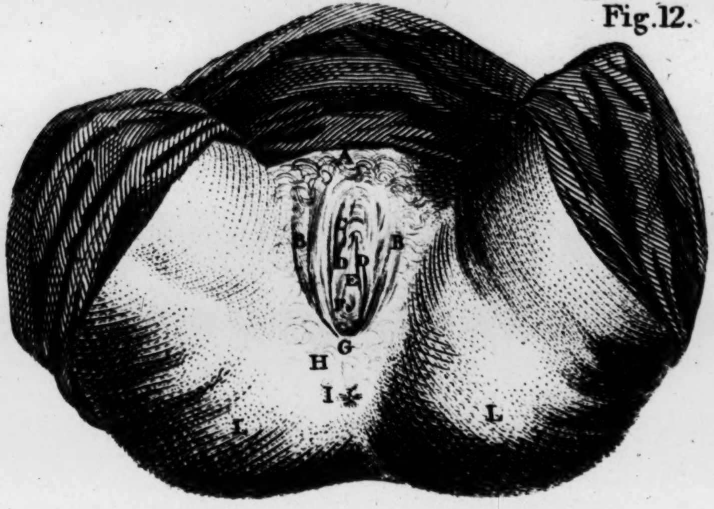


Fig. 13.

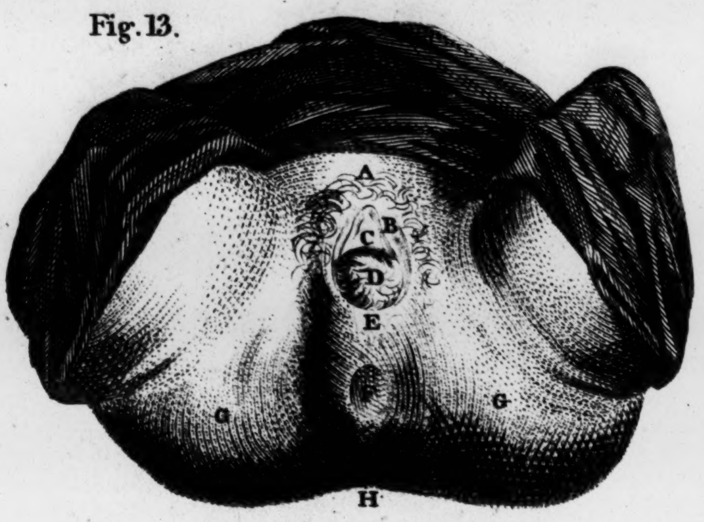


Fig. 10.

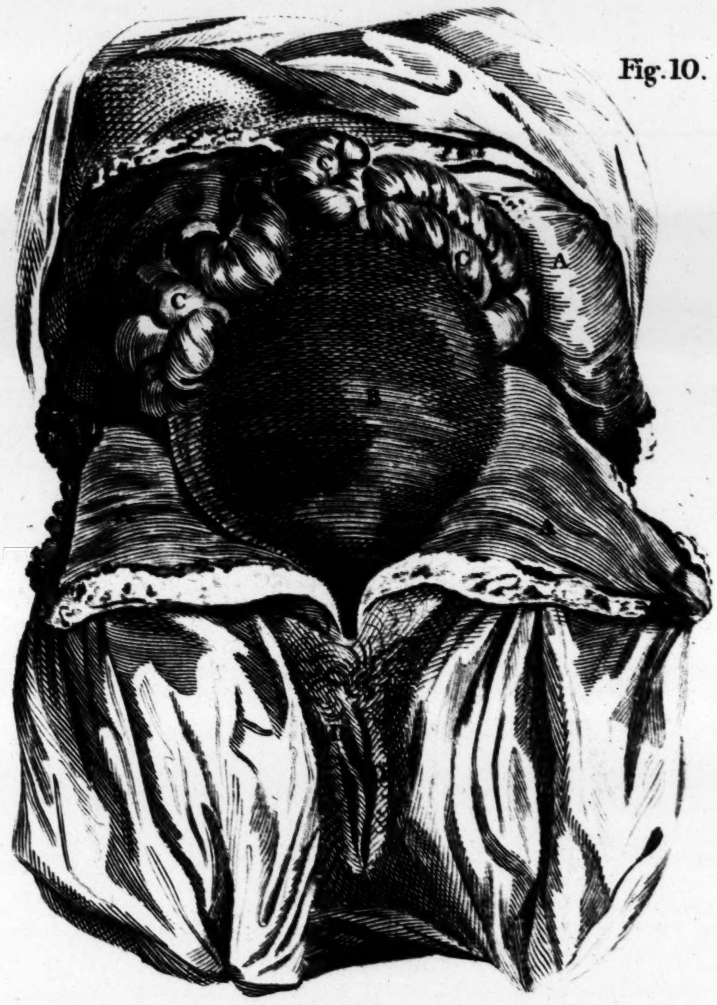


Fig. 11.

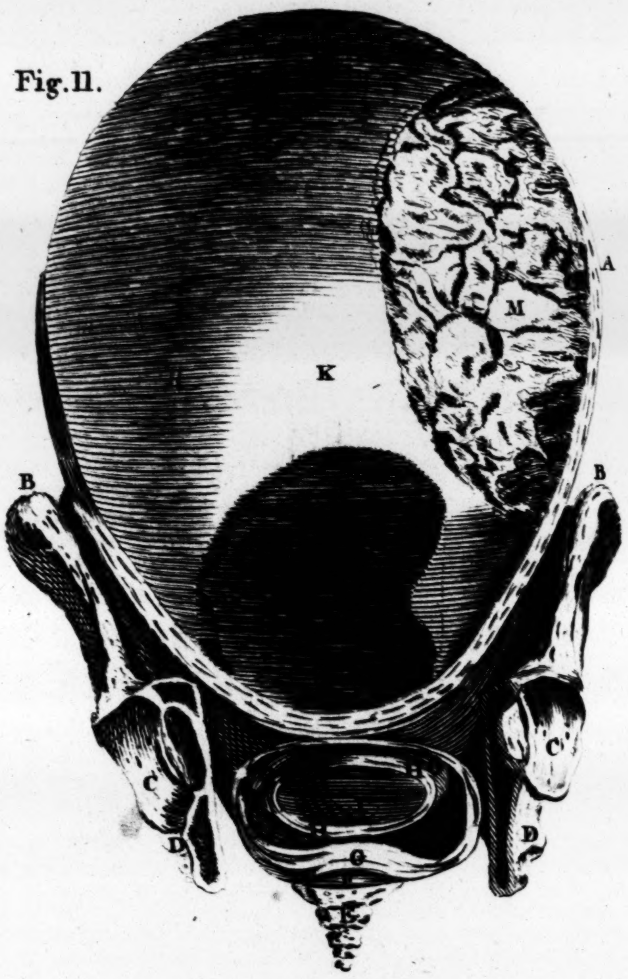


Fig. 14.

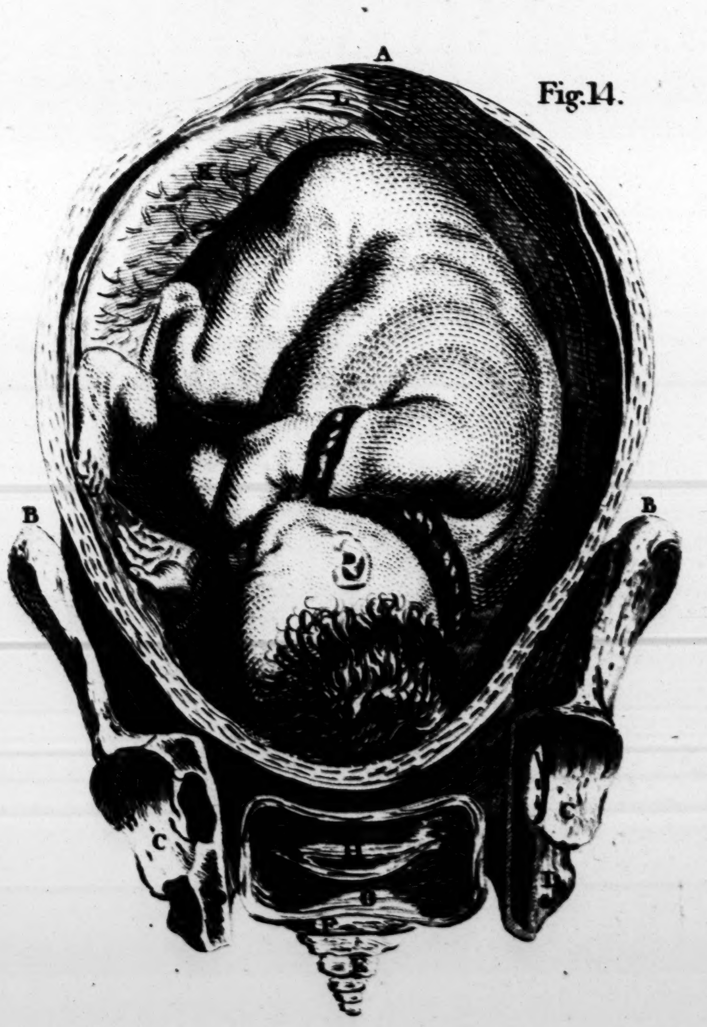
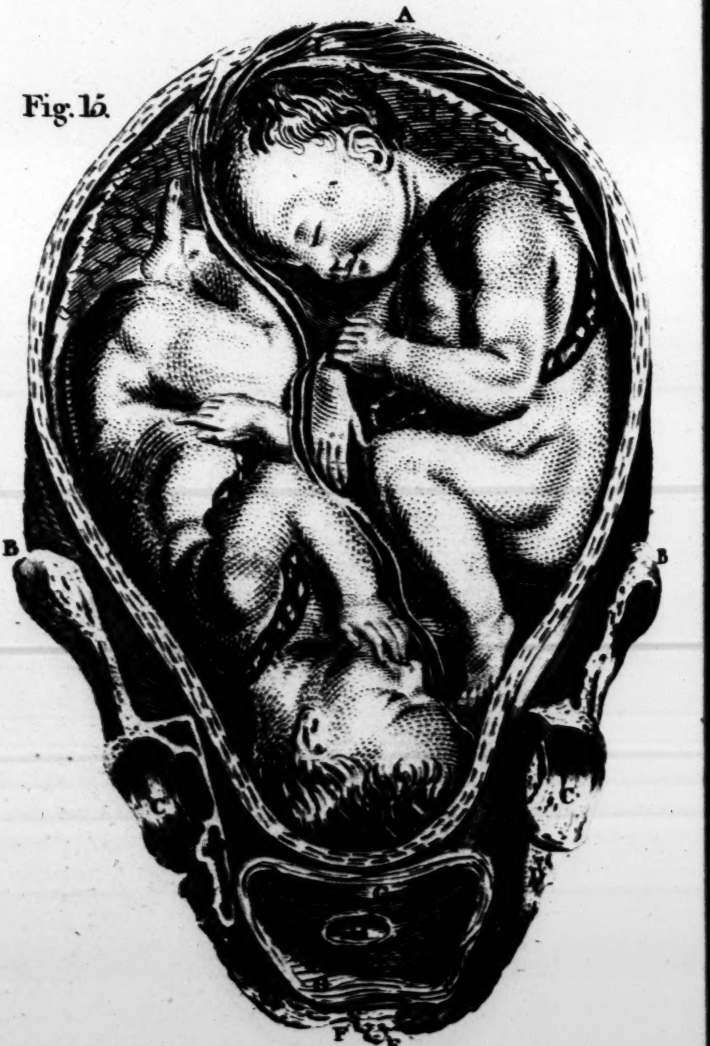


Fig. 15.



Reduced from Smellie's Tables, by Frederick Birnie, Anatomical Draughtsman, to the late Dr. William Hunter, & Engraved by William Taylor.

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chorion. The placenta has been found adhering to all the different parts of the internal ſurface of the uterus, and ſometimes even over inſide of the os uteri; this laſt manner of adheſion, however, always occaſions floodings as ſoon as the ſame begins to dilate. *Fig.* 8, 9, 14, 15, ſhow the internal ſurface of the placenta towards the fœtus, with the veſſels compoſing its ſubſtance proceeding from the funis, which is inſerted in different placentas, into all the different parts of the ſame, as well as in the middle. The thirty-third and thirty-ſixth Figures ſhow the inſertion of the funis into the abdomen of the fœtus.

With reſpect to the expulſion of the placenta when the membranes break, the uterus contracts as the waters are evacuated till it comes in contact with the body of the fœtus: the ſame being delivered, the uterus grows much thicker, and contracts cloſely to the placenta and membranes, by which means they are gradually ſeparated, and forced into the vagina. This ſhows that we ought to follow the method which nature teaches, waiting with patience, and allowing to ſeparate in a ſlow manner; which is much ſafer practice, eſpecially when the patient is weak; as the diſcharge is neither ſo great or ſudden as when the placenta is hurried down in the too common method. But then we muſt not run into the other extreme, but aſſiſt when nature is not ſufficient to expel the ſame.

FIGURE XII. ſhows the External Female Parts of Generation. A, the lower part of the *abdomen*. B, B, the *labia pudendi* ſeparated. C, the *clitoris* and *præputium*. D, D, the *nymphæ*. E, the *foſſa magna*, or *os externum*. F, the *meatus urinarius*. G, the *frænum labiorum*. H, the *perinæum*. I, the *anus*. K, the part that covers the extremity of the *coccyx*. L, L, the parts that cover the tuberoſities of the *oſſa iſchium*.

As it is of great conſequence to every practitioner in midwifery to know exactly the ſituation of the parts concerned in parturition, and which have not been accurately deſcribed by former anatomiſts with a view to this particular branch, we have given this draught from a ſubject in order to demonſtrate theſe parts in the ordinary courſe of the ſyſtem. From a view, then, of the ſituation of the parts, it appears, that the os externum is not placed in the middle of the inferior part of the pelvis, but at the anterior and inferior part of the pubes; and that the labia cover likewiſe the anterior part of theſe bones.

Secondly, It may be obſerved, that as the frænum labiorum, which is nearly adjoining to the inferior part of the oſſa pubis, is only about an inch from the anus, between which and the coccyx there is about three inches diſtance; it follows, that the anus is nearer to the firſt-mentioned bones than to the latter.

Thirdly, The view of this and of *Fig.* 4, and 5, will furniſh proper hints with reſpect to the method of touching or examining the os uteri, without hurting or inflaming the parts; as it appears that the os externum is placed forwards towards the pubes, and the os uteri backwards towards the rectum and coccyx. By this wiſe mechaniſm of nature many inconveniences are often prevented, which muſt happen if theſe parts were oppoſite to each other, and ſituated in the middle of the inferior part of the pelvis; particularly a prolapſus of the vagina and uterus, either in the unimpregnated ſtate or in any of the firſt four months of pregnancy; as alſo too ſudden deliveries in any of the laſt months.

Fourthly, From a view of the ſituation of the parts, it will appear, that in labour, when the os uteri is ſufficiently opened to allow a paſſage for the head of the fœtus, the ſame is protruded to the lower part of the vagina, by which the external parts are puſhed out in form of a large tumour, as in *Fig.* 13.

Laſtly, It may be obſerved, that when it is neceſſary to dilate the os externum, the principal force ought to be applied downwards and towards the rectum, to prevent the urethra and neck of the bladder from being hurt or inflamed.

FIGURE XIII. is intended principally to ſhow in what manner the perinæum and external parts are ſtretched by the head of the fœtus in a firſt pregnancy, towards the end of labour. A, the *abdomen*. B, the *labia pudendi*. C, the *clitoris* and its *præputium*. D, the hairy ſcalp of the *fœtus* ſwelled at the *vertex*, in a laborious caſe, and protruded to the *os externum*. E, F, the *perinæum* and *anus* puſhed out by the head of the fœtus in form of a large tumour. G, G, the parts that cover the *tuberoſities* of the *oſſa iſchium*. H, the part that covers the *os coccygis*.

The perinæum in this *Figure* is ſtretched two inches, or double its length in the natural ſtate; but when the os externum is ſo much dilated by the head of the fœtus as to allow the delivery of the ſame, the perinæum is generally ſtretched to the length of three, and ſometimes four, inches. The anus is likewiſe lengthened an inch, the parts alſo between it and the coccyx being much diſtended. All this ought to caution the young practitioner never to precipitate the delivery at this time, but to wait and allow the parts to dilate in a ſlow manner; as, from the violence of the labour-pains, the ſudden delivery of the head of the fœtus might endanger the laceration of the parts. The palm of the operator's hand ought therefore to be preſſed againſt the perinæum, that the head may be prevented from paſſing till the os externum is ſufficiently dilated, to allow its delivery, without tearing the frænum and parts betwixt that and the anus, which are at this time very thin.

FIGURE XIV. is the ſame view and ſection of the parts with the former, and repreſents the *Uterus* in the eighth or ninth month of pregnancy. A, the *uterus* as ſtretched to near its full extent, with the waters, and containing the *fœtus* entangled in the *funis*, the head preſenting at the upper part of the *pelvis*. B, B, the ſuperior part of the *oſſa ilium*. C, C, the *acetabula*. D, D, the remaining poſterior parts of the *oſſa iſchium*. E, the *coccyx*. F, the inferior part of the *rectum*. G, G, G, the *vagina* ſtretched on each ſide. H, the *os uteri*, the lips of which appear larger and ſofter than in the foregoing Figure, the neck of the *womb* being likewiſe ſtretched to its full extent, or entirely obliterated. I, I, part of the *viſica urinaria*. K, K, the *placenta* at the ſuperior and poſterior part of the *uterus*. L, L, the *membranes*. M, the *funis umbilicalis*.

This and the foregoing Figure ſhow in what manner the uterus ſtretches, and how its neck grows ſhorter, in the different periods of pregnancy; as alſo the magnitude of the fœtus. Notwithſtanding it has been handed down as an invariable truth, from the earlieſt accounts of the art to the preſent times, when the head of the fœtus preſented, the face was turned to the poſterior part of the pelvis; yet from Mr. Oald's obſervation, as well as from ſome late diſſections of the gravid uterus, and what we have obſerved in practice, we are led to believe that the head preſents for the moſt part as is here delineated, with one ear to the pubes, and the other to the os ſacrum; though ſometimes this may vary, according to the form of the head, as well as that of the pelvis. Conſult Dr. Hunter's elegant plates of the gravid uterus.

FIGURE XV. gives a front view of twins *in utero* in the beginning of labour; the anterior parts being removed, as in the preceeding Figures. A, the *uterus* as ſtretched with the *membranes* and waters. B, B, the ſuperior parts of the *oſſa ilium*. C, C, the *acetabula*. D, D, the *oſſa iſchium*. E, the *coccyx*. F, the lower part of the *rectum*. G, G, the *vagina*. H, the *os internum* ſtretched open about a finger's breadth, with the *membranes* and waters in time of labour-pains. I, I, the inferior part of the *uterus* ſtretched with the waters which are below the head of the child that preſents. K, K, the two *placentas* adhering to the poſterior part of the *uterus*, the two *fœtuſes* lying before them; one with its head in a proper poſition, at the inferior part of the *uterus*; and the other ſituated preternaturally, with the head to the *fundus*: the bodies of each are here entangled in their proper *funis*, which frequently happens in the natural as well as preternatural poſitions. L, L, L, the *membranes* belonging to each *placenta*.

This repreſentation of twins, according to the order obſerved in the ſyſtem, ought to have been placed among the laſt Figures, but we have placed it here in order to ſhow the os uteri grown much thinner than in the former figure, a little open and ſtretched by the waters and membranes which are puſhed down before the head of one of the fœtuſes in time of a labour-pain. With reſpect to the poſition of twins, it is often different in different caſes; but was thus in a late diſſection of a gravid uterus by Dr. Mackenzie.

FIGURE XVI. ſhows (in a lateral view and longitudinal diviſion of the parts) the *Gravid Uterus*, when labour is ſomewhat advanced. A, the loweſt *vertebra* of the back. B, the *ſcrobiculus cordis*; the diſtance from which to the laſt-mentioned *vertebra* is here ſhown by dotted lines; as alſo part of the region below the *diaphragm*. C, C, the uſual thickneſs and figure of the *uterus* when extended with the waters at the latter end of pregnancy. D, the ſame contracted and grown thicker after the waters are evacuated. E, E, the figure of the *uterus* when *pendulous*. In this caſe, if the *membranes* break when the patient is in an erect poſition, the head of the *fœtus* runs a riſk of ſliding over and above the *oſſa pubis*, whence the ſhoulders will be puſhed into the *pelvis*. F, F, the figure of the *uterus* when ſtretched higher than uſual, which generally occaſions vomitings and difficulty of breathing. Conſult on this ſubject Mr. Leveret *ſur le Mechaniſme de differentes Groſſeſſes*. G, the *os pubis* of the left ſide. H, H, the *os internum*. I, the *vagina*. K, the left *nympha*. L, the *labium pudendi* of the ſame ſide. M, the remaining portion of the bladder. N, the *anus*. O, P, the left hip and thigh.

In this period of labour the os uteri being more and more ſtretched by the membranes puſhing down and beginning to extend the vagina, a great quantity of water is forced down at the ſame time, and (if the membranes break) is diſcharged; whence the uterus contracts itſelf nearer the body of the fœtus, which is here repreſented in a natural poſition, with the vertex reſting at the ſuperior part of the oſſa pubis, and the forehead towards the right os ilium. As ſoon as the uterus is in contact with the body of the fœtus, the head of the ſame is forced backward towards the os ſacrum from the line of the abdomen B, G, into that of the pelvis, viz. from the uppermoſt F, to near the end of the coccyx, and is gradually puſhed lower, as in the following Figure. If the membranes do not break immediately upon their being puſhed into the vagina, they ſhould be allowed to protrude ſtill further in order to dilate the os externum.

FIGURE XVII. in the ſame view and ſection of the parts as in *Fig.* 8. ſhews the natural poſition of the head of the fœtus when ſunk down into the middle of the pelvis after the os internum is fully opened, a large quantity of the waters being protruded with the membranes through the os externum, but prevented from being all diſcharged, from the head's filling up the vagina. A, the *uterus* a little contracted, and thicker, from ſome of the waters being ſunk down before the child, or diſcharged. B,B, the ſuperior parts of the *oſſa ilium*. C, the inferior part of the *rectum*. D,D, the *vagina* largely ſtretched with the head of the fœtus. E,E, the *os internum* fully opened. F, a portion of the *placenta*. G,G, the *membranes*. H,H, the *ligamenta lata*. I,I, the *ligamenta rotunda*. Both theſe laſt ſtretched upwards with the *uterus*.

The vertex of the fœtus being now down at the inferior part of the right os iſchium, and the wide part of the head at the narrow and inferior part of the pelvis, the forehead by the force of the pains is gradually moved backwards; and as it advances lower, the vertex and occiput turn out below the pubes, as in the next Figure. Hence may be learned of what conſequence it is to know, that it is wider from ſide to ſide at the brim of the pelvis, than from the back to the fore-part; and that it is wider from the fore to the hind head of the child, than from ear to ear.

FIGURE XVIII. in a ſimilar view and ſection of the parts with *Fig*. 16. ſhows the forehead of the fœtus turned (in its progreſſion downwards, from its poſition in the former Figure) backwards to the os ſacrum, and the occiput below the pubes; by which means the narrow part of the head is to the narrow part of the pelvis; that is, between the inferior parts of the oſſa iſchium. Hence it may be obſerved, that though the diſtance between the inferior parts of the laſt mentioned bones is much the ſame as between the coccyx and pubes; yet as the cavity of the pelvis is much ſhallower at the anterior than lateral part, the occiput of the fœtus, when come down to the inferior part of either os iſchium, turns out below the pubes: this anſwers the ſame end as if the pelvis itſelf had been wider from the poſterior part than from ſide to ſide; the head likewiſe enlarging the cavity by forcing back the coccyx, and puſhing out the external parts in form of a large tumour, as is already deſcribed in *Fig*. 13. A, the *uterus* contracted cloſely to the *fœtus* after the waters are evacuated. B, C, D, the *vertebræ* of the loins, *os ſacrum*, and *coccyx*. E, the *anus*. F, the left hip. G, the *perinæum*. H, the *os externum* beginning to dilate. I, the *os pubis* of the left ſide. K, the remaining portion of the bladder. L, the poſterior part of the *os uteri*.

FIGURE XIX. and the three following, ſhow in what manner the head of the fœtus is helped along with the forceps as artificial hands, when it is neceſſary to aſſiſt with the ſame for the ſafety of either mother or child. In this Figure the hand is repreſented as forced down into the pelvis by the labour-pains, from its former poſition in *Fig*. 16. A, A, B, C, the *vertebræ* of the loins, *os ſacrum* and *coccyx*. D, the *os pubis* of the left ſide. E, the remaining part of the bladder. F, F, the *inteſtinum rectum*. G, G, G, the *uterus*. H, the *mons veneris*. I, the *clitoris*, with the left *nympha*. X, the *corpus avernoſum clitoridis*. V, the *meatus urinarius*. K, the left *labium puaendi*. L, the *anus*. N, the *perinæum*. Q, P, the left hip and thigh. R, the ſkin and muſcular part of the loins.

The patient in this caſe may be, as in this Figure, on her ſide, with her breech a little over the ſide or foot of the bed, her knees being likewiſe pulled up to her belly, and a pillow placed between them, care being taken at the ſame time that the parts are by a proper covering defended from the external air. When the poſition of the head is known, the operator muſt withdraw his hand, and wait to ſee if the ſtretching of the parts will renew or increaſe the labour-pains, and allow more ſpace for the advance of the head in the pelvis. If this, however, proves of no effect, the fingers are again to be introduced, and one of the blades of the forceps (lubricated with lard) is then to be applied along the inſide of the hand or fingers and left ear of the child, as repreſented in the Figure. But if the pelvis is diſtorted, and projects forward at the ſuperior part of the os ſacrum, and the forehead therefore cannot be moved a little backwards, in order to turn the ear from that part of the pelvis which prevents the end of the forceps to paſs the ſame: in that caſe, the blade muſt be introduced along the poſterior part of the ear at the ſide of the diſtorted bone. The hand that was introduced is then to be withdrawn, and the handle of the introduced blade held with it as far back as the perinæum will allow, whilſt the fingers of the other hand are introduced to the os uteri, at the pubes or right groin, and the other blade placed exactly oppoſite to the former. This done, the handles being taken hold of and joined together, the head is to be pulled lower and lower every pain, till the vertex, as in this Figure, is brought down to the inferior part of the left iſchium or below the ſame. The wide part of the head being now advanced to the narrow part of the pelvis betwixt the tuberoſities of the oſſa iſchium, it is to be turned from the left iſchium out below the pubes and the forehead backwards to the concave part of the os ſacrum and coccyx, as in *Fig*. 20. and afterwards the head brought along and delivered as in *Fig*. 21. and 22. But if it is found that the delivery will require a conſiderable degree of force from the head's being large or the pelvis narrow, the handles of the forceps are to be tied together with a fillet, as repreſented in the Figure, to prevent their poſition being changed, whilſt the woman is turned on her back, as in *Fig*. 27, which is then more convenient for delivering the head than when lying on the ſide.

This Figure ſhows that the handles of the forceps ought to be held as far back as the os externum will allow, that the blades may be in an imaginary line between that and the middle ſpace between the umbilicus and ſcrobiculus cordis. When the forceps are applied along the ears and ſides of the head, they are nearer to one another, have a better hold, and mark leſs than when over the occipital and frontal bones.

FIGURE XX. in the ſame view with the former, repreſents the head of the *Fœtus* brought lower with the forceps, and turned from the poſition in the former Figure, in imitation of the natural progreſſion by the labour-pains, which may likewiſe be ſuppoſed to have made this turn before it was neceſſary to aſſiſt with the Forceps. If the head is ſqueezed into a longiſh form, as in *Fig*. 24. and has been detained many hours in this poſition, the pains not being ſufficient to complete the delivery, the aſſiſtance of the forceps muſt be taken to ſave the child, though the woman may be in no danger. But if the head is high up in the pelvis as in the former Figure, the forceps ought not to be uſed except in the moſt urgent neceſſity.

This Figure alſo ſhows that the handles of the forceps are ſtill to be kept back to the perinæum, and when in this poſition they are in a line with the upper part of the ſacrum, and if held more backwards, when the head is a little higher, they would be in a line with the ſcrobiculus cordis. If the forceps are applied when the head is in this poſition, they are more eaſily introduced when the patient is in a ſupine poſition, as in *Fig*. 27! Neither is it neceſſary to tie the handles, which is only done to prevent their alteration when turning the woman from her ſide to her back. In ſeveral caſes a longer ſort of forceps that are curved upwards are of great uſe to help along the head when the body is delivered firſt, as in *Fig*. 38. the ſame are repreſented here by dotted lines. They may be uſed in laborious caſes as well as the others, but are not managed with the ſame eaſe.

Moſt of the parts of this Figure being marked with the ſame letters as the former, the deſcriptions there given will anſwer in this, except the following. L, M, the *anus*. M, N, the *perinæum*. O, the common *integuments* of the *abdomen*. R, the ſhort forceps. S, the long curved forceps. The firſt of theſe is eleven inches long, and the laſt twelve inches and a half, we have after ſeveral alterations found it ſufficient; but this need not confine others who may chooſe to alter them from this ſtandard. *Vide* Fig. 1. Plate of Inſtruments.

FIGURE XXI. in the ſame view and ſection of the parts, ſhows the head of the *Fœtus* in the ſame poſition, but brought lower down with the forceps than in the former *Figure*; for in this the *Os Fxternum* is more open, the *Occiput* comes lower down from below the *Pubes*, and the forehead paſt the *Coccyx*, by which both the *Anus* and *Perinæum* are ſtretched out in form of a large tumour, as in *Fig*. 13.

When the head is ſo far advanced, the operator ought to extract with great caution, leſt the parts ſhould be torn. If the labour-pains are ſufficient, the forehead may be kept down and helped along in a ſlow manner by preſſing againſt it with the fingers on the external parts below the coccyx: at the ſame time the forceps being taken off, the head may be allowed to ſtretch the os externum more and more in a gradual manner, from the force of the labour-pains as well as aſſiſtance of the fingers. But if the former are weak and inſufficient, the aſſiſtance of the forceps muſt be continued. (*Vide* the deſcription of the parts in *Fig*. 19.) S, T, in this repreſentation, the left ſide of the os uteri. The dotted lines demonſtrate the ſituation of the bones of the pelvis on the right ſide, and may ſerve as an example for all the views of the ſame. a, b, c, h, the outlines of the *os ilium*. D, e, f, the ſame of the *pubis* and *iſchium*. i, i, k, the *acetabulum*. And m, n, the *foramen magnum*.

FIGURE XXII. in the ſame view and ſection of the pelvis, is intended by outlines to ſhow, that as the external parts are ſtretched, and the os externum is dilated, the occiput of the fœtus riſes up with a ſemicircular turn from out below the pubes, the under part of which bones are as an axis or fulcrum, on which the back part of the neck turns, whilſt at the ſame time the forehead and face, in their turn upwards, diſtend largely the parts between the coccyx and ox externum. This is the method obſerved by nature in ſtretching theſe parts in labour; and as nature is always to be imitated, the ſame method ought to be followed when it is neceſſary to help along the head with the forceps. *Vide* the three former Figures for the deſcriptions and references.

FIGURE XXIII. in the ſame ſection of the parts, but with a view of the right ſide, ſhows the head of the *Fœtus* in the contrary poſition to the three laſt Figures, the *Vertex* being here in the concavity of the *Sacrum*, and the forehead turned to the *Pubes*, A, B, the *vertebræ* of the loins, *os ſacrum*, and *coccyx*. C, the *os pubis* of the right ſide. D, the *anus*. E, the *os externum* not yet begun to ſtretch. F, the *nympha*. G, the *labium pudendi* of the right ſide. H, the hip and thigh. I, I, the *uterus* contracted, the waters being all diſcharged.

When the head is ſmall, and the pelvis large, the parietal bones and the forehead will in this caſe, as they are forced downwards by the labour pains, gradually dilate the os externum, and ſtretch the parts between that and the coccyx in form of a large tumour, as in *Fig*. 13, till the face comes down below the pubes, when the head will be ſafely delivered. But if the ſame be large, and the pelvis narrow, the difficulty will be greater, and the child in danger; as in the following Figure.

FIGURE XXIV. ſhews the head of the *Fœtus* in the ſame poſition as in the former Figures; but being much larger, it is by

ſtrong

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Anatomical Tables, illustrative of the Theory and Practice of Midwifery. See the System.

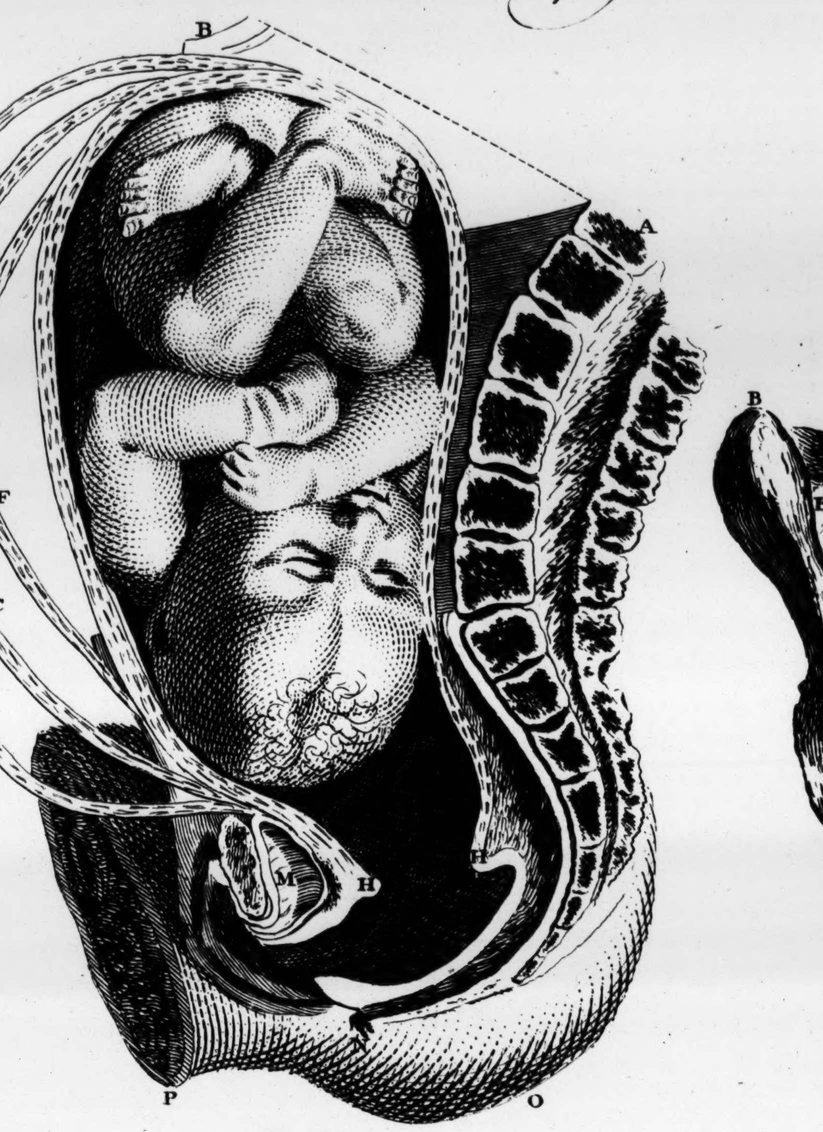
B
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Fig. 16.

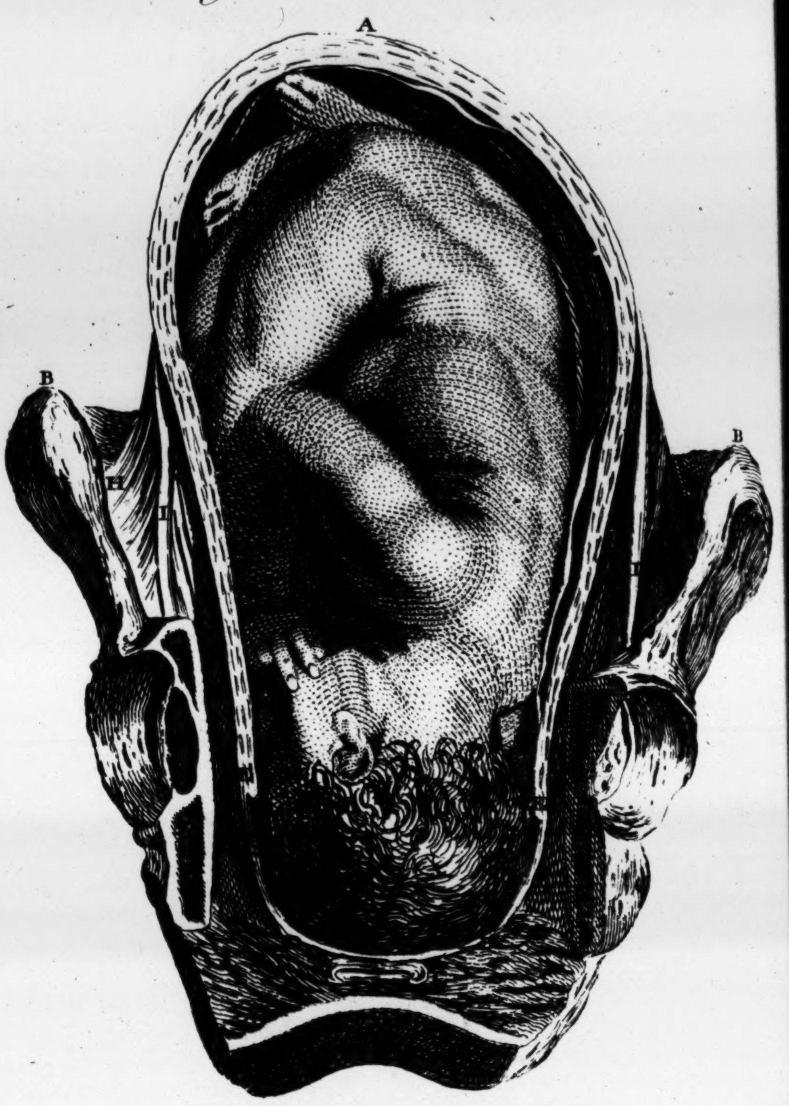

Fig. 17.

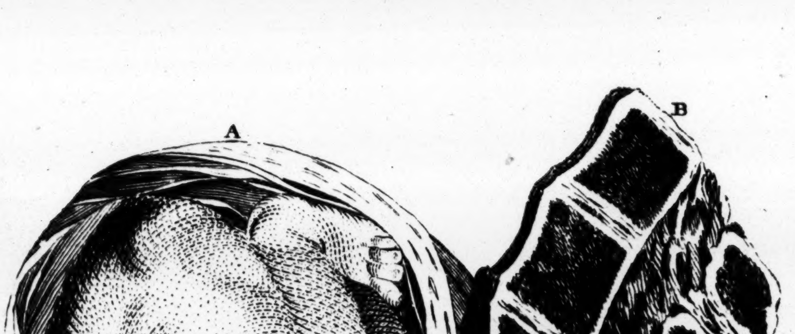

Fig. 18.

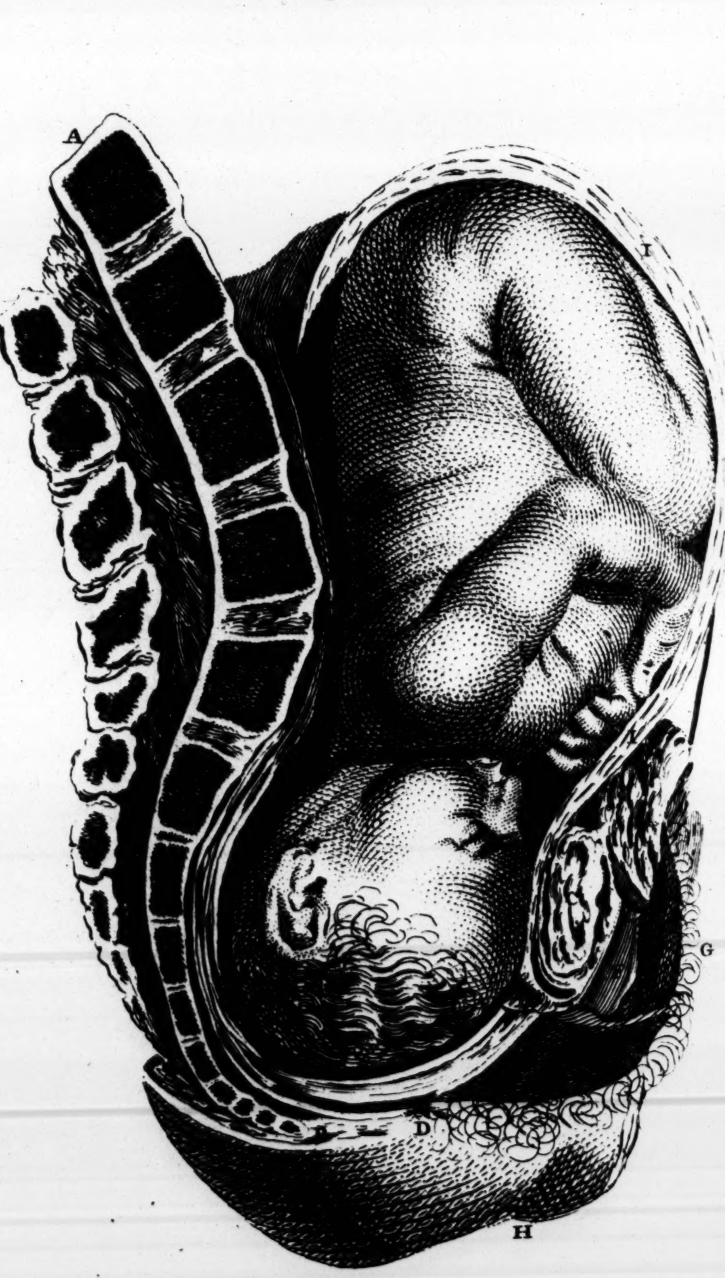

Fig. 23.

Reduced from Smellies Tables, by Frederick Birnie, Anatomical Draughtsman to the late Dr. William Hunter, & Engraved by William Taylor.

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ſtrong labour-pains ſqueezed into a longiſh form with a tumour on the *Vertex*, from the long compreſſion of the head in the *Pelvis*. If the child cannot be delivered with the labour-pains, or turned and brought footling, the forceps are to be applied on the head, as deſcribed in this figure, and brought along as it preſents: but if that cannot be done without running the riſk of tearing the *Perinæum*, and even the *Vagina* and *Rectum* of the woman, the Forehead muſt be turned backwards to the *Sacrum*. To do this more effectually, the operator muſt graſp firmly with both hands the handles of the forceps, and at the ſame time puſhing upwards raiſe the head as high as poſſible, in order to turn the forehead to one ſide, by which it is brought into the natural poſition; this done, the head may be brought down and delivered as in *Fig*. 19.

Vide the former Figure for the deſcription of the parts, except K, the tumour on the *vertex*. The ſame compreſſion and elongation of the head as well as the tumour on the *vertex*, may be ſuppoſed to happen in a greater or leſs degree in the *Figures* 19, 20, 21, 22, as well as in this, where the difficulty proceeds from the head being large or the *pelvis* narrow. *Vide* FIG. 30, 31.

L, the forceps. Sometimes the forehead may be moved to the natural poſition by the aſſiſtance of the fingers or only one blade of the forceps. The forceps may either be the ſtraight kind, or ſuch as are curved to one ſide, when it is neceſſary to uſe one or both blades. M, the *veſica urinaria* much diſtended with a large quantity of *urine* from the long preſſure of the head againſt the *urethra*; which ſhows that the urine ought to be drawn off with a catheter, in ſuch extraordinary caſes, before you apply the forceps, or in preternatural caſes where the child is brought footling. N, the under-part of the *uterus*. O, O, the *os uteri*.

FIGURE XXV. ſhows, in a front view of the parts, the Forehead of the *Fœtus* preſenting at the Brim of the *Pelvis*, the Face being turned to one ſide, the *Fontanel* to the other, and the Feet and Breech ſtretched towards the *Fundus Uteri*. A, A, the ſuperior part of the *oſſa ilium*. B, the *anus*. C, the *perinæum*. D, the *os externum*; the thickneſs of the poſterior part before it is ſtretched with the head of the child. E, E, E, the *vagina*. F, the *os uteri* not yet fully dilated. G, G, G, the *uterus*. H, the *membrana adipoſa*.

If the face is not forced down, the head will ſometimes come along in this manner; in which caſe the vertex will be flattened, and the forehead raiſed in a conical form; and when the head comes down to the lower part of the pelvis, the face or occiput will be turned from the ſide, and come out below the pubes. But if the head is large, and cannot be delivered by the pains, or if the wrong poſition cannot be altered, the child muſt, if poſſible, be brought footling, or delivered with the forceps.

FIGURE XXVI. ſhows, in a lateral view, the face of the child preſenting, and forced down into the lower part of the *Pelvis*, the chin being below the *Pubes*, and the *Vertex* in the concavity of the *Os Sacrum*: the waters likewiſe being all diſcharged, the *Uterus* appears cloſely joined to the body of the child, round the neck of which is one circumvolution of the *Funis*. A, B, the *vertebræ* of the loins, *os ſacrum*, and *coccyx*. C, the *os pubis* of the left ſide. D, the inferior part of the *rectum*. E, the *perinæum*. F, the left *labium pudendi*. G, G, G, the *uterus*.

When the pelvis is large, the head, if ſmall, will come along in this poſition, and the child be ſaved: for as the head advances lower, the face and forehead will ſtretch the parts between the frænum labiorum and coccyx in form of a large tumour.

If the pelvis, however, is narrow, and the waters not all gone, the vertex ſhould, if poſſible, be brought to preſent; but if the uterus is ſo cloſely contracted that this cannot be effected, on account of the ſtrong preſſure of the ſame and ſlipperineſs of the child's head, in this caſe the method directed in the following Figure is to be taken.

FIGURE XXVII. repreſents, in the lateral view, the Head of the *Fœtus* in the ſame poſition as in the former Figure; but the delivery is ſuppoſed to be retarded from the largeneſs of the Head, or a narrow *Pelvis*.

In this caſe, if the head cannot be raiſed, and puſhed up into the uterus, it ought to be delivered with the forceps in order to ſave the child. This poſition of the chin to the pubes is one of the ſafeſt caſes where the face preſents, and is moſt eaſily delivered with the forceps, the manner of introducing of which over the ears is ſhown in this Figure. The patient muſt lie on her back, with her breech a little over the bed, her legs and thighs being ſupported by an aſſiſtant ſitting on each ſide. The chin is then to be raiſed up over the pubes, whilſt the forehead, fontanel, and occiput, are brought out ſlowly from the perinæum and fundament, to prevent the ſame from being hurt or lacerated. But if the fœtus can neither be turned nor extracted with the forceps, the delivery muſt be left to the labour pains, as long as the patient is in no danger; but if danger is apparent, the head muſt be delivered with the curved crotchets. *Vide* FIG. 10, Plate of Inſtruments.

When the face preſents, and the chin is to the ſide of the pelvis, the patient muſt lie on her ſide; and after the forceps are fixed along the ears, the chin is to be brought down to the os iſchium, hen turned out below the pubes, and delivered in a ſlow man- as before. *Vide* FIG. 19, 20, 21, 22, for the deſcription of the parts.

FIGURE XXVIII. ſhows, in a lateral view of the right ſide, the Face of the *Fœtus* preſenting, as in *Fig*. 26, but in the contrary poſition; that is, with the Chin to the *Os Sacrum*, and the *Bregma* to the *Pubes*, the waters evacuated, and the *Uterus* contracted. A, the *os externum* not yet begun to ſtretch. B, the *anus*. *Vide* FIG. 23. for the further deſcription of the parts.

In ſuch caſes, as well as in thoſe of the laſt-mentioned Figure, if the child is ſmall, the head will be puſhed lower with the labour pains, and gradually ſtretch the lower part of the vagina and the external parts; by which means the os externum will be more and more dilated, till the vertex comes out below the pubes, and riſes up on the outſide; in which caſe the delivery is then the ſame as in natural labours. But if the head is large, it will paſs along with great difficulty; whence the brain and veſſels of the neck will be ſo much compreſſed and obſtructed as to deſtroy the child. To prevent which, if called in time, before the head is far advanced in the pelvis, the child ought to be turned and brought footling. If the head, however, is low down, and cannot be turned, the delivery is then to be performed with the forceps, either by bringing along the head as it preſents, or as in the following Figure. See the references in the preceding Figure.

FIGURE XXIX. repreſents a lateral view of the left ſide of the ſubject, the *Fœtus* in the ſame ſituation as in the former Figure. The head here is ſqueezed into a very oblong form: and though forced down ſo as fully to dilate the os externum, yet the vertex and occiput cannot be brought ſo far down as to turn out from below the pubes (as in the foregoing Figure), without tearing the perinæum and anus, as well as the vagina and rectum.

The beſt method in this caſe, after either the ſhort or long curved forceps have been applied along the ears (as is repreſented in the Figure), is to puſh the head as high up in the pelvis as is poſſible; after which the chin is to be turned from the os ſacrum to either os iſchium, and afterwards brought down to the inferior part of the laſt mentioned bone. This done, the operator muſt pull the forceps with one hand, whilſt two fingers of the other are fixed on the lower part of the chin or under-jaw, to keep the face in the middle, and prevent the chin from being detained at the os iſchium as it comes along; and in this manner move the chin round with the forceps and the above fingers till brought under the pubes; which done, the head will be eaſily extracted, as in *Fig*. 27.

In general, with reſpect to the poſture of the woman in the application of the forceps, when the ears are to the ſides of the pelvis, the forceps, as was obſerved in *Fig*. 27, are moſt eaſily introduced when the patient lies upon her back, and her breech over the ſide of the bed; but when the ear is to the pubes or groin, they are better applied when the patient lies on her ſide, as was obſerved in the caſes where the vertex preſented.

Vide FIG. 27. for the deſcription of the parts, and the references. Alſo *Fig*. 10. Plate of Inſtruments, for the manner of uſing the crotchet.

FIGURE XXX. gives a lateral view of a diſtorted *Pelvis*, divided longitudinally, with the Head of a *Fœtus* of the ſeventh month paſſing the ſame. *Vide* the Explanation of *Fig*. 3.

A, B, C, the *os ſacrum* and *coccyx*. D, the *os pubis* of the left ſide. E, the *tuberoſity* of the *os iſchium* of the ſame ſide.

The head of the fœtus here, though ſmall, is with difficulty ſqueezed down into the pelvis, and changed from a round to an oblong form before it can paſs, there being only the ſpace of two inches and one quarter between the projection of the ſuperior part of the ſacrum and oſſa pubis. If the head is ſoon delivered, the child may be born alive; but if it continues in this manner many hours, it is in danger of being loſt, on account of the long preſſure upon the brain. To prevent which, if the labour-pains are not ſufficiently ſtong, the head muſt be helped along with the forceps, as directed in *Fig*. 19.

This figure may ſerve as an example of the extreme degree of diſtortion of the pelvis, between which and the well-formed one are many intermediate degrees, according to which the difficulty of delivery muſt encreaſe or diminiſh, as well as from the diſproportion of the pelvis and head of the fœtus; all which caſes require the greateſt caution, both as to the management and ſafety of the mother and child.

FIGURE XXXI. gives a ſide-view of a diſtorted *Pelvis*, as in the former Figure, with the Head of a full-grown *Fœtus* ſqueezed into the Brim, the *Parietal* Bones decuſſating each other, and compreſſed into a conical form. A, B, C, the *os ſacrum* and *coccyx*. D, the *os pubis* of the left ſide. E, the *tuberoſity* of the *os iſchium*. F, the *proceſſus acutus*. G, the *foramen magnum*.

This Figure ſhows the impoſſibility in ſuch a caſe to ſave the child, unleſs by the Cæſarian operation; which, however, ought never to be performed, except when it is impracticable to deliver at all by any other method. Even in this caſe, after the upper part of the head is diminiſhed in bulk, and the bones are extracted, the greateſt force muſt be applied in order to extract the bones of the face and baſis of the ſkull, as well as the body of the fœtus.

FIGURE XXXII. repreſents, in a front view of the *Pelvis*, as in *Fig*. 25. the Breech of the *Fœtus* preſenting, and dilating the *Os Internum*, the *Membranes* being too ſoon broke. The fore parts of the Child are to the poſterior part of the *Uterus*; and the *Funis* with a knot upon it ſurrounds the neck, arm, and body.

We have ſometimes felt in theſe caſes, (when labour was begun, and before the breech was advanced into the pelvis), one hip at the ſacrum, the other reſting above the os pubis, and the private parts to one ſide: but before they could advance lower, the nates were turned to the ſides and wide part of the brim of the pelvis, with the private parts to the ſacrum, as in this Figure; though ſometimes to the pubes as in the following figures. As ſoon as the breech advances to the lower part of the baſin, the hips again return to their former poſition, viz. one hip turned out below the os pubis, and the other at the back-parts of the os externum.

N. B. In this caſe the child, if not very large, or the pelvis narrow, may be often delivered alive by the labour-pains; but if long detained at the inferior part of the pelvis, the long preſſure of the funis may obſtruct the circulation. In moſt caſes where the breech preſents, the effect of the labour-pains ought to be waited for, till at leaſt they have fully dilated the os internum and vagina, if the ſame have not been ſtretched before with the waters and membranes. In the mean time, whilſt the breech advances, the os externum may be dilated gently during every pain, to allow room for introducing a finger or two of each hand to the outſide of each groin of the fœtus, in order to aſſiſt the delivery when the nates are advanced to the lower part of the vagina. But if the fœtus is larger than uſual, or the pelvis narrow, and after a long time and many repeated pains the breech is not forced down into the pelvis, the patient's ſtrength at the ſame time failing, the operator muſt in a gradual manner open the parts, and, having introduced a hand into the vagina, raiſe or puſh up the breech of the fœtus, and bring down the legs and thighs. If the uterus is ſo ſtrongly contracted that the legs cannot be got down, the largeſt end of the blunt hook is to be introduced, as directed in *Fig.* 3, in the Plate of Inſtruments. As ſoon as the breech or legs are brought down, the body and head are to be delivered, as deſcribed in the next Figure, only there is no neceſſity here to alter the poſition of the child's body.

The deſcription of the parts in this and the following Figure is the ſame as in *Fig.* 25, only the dotted lines in this deſcribe the place of the oſſa pubis, and the anterior parts of the oſſa iſchium which are removed, and may ſerve in this reſpect as an example for all the other front-views, where, without disfiguring the Figure, they could not be ſo well put in.

FIGURE XXXIII. ſhows, in the ſame view and with the ſame references as the former, the breech of the fœtus preſenting; with this difference, however, that the fore-parts of the child are to the fore-part of the uterus. In this caſe, when the breech coming double as it preſents is brought down to the hams, the legs muſt be extracted, a cloth wrapped round them, and the fore-parts of the child turned to the back-parts of the woman. If a pain ſhould in the mean time force down the body of the child, it ought to be puſhed up again in turning, as it turns eaſier when the belly is in the pelvis, than when the breaſt and ſhoulders are engaged; and as ſometimes the face and forehead are rather towards one of the groins, a quarter-turn more brings theſe parts to the ſide of the pelvis, and a little backwards, after which the body is to be brought down. If the child is not large, the arms need not be brought down, and the head may be delivered by preſſing back the ſhoulders and body of the child to the perinæum, and, whilſt the chin and face are within the vagina, to bring the occiput out from below the pubes. If the woman has ſtrong pains, and when by the felt pulſation of the veſſels of the funis umbilicalis, or the ſtruggling motion of the fœtus, it is certain that the child is ſtill alive, wait with patience for the aſſiſtance of the labour: but if that and the hand are ſufficient, and the pulſation of the funis turns weaker, and if the child cannot be brought double, the breech muſt be puſhed up; and if the reſiſtance of the uterus is ſo great as to prevent the extraction of the legs, the patient ought to be turned on her knees and elbows. When the legs are thus brought down, the woman, if needful, is to be again turned on her back, to allow more freedom to deliver the body and head, as before deſcribed. If the head after ſeveral trials cannot be delivered, without endangering the child from overſtraining the neck, the long curved forceps ought to be applied, as in *Fig.* 38. If theſe fail, and the patient is not in danger, ſome time may be allowed for the effect of the labour-pains; which likewiſe proving inſufficient, the crotchet muſt be uſed as in *Fig.* 10, in the plate of inſtruments, and when it is certain that the child is dead, or that there is no poſſibility of ſaving it.

FIGURE XXXIV. repreſents, in a front view of the *Pelvis*, the *Fœtus* compreſſed by the contraction of the *Uterus* into a round form, the fore-parts of the former being towards the inferior part of the latter, and one foot and hand fallen down into the *Vagina*. In this figure the anterior part of the *Pelvis* is removed by a longitudinal ſection through the middle of the *Foramen Magnum*.

A, A, the ſuperior parts of the *Oſſa ilium*. B, B, the *uterus*. C, the mouth of the *womb* ſtretched, and appearing in O, O, O, O, the *vagina*. D, the inferior and poſterior part of the *os externum*. E, E, E, E, the remaining part of the *oſſa pubis* and *iſchium*. F, F, F, F, the *membrana adipoſa*.

This and the three following Figures, repreſenting four different preternatural poſitions of the fœtus in utero, may ſerve as examples for the manner of delivery in theſe as well as in all other preternatural caſes.

In all preternatural caſes, the fœtus may be eaſily turned and delivered by the feet, if known before the membranes are broke and the waters diſcharged; or if the pelvis is narrow, and the patient is ſtrong, the head, if large, may be brought down ſo as to preſent in the natural way: but if all the waters are diſcharged, and the uterus is ſtrongly contracted to the body of the fœtus, this laſt method can ſeldom take place, on account of the ſtrong preſſure of the uterus and ſlipperineſs of the child's head.

In the preſent caſe, the woman may either be laid on her back or ſide, as deſcribed in *Fig.* 19 and 27. and the operator, having ſhowly dilated the os externum with his fingers, muſt introduce the ſame into the vagina, and puſh up into the uterus the parts of the fœtus that preſent; or if there is ſpace for it, his hand may paſs in order to dilate the os internum, if not ſufficiently ſtretched previouſly by the membranes and waters. This done, he muſt advance his hand into the uterus, to know the poſition of the fœtus; and, as the breech is rather lower than the head, ſearch for the other leg, and bring down both feet without the os externum. If the membranes are broken before the os uteri is largely opened, and the hand of the operator cannot be introduced, which ſometimes happen in a firſt pregnancy, the parts of the fœtus ſhould be allowed to protrude ſtill further, by which means the rigidity of the os internum will in time be leſſened.

FIGURE XXXV. repreſents, in the ſame view with the former, the *Fœtus* in the contrary Poſition; the Breech and Fore-parts being towards the *Fundus Uteri*, the left Arm in the *Vagina*, and fore Arm without the *Os Externum*, the ſhoulder being likewiſe forced into the *Os Uteri*.

The operator in this caſe muſt introduce his fingers between the back part of the vagina and the arm of the fœtus, in order to raiſe the ſhoulder and make room for preſſing his hand into the uterus to diſtinguiſh the poſition. This being known, he ought to puſh up the ſhoulder to that part of the uterus where the head is lodged, in order to raiſe the ſame to the fundus.

If the feet cannot be brought down lower than into the vagina, a nooſe may be introduced over both ankles, by which the legs are brought lower by pulling the nooſe with one hand, whilſt the other, previouſly introduced into the uterus, puſhes up the ſhoulders and head. By this double force the poſition of the fœtus is to be altered, and the delivery effected. In theſe caſes, as the ſhoulder is raiſed to the fundus, the arm commonly returns into the uterus; but if the arm is ſo ſwelled as to prevent the introduction of the operator's hand, and cannot be folded up or returned into the uterus, it muſt be taken off at the ſhoulder or elbow, in order to deliver and ſave the woman. If both the arms come down when the breaſt preſents, the methods above deſcribed are to be uſed. *Vide* the explanations and references of the foregoing Figure.

FIGURE XXXVI. exhibits, in the ſame view likewiſe of the *Pelvis* with the former, a third poſition of the *Fœtus*, when compreſſed into the round form; the Belly, *viz.* or *Umbilical* Region, preſenting at the *Os Internum*, and the *Funis* fallen down into the *Vagina*, and appearing at the *Os Externum*.

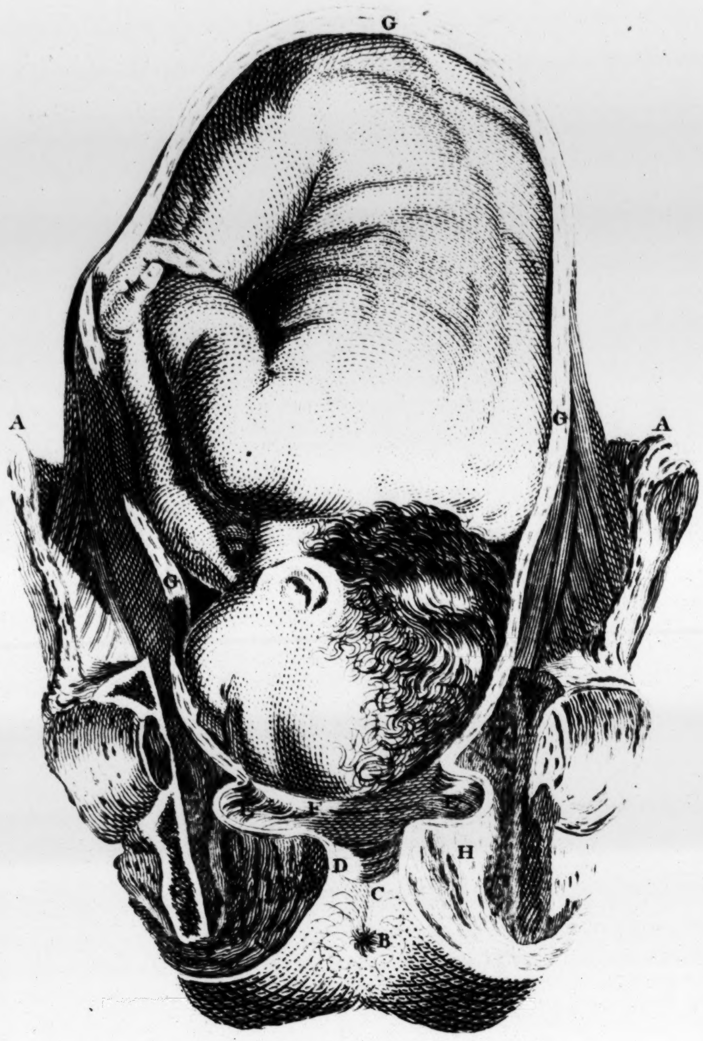
The delivery in this caſe is to be effected as in the former Figure, by puſhing up the breaſt and bringing down the legs. When the belly preſents, it is eaſier coming at the legs than when the breaſt preſents, becauſe in the former caſe the head is nearer to the fundus uteri, and the legs and thighs lower. If the belly or breaſt is forced down into the lower part of the pelvis, the child will be in danger from the bending of the vertebræ and the preſſure of the ſpinal marrow. Such great force is alſo required to raiſe theſe parts up into the uterus, in order to come at the feet, that it will ſometimes be neceſſary to turn the woman to her knees and elbows to diminiſh the reſiſtance of the abdominal muſcles. When the funis comes down without the os externum, if there is a pulſation felt, it muſt immediately be replaced and kept warm in the vagina, to preſerve the circulation, and prevent a ſtagnation from its being expoſed to the cold air. If the funis comes down when the head preſents, the child is in danger, if not ſpeedily delivered with the pains, or brought footling. See explanations in the two former Figures.

FIGURE XXXVII. ſhows, in a lateral view of the *Pelvis*, one of the moſt difficult preternatural caſes. The left ſhoulder, breaſt, and neck of the *Fœtus* preſenting, the head reflected over the *Pubes* to the right ſhoulder and back, and the feet and breech ſtretched up to the *Fundus*, the *Uterus* contracted at the ſame time in form of a long ſheath round the body of the *Fœtus*.

A, B, C, the *os ſacrum* and *coccyx*. D, the *os pubis* of the left ſide. E, part of the *urinary* bladder. F, the *rectum*. H, I, K, the private parts. M, the *anus*. M, N, the *perinæum*. V, the *meatus urinarius*. O, The *os uteri*, not yet opened, and ſituated backwards towards the *rectum* and *coccyx*. R, S, the ſame repreſented in dotted lines, as opened when the labour is begun. T, U, the ſame more fully dilated, but nearer to the poſterior than anterior part of the *pelvis*. W, P, the ſame not fully ſtretched at the fore-part, though entirely obliterated at the back-part, the *uterus* and *vagina* being there only ſometimes one continued ſurface.

Hence it appears why the anterior part of the *os uteri* is frequently protruded before the head of the *fœtus* at the *pubes*, which, if it retards delivery, is removed by ſliding it up with a finger or two between the head and laſt mentioned part. *Vide* Fig. 11, 14, 15, 16, 17.

Anatomical Tables, illustrative of the Theory and Practice of Midwifery. See the System.



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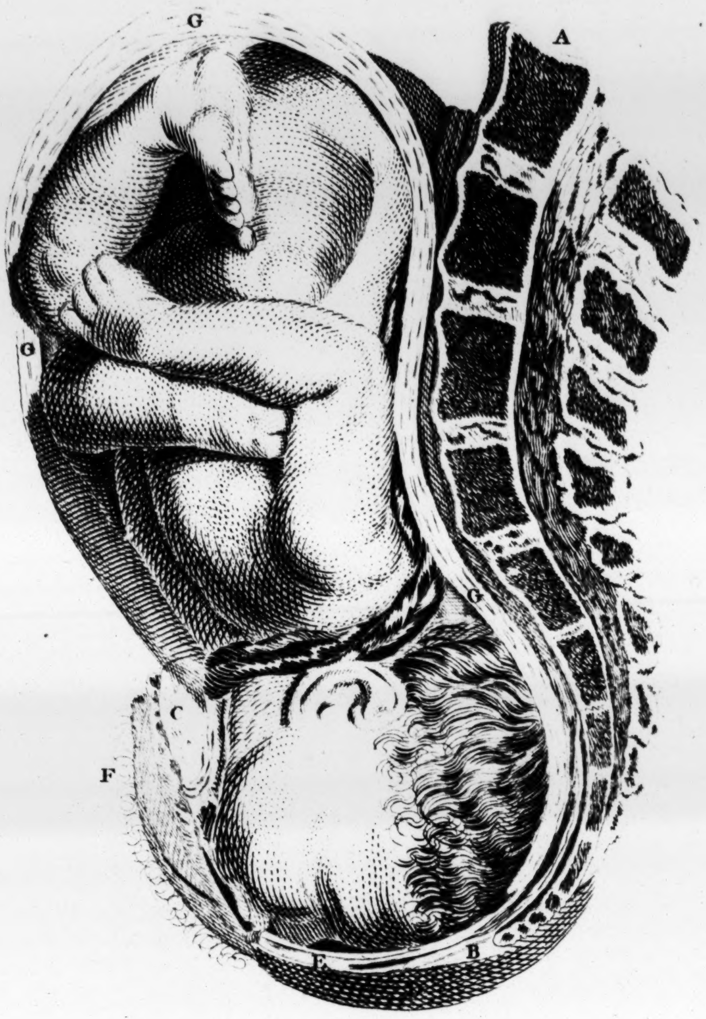

Fig. 26.

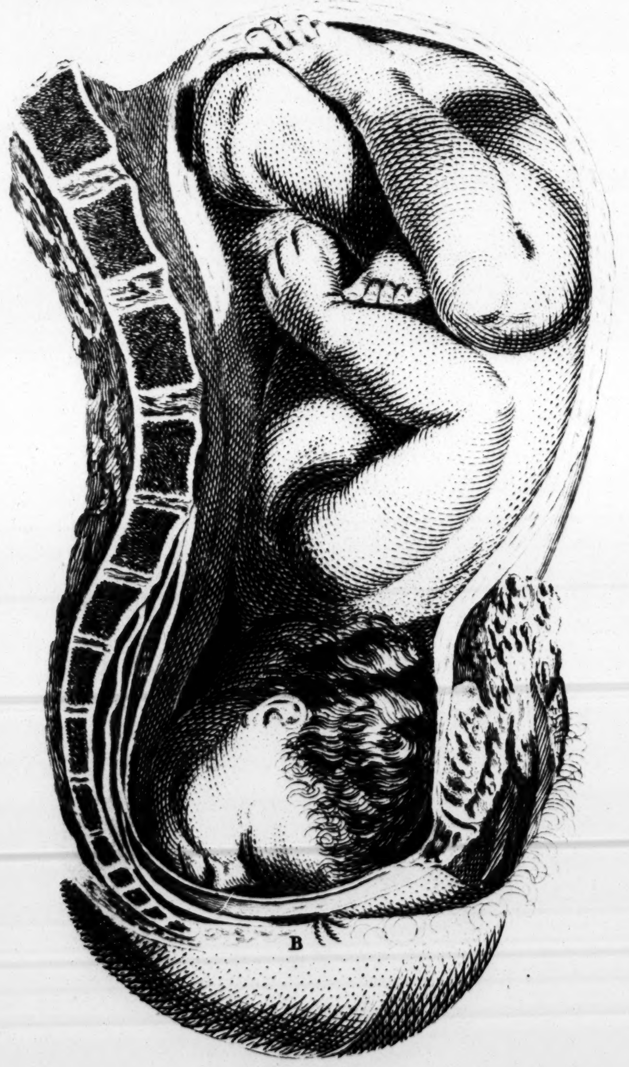

Fig. 28.

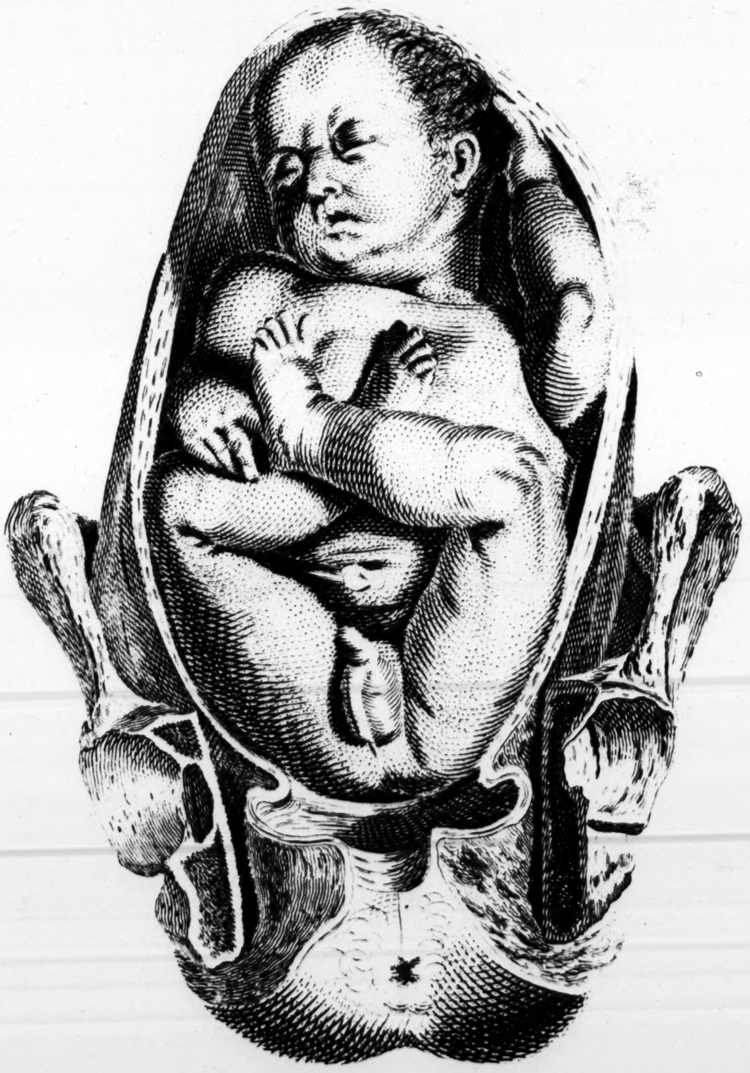

Fig. 33.

Reduced from Smellie's Tables by Frederick Birnie, Anatomical Draughtsman to the late Dr. William Hunter, and Engraved by William Taylor.

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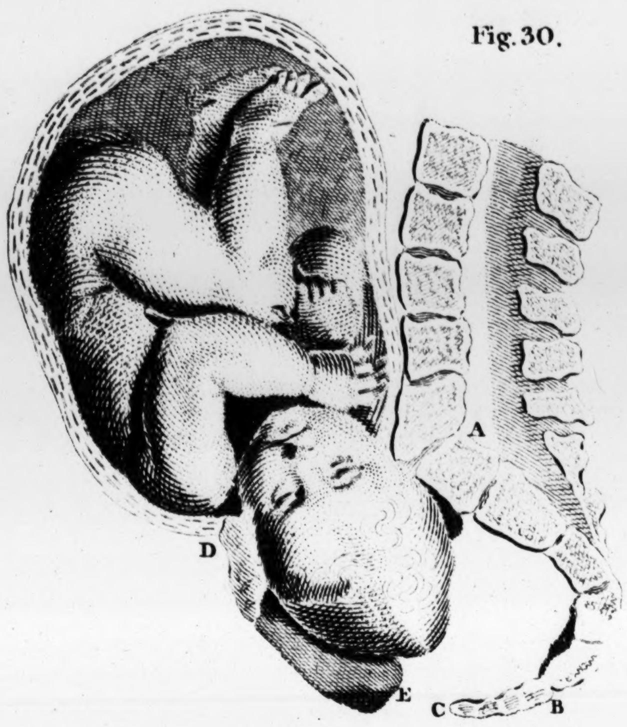
Anatomical Tables, illustrative of the Theory and Practice of Midwifery. See the System.

Fig. 30.



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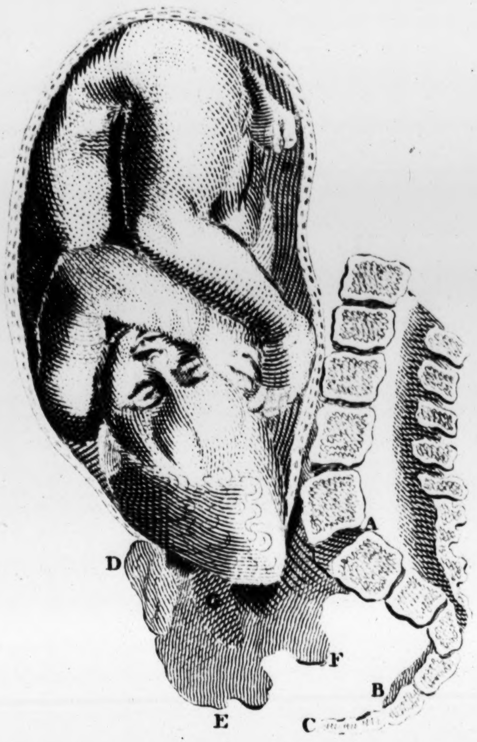

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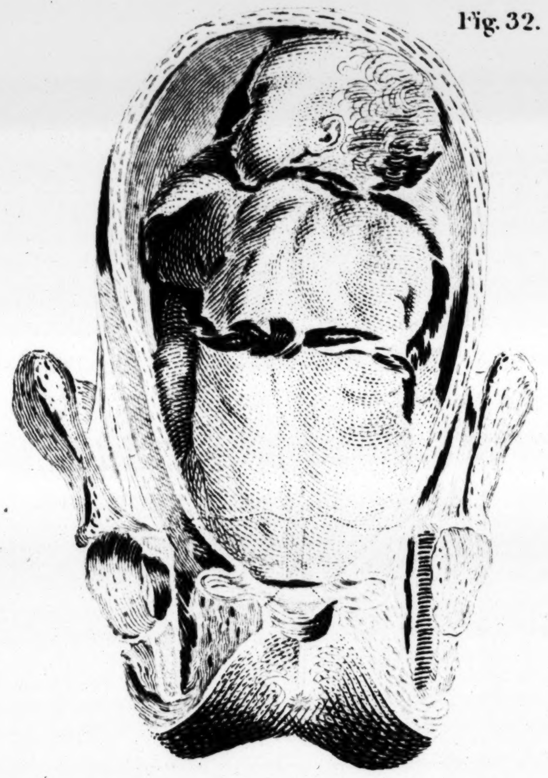

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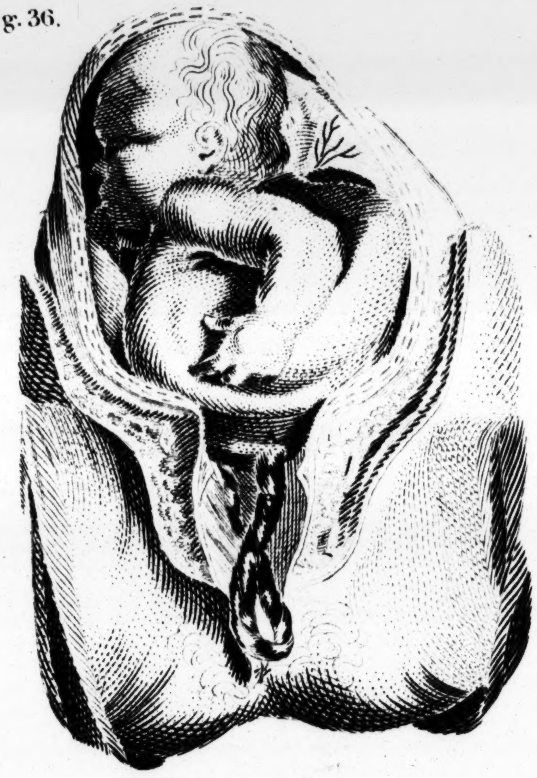

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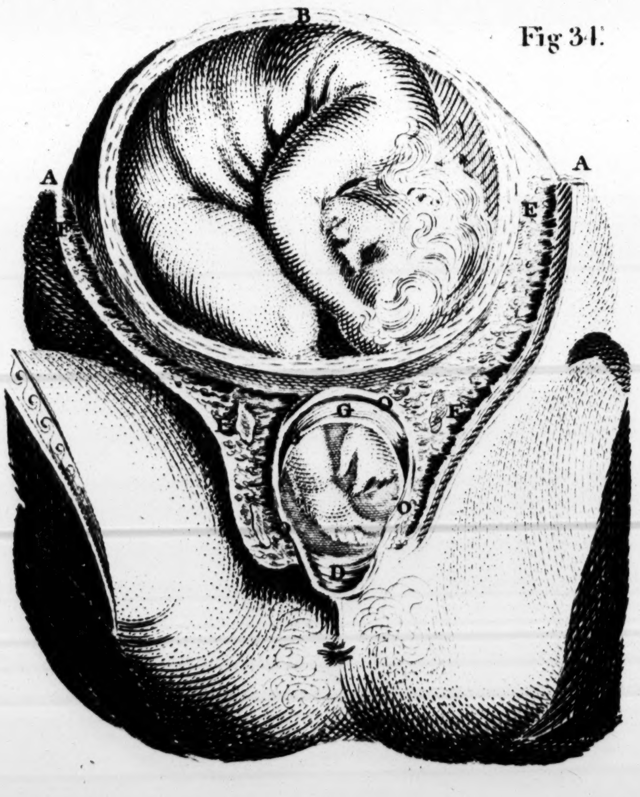
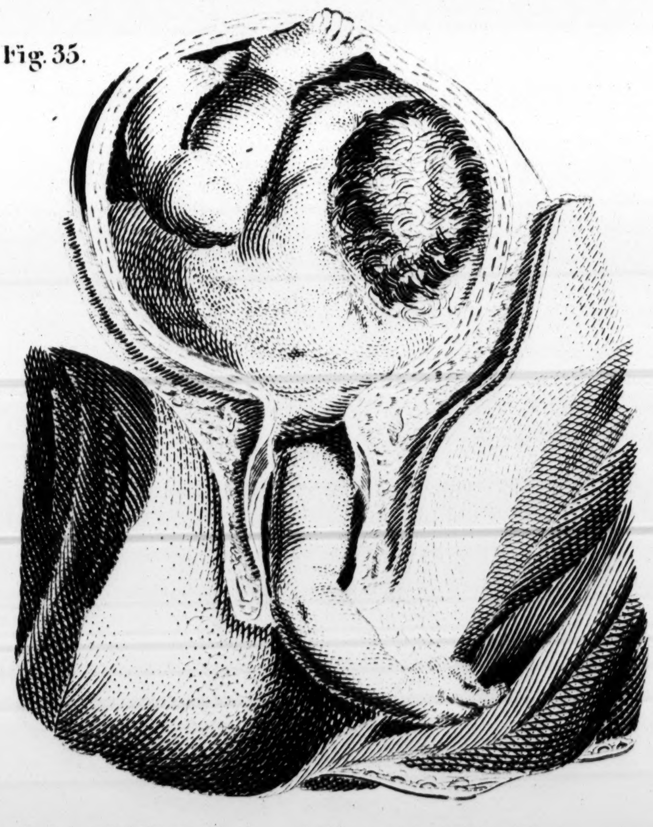


Fig. 35.



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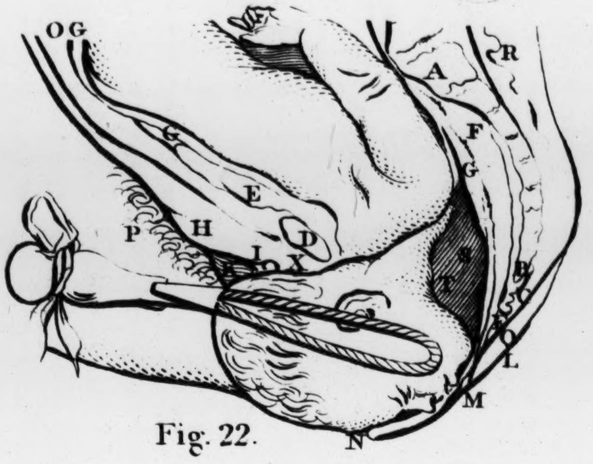
Anatomical Tables, illustrative of the Theory and Practice of Midwifery. See the System.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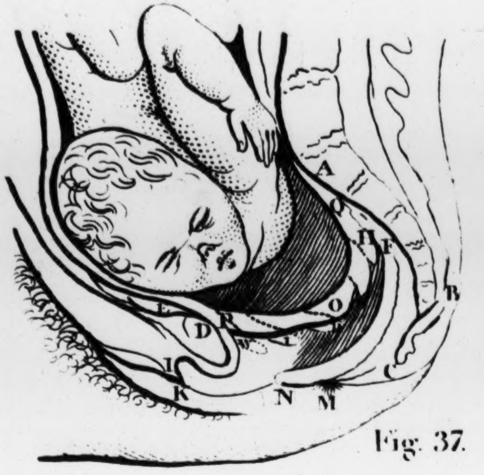
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Fig. 37.

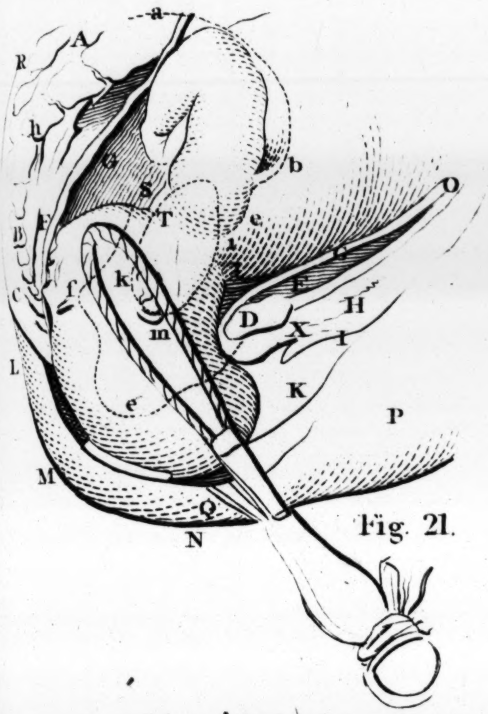
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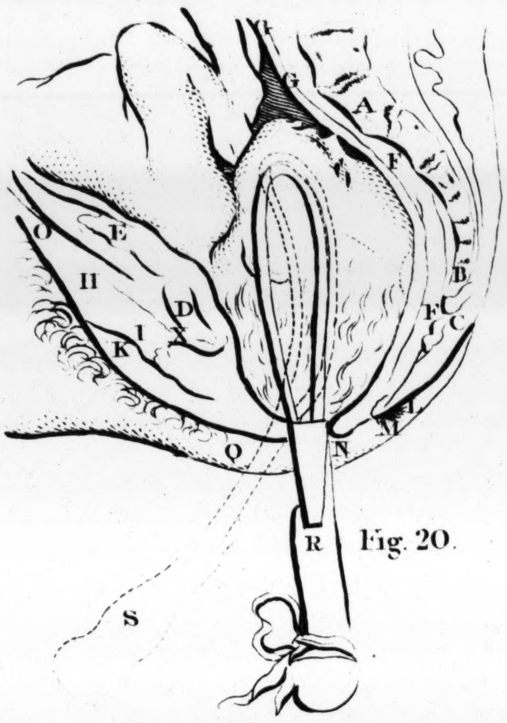
Fig. 21.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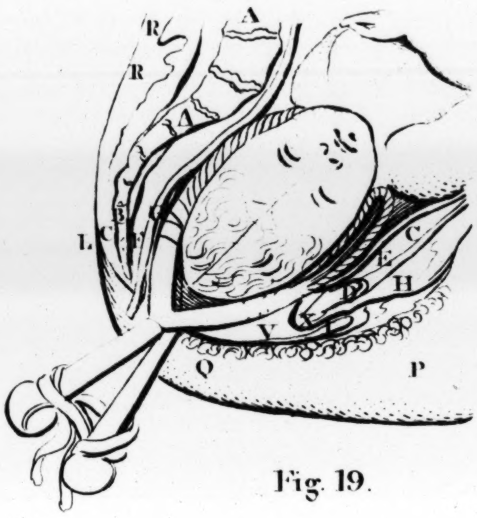
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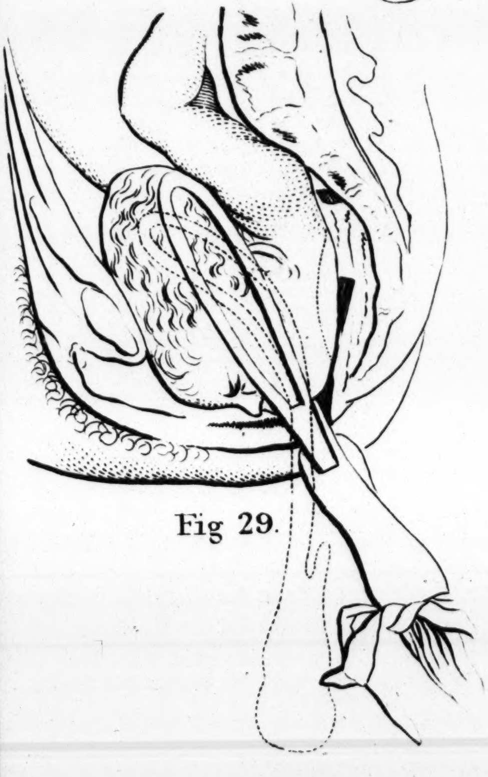
Fig. 19.



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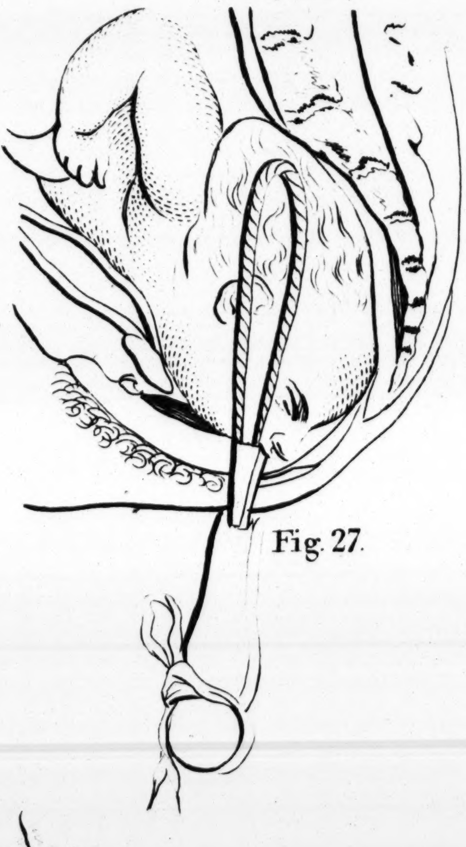

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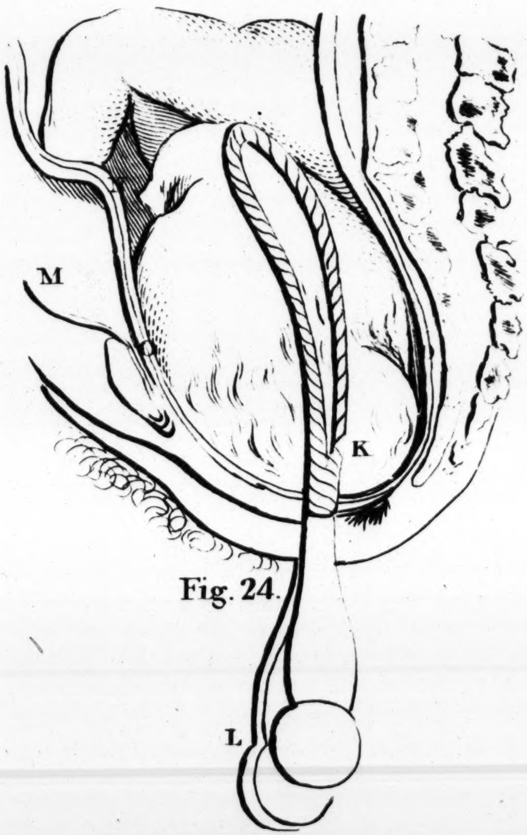

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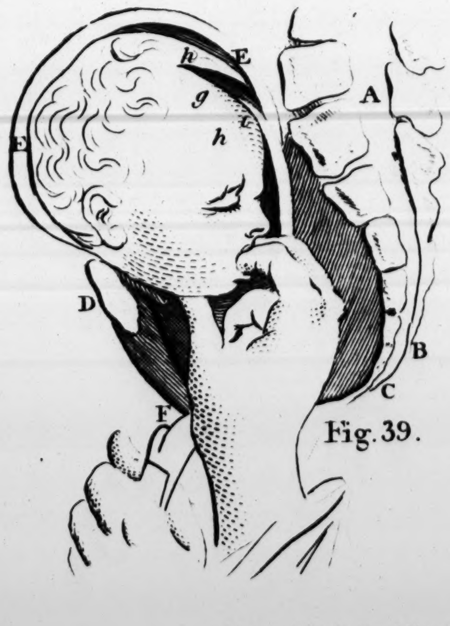
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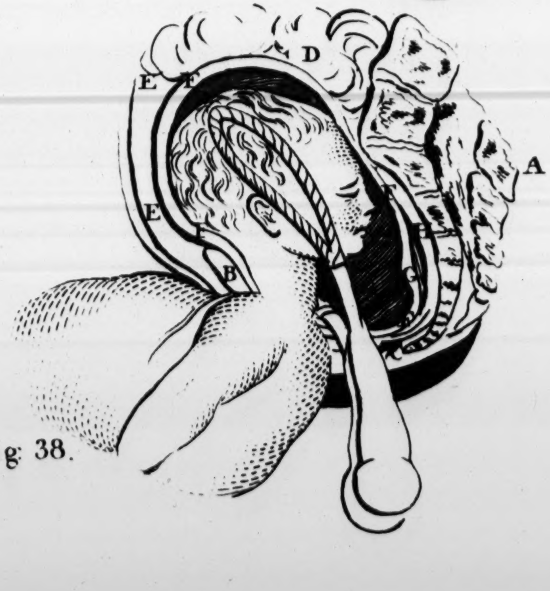

Fig. 38.

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Representation of the manner in which the Fœtus is nouriſhed in Utero, also a View of the Membrana decidua discovered by the late Dr. Hunter. See System of Midwifery.

Fig. 42.

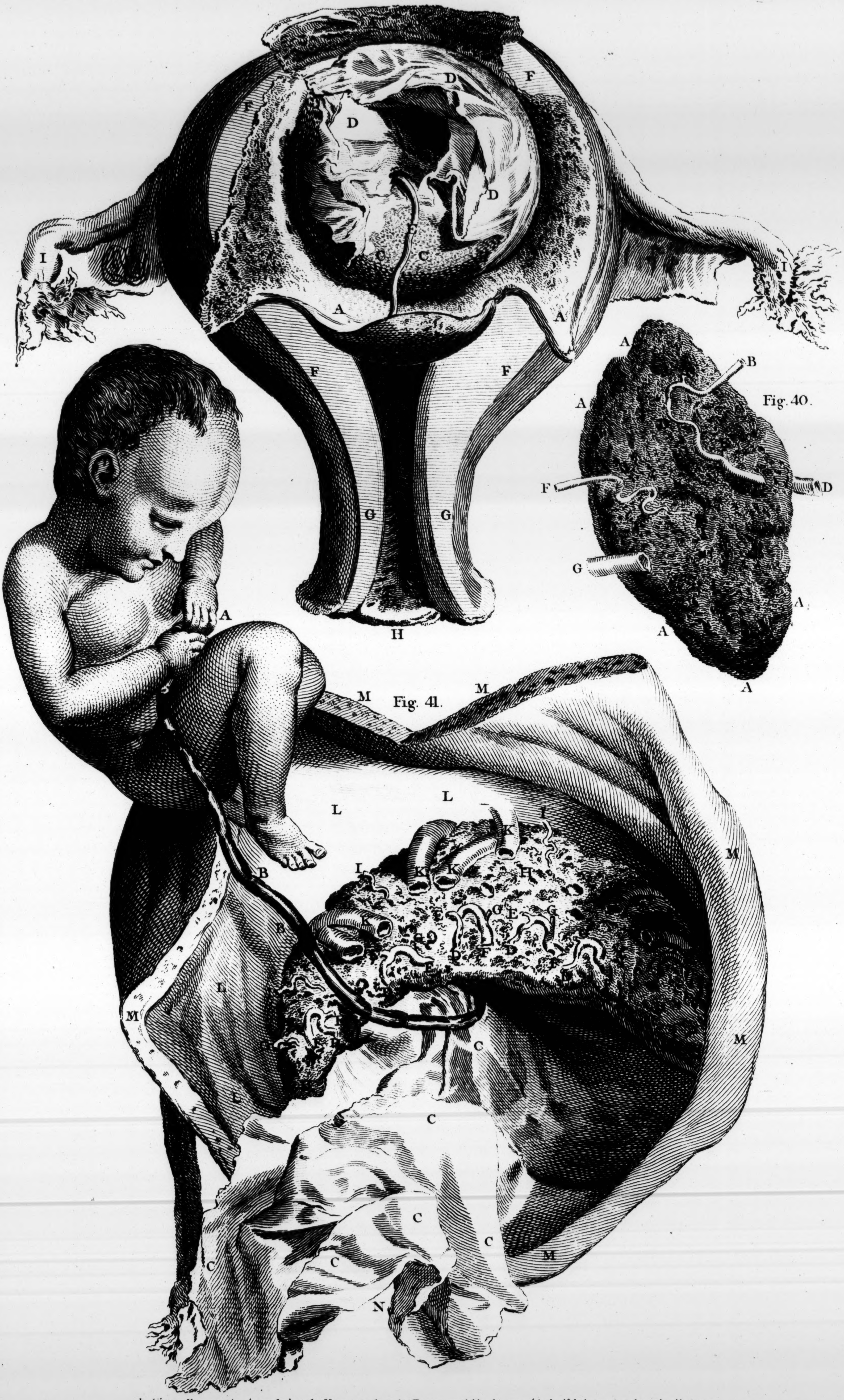

Fig. 41.

Fig. 40.

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In Figure 41, an opening is made into the Uterus, to shew the Placenta and Membranes, with the Veſsels coming from the Mother to the Fœtus. Figure 40, is a portion of the spongy parts of the Placenta diſsected off, that those Veſsels may be more completely seen.

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Various Instruments used in the Practice of Midwifery. See the System.

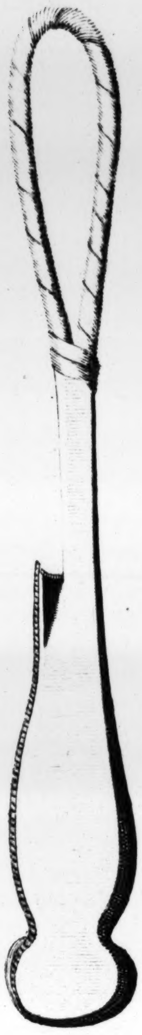
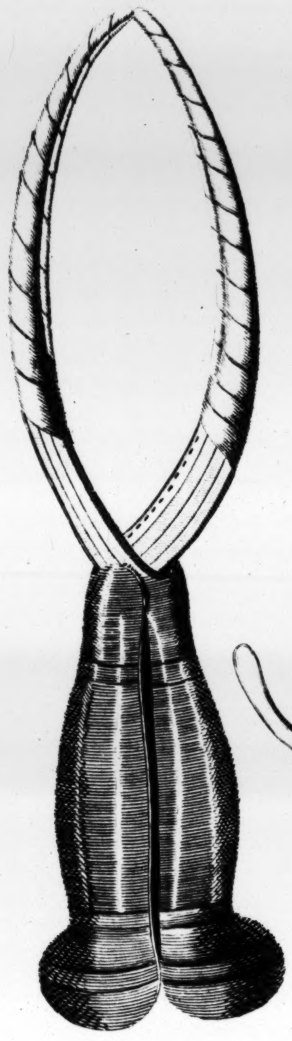


Fig. 2.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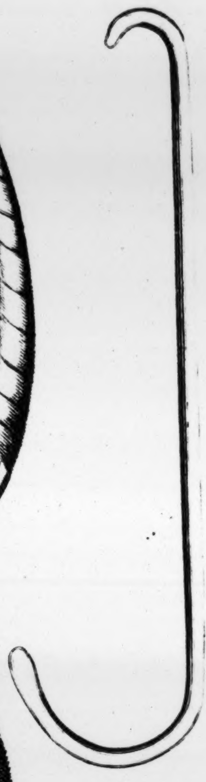
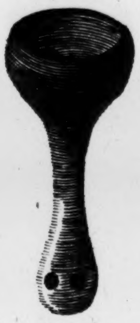


Fig. 3.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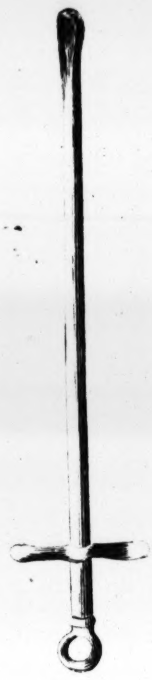
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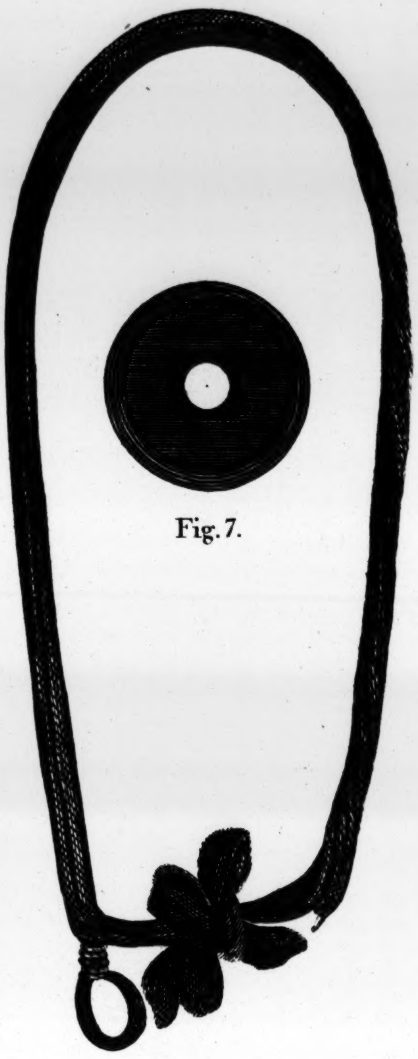
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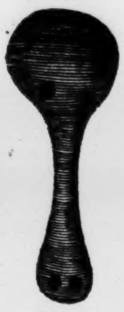
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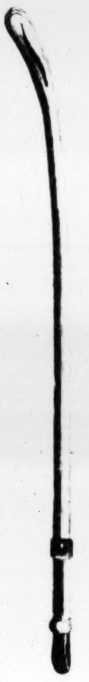
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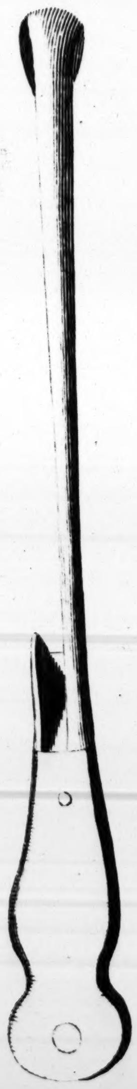

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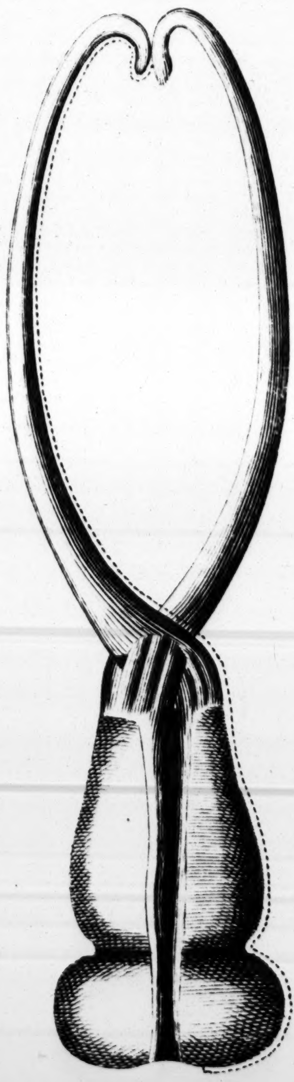

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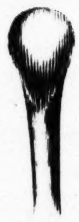

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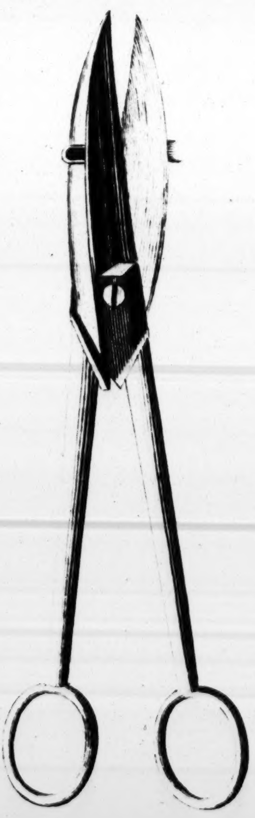

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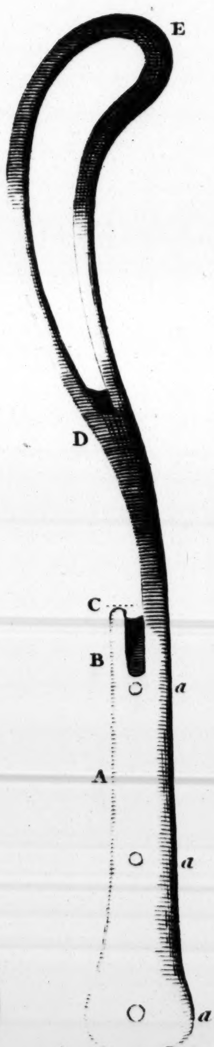

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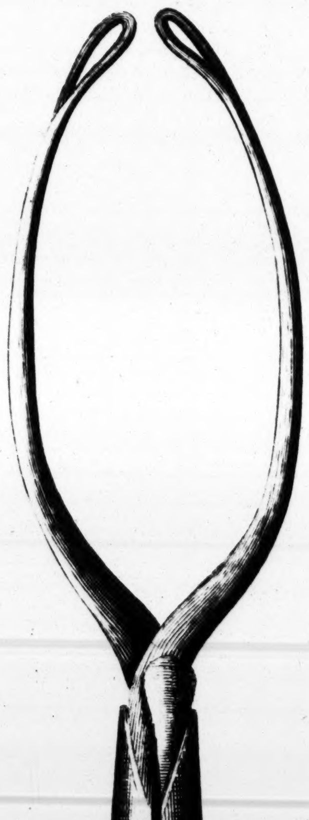

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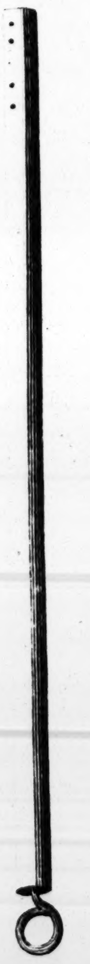

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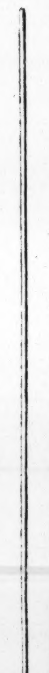

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MIDWIFERY.

FIGURE XXXVIII. ſhows, in a lateral view of the *Pelvis*, the method of aſſiſting the delivery of the head of the *Fœtus* with the long curved Forceps, in preternatural caſes, when it cannot be done with the hands as deſcribed in Figures 32, 33.

A, the three loweſt *vertebræ* of the loins, with the *os ſacrum* and *coccyx*. B, the *os pubis* of the left ſide. C, C, the *perinæum* and *anus* preſſed backwards with the forceps. D, the *inteſtines*. E, E, the *parietes* of the *abdomen*. F, F, F, the *uterus*. G, the poſterior part of the *os uteri*. H, the *rectum*. I, the *vagina*.

After the body and arms of the child are delivered, and the different methods uſed to bring down the head with the hands, as directed in *Fig*. 37. the following method is to be tried in order to ſave the child, who muſt otherwiſe be loſt by overſtraining the neck and ſpinal marrow. The woman being in the ſupine poſition, as in *Fig*. 27. one of the aſſiſtants ought to hold the body and arms of the child up towards the abdomen of the woman, to give more room to the operator, who having introduced one hand up to the child's face, and moved it from the ſide a little backwards for the eaſier application of the forceps along the ſides of the head, muſt then turn his hand to one of the ears, and introduce one of the blades with the other hand between the ſame and the head, with the curved ſide towards the pubes, as in this Figure. This done, the hand is to be brought down to hold the handle of the blade of the forceps till the other hand is introduced to the other ſide of the head, by which means the ſame is preſſed againſt the blade that is up, and which is thus prevented from ſlipping whilſt the other hand introduces the ſecond blade on the oppoſite ſide. The blades being thus introduced, care muſt be taken that, in joining them, no part of the vagina is locked in.

The handles of the forceps ſhould be raiſed upwards, and the ſame caution uſed in bringing the head through the os externum, as deſcribed in *Fig*. 22, 23. By this method the head will be delivered, the child frequently ſaved, and the uſe of the crotchet prevented; except in thoſe baſins that are ſo narrow that it is impoſſible to deliver without diminiſhing the bulk of the head.

FIGURE XXXIX. repreſents, in a lateral view of the *Pelvis*, the method of extracting, with the aſſiſtance of a curved crotchet, the head of the *Fœtus*, when left in the *Uterus*, after the body is delivered and ſeparated from it, either by its being too large, or the *Pelvis* too narrow.

A, B, C, the *os ſacrum* and *coccyx*. D, the *os pubis* of the left ſide. E, E, the *uterus*. F, the locking part of the crotchet. g, h, i, the point of the crotchet on the inſide of the cranium.

If this caſe happens from the forehead's being towards the pubes, or the child long dead, and ſo mortified that both the body and under jaw are ſeparated unexpectedly, the long forceps that are curved upwards will be ſufficient to extract the head; but if the ſame is large, and the pelvis narrow, and the delivery cannot be effected by the above method, then the head muſt be opened, that its bulk may diminiſh as it is extracted. The patient being placed either on her back or ſide, as in the explanation of *Fig*. 19 and 27, the left hand of the operator is to be introduced into the uterus, and the forehead of the fœtus turned to the right ſide of the brim of the pelvis, and a little backwards, the chin being downwards; after which the palm of the hand and fingers are to be advanced as high as the fontanel, and the head graſped with the thumb and little finger on each ſide, as firm as is poſſible, whilſt an aſſiſtant preſſes on each ſide of the abdomen with both hands, to keep the uterus firm in the middle and lower part of the ſame. This done, the operator having with his right-hand introduced and applied the crotchet to the head, (the point being turned towards the forehead, and the convex ſide towards the ſacrum), he muſt go up along the inſide of the left-hand as high as the fontanel, and there, or near it, fix the point of the crotchet, keeping ſtill the left-hand in the former poſition, till with the other he pierces the cranium with the point of the inſtrument, and tears a large opening in it from K to I; after this, keeping the crotchet ſteady, he may ſlide down with his left-hand in a cautious manner, leſt the former poſition ſhould be altered, and the head will ſink lower down by the aſſiſtants preſſing on the abdomen. The two fore-fingers of the left-hand are then to be introduced into the mouth, and the thumb below the under-jaw, the hand being above the blade of the crotchet. When this firm hold is taken, the operator may begin and pull ſlowly with both hands; and as the brain diſcharges through the perforation, the head will diminiſh and come along.

The Figure may alſo ſerve for an example to ſhow the method of fixing the crotchet on the head, when although the body is not ſeparated from it, yet it cannot be delivered with the operator's hands or the long forceps, as in *Fig*. 32, and 38.

FIGURE XL. A, a portion of placenta magnified to ſhew the veſſels more diſtinctly. B, one of the arteries of the fœtus, ſent off by the navel ſtring. C, the inhaling, or abſorbing veſſel of the artery. D, one of the veins belonging to the navel ſtring. The letter D is placed upon the curvature, where the artery of the fœtus anaſtomoſes with the vein. E, the exhaling veſſel from the vein of the fœtus. F, an artery of the uterus opening into the ſpongy part of the placenta. G, the vein of the uterus.

From this Figure it appears that both the vein and artery of the uterus are inducted into the placenta with their mouths extended, and do not anaſtomoſe, like the veſſels of the fœtus. This portion of placenta was choſen, in order to demonſtrate the ſubject with greater ſimplicity and perſpicuity.

FIGURE XLI. A, the fœtus out of the uterus to ſhew the ſituation of the after-birth with greater preciſion. B, the navel ſtring. C, membranes of the placenta. D, arteries of the fœtus branching from the navel ſtring to the placenta. E, inhaling veſſels of the arteries of the fœtus. F, veins branching off from the navel ſtring of the fœtus. G, exhaling veſſels of the veins of the fœtus. H, the ſpongy part of the placenta. I, the arteries of the uterus. K, the veins of the uterus. L, the cavity of the uterus; the uterus is ſuppoſed to be cut in halves. M, the cut edges of the uterus. N, the os uteri or os externum.

In this Figure we have given a view of the uterus and fœtus at the ninth month, in which is ſhewn the placenta or after-birth adhering to the uterus, by the veſſels of the mother; the veſſels are ſuppoſed to be half extracted, in order to ſhew their connection with the placenta.

This exertion of nature may be diſcovered by examining the cotylidones or placentulæ of the cow; in which the veſſels are diſtinctly ſeen as you pull the cotylidone from the uterus.

There being a full and diſtinct circulation in the veſſels of the fœtus and placenta without any anaſtomoſes with the veſſels of the mother; the explanation of the nouriſhment of the fœtus was thereby rendered difficult, till the time of Mr. John Hunter's experiment, in which he injected the arteries of the uterus, from a recent ſubject about the eighth month of pregnancy, with wax, when he found that he filled the whole of the ſpongy part of the placenta; and after that the wax returned by the veins of the uterus, ſo that there was a complete circulation without any of the wax entering the veſſels of the fœtus. Mr. John Hunter alſo injected the veſſels of the navel-ſtring, by putting his pipe into the artery of it, and by this means filled the whole of the veſſels, which belonged to the fœtus in the placenta; but none of the veſſels which belonged to the mother; for the wax returned back again by the veins of the navel-ſtring. So that here again the circulation was full and complete; no branches anaſtomoſing between the veſſels of the fœtus and thoſe of the mother. By theſe means therefore he demonſtrated that the nouriſhment of the child in the uterus is by abſorption, or in other words, that the blood from the mother is conveyed by the arteries of the uterus into the ſpongy part of the placenta, and there taken up by the inhaling veſſels of the arteries of the fœtus, and thence paſſing by the arteries into the fœtus, the nutritious parts of the blood are ſeparated by the animal œconomy of the fœtus, and the refuſe blood returned by the veins back again to the placenta, where, as the laſt courſe, it is taken up by the veins of the mother.

That the fœtus muſt be nouriſhed by abſorption is evident from the ſtructure of animals which are born without either mouth or noſe, or any paſſage through theſe parts into the ſtomach; and yet the fœtuſes are plump and well nouriſhed, without imbibing the ſmalleſt degree of the *liquor amnii*, as ſome writers have advanced.

FIGURE XLII. A, decidua reflexa. B, decidua vera. C, the true chorion. D, the amnion. E, the navel ſtring. F, cut edges of the uterus. G, the cervix uteri. H, the os externum. I, the fallopian tubes. K, one of the ovaries cut through to ſhew the corpus luteum, or that appearance which always takes place in early pregnancy in the ova of the ovarium.

This figure exhibits a view of the pregnant uterus about the fourth month, to ſhow the texture and ſituation of the *membrana decidua*. This membrane with its peculiarities was firſt diſcovered by Dr. William Hunter. It is diſtinguiſhed from the other, by the very near reſemblance it bears to Bruſſels lace; the term by which the Doctor always expreſſed it. The membrana decidua is the inner lamella of the uterus, and connects the ſecundines with the uterus. It is the firſt membrane that is formed, and rather belongs to the uterus than to the ſecundines: for when the uterus is injected, this membrane is alſo injected, but none of the others. So peculiarly does this membrane belong to the uterus that when conception in the ovarium takes place, the fœtus will have a placenta there; but the *decidua* will be found in the uterus, The membrana decidua forms as ſoon as conception takes place; it covers the inſide of the uterus. That part of it which covers the ovum Dr. Hunter called *decidua vera*, that part which overſpread the uterus, he called *decidua reflexa*.

DESCRIPTION OF THE PLATE OF INSTRUMENTS, *uſed in the Practice of* MIDWIFERY *in laborious and difficult* CASES.

FIGURE 1. the ſtraight ſhort forceps, in the exact proportion as to the width between the blades, and length from the points to the locking part: the firſt being two and the ſecond ſix inches, which with five inches and a half (the length of the handles), makes in all eleven inches and a half. The length of the handles may be altered at pleaſure. We find, however, in practice, that this ſtandard is the moſt convenient, and with leſs difficulty introduced than when longer, having alſo ſufficient force to deliver in moſt caſes where their aſſiſtance is neceſſary.

FIGURE 2. repreſents the poſterior part of a ſingle blade, in order to ſhow the open part of the ſame, and the form and proportion

portion of the whole. The handles, however, as here repreſented, are rather too large.

For the figure and proportions of the long forceps, that are curved upwards, and covered in the ſame manner as the former, ſee FIG. 24. in the former Plate.

FIGURE 3. the blunt hook; uſed for three purpoſes. *Firſt*, To aſſiſt the extraction of the head after the cranium is opened with the ſciſſars, by introducing the ſmall end along the ear on the outſide of the head to above the under jaw, where the point is to be fixed; the other extremity of the hook being held with one hand, whilſt two fingers of the other are to be introduced into the foreſaid opening, by which holds, the head is to be gradually extracted.

Secondly, The ſmall end is uſeful in abortions, in any of the firſt four or five months, to hook down the ſecundines when lying looſe in the uterus, when the patient is much weakened by floodings from the too long retention of the ſame, the pains being alſo unable to expel them, and when they cannot be extracted with the fingers. But if the placenta ſtill adheres, it is dangerous to uſe this or any other inſtrument to contract the ſame, as it ought to be left till it ſeparates naturally. If a ſmall part of the ſecundines is protruded through the os uteri, and pulled away from what ſtill adheres in the uterus, the mouth of the womb contracts, and that irritation is thereby removed which would have continued the pains, and have ſeparated and diſcharged the whole.

Thirdly, The large hook at the other end is uſeful to aſſiſt the extraction of the body, when the breech preſents; but ſhould be uſed with great caution, to avoid the diſlocation or fracture of the thighs.

FIGURE 4. repreſents the whalebone-fillet, which may be ſometimes uſeful in laborious caſes, when the operator is not provided with the forceps in ſudden and unexpected exigencies.

When the vertex of the fœtus preſents, and the head is forced down into the lower part of the pelvis, the woman weak, and the pains not ſufficient to deliver it, the double of the fillet is to be introduced along the fore-part of the parietal bones to the face, and, if poſſible, above the under jaw; which done, the whalebone may be either left in or pulled down out of the ſheath, and every weak pain aſſiſted by pulling gently at the fillet. If the head can be raiſed to the upper part of the pelvis, the fillet will be more eaſily got over the chin, which is a ſafer and better hold than on the face. If the face or forehead preſents, the fillet is to be introduced over the occiput.

In ſuch caſes likewiſe the whalebone may be ſupplied by a twig of any tough wood, mounted with a limber garter or fillet ſewed in form of a long ſheath.

FIGURES 5. and 6. give two views of a new kind of peſſary for the *prolapſus uteri*, being taken from the French and Dutch kind. After the *uterus* is reduced, the large end of the peſſary is to be introduced into the *vagina*, and the *os uteri* retained in the concave part, where there are three holes to prevent the ſtagnation of any moiſture. The ſmall end without the *os externum* has two tapes drawn through the two holes, which are tied to four other tapes, that hang down from a belt that ſurrounds the woman's body, and by this means keep up the peſſary. This ſort may be taken out by the patient when ſhe goes to bed, and introduced again in the morning; but as this ſometime rubs the *os externum*, ſo as to make its uſe uneaſy, the round kind, FIG. 7. are of more general uſe. They are made of wood, ivory, or cork, (the laſt covered with cloth and dipt in wax); the peſſary is to be lubricated with pomatum, the edge forced through the paſſage into the *vagina*, and a finger introduced into the hole in the middle, lays it acroſs within the *os externum*. They ought to be larger or ſmaller, according to the wideneſs or narrowneſs of the paſſage, to prevent their being forced out by any extraordinary ſtraining.

FIGURES 8. and 9. give two views of a female catheter, to ſhow its degree of curvature and different parts. Thoſe for common uſe may be made much ſhorter, for conveniency of carrying in the pocket: but ſometimes, when the head or body of the child preſſes on the bladder above the *pubes*, it requires one of this length; and in ſome extraordinary caſes we have been obliged to uſe a male catheter.

FIGURE 10. repreſents a pair of curved crotchets locked together in the ſame manner as the forceps. It is very rare that the uſe of both is neceſſary, excepting when the face preſents with the chin turned to the *ſacrum*, and when it is impoſſible to move the head to bring the child footling, or deliver with the forceps. In that caſe, if one crotchet is not ſufficient, the other is to be introduced, and, when joined together, will act both as crotchets, in opening the *cranium*, and, as the head advances, will likewiſe act as forceps in moving and turning the head more conveniently for the delivery of the ſame. They may alſo be uſeful to aſſiſt when the head is left in the *uterus*, and one blade is not ſufficient. There is ſeldom occaſion however, for the ſharp crotchet, when the head preſents; the blunt hook in FIG. 30, of the former Plate, being commonly ſufficient; or even the forceps to extract the ſame, after it is opened with the ſciſſars. Great care ought to be taken, when the ſharp crotchet is introduced, to keep the point towards the *fœtus*, eſpecially in caſes where the fingers cannot be got up to guide the ſame. The dotted lines along the inſide of one of the blades repreſent a ſheath that is contrived to guard the point till it is introduced high enough; the ligature at the handles marked with the two dotted lines is then to be untied, the ſheath withdrawn, and the point, being uncovered, is fixed as directed in FIG. 39, of the former Plate. The point, guarded with this ſheath, may alſo be uſed inſtead of the blunt hook.

FIGURE 11. gives a view of the back part of one of the crotchets, which is twelve inches long.

FIGURE 12. gives a front-view of the point, to ſhow its length and breadth, which ought to be rather longer and narrower than here repreſented.

FIGURE 13. repreſents the ſciſſars proper for perforating the *cranium* in very narrow and diſtorted *pelviſes*. They ought to be made very ſtrong, and nine inches at leaſt in length, with ſtops or reſts in the middle of the blades, by which a large dilatation is more eaſily made. The above inſtruments ought only to be uſed in the moſt extraordinary caſes, where it is not poſſible to ſave the woman without their aſſiſtance.

Among the few improvements which have been made in the obſtetrical apparatus, the moſt important are the alterations in the forceps, by which the inconveniences formerly attending the uſe of that inſtrument are obviated, and the operation is rendered more ſafe and eaſy.

In contriving theſe alterations, the intentions were, 1. That the large curves ſhould correſpond as nearly as poſſible with that of the pelvis. 2. That their points ſhould be thrown forwards, and made round, to prevent their hitching, or even preſſing uneaſily againſt any part of the pelvis; and likewiſe to maintain their hold of the head whilſt it is to be brought forwards in that curved line of direction which nature obſerves. 3. That an inverted curve ſhould be made towards the joints, whereby the perinæum may be ſaved from injury, the extracting force rightly conducted, and the handles at the ſame time kept from preſſing uneaſily on the inferior and anterior parts of the pubes. 4. That their ſubſtance ſhould be reduced as much as poſſible, ſo that they are not made flexible, or ſo thin at the edges as to hurt the part. 5. That their clams may be made to preſs equally on the child's head, and ſpread gradually from the joint, ſo as not to dilate the os vaginæ too ſuddenly. 6. That the clams be of a due breadth with the outer ſurface, a little convex, and extremely ſmooth, that they may not preſs uneaſily to hurt the woman. 7. That their length be ſuch as can be applied ſafely and commodiouſly within the pelvis, and at the ſame time ſuit the different ſizes of the heads as much as poſſible.

The inſtrument executed according to theſe intentions, is called the *ſhort curved forceps*. It conſiſts of two blades, or parts; each of which is diſtinguiſhed into the handle A, the joint B, C, and the clams D, E. See FIG. 14. which repreſents one of the blades before it is bent into its perfect ſtate: *a*, *a*, *a*, are three holes for admitting ſcrews to fix the wooden handle. FIG. 15. ſhows the inſtrument finiſhed and locked, in which ſtate it meaſures about 11 inches; and, when properly made, weighs about 11 ounces troy. The clams muſt be covered with the beſt Morocco leather ſhaved thin, moiſtened with water, and ſewed on with waxed ſilk.

FIGURE 16. repreſents a catheter lately preferred by practitioners. It is ſtraight, perforated with 16 holes in four rows near the point, and terminated by a ſlight knob. The length is about 5¾ inches.

The foregoing Syſtem was preſented to us as an abridgement from Dr. Smellie, by Mr. Abraham Yeates O'Connor, ſurgeon and man-midwife, in Rathbone Place, a ſubſcriber and contributor to this work. We have given the whole of the Plates contained in the Doctor's valuable Treatiſe. Doctor Smellie profeſſes to have induſtriouſly avoided all Theory, except ſo much as may ſerve to aid the genius of young practitioners, and be as hints to introduce more valuable diſcoveries in the art. He adds, that as he has endeavoured to treat every particular in the moſt diſtinct though conciſe manner, many directions might occur that may be thought too minute and trivial by thoſe who have already had the advantage of an extenſive practice; but the work being principally intended for the inſtruction of young practitioners in general, he thought it neceſſary to mention every thing that he had found uſeful in the courſe of practice. The obſervations contained in his Treatiſe are not only the fruits of intenſe ſtudy and application in the early part of life, but more immediately of his practice in London during ten years, in which he had given upwards of two hundred and eighty courſes of Lectures on Midwifery, for the inſtruction of more than nine hundred pupils, excluſive of female ſtudents.

Mr. O'Connor, to render the Syſtem as complete as poſſible, has introduced in addition to Dr. Smellie's Plates, a View of the Membrana Decidua, *firſt diſcovered by Dr. William Hunter, to ſhew the texture and ſituation of this Membrane, and which was conſidered as highly uſeful to the Doctor's Pupils, and all who are in poſſeſſion of his excellent Lectures.*

Though the manner in which the Fœtus is nouriſhed in the womb, has been well explained in ſeveral anatomical publications, it has never been repreſented by Drawings, and has therefore perplexed young ſtudents and practitioners, for want of views to demonſtrate and illuſtrate it; in conſequence of which Mr. O'Connor has introduced in this Syſtem two diſtinct views, in order to ſupply this defect, and to render the fact more clear to our Readers.

THE EDITORS.

TREATISE ON MILITARY AFFAIRS.

SECT. I.

RISE AND PROGRESS OF THE MILITARY STATE IN BRITAIN.

THIS ſtate includes the whole of the ſoldiery; or ſuch perſons as are peculiarly appointed among the reſt of the people, for the ſafe guard and defence of the realm. In a land of liberty, it is extremely dangerous to make a diſtinct order of the profeſſion of arms. In abſolute monarchies, this is neceſſary for the ſafety of the prince, and ariſes from the main principle of their conſtitution, which is that of governing by fear: but, in free ſtates, the profeſſion of a ſoldier, taken ſingly and merely as a profeſſion, is juſtly an object of jealouſly. In theſe no man ſhould take up arms but with a view to defend his country and its laws: he puts not off the citizen when he enters the camp; but it is becauſe he is a citizen, and would wiſh to continue ſo, that he makes himſelf for a while a ſoldier. The laws, therefore, and conſtitution of theſe kingdoms, know no ſuch ſtate as that of a perpetual ſtanding ſoldier, bred up to no other profeſſion than that of war: and it was not till the reign of Henry VII. that the kings of England had ſo much as a guard about their perſons.

In the time of the Anglo-Saxons, as appears from Edward the confeſſor's laws, the military force of England was in the hands of the dukes or heretochs, who were conſtituted through every province and county in the kingdom; being taken out of the principal nobility, and ſuch as were moſt remarkable for being *ſapientes, fideles, et animoſi*. Their duty was to lead and regulate the Engliſh armies, with a very unlimited power; *prout eis viſum fuerit, ad honorem coronæ et utilitatem regni*. And becauſe of this great power they were elected by the people in their full aſſembly, or folkmote, in the ſame manner as ſheriffs were elected: following ſtill that old fundamental maxim of the Saxon conſtitution, that where any officer was entruſted with ſuch power, as if abuſed, might tend to the oppreſſion of the people, that power was delegated to him by the vote of the people themſelves. Among the ancient Germans, the anceſtors of our Saxon forefathers, they had their dukes, as well as kings, with an independent power over the military, as the kings had over the civil ſtate. The dukes were elective, the kings hereditary: for ſo only can be conſiſtently underſtood that paſſage of Tacitus, *Reges ex nobilitate, duces ex virtute ſumunt*. In conſtituting their kings, the family or blood-royal was regarded; in chooſing their dukes or leaders, warlike merit: juſt as Cæſar relates of their anceſtors in his time, that whenever they went to war, by way either of attack or defence, they elected leaders to command them. This large ſhare of power, thus conferred by the people, though intended to preſerve the liberty of the ſubject, was perhaps unreaſonably detrimental to the prerogative of the crown: and accordingly we find a very ill uſe made of it by Edric duke of Mercia, in the reign of king Edmund Ironſide; who, by his office of duke or heretoch, was entitled to a large command in the king's army, and by his repeated treacheries at laſt transferred the crown to Canute the Dane.

It ſeems univerſally agreed by all hiſtorians, that king Alfred firſt ſettled a national militia in this kingdom, and by his prudent diſcipline made all the ſubjects of his dominion ſoldiers: but we are unfortunately left in the dark as to the particulars of this his ſo celebrated regulation; though, from what was laſt obſerved, the dukes ſeem to have been left in poſſeſſion of too large and independent a power; which enabled duke Harold on the death of Edward the confeſſor, though a ſtranger to the royal-blood, to mount for a ſhort ſpace the throne of this kingdom, in prejudice of Edgar Atheling the rightful heir.

Upon the Norman conqueſt, the feodal law was introduced here in all its rigour, the whole of which is built on a military plan. In conſequence thereof, all the lands in the kingdom were divided into what were called knights fees, in number above 60,000; and for every knight's fee a knight or ſoldier, *miles*, was bound to attend the king in his wars, for 40 days in a year: in which ſpace of time, before war was reduced to a ſcience, the campaign was generally finiſhed, and a kingdom either conquered or victorious. By this means the king had, without any expence, an army of 60,000 men always ready at his command. And accordingly we find one, among the laws of William the conqueror, which in the king's name commands and firmly enjoins the perſonal attendance of all knights and others. This perſonal ſervice in proceſs of time degenerated into pecuniary commutations or aids; and at laſt the military part of the feodal ſyſtem was aboliſhed at the Reſtoration, by ſtatute 12 Car. II. c. 24.

In the mean time we are not to imagine that the kingdom was left wholly without defence in caſe of domeſtic inſurrections, or the proſpect of foreign invaſions. Beſides thoſe who by their military tenures were bound to perform 40 days ſervice in the field, firſt the aſſiſe of arms, enacted 27 Hen. II. and afterwards the ſtatute of Wincheſter, under Edward I. obliged every man, according to his eſtate and degree, to provide a determinate quantity of ſuch arms as were then in uſe, in order to keep the peace; and conſtables were appointed in all hundreds by the latter ſtatute, to ſee that ſuch arms were provided. Theſe weapons were changed, by the ſtatute 4 and 5 Ph. and M. c. 2. into others of more modern ſervice; but both this and the former proviſions were repealed in the reign of James I. While theſe continued in force, it was uſual from time to time for our princes to iſſue commiſſions of array, and ſend into every county officers in whom they could confide, to muſter and array or (ſet in military order) the inhabitants of every diſtrict; and the form of the commiſſion of array was ſettled in parliament in the 5th Hen. IV. But at the ſame time it was provided, that no man ſhould be compelled to go out of the kingdom at any rate, nor out of his ſhire, but in caſes of urgent neceſſity; nor ſhould provide ſoldiers unleſs by conſent of parliament. About the reign of king Henry VIII. lord-lieutenants began to be introduced, as ſtanding repreſentatives of the crown, to keep the counties in military order; for we find them mentioned as known officers in the ſtatute 4 and 5 Ph. and M. c. 3. though they had not been then long in uſe; for Cambden ſpeaks of them in the time of queen Elizabeth as extraordinary magiſtrates, conſtituted only in times of difficulty and danger.

In this ſtate things continued till the repeal of the ſtatutes of armour in the reign of king James I; after which, when king Charles I. had, during his northern expeditions, iſſued commiſſions of lieutenancy, and exerted ſome military powers which, having been long exerciſed, were thought to belong to the crown, it became a queſtion in the long-parliament, how far the power of the militia did inherently reſide in the king; being now unſupported by any ſtatute, and founded only upon immemorial uſage. This queſtion, long agitated with great heat and reſentment on both ſides, became at length the immediate cauſe of the fatal rupture between the king and his parliament: the two houſes not only denying this prerogative of the crown, the legality of which claim perhaps might be ſomewhat doubtful; but alſo ſeizing into their hands the entire power of the militia, the illegality of which ſtep could never be any doubt at all.

Soon after the reſtoration of king Charles II. when the military tenures were aboliſhed, it was thought proper to aſcertain the power of the militia, to recognize the ſole right of the crown to govern and command them, and to put the whole into a more regular method of military ſubordination: and the order in which the militia now ſtands by law, is principally built upon the ſtatutes which were then enacted. It is true, the two laſt of them are apparently repealed; but many of their proviſions are re-enacted, with the addition of ſome new regulations, by the preſent militia-laws: the general ſcheme of which is to diſcipline a certain number of the inhabitants of every county, choſen by lot for three years, and officered by the lord-lieutenant, the deputy-lieutenants, and other principal landholders, under a commiſſion from the crown. They are not compellable to march out of their counties, unleſs in caſe of invaſion or actual rebellion, nor in any caſe compellable to march out of the kingdom. They are to be exerciſed at ſtated times: and their diſcipline in general is liberal and eaſy; but, when drawn out into actual ſervice, they are ſubject to the rigours of martial law, as neceſſary to keep them in order. This is the conſtitutional ſecurity which our laws have provided for the public peace, and for protecting the realm againſt foreign or domeſtic violence; and which the ſtatutes declare is eſſentially neceſſary to the ſafety and proſperity of the kingdom.

When the nation was engaged in war, more veteran troops and more regular diſcipline were eſteemed to be neceſſary, than could be expected from a mere militia; and therefore at ſuch times more rigorous methods were put in uſe for the raiſing of armies and the due regulation and diſcipline of the ſoldiery; which are to be looked upon only as temporary excreſcences bred out of the diſtemper of the ſtate, and not as any part of the permanent and perpetual laws of the kingdom. For martial law, which is built upon no ſettled principles, but is entirely arbitrary in its deciſions, is, as Sir Matthew Hale obſerves, in truth and reality no law, but ſomething indulged rather than allowed as a law. The neceſſity of order and diſcipline in an army is the only thing which can give it countenance; and therefore it ought not to be permitted in time of peace, when the king's courts are open for all perſons to receive juſtice according to the laws of the land. Wherefore, Thomas earl of Lancaſter being conducted at Pontefract, 15. Edw. II. by martial law, his attainder was reverſed 1 Edw. III. becauſe it was done in time of peace. And it is laid down, that if a lieutenant, or other, that hath commiſſion of martial authority, doth in time of peace hang or otherwiſe execute any man by colour of martial law, this is murder; for it is againſt *magna charta*. And the petition of right enacts, that no ſoldier ſhall be quartered on the ſubject without his own conſent; and that no commiſſion ſhall iſſue to proceed within this land according to martial law. And whereas, after the Reſtoration, king Ch. II. kept up about 5000 regular troops, by his own authority, for guards and garriſons; which king James II. by degrees increaſed to no leſs than 30,000, all paid from his own civil liſt; it was made one of the articles of the bill of rights, that the raiſing or keeping a ſtanding army within the kingdom in time of peace, unleſs it be with conſent of parliament, is againſt law

But as the faſhion of keeping ſtanding armies (which was firſt introduced by Charles VII. in France, 1445.) has of late years univerſally prevailed over Europe, (though ſome of its potentates, being unable themſelves to maintain them, are obliged to have recourſe to richer powers, and receive ſubſidiary penſions for that purpoſe), it has alſo for many years paſt been annually judged neceſſary by our legiſlature, for the ſafety of the kingdom, the defence of the poſſeſſions of the crown of Great Britain, and the preſervation of the balance of power in Europe, to maintain even in time of peace a ſtanding body of troops, under the command of the crown; who are however *ipſo facto* diſbanded at the expiration of every year, unleſs continued by parliament. And it was enacted by ſtatute 10 W. III. c. 1. that not more than 12,000 regular forces ſhould be kept on foot in Ireland, though paid at the charge of that kingdom: which permiſſion is extended by ſtat. 8 Geo. III. c. 13. to 16,235 men in time of peace.

To prevent the executive power from being able to oppreſs, ſays baron Monteſquieu, it is requiſite that the armies with which it is entruſted ſhould conſiſt of the people, and have the ſame ſpirit with the people; as was the caſe at Rome, till Marius new-modelled the legions by enliſting the rabble of Italy, and laid the foundation of all the military tyranny that enſued. Nothing then, according to theſe principles, ought to be more guarded againſt in a free ſtate, than making the military power, when ſuch a one is neceſſary to be kept on foot, a body too diſtinct from the people. Like ours, therefore, it ſhould wholly be compoſed of natural ſubjects; it ought only to be enliſted for a ſhort and limited time; the ſoldiers alſo ſhould live intermixed with the people; no ſeparate camp, no barracks, no inland fortreſſes ſhould be allowed. And perhaps it might be ſtill better, if, by diſmiſſing a ſtated number, and enliſting others at every renewal of their term, a circulation could be kept up between the army and the people, and the citizen and the ſoldier be more intimately connected together.

To keep this body of troops in order, an annual act of parliament likewiſe paſſes, "to puniſh mutiny and deſertion, and for the better payment of the army and their quarters." This regulates the manner in which they are to be diſperſed among the ſeveral inn-keepers and victuallers throughout the kingdom; and eſtabliſhes a law-martial for their government. By this, among other things, it is enacted, that if any officer or ſoldier ſhall excite, or join any mutiny, or, knowing of it, ſhall not give notice to the commanding officer, or ſhall deſert, or liſt in any other regiment, or ſleep upon his poſt, or leave it before he is relieved, or hold correſpondence with a rebel or enemy, or ſtrike or uſe violence to his ſuperior officer, or ſhall diſobey his lawful commands; ſuch offender ſhall ſuffer ſuch puniſhment as a court-martial ſhall inflict, though it extend to death itſelf.

However expedient the moſt ſtrict regulations may be in time of actual war, yet, in times of profound peace, a little relaxation of military rigour would not, one ſhould hope, be productive of much inconvenience. And, upon this principle, though by our ſtanding laws (ſtill remaining in force, though not attended to) deſertion in time of war is made felony without benefit of clergy, and the offence is triable by a jury and before the judges of the common law; yet, by our militia-laws before-mentioned, a much lighter puniſhment is inflicted for deſertion in time of peace. So, by the Roman law alſo, deſertion in time of war was puniſhed with death, but more mildly in time of tranquility. But our mutiny-act makes no ſuch diſtinction: for any of the faults above-mentioned are, equally at all times, puniſhable with death itſelf, if a court-martial ſhall think proper. This diſcretionary power of the court-martial is indeed to be guided by the directions of the crown; which, with regard to military offences, has almoſt an abſolute legiſlative power. "His Majeſty (ſays the act) may form articles of war, and conſtitute courts-martial, with power to try any crime by ſuch articles, and inflict ſuch penalties as the articles direct." A vaſt and moſt important truſt! an unlimited power to create crimes, and annex to them any puniſhments not extending to life or limb! Theſe are indeed forbidden to be inflicted, except for crimes declared to be ſo puniſhable by this act; which crimes we have juſt enumerated, and among which, we may obſerve, that any diſobedience to lawful commands is one. Perhaps in ſome future reviſion of this act, which is in many reſpects haſtily penned, it may be thought worthy the wiſdom of parliament to aſcertain the limits of military ſubjection, and to enact expreſs articles of war for the government of the army, as is done for the government of the navy: eſpecially as, by our preſent conſtitution, the nobility and gentry of the kingdom, who ſerve their country as militia officers, are annually ſubjected to the ſame arbitrary rule during their time of exerciſe.

One of the greateſt advantages of our law is, that not only the crimes themſelves which it puniſhes, but alſo the penalties which it inflicts, are aſcertained and notorious: nothing is left to arbitrary diſcretion: the king by his judges diſpenſes what the law has previouſly ordained: but is not himſelf the legiſlator. How much therefore is it to be regretted, that a ſet of men, whoſe bravery has ſo often preſerved the liberties of their country, ſhould be reduced to a ſtate of ſervitude in the midſt of a nation of freemen! for Sir Edward Coke will inform us, that it is one of the genuine marks of ſervitude, to have the law, which is our rule of action, either concealed or precarious: *Miſera eſt ſervitus, ubi jus eſt vagum aut incognitum.* Nor is this ſtate of ſervitude quite conſiſtent with the maxims of ſound policy obſerved by other free nations. For the greater the general liberty is which any ſtate enjoys, the more cautious has it uſually been in introducing ſlavery in any particular order or profeſſion. Theſe men, as baron Monteſquieu obſerves, ſeeing the liberty which others poſſeſs, and which they themſelves are excluded from, are apt (like eunuchs in the eaſtern ſeraglios) to live in a ſtate of perpetual envy and hatred towards the reſt of the community, and indulge a malignant pleaſure in contributing to deſtroy thoſe privileges to which they never can be admitted. Hence have many free ſtates, by departing from this rule, been endangered by the revolt of their ſlaves: while, in abſolute and deſpotic governments, where no real liberty exiſts, and conſequently no invidious compariſons can be formed, ſuch incidents are extremely rare. Two precautions are therefore adviſed to be obſerved in all prudent and free governments: 1. To prevent the introduction of ſlavery at all: or, 2. If it be already introduced, not to entruſt thoſe ſlaves with arms; who will then find themſelves an overmatch for the freemen. Much leſs ought the ſoldiery to be an exception to the people in general, and the only ſtate of ſervitude in the nation.

But as ſoldiers, by this annual act, are thus put in a worſe condition than any other ſubjects; ſo, by the humanity of our ſtanding laws, they are in ſome caſes put in a much better. By ſtatute 43 Eliz. c. 3. a weekly allowance is to be raiſed in every county for the relief of ſoldiers that are ſick, hurt, and maimed: not forgetting the royal hoſpital at Chelſea for ſuch as are worn out in their duty. Officers and ſoldiers, that have been in the king's ſervice, are by ſeveral ſtatutes, enacted at the cloſe of ſeveral wars, at liberty to uſe any trade or occupation they are fit for, in any town in the kingdom (except the two univerſities), notwithſtanding any ſtatute, cuſtom, or charter to the contrary. And ſoldiers in actual military ſervice may make nuncupative wills, and diſpoſe of their goods, wages, and other perſonal chattels, without theſe forms, ſolemnities, and expences, which the law requires in other caſes. Our law does not indeed extend this privilege ſo far as the civil law, which carried it to an extreme that borders upon the ridiculous: for if a ſoldier, in the article of death, wrote any thing in bloody letters on his ſhield, or in the duſt of the field with his ſword, it was a very good military teſtament.

SECT. II.

MILITARY DISCIPLINE, GENERAL AND PARTICULAR.

Military diſcipline, generally conſidered, is the training of ſoldiers, and the due enforcement of the laws and regulations inſtituted by authority for their conduct. Next to the forming of troops, military diſcipline is the firſt object that preſents itſelf to our notice: it is the ſoul of all armies; and unleſs it be eſtabliſhed amongſt them with great prudence, and ſupported with unſhaken reſolution, they are no better than ſo many contemptible heaps of rabble, which are more dangerous to the very ſtate that maintains them, than even its declared enemies.

Though the general principles of the art of war be the ſame in all ages and countries, yet in the particular modes various changes are effected by the flux of time, and by the improvements that are made, and the arts that are invented, in the courſe of it. Conqueſt is no longer eſtabliſhed on the ſame baſis, and the ſuperiority of troops is no longer founded on the ſame principles as they have been. The event of a battle depends much leſs at preſent on the perſonal ſtrength and proweſs of individuals, than it did in the days of our forefathers; and the ſuperiority of one nation over another in thoſe particulars is no longer of the ſame importance. No great degree of perſonal ſtrength is required for the preſent method of fighting; and, as for courage, it has been found to conſiſt more in diſcipline, than in any particular conſtitution either of mind or body. Diſcipline improves the courage men have derived from nature, and by inſpiring them with a confidence in themſelves, and in each other, excites an artificial courage where the natural one is deficient. It is diſcipline that creates and preſerves that principle of union, which guides and directs to an uniform end thouſands of perſons endowed with different and even oppoſite talents, and urged on by various intereſts, wiſhes and inclinations.

By the force of diſcipline men are kept in order and obedience to command, in oppoſition to the ſtrongeſt immediate impulſe of their paſſions. When troops are ſaid to be routed, nothing more is meant, than that they are put into confuſion, or that order, ſubordination and obedience to command are fled; in which caſe every man conſults his own perſonal ſafety, at the inſtigation of the predominant paſſion, fear, or the deſire of ſelf-preſervation. Now thoſe troops that are the beſt diſciplined will retain the longeſt due order and obedience: therefore, the beſt diſciplined troops are with moſt difficulty put into confuſion; or, in other words, are the leaſt liable to be conquered.

But to illuſtrate the advantages of diſcipline is required neither logical proof, nor mathematical demonſtration; its neceſſity having been eſtabliſhed by the moſt convincing, if not the ſureſt, of all teſts, that of experience: and this ſubject has been ſo copiouſly treated by numbers of military authors, that it is needleſs to expatiate any further on it here; and indeed it would be difficult to produce any new matter on ſo threadbare a topic. It ſhall not then be our buſineſs to hold forth the uſe and neceſſity of diſcipline, but to explain what that diſcipline conſiſts in, through its ſeveral branches.

Before we proceed any further, it will be neceſſary to premiſe, that though ſome parts of our ſubject may appear trifling, yet perhaps they are ſo only in appearance, and may poſſibly be of more importance than our readers may imagine; that even the *minutiæ* of diſcipline are not beneath the notice of any military man: for it has been a general remark, that as thoſe regiments, which have made the beſt figure on the parade, have, when taken upon ſervice, diſtinguiſhed themſelves the moſt againſt the enemy; ſo that thoſe officers, who have in their riper years turned out to be the ableſt generals, have, when young in the ſervice, been the moſt remarkable for their attention to every point of diſcipline, to the minute and trifling, as well as to the greater and more important parts of their duty.

By *military diſcipline*, in a particular ſenſe, we are to underſtand the mechanical part of the buſineſs of war; which is the only one that can be reduced to fixed and preciſe rules. Sometimes the word, *diſcipline*, bears the confined ſignification of *regimen*; or the principles, laws, and method of government; thus, when we ſay, ſuch troops are kept under ſtrict diſcipline, we mean, that the laws, by which they are governed, are ſevere: but here it is to be taken in its utmoſt latitude.

In this ſenſe, we conſider *military diſcipline* as divided into three diſtinct branches, which alſo admit of their ſeveral ſub-diviſions. The firſt is, the formation, training and exerciſing of troops, or teaching them how to array themſelves, the management of their arms, their movements or evolutions, and the practice of every thing that may be executed in the field: the ſecond we take to be the ordinary duties and *routine* of the ſervice, as the manner of mounting guards in camp and garriſon, going rounds, paying honours, performing ceremonies, &c. which is intimately connected with the firſt part, and founded principally upon it: the third part of diſcipline conſiſts in the laws and inſtitutions of war, which are, firſt, the act of parliament for the government of the army; then the articles of war framed by his Majeſty, as well as other regulations eſtabliſhed by him; and laſtly, the unwritten law, or cuſtom of war and comprehends every thing that relates to rights of perſons, adminiſtration of juſtice, &c. The ſame connexion ſubſiſts between this and the ſecond part of diſcipline, as between the ſecond and the firſt. Of theſe parts, the firſt is defined by the expreſſion of *Military Arrangement*, the two others by that of *Diſcipline of War*.

SECT. III.

MILITARY ARRANGEMENT AND INSTITUTIONS.

An army is to be conſidered as it is formed of different *arms*, or kinds of troops, or as it is reſolved into its component parts. As to the different kinds or ſpecies of troops, they are either cavalry, dragoons or infantry; beſides the corps appointed to the ſervice of the artillery. Infantry conſiſted formerly of pikemen and muſketeers; but ſince the invention of the bayonet, pikes have been exploded throughout Europe. Of late years the inſtitution of light-armed infantry has been revived, and a company in each regiment allotted to that ſervice. Again, when we conſider an army as reſolved into its conſtituent parts, it is firſt divided into wings; thoſe wings into brigades: and thoſe brigades into regiments, or into ſquadrons and battalions.

It is worthy of obſervation, that in the moſt remote parts of the world, and among nations, who have not had the ſmalleſt intercourſe with each other, the ſame diviſions, or nearly the ſame, have been adopted in their reſpective armies; at leaſt among ſuch as have arrived to any degree of proficiency in the art of war. Experience, which is productive of the ſame effects in all countries, and which dictates the ſame precepts in all quarters of the globe, has pointed out to different people the neceſſity of forming their troops into ſmall diſtinct bodies; the cavalry into ſquadrons, conſiſting of from 100 to 200 men, and the infantry into battalions, of from 500 to 1000. The preſent eſtabliſhment of battalions, which prevails among the European powers, is generally of about 600 or 700 men; which have been found as many as can be manœuvered together with eaſe and ſafety before an enemy.

The ſervice of the dragoons, on its firſt inſtitution, was a kind of medium between that of the cavalry and the infantry. They were then muſketeers mounted on horſeback, more for the ſake of expedition, than for fighting or charging an enemy: when they had occaſion to fight, they generally diſmounted. But now in moſt ſervices in Europe, and particularly in the Britiſh, the dragoons are nothing inferior to the cavalry, but being ſtill trained to the exerciſe of the foot, they are capable of ſerving alike on foot as on horſeback.

The inſtitution of dragoons we derived from the French, among whom it was deviſed by Marſhal Briſac. Whence they took their name does not appear ſo clearly. Some think they were called Dragons, becauſe a ſoldier mounted in this manner, with his burning match, (which was in uſe before the invention of the firelock) bore ſome reſemblance to a fiery dragon; others imagine, that this name was given them, in the way of diſparagement, by the enemy, on account of the ravages they committed; for it was chiefly their buſineſs to go upon expeditions, and lay countries under contribution. Others think, that the name was taken from the Roman *draconarius*; but this was an officer, whoſe duty had no reſemblance to that of a dragoon. After all, the moſt probable ſuppoſition is, that the name was either given them by the inſtitutor, or elſe aſſumed by themſelves, as expreſſive of their activity and valour.

Since dragoons have been put on the footing of cavalry, a very ſmall number of the latter have been kept up in our ſervice; there being at preſent only five regiments of cavalry, properly ſo called, on the Britiſh and Iriſh eſtrbliſhments; beſides the four troops of horſe, and horſe-grenadier guards. We have three regiments called Dragoon-guards; but this diſtinction is merely nominal; thoſe three regiments being exactly on the ſame footing with the other regiments of dragoons: notwithſtanding they claim precedence of them.

Of the dragoons or cavalry, ſome regiments are light and others heavy; but this regards only the ſize of men and horſes, weight of offenſive arms, and difference of training. Formerly the heavy cavalry were completely provided with defenſive arms; at preſent none are uſed but the helmet, and that not muſket-proof, worn by the dragoons. In time of war, indeed, the heavy-mounted have of late been furniſhed with ſkull caps and breaſt plates: and their uſe in battle may be readily convinced from a computation made by the King of Pruſſia, that in one action laſt war above 600 horſemen's lives were ſaved by the *cuiraſs* or breaſt-plate. Thoſe worn by the French cavalry are proof only againſt a piſtol bullet.

The bulk of our modern armies is compoſed, as was the caſe among the antients, of infantry. In that dreary and barbarous interval between the decay of the military ſcience, which took place with the ſubverſion of the Roman empire, and its modern revival, which happened about the ſame time with that of arts and letters, an army was judged to be ſtrong and formidable, in proportion as it abounded with cavalry; and this branch, from the ſuperiority of its inſtitution, the repute in which it was held, and the rank of the perſons who compoſed it, challenged a precedency beyond the other, which it is now by no means entitled to. The Engliſh, indeed, who during theſe ages were ſuperior to moſt, if not to all the other European nations in their military inſtitution, always had in their armies a conſiderable body of infantry; (for moſt of the archers ſerved on foot, though a great part of them were mounted) and this perhaps was a principal cauſe of thoſe ſplendid victories, which our Edwards and Henries obtained with ſmall bodies over much greater numbers of the enemy. Among the French not a ſingle foot ſoldier was to be ſeen; and their armies conſiſted entirely of horſe, for the ſpace of ſeveral centuries, excepting ſome mercenary foot, hired of foreigners, and particularly of their neighbours, the Swiſs cantons. Infantry was no leſs neglected among the Spaniards, as we are informed from a circumſtance, which at the ſame time gives us the derivation of the name. The army of a Spaniſh monarch, which conſiſted entirely of cavalry, having been routed by the Moors, and being cloſely purſued by the enemy, the Infanta ſuddenly raiſed a body of men, whom ſhe armed, as well as ſhe could, and marched with all expedition to the ſuccour of her father. The Mooriſh cavalry purſuing the Spaniards in ſome diſorder, the Infanta with her levies met them in a cloſe country, engaged, and gave them a complete overthrow. Footmen were then ſo unuſual among the Spaniards, that they had no name for them: Hence, on that occaſion, they called them *Infanteria*, in honour of the Infanta; which name was perpetuated, and adopted by the other European armies.

SECT. IV.

SUBORDINATION OF RANK.

The firſt ſtep towards the eſtabliſhment of diſcipline, and the formation of the troops, is the appointment of officers to command them. And in this appointment of officers, the firſt principle is, that there be always *one ſupreme and ſole in command*. Therefore a regular gradation or chain of authority muſt be obſerved, from the commander in chief of an army down to the loweſt non-commiſſion officer of a company; the ſmalleſt diſtinct body of which an army is compoſed. But excluſive of this ſubordinate chain, there are branches which take different directions, and which terminate in themſelves; though they derive their origin from the ſame general head. Such are the officers who are called of the ſtaff; they have peculiar departments, and are ſubject only to the authority of the commander of that body to which they are appendages; or to his ſuperiors. Thus the adjutant-general is immediately ſubſervient to the commander in chief; a major of brigade to his brigadier, and an adjutant to the commanding officer of his battalion.

It muſt be obſerved, that, by the ſyſtem of ſubordinate repreſentation, the power and prerogative of the higheſt officer deſcends in his abſence to the next in degree; thus, while an officer remains, no corps can be without its commander. For inſtance, if the colonel and lieutenant colonel of a regiment are not preſent, the major ſucceeds to the authority of commandant; and, in that caſe, the ſame obedience is due to him as to the colonel. This points out the method by which we ſhall conſider the rank and duties of the different officers.

The officers, by which an army, conſidered as an aggregate body, is commanded, are the CAPTAIN GENERAL, or commander in chief, and the other GENERAL and STAFF OFFICERS.

A general appointed to command an army has for the moſt part a commiſſion of commander in chief: and the extent of his authority muſt depend on the powers with which he is inveſted by that commiſſion. Some years back there were field-marſhals, but at preſent there are none of that denomination among the Britiſh troops. The rank of commander in chief, or captain-general, is commonly ſuppoſed to correſpond to the degree of field-marſhal in the French ſervice; yet there is this difference: the rank of a field-marſhal of France is permanent and general; whereas that of an Engliſh commander in chief or captain-general is temporary and local: for a lieutenant or even a major general, has often in our ſervice the appointment of commander in chief. The power of filling up vacant commiſſions, and of iſſuing warrants for the aſſembling and holding of general courts martial, &c. is uſually delegated by the king to the commanders in chief, whom he appoints, within their reſpective commands or diſtricts. On ſervice abroad, the commanders in chief generally have the privilege of ſigning the commiſſions; but in Great Britain and Ireland, though they may nominate to vacancies, yet every thing is done in the king's name, and all commiſſions are ſigned by his Majeſty.

A proper number of GENERAL OFFICERS are appointed according to the ſtrength of the army. For this proportion no certain rules are eſtabliſhed. When the army is conſiderable, the following may be conſidered as an adequate ſtaff, excluſive of the commander in chief: a general for the horſe, and one for the foot; or a general for each wing of the army: a major general for every two brigades; and about half that number of lieutenant generals. Notwithſtanding the diſtinct appellations of general; lieutenant, and major general; their duties are much the ſame. Thoſe terms ſerve to little other purpoſe, but to denote the ſucceſſive gradations of rank.

At a ſiege, a general officer is appointed to the command of each attack. On the day of march, each column of the army has its own general officer to lead and command it. Theſe duties are done by ſeniority.

Beſides the general officers and their aid-de-camps, there are other officers upon the ſtaff; who are properly called STAFF-OFFICERS of the army. Of theſe the principal are, the ADJUTANT, and QUARTER-MASTER GENERAL.

The adjutant-general is the officer who manages, in conjunction with the majors of brigade, the whole detail of the army. He is always an attendant upon the general's perſon; and muſt reſide at or near the head-quarters. This poſt of adjutant-general confers no rank on the perſon who holds it; but as it requires experience, no leſs than activity, it is in a large army uſually occupied by a general officer.

The officer of QUARTER-MASTER-GENERAL relates, as the name itſelf implies, to the diſtribution of quarters for the army. When the army is to encamp, he goes on, the day before, with the major-general of the day, to chuſe the ground for the encampment. The adjutant-general is provided with a deputy, who is alſo an officer of the army, to aſſiſt him in the execution of his duty. The quarter-maſter-general likewiſe has a deputy, beſides a certain number of aſſiſtants. Theſe are the principal ſtaff-officers.

A BRIGADIER, or as he is commonly ſtyled BRIGADIER-GENERAL, is the commanding officer of a brigade; and his rank, like that of a captain-general, is temporary and local.

Each brigadier has an officer, called MAJOR OF BRIGADE, who ſerves him both in quality of adjutant and aid-de-camp: but as a brigadier is a general officer only in his own brigade, he cannot iſſue his orders, or extend his authority, any farther.

The general officers always appoint their own aid-de-camps; but the majors of brigade are not always appointed by their own brigadiers. Sometimes they are nominated by his Majeſty, or the perſon who repreſents him; in which caſe they have commiſſions. When appointed by the brigadiers, they are generally choſen among the captains or ſubalterns of the brigade. As the adjutants of regiments are often ſubaltern officers, the poſt of brigade-major ſhould always be given to ſome officer of a higher rank: it has frequently been the maxim to confer this office on the oldeſt captain in the brigade.

The officers of a regiment or battalion are the field and ſtaff officers; they correſpond to the general and ſtaff officers of an army. And firſt of the FIELD OFFICERS, who are in general three, viz. a COLONEL, a LIEUTENANT-COLONEL, and a MAJOR.

The power of the colonel was formerly much more extenſive than it is at preſent. As they generally raiſed their own regiments, they had the abſolute diſpoſal of the commiſſions; and if they had not authority to break their officers without trial, they had at leaſt that to ſuſpend them at diſcretion. They have ſtill the power, when preſent with their regiments, of appointing the non-commiſſion officers, and of reducing them without a court-martial: but all that remains of their former authority to fill up the vacant commiſſions, is that of examining, and either approving or rejecting ſuch gentlemen as wiſh to purchaſe into the corps.

The cloathing and accoutrements of the regiment are provided by the colonel from the ſtoppages made for that purpoſe; and he has the ſole power of fixing and altering the uniform, in conformity to the King's regulations. A colonel's command is from 600 to 1000 men or upwards. But it is to be remarked, that a colonel, as well as all other officers of whatſoever rank, cannot refuſe to march with any number of men, however ſmall, when the ſervice requires it.

The LIEUTENANT-COLONEL is ſimply the *locum tenens* of the colonel, commanding the regiment in the abſence of the latter. There are nevertheleſs ſome branches of the colonel's prerogative which are peculiar to himſelf, whether abſent or preſent with his corps, and which the lieutenant-colonel does not partake of. A lieutenant-colonel's command may conſiſt of from 300 to 600 men, or upwards.

The third and laſt field-officer of a regiment is the MAJOR. When the colonel and lieutenant-colonel are both abſent, he becomes the commanding officer; and, in that caſe, the oldeſt captain uſually does his duty. The duties of the major are of great number and variety; but the firſt and principal one is to exerciſe the regiment under the inſpection of the colonel; for which reaſon he muſt have a perfect knowledge of the exerciſe, and of all the manœuvres.

The ſtaff commiſſion officers in a regiment are, the adjutant, the quarter-maſter, the ſurgeon, and the chaplain. The non-commiſſion officers, who act upon the ſtaff, are the ſerjeant-major, the quarter-maſter-ſerjeant, and the drum-major. Theſe two laſt, indeed, are not in general reckoned as part of the ſtaff: yet, having peculiar duties of their own, they come under our deſcription of ſtaff-officers.

The ADJUTANT is to the commanding-officer of a regiment what an aid-de-camp is to a general, and a major of a brigade to a brigadier. He likewiſe bears the ſame relation to a regiment as an adjutant-general does to an army.

The QUARTER-MASTER is the next ſtaff officer to the adjutant. His employment is rather of a civil than a military nature, he having nothing to do with the diſcipline of the regiment. The name itſelf of quarter-maſter is expreſſive of his principal duty, viz. the care of providing and inſpecting the quarters of the regiment.

The SURGEON is another commiſſion officer on the ſtaff of a regiment, and ſhould not only be well ſkilled in the branch of ſurgery, but ſhould alſo be a good phyſician and apothecary, being obliged to act in thoſe three capacities towards the ſick and wounded. He is allowed a mate to aſſiſt him, who has no commiſſion, but acts by virtue of a warrant from the colonel. Before any perſon can be appointed ſurgeon or mate to a regiment, he muſt paſs an examination for each degree before the board of ſurgeons.

The next and laſt commiſſion officer on the ſtaff is the CHAPLAIN; the nature of whoſe office is too well known to require any explanation. He is generally allowed, when he thinks proper, to act by deputy.

The SERJEANT-MAJOR is the firſt, and properly ſpeaking the only non-commiſſion officer on the ſtaff. He bears the ſame ſubordinate relation to the adjutant, as the adjutant does to the commanding officer; and as the adjutant keeps the roſter of the officers, ſo does the ſerjeant-major keep that of the ſerjeants and corporals, whom he warns for duty in their turns, and orders the *quota* of private men each company is to furniſh, according to the number of men in each fit for duty. The ſerjeant-major attends all parades of the regiment, to ſee that the exact number of men, that were ordered for duty, are brought from each company, and that they are clean and well-dreſſed. He is to make the orderly ſerjeants and corporals reſponſible for the leaſt neglect in any of theſe particulars When the rolls are called, he aſſembles the orderly ſerjeants of each company in front or rear of the regiment, in order to receive their reports, and deliver them to the adjutant. He muſt be perfectly acquainted with the exerciſe and manœuvres, in which it will frequently be his buſineſs to inſtruct the young officers. He muſt be well verſed in the detail of regimental duty in general, and of his own regiment in particular, and muſt have a thorough knowledge of every part of the ſervice. On the vacancy of adjutant, or quarter-maſter, the ſerjeant-major, if he has merit, is commonly recommended for the ſucceſſion.

The DRUM-MAJOR has the command of all the drummers of the regiment, and warns them in their turns for the different duties. At roll-calling and all other parades he is to be anſwerable for the good appearance of the drummers, and is to report ſuch as are abſent without leave to the adjutant or ſerjeant-major. He is likewiſe to ſee that the drums are kept in repair.

In action the drum-major puts himſelf in the rear of the battalion, with all the drummers, except the orderly, to aſſiſt the wounded. Whenever the colours are taken out or returned, it is his buſineſs to uncaſe and put them up again in a proper manner. All corporal puniſhments being inflicted by the drummers of the regiment, the drum-major is always to provide the proper inſtruments, and is to attend and oblige the drummers to do their duty.

Having taken a ſummary view of the rank and duties of the officers properly belonging to an army, a brigade, and a regiment or battalion, we come to the conſideration of thoſe belonging to a company; the ſmalleſt independent body of which an army is compoſed.

The CAPTAIN is to his own company what the colonel is to the whole regiment. He has the entire charge and command of it in every particular that regards its diſcipline and œconomy.

A captain's uſual command on guard, picquet, or detachment, is from 50 to 100 men; and he has always at leaſt two ſubalterns along with him: with 100 men he has three ſubalterns.

The commiſſion-officers in a company, ſubordinate to the captain, are, the LIEUTENANTS and ENSIGNS; who are commonly called the SUBALTERN OFFICERS. Theſe, though their rank is not the ſame, yet, for the moſt part, roll in duty together without diſtinction. Their ordinary duties are, in garriſon, guards, detachments, courts-martial, viſiting the hoſpital and barracks: in camp;

guards, detachments, out-poſts, picquets, courts-martial, fatigues or working parties, and orderly duties. No officer can change his duty with another, unleſs by permiſſion of the commanding officer.

The non-commiſſion officers of a company are the SERJEANTS and CORPORALS; and upon a proper choice of theſe officers the diſcipline of the company, and conſequently that of the corps, principally depends. For it is more immediately their buſineſs, than that of the commiſſion officers, to inſtruct and form the ſoldiers; and from their continual intercourſe with them they have it in their power to attend to matters which cannot ſo well come under the notice of the others.

The ſerjeants being the nerves and ſinews of the corps, a commanding officer muſt, in promoting private ſoldiers to the knot, have principally in view the training up and forming of proper characters for the halbert. Any active young ſoldier, who has already perfected himſelf in the exerciſe, and has ſome general knowledge of his duty as a private ſoldier, with an emulous ambition of improvement, may be fit to do the duty of corporal: but to make a good ſerjeant, requires various qualifications, and good natural and acquired abilities. A ſerjeant ſhould not only be perfectly expert himſelf in the exerciſe of the firelock and halbert, and in all the parade and field duties; but ſhould likewiſe be able to inſtruct others: and he will be not only required to inform his inferiors alone, but ſometimes his ſuperiors likewiſe. He muſt underſtand writing and accounts, and muſt be well informed of the whole *routine* of the ſervice and the cuſtoms of the army.

Since it requires ſuch length of time and experience to qualify a ſoldier to do the duty of ſerjeant, it follows that none but young men ſhould be made corporals. Should the oldeſt ſoldiers in each company be promoted to the knot, they might be ſuperannuated, or at leaſt unfit for active ſervice, by the time they became candidates for the halbert. Though the duties of the ſerjeant and corporal are not the ſame, yet they have a very intimate connexion with each other: and it is neceſſary that there be in every company one or more corporals, who can ſupply the place of the ſerjeants, when there is a deficiency of the latter, either from ſickneſs or other cauſes.

A ſerjeant's command is from 12 to 18 with a corporal, and that of a corporal from 3 to 9 privates. No non-commiſſion officer can change his duty without leave of the ſerjeant-major or the adjutant, as well as the commanding officer of his company.

The CORPORALS take the orderly duty among themſelves in the ſame manner with the ſerjeants. In ſome regiments the orderly corporals make up the morning reports of their companies, inſtead of the ſerjeants; and in others they make up the reports for the ſubaltern officers of their companies, whilſt the ſerjeants make them up for the captain or commanding officer. The orderly corporal keeps the ſize and duty roll of the company, and warns each individual when it is his turn for duty. Whenever the drum beats for orders, he attends with his firelock, and receives the orders from the orderly ſerjeant. He is to march the men of his company for duty from their quarters to the parade, and muſt be reſponſible to the orderly ſerjeant, who is in like manner to be reſponſible to the ſerjeant major, for their good appearance. It is the orderly corporal's buſineſs to report the ſick of the company to his own officers, and to the ſurgeon of the regiment.

When under arms, or drawn up in the ranks, the corporals are not to aſſume any command, or preſume to give any directions; but muſt attend to the word of command like the private men. It is expected that a corporal be more particularly expert and graceful in handling his arms, as he is to ſerve as a model to the young ſoldiers: yet he ſhould not confine his views in perfecting himſelf in his own duty, but ſhould qualify himſelf as ſoon as poſſible to do the duty of ſerjeant. The recruit, on firſt joining his company, muſt be inſtructed by the corporals in the reſpect and obedience due to his ſuperiors, and the compliment each rank of officers is entitled to. They muſt alſo acquaint him with the articles of war, and the rules and regulations of the regiment, together with the penalty attending the tranſgreſſion of them.

SECT. V.

METHOD OF ASSEMBLING A REGIMENT, AND THE TACTICK, OR MANNER OF DRAWING UP, TELLING OFF, &c.

The mode of aſſembling a regiment on the parade for exerciſe depends on its ſituation, whether in camp or quarters. When the regiment is in quarters, each company parades ſeparately, ſome time before the regiment is to aſſemble, in a convenient place, appointed by the captain, where one of the ſubaltern officers muſt attend, in order to inſpect the men's arms and accoutrements, to ſee that they are provided with the proper quantity of ammunition, and that they are clean and dreſſed in a ſoldier-like manner. After which they are to be marched regularly to the parade of the regiment.

It is improper that any general rule ſhould be eſtabliſhed for the marching of companies to the parade, without the conſideration of their numbers and the ground they are to march over. Yet the method heretofore laid down and practiſed was for each company to march in three diviſions, the captain leading the firſt, the enſign the center, and the lieutenant the rear diviſion; the drummers between the front and center ranks of the firſt diviſion, and the ſerjeants upon the flanks. The companies muſt be ſized from right and left to the center; which is to be done by the ſerjeants before the officers come to inſpect them.

Whenever a battalion is under arms for exerciſe to review, a field return is to be made out, which is to compriſe the following particulars: the number and rank of the ſeveral commiſſion officers, the non-commiſſion officers, the officers and men upon duty, thoſe abſent with leave, recruiting, ſick in quarters, ſick in hoſpital, and wanting to complete. The return is to be given to the general or commanding officer who reviews them.

It is the cuſtom to draw up a battalion in three ranks; the talleſt men compoſing the front rank, the next in height the rear rank, and the ſhorteſt the center rank. The granadier company is drawn up in the ſame order on the right of the battalion, with a ſmall interval; and the light company on the left in two ranks only. The ranks are either in cloſe or open order. When the battalion is drawn up in open order, the ranks are at the diſtance of four ordinary paces from each other; the officers four paces before the front rank, and the ſerjeants the ſame diſtance behind the rear rank. This is the proper method of drawing up; but it is not always adhered to: in general there is not the ſame diſtance allowed between the rank of officers and the front rank of men, and between the rank of ſerjeants and rear rank, as there is between the different ranks of men. In cloſe order the officers and ſerjeants fall into the ranks with the private men, which are then one pace diſtant from each other. The files are half a pace diſtant, or half the length of an out-ſtretched arm. That is the regular diſtance on the parade: but in the field the files may be opened or cloſed as exigencies may require. When the ranks are cloſed, the officers and ſerjeants fall into the intervals between the companies or diviſions; yet when in open order, they are not oppoſite to the intervals, but to the ſecond or third file on each flank of their companies or diviſions.

SECT. VI.

DIRECTIONS FOR PERFORMING THE MANUAL EXERCISE, ILLUSTRATED BY FIGURES TAKEN FROM LIFE, DESCRIPTIVE OF ALL THE MOTIONS. Vide Plate I, II, III.

The ultimate intention of all exerciſe can be nothing more than to render a battalion expert in what it may have to perform before an enemy. It ſhould follow, therefore, that whatever cannot be ſo practiſed in the face of an enemy is ſuperfluous, and that all ſuperfluous and unneceſſary matter ſhould be exploded, as only tiring the patience of the ſoldier to no good purpoſe. However ſpecious this concluſion may appear, yet it is certain there are many things in the exerciſe performed by a regiment, which it is never ſuppoſed are to be done before an enemy, the practice of which is attended by ſome collateral benefit. Such is the manual exerciſe in general, which, however uſeleſs many of the particular motions, contributes greatly to teach a recruit to handle his arms with eaſe and dexterity.

A prodigious alteration has of late years been introduced in the manual exerciſe, correſponding to the preſent mode of drawing up the battalion. The motions of the old exerciſe were ſo wide, that it required double the interval now allowed between each file to perform them in; whence it was neceſſary to open the files, as well as the ranks, for the performance of the manual, and to cloſe them again, when it was over for the firings: ſo that the opening and cloſing of the files made half the buſineſs of a field day: whereas, now, the ſame order ſerves for every different operation. Beſides the avoiding of this inconvenience and delay, the new exerciſe has this further advantage over the old, that its motions are leſs complicated, and more eaſily compaſſed by a recruit. For theſe improvements in the manual we are indebted to the Pruſſians, from whom they have been either copied, or imitated, by the troops of almoſt every power in Europe.

At the ſame time that the motions have been contracted, a conſiderable change has likewiſe been effected in the time. The Britiſh foot have lately adopted a very quick one in the performance of the manual. But this is an *alteration*, which cannot be conſidered as an *improvement*. It certainly diminiſhes much the grace and beauty of the exerciſe, without the compenſation of any ſolid advantage: for it does not appear, that a battalion can fire oftener in the ſame ſpace of time, ſince the quick method has taken place, than before it. Beſides, it may be doubted, whether ſteadineſs be not of greater advantage in action than quick firing. At any rate it muſt be allowed, that the German troops in general fire as well and as quick as any troops in Europe; and yet they ſtill adhere to the ſlow method of performing the manual.

(I.) POIZE YOUR FIRELOCK. *Two Motions.*

1. Seize the firelock by the ſmall of the ſtock, with the right hand; at the ſame time turn the lock in the front, ſo as the cock may touch your left breaſt, keeping the barrel perpendicular.

2. Bring up the firelock with a quick motion, and ſtrike the ſling with the left hand; the fingers pointing upwards, and the wriſt upon the guard; both elbows cloſe down. *N. B.* The point

of the fingers ſhould be no higher than the mouth, and the firelock cloſe in to the left ſide and barrel, perpendicular.

(II.) Cock your Firelock. *Two Motions.*

1. Turn the barrel inwards, ſupport the firelock in the left hand, ſquare the right elbow, with the thumb of the right hand upon the cock.
2. Bring the thumb over the cock, and ſeize the firelock by the ſmall under the lock. *N. B.* As you do not cock in manual exerciſe, the motion only is to be made.

(III.) Present. *One Motion.*

The right hand throws the firelock down to the preſent, and is ſtopped with the left at the ſwell, the butt to be raiſed to the ſhoulder, and the fore finger of the right hand before the trigger. *N. B.* At the time you bring the firelock down, draw the right foot back 6 inches, and turn the left toe to the front.

(IV.) Fire. *One Motion.*

After you are ſuppoſed to havepulled the trigger, count *one*, *two*, then bring up the right heel, with inſide of the left, and at the ſame time bring the firelock to the priming poſition. By ſupporting the firelock in the left hand betwixt the ſwell and the lock, having hold of the cock between the 2d joint of the fore-finger and thumb, and your elbow ſquare. *N. B.* That you may have a full command of the firelock, the lock muſt be oppoſite the center of your body, and the muzzle the height of your hat.

(V.) Half Cock your Firelock. *One Motion.*

Bring the right elbow down upon the butt, ſtill keeping your finger and thumb at the cock.

(VI.) Handle your Cartridge. *One Motion.*

Bring your right hand ſmartly down to your pouch, clapping it hard, then bring your hand up with the three laſt fingers ſhut, and your fore-finger and thumb pointing to your mouth, your elbow down upon the ſtock.

(VII.) Prime. *One Motion.*

Give a ſingle ſhake over the pan, then bring your right hand behind the hammer, with your little finger laying acroſs the barrel, your elbow ſquare.

(VIII.) Shut your Pans. *Two Motions.*

1. Bring your elbow down upon the ſtock, ſtill holding the hammer in your hand for the ſpace of time that you count *one, two.*
2. Turn the piece nimbly round to the loading poſition, with the butt to the ground in a line with your left toe, barrel to the front; and leaning acroſs, that the muzzle may be oppoſite the centre of your body, the three laſt fingers of your right hand ſhut, and laying againſt the barrel, your fore finger and thumb as high as the elbow down, your left arm extended, holding the firelock with the thumb behind the ſling, and fingers upon the barrel.

(IX.) Charge with Cartridge. *Two Motions.*

1. Raiſe your right elbow, turn the back of your hand inwards, with your fore finger upon the muzzle, count *one, two,* between this and the following motion.
2. Seize the ram-rod between the ſecond joint of the fore finger and thumb, juſt below the top, your elbow down.

(X.) Draw your Rammer. *Two Motions.*

1. Draw the rammer with a quick motion half way, ſeizing it at the muzzle back-handed.
2. Draw it quite out, turn it and enter it into the muzzle, with your right arm extended.

(XI.) Ram down your Cartridge. *One Motion.*

Spring the ram-rod in the barrel, which will recoil half way out, (there being no cartridge uſed in the manual exerciſe) ſeize it back handed at the muzzle; enter it into the loops, and return it quite home; bring the firelock into the hollow of the left arm, with the fingers of the right hand, the left ſtill extended, with thumb behind the ſling.

(XII.) Return your Rammer. *One Motion.*

Bring up the firelock with the left hand, ſeize it with the right under the cock, ſo as you may feel the lower ſide nail of the lock with your right thumb, bring the left elbow down upon the lock, and fingers extended. *N. B.* you muſt turn to the left upon both heels, at the ſame time you bring the firelock up, to bring your body ſquare to the front, it being neceſſary in the priming and loading poſitions, to be a quarter face to the right, having the right toe to the right, and left to the front.

(XIII.) Shoulder your Firelock. *Two Motions.*

1. Quit the left hand and place it ſtrong upon the butt, then let the right hand lay flat upon the breaſt, the fingers pointing to the ſtock.
2. Bring the right hand ſmart down by the right ſide, fingers extended.

(XIV.) Rest your Firelock. *Three Motions.*

The firſt and ſecond motions the ſame as directed for the poize.

3. Bring the firelock quick down to reſt with the right hand, and ſeize it ſmart acroſs the ſling with the left, the little finger ſo low as the hammer ſpring, the thumb between the ſtock and barrel, the fingers of the right hand to be under the guard and thumb, behind the cock; the firelock muſt be no lower; then the butt to be oppoſite the centre of the left thigh, ſo as you may ſtand at this poſition in a graceful manner, and without reſtraint. *N. B.* At the time the firelock is brought down to the reſt, ſtep back 4 inches, with the right foot in a direſt line; and on no account to croſs your left heel.

(XV.) Order your Firelock. *Three Motions.*

1. Bring the firelock ſmartly into the right ſide, that the butt may be oppoſite the center of the right thigh; ſeize it at the ſame time with the left hand above the ſwell, the fingers of the right hand being ſtill under the guard.
2. Quit the firelock with the right hand, ſinking it with the left till the butt is within 2 inches of the ground; at the ſame time ſeize it at the muzzle with the right hand, the back of the hand to the front, and the right elbow cloſe down upon the ſtop ſwivel.
3. Bring up your right foot to the left, at the ſame time bring your left hand down by your left ſide, your fingers extended; and with the right hand bring the butt to the ground, and in a line with your right toe, the muzzle cloſe into the hollow of your right arm. *N. B.* The body to be ſquare to the front in all the motions of the order.

(XVI.) Ground your Firelock. *Four Motions.*

1. Half face to the right upon your heels, at the ſame time turn the firelock, ſo that the lock may point to the rear. The flat of the butt muſt lie againſt the inſide of your foot, at the ſame time ſlipping the right foot behind the butt of the firelock, the right toe pointing to the right, and the left toe to the front.
2. Step directly forward with your left foot as far as the ſwell of the firelock, then let your right hand ſlip down the piece, and lay it upon the ground, your left hand in the mean time hanging down by the calf of your left leg.
3. Raiſe yourſelf up again nimbly, bringing back your left foot to its former poſition, and keeping your body faced to the right.
4. Face again to the left upon your heels, and come to your proper front, letting your hands hang down your ſides without motion.

(XVII.) Take up your Firelock. *Four Motions.*

1. Face to the right upon both heels.
2. Briſkly ſtoop down and come to the ſame poſition as in the ſecond motion of grounding.
3. Raiſe yourſelf and firelock briſkly, bringing it cloſe to the right ſide.
4. Come to your proper front, ſeizing the firelock at the muzzle as in explanation XV.

(XVIII.) Rest your Firelock. *Three Motions.*

1. Bring down briſkly your right hand as low as you can, without reſtraint; ſeize the firelock with the thumb behind the ſling, and fingers upon the barrel.
2. Raiſe up the firelock with your right hand, in a direct line from where it ſtood at the order; then ſeize it with the left, the little finger to be as low as the hammer ſpring, and the thumb between the ſtock and barrel, the left hand ſupporting the firelock, and the right elbow down upon the ſtock.
3. Bring the firelock ſmart to the reſt with the left-hand, bring the fingers of the right under the guard. *N. B.* At the ſame time the firelock is brought acroſs the body to the reſt, you are to ſtep back with the right foot, 4 inches, as directed in the 22d motion.

(XIX.) Shoulder your Firelock. *Two Motions.*

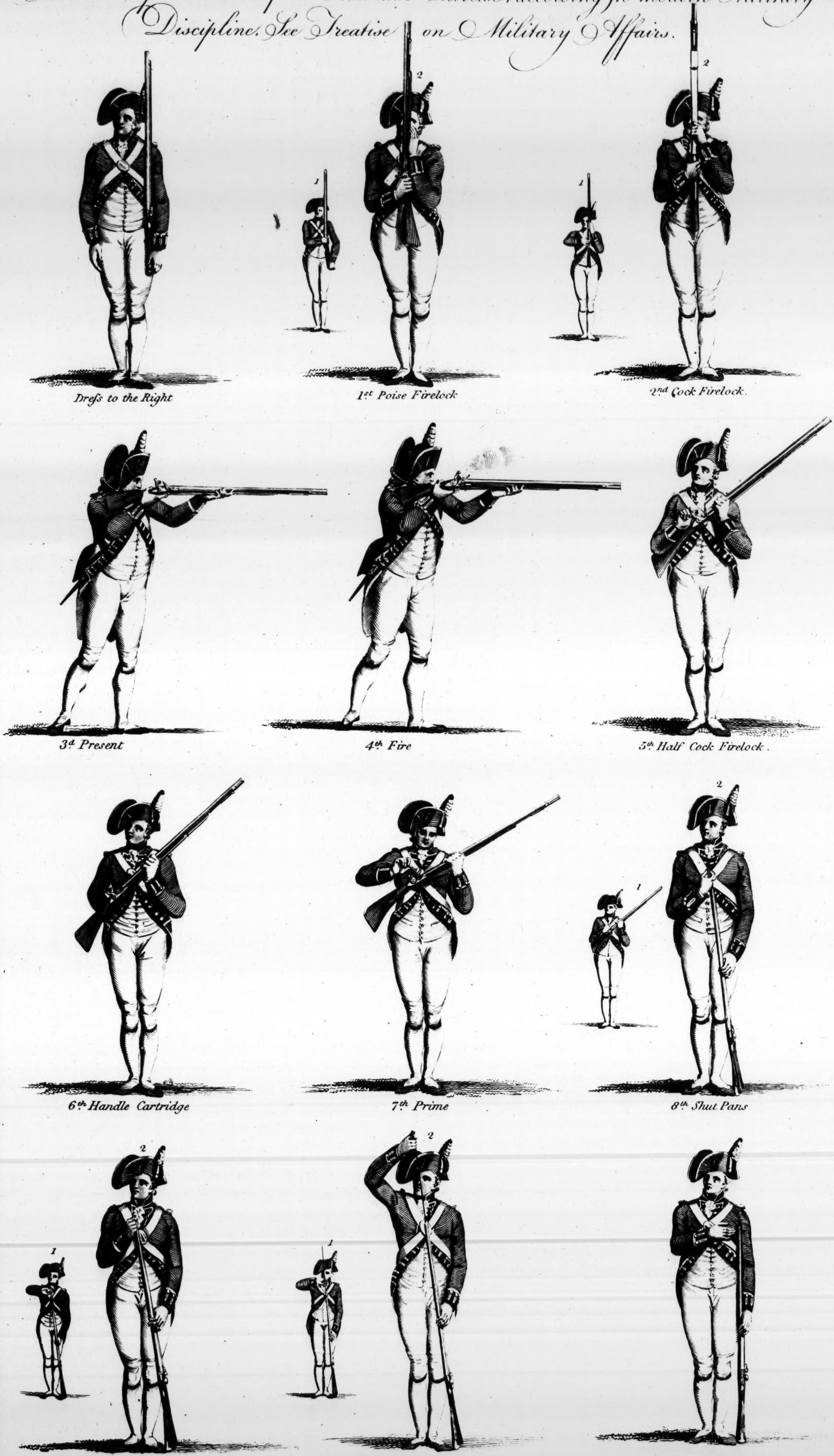
1. Bring up your right foot ſquare with the left, and at the ſame time with the right hand turn the firelock into the ſhoulder, and with the left ſeize the butt ſmartly, keeping the firelock ſteady to the ſhoulder with the right hand. *N. B.* As ſoon as the left hand ſupports the firelock under the butt, the right to lay flat upon the breaſt, with the fingers pointing to the breech, as before directed in the 18th motion.
2. Bring the right hand ſmartly down to the right ſide, fingers extended.

(XX.) Secure your Firelock. *Three Motions.*

1. Bring the right hand briſkly up with the fingers under the cock, and the thumb to touch the lower ſide nail of the lock, in order to keep the firelock ſteady to the ſhoulder.
2. With the left hand ſeize the firelock about the ſwell, the thumb behind the ſling, fingers upon the barrel, and elbow down upon the lock; the firelock to be kept ſteady in this motion.

Plate I

An exact representation of the Manual Exercise, according to modern Military Discipline. See Treatise on Military Affairs.



Dreſs to the Right

1st Poise Firelock

2nd Cock Firelock.

3d Present

4th Fire

5th Half Cock Firelock.

6th Handle Cartridge

7th Prime

8th Shut Pans

9th Load Cartridge

10th Draw Ramrods.

11th Ram Down Cartridge

Drawn by W. Grainger

Published as the Act directs by C. Cooke No. 17 Paternoster Row May 28 1790

Engraved by W. Grainger

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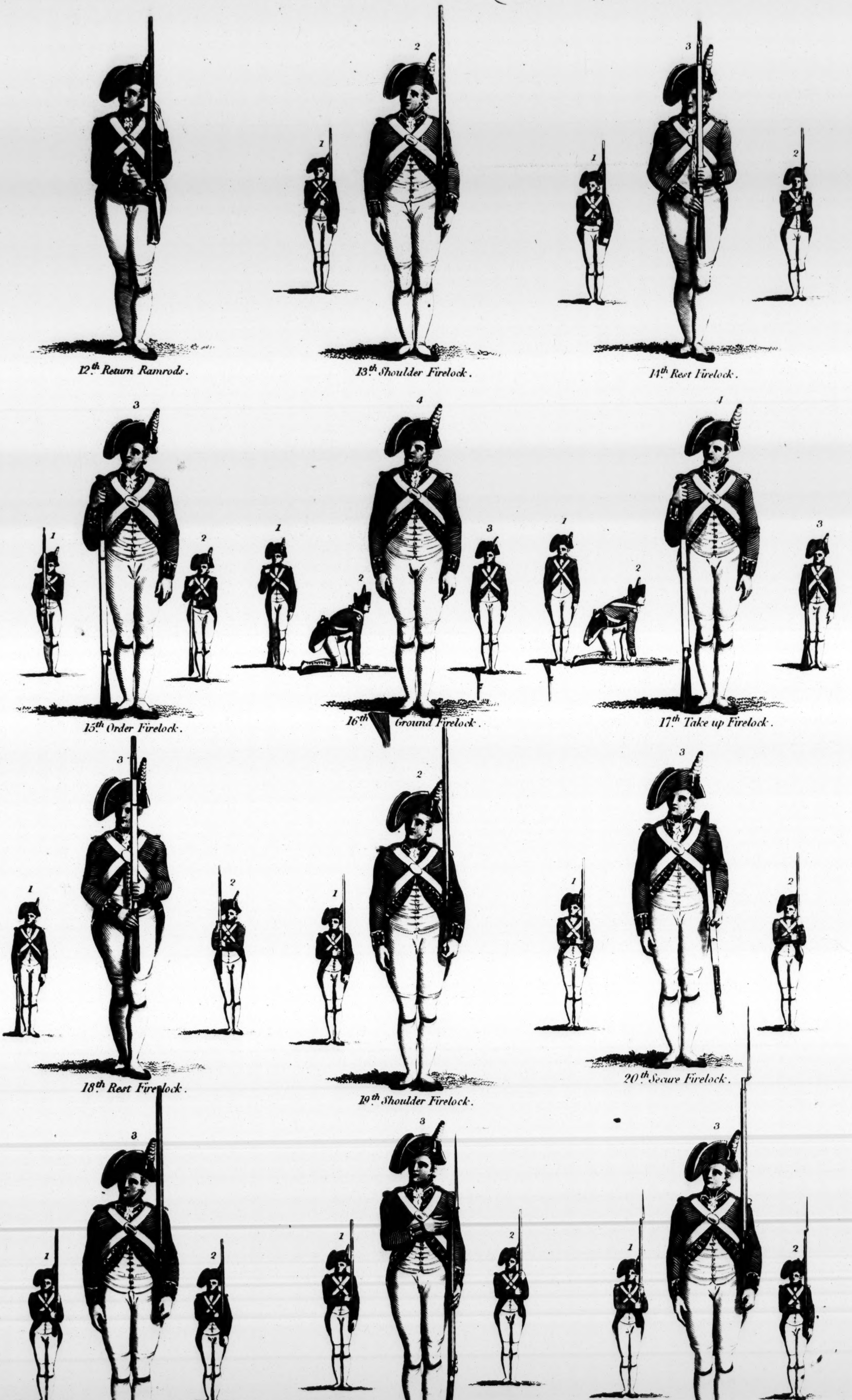
Plate 2

An exact representation of the Manual Exercise, according to modern Military Discipline, See Treatise on Military Affairs –



12th Return Ramrods.
13th Shoulder Firelock.
14th Rest Firelock.
15th Order Firelock.
16th Ground Firelock.
17th Take up Firelock.
18th Rest Firelock.
19th Shoulder Firelock.
20th Secure Firelock.
21st Shoulder Firelock.
22nd Fix Bayonets.
23d Shoulder Firelock.

Drawn from Life by W. Grainger.
Published as the Act directs by C. Cooke, No. 17, Paternoster Row, July 2d 1790
Engraved by W. Grainger.

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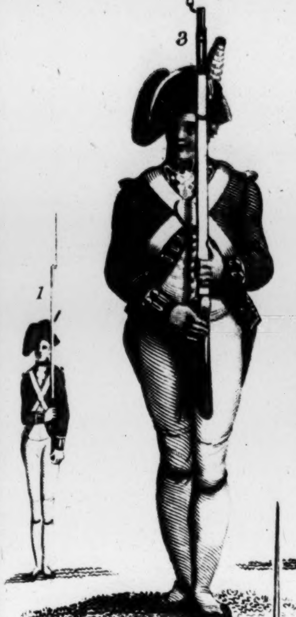
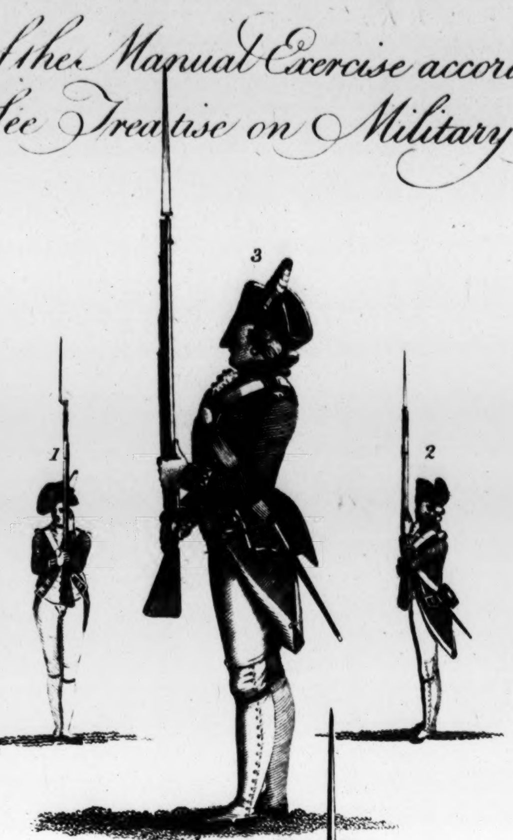
Plate 3.

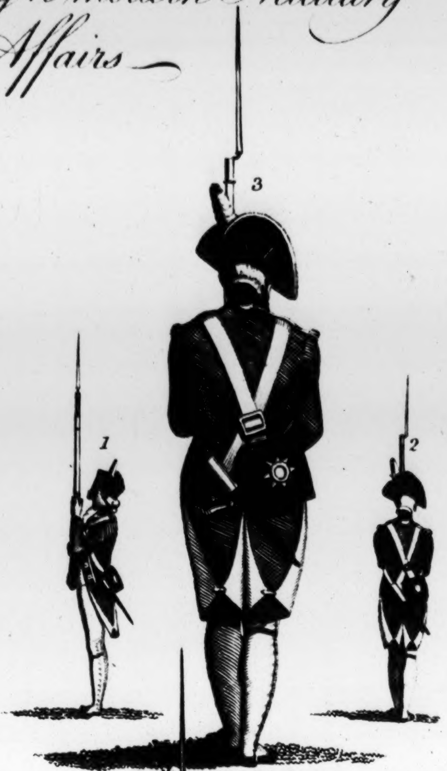
An exact representation of the Manual Exercise according to modern Military Discipline. See Treatise on Military Affairs —



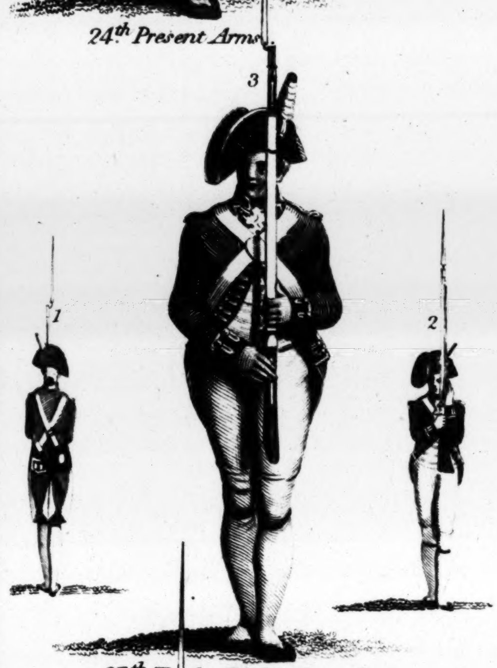
24th Present Arms.



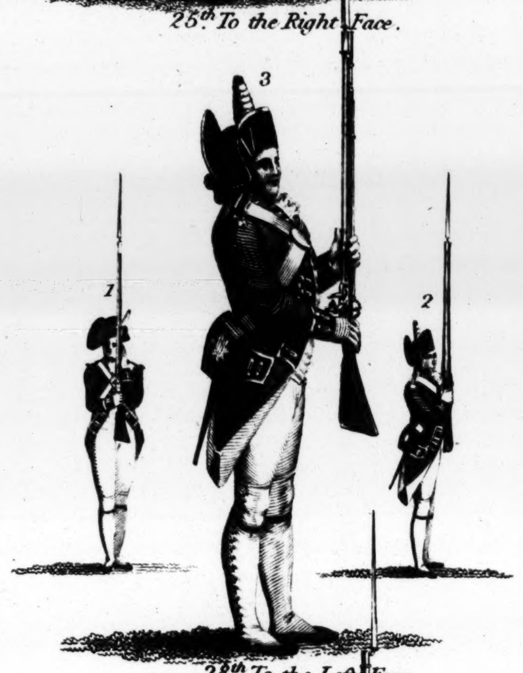
25th. To the Right Face.



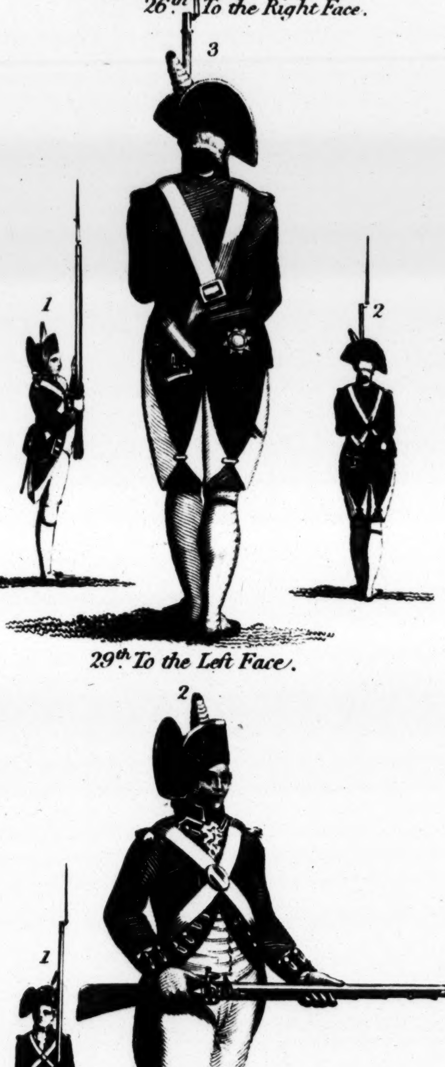
26th. To the Right Face.



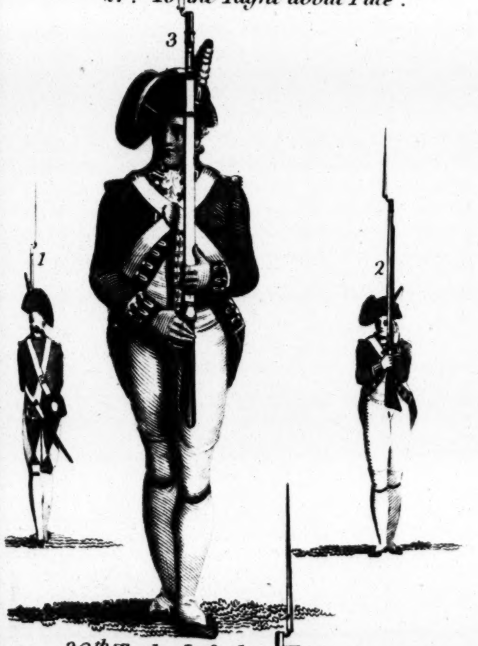
27th. To the Right about Face.



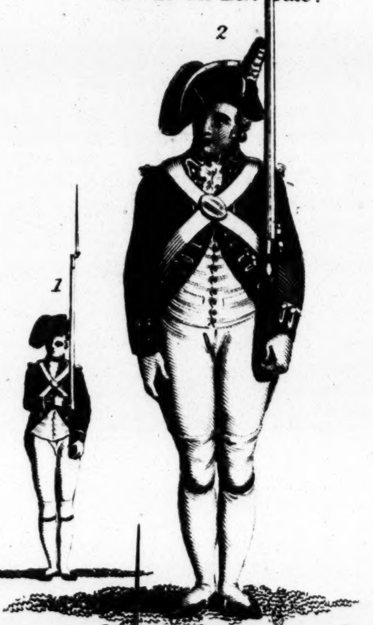
28th. To the Left Face.



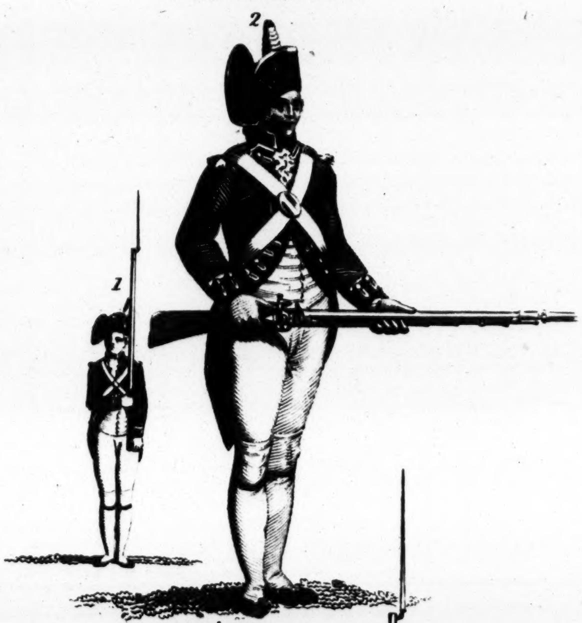
29th. To the Left Face.



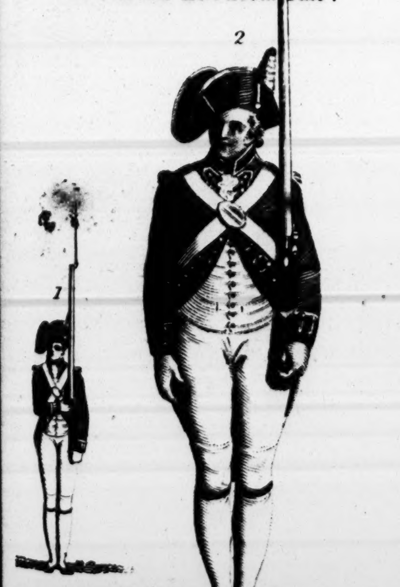
30th To the Left about Face.



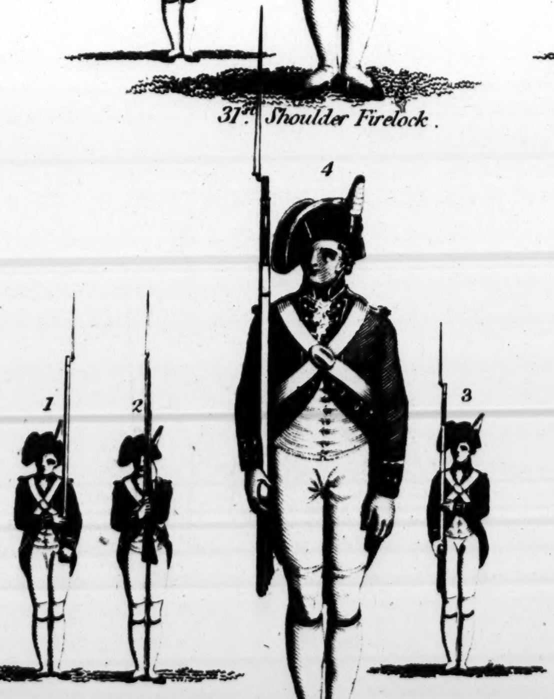
31st. Shoulder Firelock.



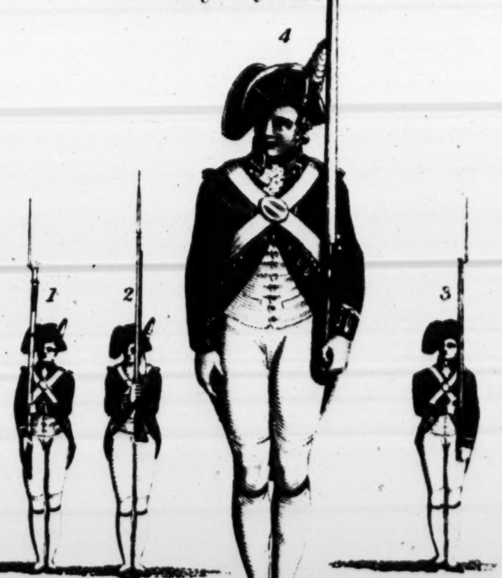
32nd Charge Bayonets.



33d Shoulder Firelock.



34th Advance Arms.



35th Shoulder Firelock.

Drawn from Life, by W. Grainger.

Published as the Act directs, by C. Cooke, No. 17, Paternoster Row, Sept. 3d 1790.

Engraved by W. Grainger.

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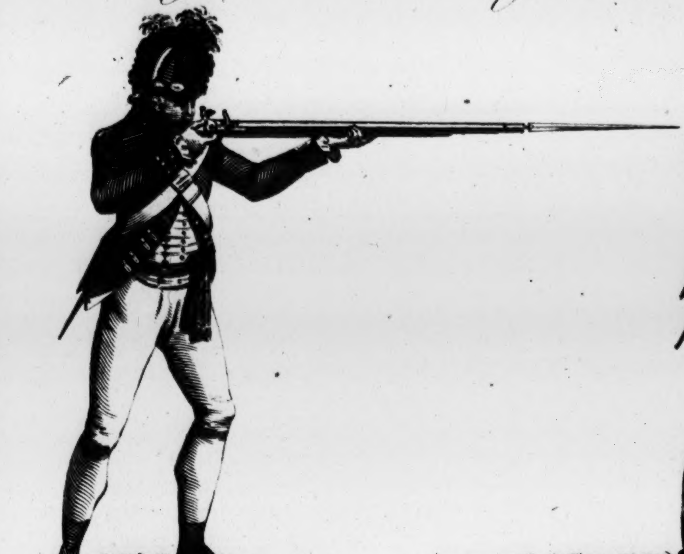
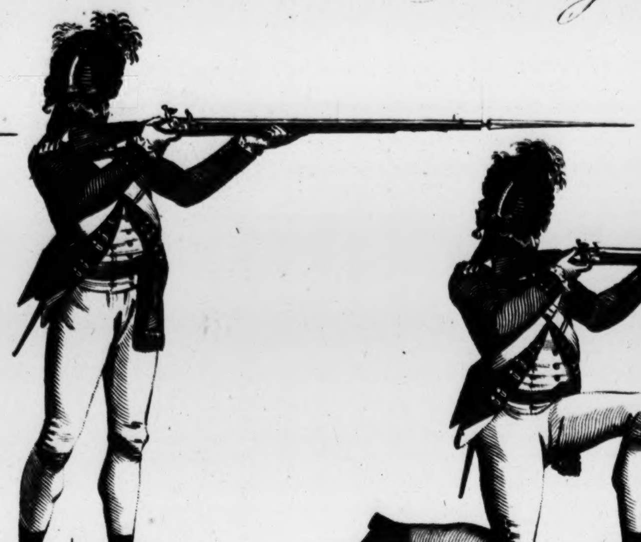
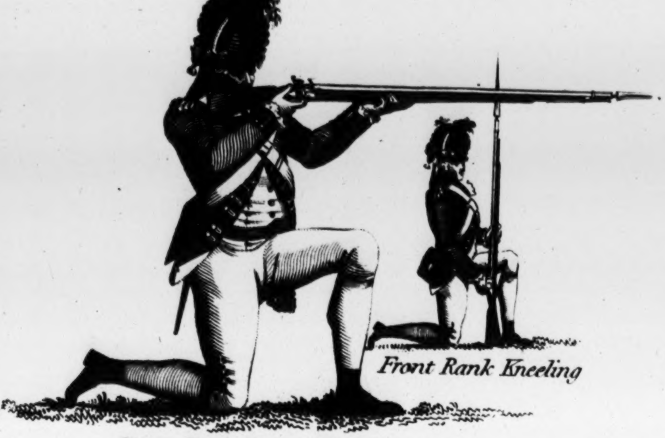
An exact representation of the three Rank Firings, with Officers Fusee & Sword Salute, according to the last new regulation. See the Treatise on Military Affairs.



Rear Rank Firing

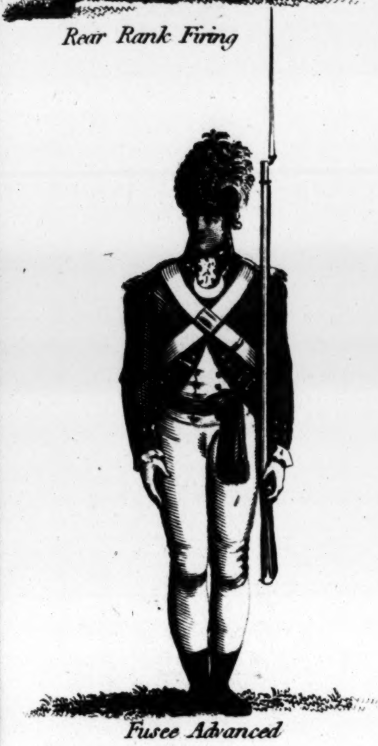


Center Rank Firing

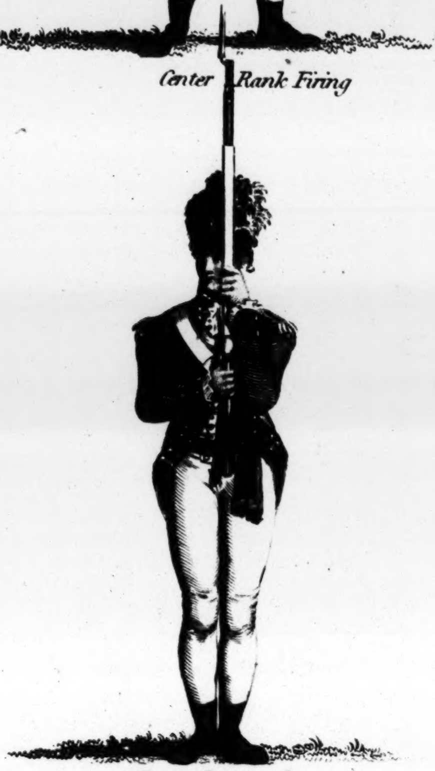


Front Rank Kneeling

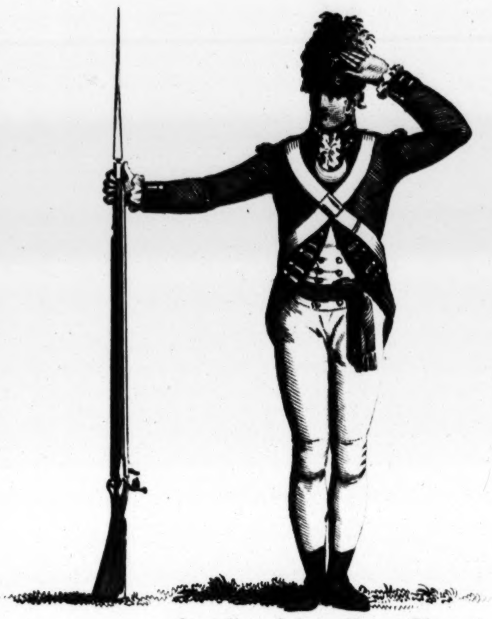
Front Rank, Firing Kneeling



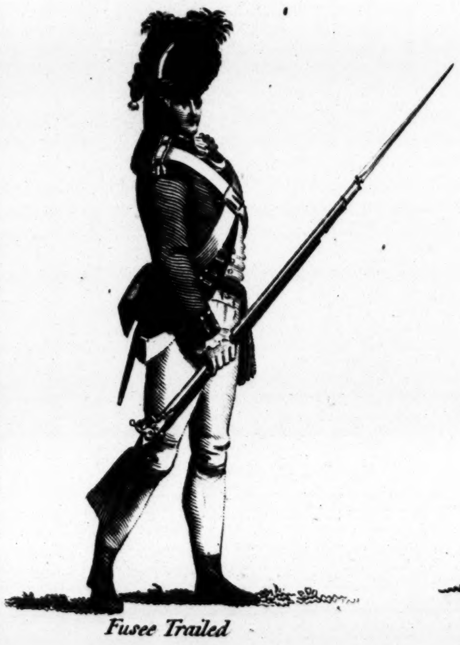
Fusee Advanced



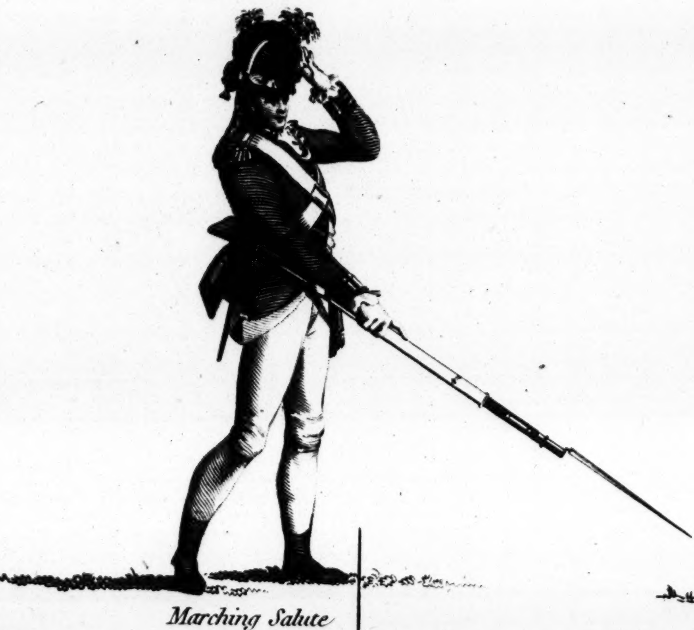
Fusee Recovered



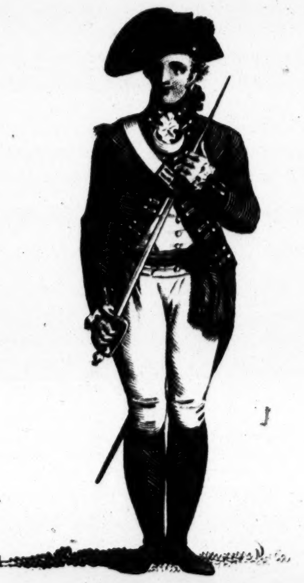
Standing Salute, Fusee Planted



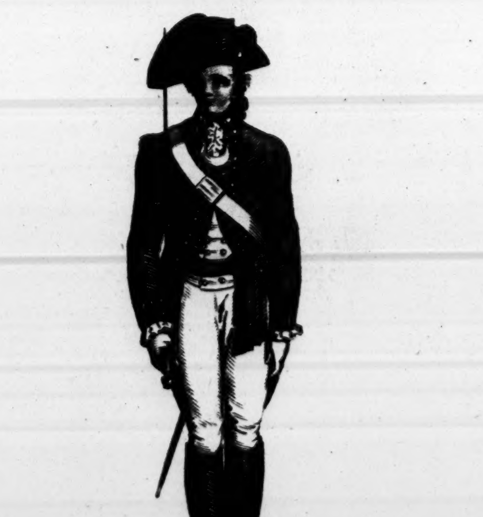
Fusee Trailed



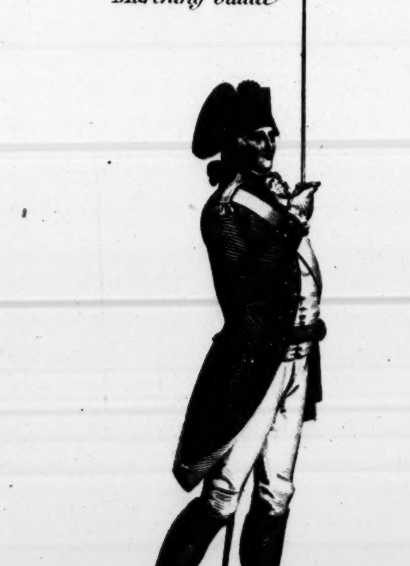
Marching Salute



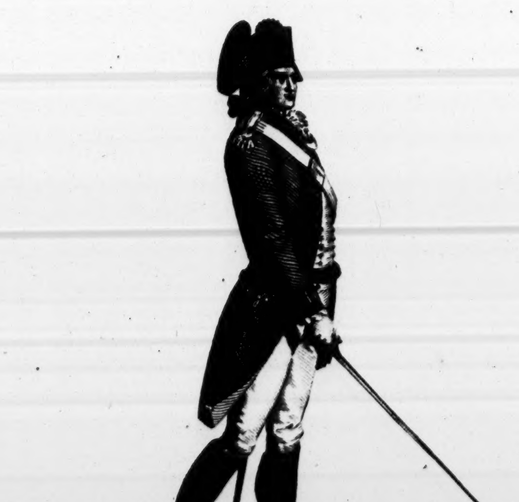
Sword Supported



Sword Advanced



Sword Recovered



Sword Salute

from Life by W. Grainger. Engraved for the Royal Encyclopedia, & Published as the Act directs, by C. Cooke, N.o 17, Paternoster Row. Oct.r 1st 1790. Engraved by W. Grainger.

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3. Quit the right hand, bringing it down by the right ſide; at the ſame time, with the left hand, bring the firelock down to the ſecure, the guard under the arm, and muzzle pointing downwards, keeping the thumb of the left hand ſtill upon the ſling, and fingers upon the barrel.

(XXI.) Shoulder your Firelock. *Three Motions.*

2. Bring the firelock up to the ſhoulder with the left hand, the right hand to be brought under the cock, as directed in the firſt motion of the ſecure.

2. Quit the left hand, ſtrike it ſtrong upon the butt, the firelock kept ſteady to the ſhoulder, and barrel perpendicular, the right hand to be in the poſition in the 18th motion.

3. Quit the right hand, and bring it ſmart acroſs the body to the right ſide, fingers pointing down.

(XXII.) Fix your Bayonet. *Three Motions.*

The firſt and ſecond are the ſame as in the two firſt of the ſecure.

3. Bring the firelock down with the left hand, till the butt touch the ground, in a line with your left toe, the barrel to the front, and the muzzle let fall into the weild of your right arm; at the ſame time ſieze the ſcabbard with the left hand, and the ſocket of the bayonet with the right; as ſoon as the bayonet is out of the ſcabbard, ſeize the firelock with the left hand as low as you can, without reſtraint, and bring the muzzle oppoſite the center of the body, and with the right hand ſcrew the bayonet on; bring the muzzle of the firelock into the hollow of the left arm, the right hand laying acroſs the breaſt, fingers touch the noſe braſs.

(XXIII.) Shoulder your Firelock. *Three Motions.*

1. Bring the firelock up with the left hand, ſeize it under the cock with the right, as directed in the 17th motion, with the left elbow down upon the lock.

2. Quit the left hand, and place it ſtrong upon the butt; at the ſame time the right hand laying flat upon the breaſt, as before directed.

3. Bring the right hand ſmart acroſs to the right ſide, fingers extended. *N. B.* when the right hand is to be brought down by the right ſide, it muſt be done cloſe and ſmart, and the body and firelock kept perfectly ſteady.

(XXIV.) Present your Arms. *Three Motions.*

Theſe three motions are deſcribed in the explanation of the 14th command.

(XXV.) To the Right Face. *Three Motions.*

1. Bring up the firelock with a quick motion to the poize, as directed in the ſecond motion; at the ſame time place the hollow of the right foot againſt the left heel.

2. Face to the right, by turning upon both heels, the firelock to be perpendicular and kept ſteady.

3. Step the right foot back, and come ſmartly down to the preſent.

(XXVI.) To the Right Face. *Three Motions.*

Repeat the above deſcribed motions.

(XXVII.) To the Right About Face. *Three Motions*

The motions are the ſame as before, only you muſt bring the right toe as far back as the left heel; to come to the right about, in place of the right only.

(XXVIII.) To the Left Face. *Three Motions.*

1. Bring the firelock to the poize, and bring the right heel to the hollow of the left foot.

2. Face to the left, by turning upon both heels.

3. Come briſkly down to the preſent.

(XXIX.) To the Left Face. *Three Motions*

Repeat the three laſt motions deſcribed.

(XXX.) To the Left About Face. *Three Motions.*

Repeat the motions laſt referred to in every particular, except in coming to the left about, by bringing the right heel up to the ball of the left toe.

(XXXI.) Shoulder your Firelock. *Two Motions.*

The motions the ſame as in the explanation of the 19th command.

(XXXII.) Charge your Bayonet. *Two Motions.*

1. Turn up the lock as in the firſt explanation.

2. Bring the firelock ſmart down to the charge, meeting it in the palm of the left hand at the ſwell, at the ſame time you bring the firelock acroſs the body, turn upon both heels a quarter face to right; the right toe being to the right, and the left to the front. *N. B.* The right hand graſping the ſmall of the ſtock, the point of the fingers muſt feel the top of the hip bone, the barrel horizontal, and pointing direct to the man.

(XXXIII.) Shoulder your Firelock. *Two Motions.*

1. Bring up the firelock quick to the ſhoulder, place the left hand upon the butt, and bring the feet ſquare to the front.

2. Quit the right hand, and throw it ſmartly down by the right ſide.

(XXXIV.) Advance your Arms. *Four Motions.*

The firſt and ſecond as in the explanation of the firſt command.

3d. Bring the firelock ſmartly down the right ſide with the right hand, as low as can be admitted, without conſtraint; keep the body ſteady; ſlip the left hand to the ſwell; keep the guard between the thumb and fore-finger of the right hand, and the three laſt fingers under the cock, with the barrel to the rear.

4th. Quit the left hand and bring it ſmartly down the left ſide.

(XXXV.) Shoulder your Firelock. *Four Motions.*

1. Bring the firelock up in a direct line from where it is at the advance, juſt ſo high as to get hold of the ſmall of the ſtock with the right hand; and at the ſame time ſeize the piece at the ſwell with the left.

2. Bring the firelock ſmart up to the poize with the right hand; the left to be as directed in the firſt explanation.

3. Bring the firelock quick into the ſhoulder, and ſtrike the butt ſmart with the left hand.

4. Quit the right hand down by the right ſide; fingers pointing downwards.

(XXXVI.) Prime and Load. *Fifteen Motions.*

1. Come ſmartly to the recover, the firelock is ſprung up with the left hand and ſeized with the right by the ſmall, and the left above the hammer ſpring, the barrel is to the rear, the cock to touch the left breaſt, and both elbows cloſe down upon the ſtock, the body to remain ſquare to the front and the piece perpendicular.

2. Bring the firelock down with a briſk motion to the priming poſition (turning the right toe to the right and the left to the front) the left hand holding the firelock as in priming, the thumb of the right hand placed againſt the face of the hammer, the fingers clenched, and the elbow a little turned out, that the wriſt may be clear of the cock.

3. Open the pan by throwing up the ſteel with a ſtrong motion of the right arm, turning the elbow in, and keeping the firelock ſteady in the left hand.

4. Handle your cartridge.
5. Prime.
6. Shut your pan.
7. Caſt about.
8 and 9. Load.
10 and 11. Draw your rammer.
12. Ram down your cartridge.
13. Return your rammer.
14 and 15. Shoulder.

N. B. Obſerve that the motions of recover, coming down to the priming poſition, and opening the pan, are to be done in the uſual time. The motions from handling the cartridge to ſhutting the pans, to be done as quick as poſſible. When the pans are ſhut, make a pauſe, and caſt about. The loading motions are likewiſe to be executed with all imaginable briſkneſs. Before the rammer is returned, another ſmall pauſe muſt be made, counting *one*, *two*, between each motion, till the firelock is ſhouldered, but the motions themſelves to be done with activity.

SECT. VII.

The POSITION of the three RANK FIRINGS.

Illuſtrated with Figures drawn from Life. Vide Plate IV.

Front Rank Kneeling, make Ready.

Spring the firelock briſkly to the recover, keeping the left foot faſt; then, without any ſtop, briſkly ſink the body, and without ſtooping forward, come down with a quick motion upon the right knee, the but end of the firelock at the ſame time muſt fall upon the ground, the front part of the butt to be in a line with the heel of the left foot. See the ſmall Figure in Plate IV. As ſoon as the butt comes to the ground, cock the firelock immediately, ſeizing the cock with the fore-finger and thumb of the right hand; the firelock to be held firm in the left hand about the middle of that part of the firelock, between the cock and the ſwell. The point of the left thumb to be cloſe to the ſwell, pointing upwards.

As the body is ſinking, the right knee muſt be brought as far back as to admit of the left leg being upright; the right foot to be thrown out a little to the right; the body to be kept ſtraight, the head upright, looking towards the right along the rank; the firelock to be held perpendicular with the butt, about four inches to the right of the inſide of the left foot.

Present. Bring the firelock down to the preſent, by extending the left arm to the full length with a ſtrong motion; as in the right hand Figure, Plate IV. at the ſame time ſpring up the butt by the cock with the right hand, and elevate it upon the right ſhoulder, ſo as not to ſtoop too much with the head, the right cheek to be cloſe to the butt, and the left eye ſhut; look along the barrel with the right eye from the breech pin to the muzzle; keep the left elbow down in an eaſy poſition, and keep as ſteady as poſſible; the thumb of the right hand to remain in the poſition as deſcribed in the explanation of the third command in the Manual Exerciſe.

Fire. Pull the trigger, and as ſoon as the piece is fired, give yourſelf a ſtrong ſpring upon your left leg, raiſing your body briſkly and ſtraight up, keeping the left foot faſt, and bringing the right heel to the inſide of the left; at the ſame time the firelock muſt be brought up to the priming poſition, and half cocked immediately; a ſhort pauſe muſt enſue; then handle your cartridge, and go on with the loading motions as in the explanations of prime and load.

Front Rank Standing, Make Ready.

Come to a good recover, and cock.

Present. As directed in the manual exerciſe.

Fire. Pull the trigger and count *one, two*; then bring the firelock into the priming poſition, and go on as directed in the priming and loading.

Centre Rank, Make Ready.

Spring the firelock to the recover, as ſoon as the left hand ſeizes the firelock above the lock, the right elbow is to be raiſed a little with a nimble motion, placing the thumb of the right hand upon the cock, the fingers by the guard; then as quick as poſſible force the cock back, ſlipping the thumb over the cock, and ſeizing the firelock by the ſmall, with the left elbow cloſe down; at the ſame time ſtep to the right a moderate pace, with the right toe pointing to the right, keeping the left foot faſt, as in the centre figure, Plate IV.

N. B. The cock is to touch the breaſt when at the recover, and firelock perpendicular; the finger is not to be brought before the trigger till the firelock is down to the preſent.

Present. The right hand having hold of the ſmall, throws the firelock down to the preſent, meeting it firm in the left, at the ſwell, and bring the butt firm to the ſhoulder as directed in front rank kneeling.

Fire. This is to be performed as in the fourth explanation of the Manual Exerciſe, with this difference, that the left foot is to be brought up to the right, at the ſame time that the firelock is brought down to the priming poſition.

The loading motions are as in the explanations of the priming and loading.

N. B. At the laſt motion of ſhouldering, ſpring to the left again, and cover the file leaders.

Rear Rank, make Ready.

Recover and cock as directed in the centre rank, ſtep to the right a moderate pace, with the right foot, the toe pointing to the right; bring the left heel about 4 inches in front of the right foot, the toe pointing to the front, keeping the body ſtraight, and firelock at a good recover.

Present. Bring the firelock ſmartly down to the preſent; at the ſame time ſtep to the front with the left foot, that the toe may touch the right foot of the man in the center rank; keep the right knee ſtraight and bend the left knee to throw the body forward, that the muzzle may clear the front rank, as repreſented in the left hand figure, plate IV. *N. B.* The above poſition is only when troops are formed three deep, and fire with the front rank ſtanding; when the front rank kneels, the rear rank is not to ſtep ſo much forward.

Fire. Perform as in the explanations of the center rank. Then as the firelock is coming down to the priming poſition, the left foot muſt be brought back to the right, and at the laſt motion of ſhouldering, to ſpring to the left again, and cover the file leaders.

Trail your Arms. Seize the firelock ſmartly with the right hand at the ſwell, and bring it quick down on the right ſide, ſloping in the right hand; the left hand to hang down the left ſide.

Order your Firelock. Drop the butt to the ground, bringing the firelock cloſe to the right, the barrel to the rear, the butt to dreſs with the right foot, and the right arm to be lowered with the finger, extended down the ſtock.

Shoulder in two Motions. At the word ſhoulder, ſlip the thumb behind the barrel, and bring the firelock ſmartly up to the left ſhoulder; then place the left hand ſtrongly upon the butt, and immediately after quit the right hand, and throw it down cloſe by the right ſide.

SECT. VIII.

FUSEE SALUTE.

Illuſtrated with Figures drawn from Life. Vide Plate IV.

Fusee Advanced.

The firſt motion in the fuſee ſalute of the officers in the granadiers and light infantry, is to ſlip the right hand down, the fuſee as far as can be done with eaſe, at the ſame inſtant placing the right foot behind the left heel.

The ſecond motion is to raiſe with the right hand the fuſee from the ground, and bringing it with a ſmart motion to the left ſide of the body, ſeize it with the left at the cock, facing to the right about on both heels at the ſame time.

The third motion is to place the right foot in a line with the left, and throw back the right hand to the right ſide, letting the fuſee fall againſt the left ſhoulder in the left hand, at the ſame time graſping the cock.

Fusee Recovered.

With the left hand bring up the fuſee to a perpendicular line; at the ſame time quit it with the right hand, and ſieze it again with the ſame hand at the ſmall part of the ſtock below the guard, and keep it in an erect poſition.

Fusee Planted.

Firſt motion: Remove the left hand, bringing it down to the left ſide, turn at the ſame inſtant to the front on both heels, with an extended arm, and plant the butt of the fuſee on the ground, and in a line parallel with the right ſide.

Second motion: Raiſe the left hand, and, with the palm open, place it againſt the cap, as repreſented in the Plate.

When the general has paſſed, the left hand is to be brought down, with an eaſy, graceful motion, from the cap to the left ſide, where it was placed at the laſt motion of the ſalute.

Fusee Trailed.

Firſt motion: Seize the fuſee near the ſwivel of the ſtock with the right hand.

Second motion: Quit the fuſee with the left hand, and with the right hand bring it over to the right ſide, to the poſition of trailing, as repreſented in the Plate.

Fusee Salute.

Firſt motion: In ſtepping with the right foot, dart with the right hand the muzzle of the fuſee forwards in a direct line, ſo as to bring it nearly on a level.

Second motion: At the next, ſtep with the left foot turn the fuſee round about in ſuch a manner as to bring the muzzle ſloping upwards towards the rear, with the lock downwards; at the ſame inſtant placing the left hand upon the ſmall part of the ſtock behind the guard.

Third motion: Salute with the fuſee, at the next ſtep with the right foot, by turning it round towards the front, ſo as to incline the point of the bayonet towards the ground, with the lock of the fuſee upwards, and throwing back the left hand to the left ſide, as before directed.

Fourth motion: At the next, ſtep with the left foot, raiſe the left hand, and, with the palm open place it againſt the cap, as directed in the fuſee planted.

When the general has paſſed about ten paces, bring the fuſee back again to the trailing poſition in two motions.

SECT. IX.

SWORD SALUTE.

Illuſtrated with Figures drawn from Life. Vide Plate IV.

Sword Supported.

Hold the belt of the ſword near the right hip in the right hand, as low down the right ſide as can be done with eaſe; bring the flat of the blade acroſs the body upwards, the upper part graſped with the left hand, and held oppoſite to the left ſhoulder, with the thumb running along the blade towards the point, as repreſented in the Plate.

Sword Advanced.

Raiſe the right foot, and planting it in a line with the left, at the ſame time throwing back the left hand to the left ſide, holding the hilt of the ſword firm in the right hand againſt the outſide of the right thigh, the blade running up the right ſide, and reſting againſt the hollow of the right ſhoulder, as repreſentedin the Plate.

Sword Recovered.

Let go the left hand, bringing it down to the left ſide, raiſing up at the ſame time the right hand nearly as high as the right ſhoulder, holding the ſword in a perpendicular poſition oppoſite to the right breaſt.

Sword Salute.

Bring the point of the ſword in an eaſy graceful manner, with the right hand as low down towards the ground as can be done by that hand with eaſe.

The hat to remain untouched. The officers ſhould bring up their ſwords when the general has paſſed them to the former poſition.

MILITIA, in general, denotes the body of ſoldiers, or thoſe who make profeſſion of arms. In a more reſtrained ſenſe, militia denotes the trained bands of a town or country, who arm themſelves, upon a ſhort warning, for their own defence. So that, in this ſenſe, militia is oppoſed to regular or ſtated troops. See MILITARY *State*, in the Treatiſe of *Military Affairs*.

MILK, a well-known fluid, prepared by nature in the breaſts of women, and the udders of other animals, for the nouriſhment of their young. Milk is a connecting and intermediate ſubſtance between animals and vegetables. It ſeems immediately to be ſecreted from the chyle, both being a white liquor of the ſame conſiſtence: it is moſt copiouſly ſecreted after meals, and of an aceſſent nature. In moſt animals who live on vegetables, the milk is aceſcent; and it is uncertain, though at the ſame time no obſervation proves the contrary, whether it is not ſo likewiſe in carnivorous animals. But, whatever be in this, it is certain, that the milk of all animals who live on vegetables is aceſcent. Milk being derived from the chyle, we thence conclude its vegetable nature; for in thoſe who live on both promiſcuouſly, more milk is got, and more quickly, from the vegetable than the animal food. Milk, however, is not purely vegetable; though we have a vegetable liquor that reſembles its taſte, conſiſtence, colour, aceſcency, and the ſeparability of the oily part, viz. an emulſion of the nuces oleoſæ and farinaceous ſubſtances. But theſe want the coagulable part of milk, which ſeems to be of animal-nature, approaching to that of the coagulable lymph of the blood. Milk, then, ſeems to be of an intermediate nature, between chyle taken up from the inteſtines and the fully elaborated animal-fluid.

Its contents are of three kinds: firſt, an oily part, which, whatever may be ſaid concerning the origin of other oils in the body, is certainly immediately derived from the oil of the vegetables taken in, as with theſe it agrees very exactly in its nature, and would entirely if we could ſeparate it fully from the coagulable part. Another mark of their agreement is the ſeparability, which proves that the mixture has been lately attempted, but not fully performed. 2dly. Beſides this oily, there is a proper coagulable part: and, 3dly, Much water accompanies both, in which there is diſſolved a ſaline ſaccharine ſubſtance. Theſe three can be got ſeparate in cheeſe, butter, and whey; but never perfectly ſo, a part of each being always blended with every other part.

Nothing is more common, from what has been ſaid of its immediate nature, than to ſuppoſe that it requires no aſſimilation; and hence has been deduced the reaſon of its exhibition in the moſt weakly ſtate of the human body. But wherever we can examine milk, we always find that it coagulates, ſuffers a decompoſition, and becomes aceſcent. Again, infants, who feed entirely on milk, are always troubled with eructations, which every body obſerves are not of the ſame quality with the food taken; and therefore it appears, that, like all other food, milk turns naturally aceſcent in the ſtomach, and only enters the chyle and blood in conſequence of a new recompoſition. It approaches then to the nature of vegetable aliment, but is not capable of its noxious vinous fermentation, and therefore has an advantage over it; neither from this quality, like animal-food, is it heating in the ſtomach, and productive of fever; though at the ſame time, from its quantity of coagulated matter, it is more nouriſhing than vegetables.

Milk is evidently one of the beſt nouriſhments of the body; and it is not wonderful that it ſhould prove ſo, when we conſider that in all caſes of nouriſhment the proximate matter taken to nouriſh ought to be as like as may be to the body to be nouriſhed by it. We ſubſiſt by the ſame things by which we are generated, and even while in the ſtate of a fœtus in the womb, we are nouriſhed not by blood, as ſome ſuppoſe, but by a lacteous juice, which is ſeparated from the blood in the uterus by means of the placenta, as it is in the breaſts of women who give ſuck, by glandules and tubuli deſtined for that purpoſe. Meats which we daily feed upon paſs down into the ſtomach indeed in their own form, but they do not nouriſh us till they are changed into chyle, or a milky liquor. Milk being analyſed is found to be compoſed of fatty, ſerous, and terreſtrial parts; and theſe its conſtituent principles being eaſily mixed and ſeparated again, are made of it matter for the nouriſhment of the different parts of the body. The ſerous part, which is alſo nitrous, being a proper vehicle to convey through the veſſels the fatty parts, which are as well adapted to all the offices of nutrition as any ſubſtance can be.

It is eaſy to infer from this account of milk that it is not only a proper food for children, but for grown people alſo; but proper regulations are to be obſerved as to its uſe in particular caſes; no aliment any more than this being capable of ſuiting all conſtitutions and circumſtances. Meat in the ſtomach is converted into chyle, or a ſubſtance like milk: this chyle paſſes into the heart through the blood-veſſels, and its fineſt and moſt ſpirituous parts are there tranſmuted into the red part of the blood; and after this the other groſſer parts of it are by different elaborations transformed into bile, and the ſeveral other humours of the body. It is evident that theſe humours, as well as the blood itſelf, muſt all have a ſupply; and that meat cannot give this ſupply, till it is converted into chyle or milk; how much labour then is ſaved the animal functions by giving at once into the ſtomach chyle ready formed, that is milk; and in caſes where the action or juices of that organ are ſo debilitated as not to be of power to convert the meat into chyle, what remains but that the perſon muſt die ſlowly, by want of the ſupplies of the ſeveral fluids of the body, if ſomething be not given that is capable of paſſing into the blood with leſs preparation than meats are; and what is ſo proper on ſuch an occaſion as milk, which is already ſo nearly allied to the nature of the fluid that ſhould have been there ſeparated from meat, that it will really ſupply all its offices?

Milk is almoſt ſuited to all temperaments; and it is even ſo to ſtomachs diſpoſed to aceſcency, more than thoſe ſubſtances which have undergone the vinous fermentation; nay, it even cures the heart-burn, checks vinous fermentation, and precipitates the lees, when, by renewal of fermentation, the wine happens to be fouled. It therefore very properly accompanies a great deal of vegetable aliment; although ſometimes its aceſcency is troubleſome, either from a large proportion taken in, or from the degree of it; for, according to certain unaccountable circumſtances, different acids are formed in the ſtomach in different ſtates of the body; in a healthy body, *e. g.* a mild one; in the hypochondriac diſeaſe, one ſometimes as corroſive as the foſſil acid. When the acidity of milk is carried to a great degree, it may prove remarkably refrigerant, and occaſion cold crudities, and the recurrence of intermitting fevers. To take the common notion of its paſſing unchanged into the blood, it can ſuffer no ſolution. But if we admit its coagulum in the ſtomach, then it may be reckoned among ſoluble or inſoluble foods, according as that coagulum is more or leſs tenacious. Formerly rennet, which is employed to coagulate milk, was thought an acid; but, from late obſervations, it appears, that, if it be an acid, it is very different from other acids, and that its coagulum is ſtronger than that produced by acids. It has been imagined, that a rennet is to be found in the ſtomachs of all animals, which cauſes coagulation of milk; but the coagulation of milk ſeems to be owing to a weak acid in the ſtomach, the relicts of our vegetable food, inducing in healthy perſons, a weak and ſoluble coagulum; but in different ſtomachs this may be very different, in theſe becoming heavy and leſs ſoluble food, and ſometimes even evacuated in a coagulated undiſſolved ſtate both by ſtomach and ſtool. As milk is aceſcent, it may be rendered ſometimes purgative by mixing with the bile; and ſome examples of this have been remarked. More commonly, however, it is reckoned among thoſe foods which occaſion coſtiveneſs.

Hoffman, in his experiments on milk, found that all kinds of it contained much water: and when this was diſſipated, found the reſiduum very different in their ſolubility. But we muſt not thence conclude, that the ſame inſolubility takes place in the ſtomach; for extracts made from vegetables with water are often very inſoluble ſubſtances, and hardly diffuſible through water itſelf: therefore, in Hoffman's extracts, if we may ſo call them, of milk, ſomewhat of the ſame kind might have appeared; and theſe ſubſtances, which in their natural ſtate were not ſo, might appear very inſoluble. However, we may allow that milk is generally inſoluble in the inteſtines, as it is of a drying nature, and, as cheeſe, &c. is very coſtive. And this effect ſhows that milk is always coagulated in the ſtomach; for if it remained fluid, no fæces would be produced, whereas ſometimes very hard ones are obſerved. In the blood-veſſels, from its animal-nature, it may be conſidered as nutritions; but when we conſider its vegetable contents, and aceſcency in the primæ viæ, we find, that, like animal food, it does not excite that degree of fever in time of digeſtion, and that from its aceſcency it will reſiſt putrefaction. Hence its uſe in hectic fevers, which, whatever be their cauſe, appear only to be exacerbations of natural feveriſh paroxyſms, which occur twice every day, commonly after meals, and at night. To obviate theſe, therefore, we give ſuch an aliment as produces the leaſt exacerbation of theſe fevers: and of this nature is milk, on account of its aceſcent vegetable nature.

There appears alſo ſomewhat peculiar to milk, which requires only a ſmall exertion of the animal-powers in order to its aſſimilation; and beſides, in hectic complaints there is wanted an oily, bland food, approaching to the animal-nature; ſo that on all theſe accounts, milk is a diet peculiarly adapted to them, and, in general, to moſt convaleſcents, and to thoſe of inflammatory temperaments. So far of milk in general. We ſhall now ſpeak of the particular kinds which are in common uſe.

The milk of women, mares, and aſſes, agree very much in their qualities, being very dilute, having little ſolid contents, and, when evaporated to dryneſs, having theſe very ſoluble, containing much ſaccharine matter, of a very ready aceſcency, and, when coagulated, their coagulum being tender and eaſily broke down. From this view they have leſs oil, and ſeem to have leſs coagulable matter, than the reſt.

The milk of cows, ſheep, and goats, agree, in oppoſite qualities to the three juſt mentioned; but here there is ſomewhat more of gradation. Cows milk comes neareſt to the former milk: goats milk is leſs fluid, leſs ſweet, leſs flatulent, has the largeſt proportion of inſoluble part after coagulation, and indeed the largeſt proportion of coagulable part; its oily and coagulable parts are not ſpontaneouſly ſeparable, never throwing out a cream, or allowing butter to be readily extracted from it. Hence the virtues of theſe milks are obvious, being more nouriſhing, though, at the ſame time, leſs eaſily ſoluble in weak ſtomachs, than the three firſt, leſs aceſcent than theſe, and ſo more rarely laxative, and peculiarly fitted for the diet of convaleſcents without fever. The three firſt, again, are leſs nouriſhing, more ſoluble, more laxative, as more aceſcent, and adapted to the convaleſcents with fever.

Theſe qualities, in particular milks, are conſiderably diverſified by different circumſtances. Firſt, different animals, living on the ſame diet, give a conſiderably different milk; for there ſeems to be ſomething in the conſtitution, abſtracting from the aliment, which conſtitutes a conſiderable diverſity of milk, not only in the ſame ſpecies of animals, but alſo in the ſame animal, at different ages, and at different diſtances after delivery; this applies to the choice of nurſes. Secondly, milk follows the nature of the aliment more than any other juice in the human body, being more or leſs fluid and dilute, more or leſs ſolid and nouriſhing, in proportion as theſe qualities are more or leſs in the aliment. The nature of the aliment differs according to its time of growth, *e. g.* old graſs being always found more nouriſhing than young. Aliment, too, is always varied according to the ſeaſon, as that is warm or dry, moiſt or cloudy.

The milk of each particular kind of animal is fitter for particular purpoſes, when fed on proper food. Thus the cow delights in the ſucculent herbage of the vale: if the ſheep be fed there he certainly rots, but on the higher and more dry ſide of the mountain he feeds pleaſantly and healthy; while the goat never ſtops near the bottom, but aſcends to the craggy ſummit: and certainly the milks of theſe animals are always beſt on their proper ſoil, and that of goats is beſt on a mountainous country. From a diſſertation of Linnæus, we have many obſervations concerning the diverſity of plants on which each animal chooſes to feed. All the Swediſh plants which could be collected together, were preſented alternately to domeſtic animals, and then it appeared that the goat lived on the greateſt variety, and even on many which were poiſonous to the reſt; that the cow may chooſe the firſt ſucculent ſhoots of the plant, and neglected the fructification; which laſt was preferred by the goat. Hence may be deduced rules concerning the paſturage of different animals; *e. g.* Farmers find, that, in a paſture which was only fit to feed a certain number of ſheep, an equal number of goats may be introduced, while the ſheep are no leſs nouriſhed than before.

It is not eaſy to aſſign the difference between milk freſh-drawn and that detained in the open air for ſome time; but certainly there is ſome material one, otherwiſe nature univerſally would not have directed infants to ſucking; and indeed it ſeems, better than the other, fitted for digeſtion and nouriſhment. Phyſicians have ſuppoſed that this depended on the evaporation of ſome *ſpt. rector.* but we cannot conceive any ſuch, except common water here: and beſides, theſe volatile parts can hardly be nutritious. A more plauſible account ſeems deducible from mixture: milk, new drawn, has been but lately mixed, and is expoſed to ſpontaneous ſeparation, a circumſtance hurtful to digeſtion; none of the parts being, by themſelves, ſo eaſily aſſimilated as when they are all taken together. Hence, then, milk new-drawn is more intimately blended, and therefore then is moſt proper to the weakly and infants.

Another difference in the uſe of milk expoſed for ſome time to the air, is taking it boiled or unboiled. Phyſicians have generally recommended the former; but the reaſon is not eaſily aſſigned. Perhaps it is this: Milk kept for ſome time expoſed to the air has gone ſo far to a ſpontaneous ſeparation; whereas the heat thoroughly blends the whole, and hence its reſolution is not ſo eaſy in the ſtomach; and thus boiled milk is more coſtive than raw, and gives more fæces. Again, when milk is boiled, a conſiderable quantity of air is detached, as appears from the froth on the ſurface; and air is the chief inſtrument of fermentation in bodies; ſo that, after this proceſs, it is not liable to aceſcency; for theſe reaſons it is proper for the robuſt and vigorous.

Milk by evaporation yields a ſweet ſaline matter, of which Dr. Lewis gives the following proportions:

Twelve ounces of	Left of dry matter	From which water extracted a ſweet ſaline ſubſtance amounting to
Cows milk	13 drams.	$1\frac{1}{2}$ drams.
Goats milk	$12\frac{1}{2}$	$1\frac{1}{2}$
Human milk	8	6
Aſſes milk	8	6

The ſaline ſubſtance extracted from aſſes milk was white, and ſweet as ſugar; thoſe of the others brown, or yellow, and conſiderably leſs ſweet; that from cows milk had the leaſt ſweetneſs of any.

Milk, ſet in a warm place, throws up to the ſurface an unctuous cream, from which, by agitation, the butter is eaſily ſeparated. The addition of alkaline ſalts prevents this ſeparation, not (as ſome have ſuppoſed) by abſorbing an acid from the milk, but by virtue of their property of intimately uniting oily bodies with watery liquors. Sugar, another grand intermedium betwixt oils and water, has this effect in a greater degree, though that concrete is by no means alkaline, or an abſorbent of acids.

New cows milk, ſuffered to ſtand for ſome days on the leaves of butterwort or ſun-dew, becomes uniformly thick, ſlippery, and coherent, and of an agreeable ſweet taſte, without any ſeparation of its parts. Freſh milk, added to this, is thickened in the ſame manner, and this ſucceſſively. In ſome parts of Sweden, as we are informed in the Swediſh Memoirs, milk is thus prepared for food. New milk has a degree of glutinous quality, ſo as to be uſed for joining broken ſtone-ware. There is a far greater tenacity in cheeſe properly prepared. Milk, when examined by a microſcope, appears compoſed of numerous globules ſwimming in a tranſparent fluid.

MILK *of Vegetables.* For the ſame reaſon that milk of animals may be conſidered as a true animal-emulſion, the emulſive liquors of vegetables may be called *vegetable milks.* Accordingly emulſions made with almonds are commonly called *milk of almonds.* But beſides this vegetable milk, which is in ſome meaſure artificial, many plants and trees contain naturally a large quantity of emulſive or milky juices. Such are lettuce, ſpurge, fig-tree, and the tree which furniſhes the elaſtic American reſin. The milky juices obtained from all theſe vegetables derive their whiteneſs from an oily matter, mixed and undiſſolved in a watery or mucilaginous liquor. Moſt reſinous gums were originally ſuch milky juices, which afterwards become ſolid by the evaporation of their moſt fluid and volatile parts.

Theſe natural milky juices have not been examined by any chymiſt. Such an examination would, however, procure much eſſential knowledge concerning vegetable œconomy. We ſhould probably find examples of all kinds of oils reduced into milky juices; and this knowledge cannot fail of throwing much light on the nature of reſins and gum reſins.

MILK *Fever*, for copious directions for the management of women in this dangerons diſorder, ſee the Syſtem of MIDWIFERY, Part X. Sect. VI.

MILL, denotes a machine for grinding corn, &c. but, in a more general ſignification, is applied to all machines whoſe action depends on a circular motion. Of theſe there are ſeveral kinds, according to the various methods of applying the moving power; as water-*mills*, wind-*mills*, *mills* worked by horſes, &c. See the Syſtem of MECHANICS, Sect. III. *Article Mills*, &c. Plate III.

MILLEPEDES, or WOOD-LOUSE, in entomology; a ſpecies of Oniſcus. Theſe inſects are found in cellars, under ſtones, and in cold moiſt places; in the warmer countries they are rarely met with. Millepedes have a faint diſagreeable ſmell, and a ſomewhat pungent, ſweetiſh, nauſeous taſte. They have been highly celebrated in ſuppreſſions of urine, in all kinds of obſtructions of the bowels, in the jaundice, weakneſs of ſight, and a variety of other diſorders. Whether they have any juſt titles to theſe virtues is greatly to be doubted: thus much is certain, that their real effects come far ſhort of the character uſually given them. For claſſification, ſee the Syſtem, Order VII. Genus 84.

MILLET is reckoned by Pliny the moſt fertile of all grain: one grain of it produced three Roman ſextaries. *Millet* is cooling, drying, and binding, ſomewhat windy, and not eaſily digeſted; a ſtrong decoction of it with figs and raiſins, mixed with wine, and drank warm in bed, is a very good ſudorific, though it is ſeldom uſed. *Millet*, by conſent of authors both ancient and modern, is refrigerating and drying; it is of bad juice, difficult of digeſtion, binds the belly, and generates flatulencies; it is however well known to be a very grateful food to many nations at preſent. In former times it ſerved to make bread, under a dearth of better corn, as we are aſſured by Dioſcorides, Pliny, Galen, and others of the ancients. Among the Italians, ſays C. Bauhine, loaves are made of *millet*, which are yellow, and eaten hot by many, not out of neceſſity, but for their ſweetneſs; but, when this bread is grown hard, it is quite black. Of the flour of *millet* and milk, the Italians make fine cakes, which muſt be eaten as ſoon as dreſſed, or elſe they become glutinous, and ungrateful to the taſte. A pudding prepared of *millet*, boiled in milk with an addition of butter, and ſugar ſprinkled over it, is much in requeſt among the Germans at preſent; and theſe puddings have been long ago introduced into England, and are ſtill in faſhion.

MILLING, in the manufactories, an operation called alſo Fulling. See FULLING.

MILLING, or *throwing of Silk*, is the laſt preparation of ſilk before dying; ſerving to twiſt it, more or leſs, according to the work for which it is intended.

MILLION, in arithmetic, the number of ten hundred thouſand; or a thouſand times a thouſand. See the Syſtem, Art. I.

MILT, in anatomy, a popular name for the ſpleen.

MILT, or MELT, in natural hiſtory, the ſoft roe in fiſhes; thus called becauſe it yields, by expreſſion, a whitiſh juice reſembling milk. The *milt* is properly the ſeed, or ſpermatic part of the male fiſh. The *milt* of a carp is reckoned a choice bit. It conſiſts of two long whitiſh irregular bodies, each included in a very thin fine membrane. M. Petit conſiders theſe as the teſticles of the fiſh wherein the ſeed is preſerved: the lower part, next the anus, he takes for the veſiculæ ſeminales. Vide Mem. Acad. R. Scien. anno 1733. p. 291. In the *milt* of a living cod-fiſh there are ſuch incredible numbers of thoſe ſmall animalcules found in the male ſeed of all animals, that in a drop of the juice of it, no more in quantity than a ſmall grain of ſand, there are contained more than ten thouſand of them; and, conſidering how many ſuch quantities there are in the whole *milt* of one ſuch fiſh, it is not exceeding the bounds of truth to affirm, that there are more animals in one *milt* of it, than there are living men at one time upon the whole face of the earth. However ſtrange and romantic ſuch a conjecture may appear at firſt ſight, a ſerious conſideration, and calculation, will make it appear very plain. A hundred ſuch grains of ſand as here mentioned, will make about an inch in length; therefore in a cubic inch there will be a million of ſuch ſands.

The *milt* of one of theſe fiſhes is frequently about the quantity of fifteen cubic inches, it muſt therefore contain fifteen millions of quantities as big as one of theſe ſands; and if there be ten thouſand animals in each of thoſe quantities, there muſt be, in the whole, a hundred and fifty thouſand millions: which is a number vaſtly exceeding the number of mankind, even though we were to ſuppoſe the whole earth as populous as Holland. See Philoſophical Collections, p. 4. See alſo the Syſtem of ICHTHYOLOGY, Sect. III.

MIMESIS, μιμησις, imitation of the words, geſtures, ſpeech, actions, &c. of any perſon. See IMITATION.

MIND, *Mens*, denotes a thinking or underſtanding being. See SPIRIT. Philoſophers generally allow three kinds of *minds*, viz. *God*, *angels*, and the human *ſoul*. For a thinking being muſt either be finite or infinite: if infinite, it is *God*; and if finite, it is either joined with a human body, or not; if the latter, it is an *angel*; if the former, a *ſoul*. The *human mind* is properly defined a thinking rational ſubſtance: by *thinking*, it is diſtinguiſhed from body; and by *reaſoning*, From God and angels, who are ſuppoſed to ſee and know things intuitively, without the help of deduction and diſcourſe.

MINE, in natural hiſtory, a place under ground, where metals, minerals, or even precious ſtones, are dug up. As, therefore, the matter dug out of *mines* is various; the *mines* themſelves acquire various denominations; as *gold-mines*, *ſilver-mines*, *copper-mines*, *iron-mines*, *diamond-mines*, *ſalt-mines*, *mines of antimony*, *of alum*, &c. For *gold*, and *ſilver-mines*, the richeſt and moſt celebrated are thoſe of Peru and Chili, in America. *Iron-mines* are more abundant in Europe than elſewhere. *Copper-mines* are chiefly found in Sweden, Denmark, and England. *Lead* and *tin-mines* abound moſt in in England and Wales. *Quickſilver mines* in Hungary and Spain. *Diamond-mines* in the Eaſt Indies, and in the Braſils. *Salt-mines* in Poland, &c. *Metallic-mines* are chiefly found in mountains; though the reaſon thereof does not appear. It is probable, plains may abound as much therewith, would people dig deep enough. But plains are commonly cultivated; and beſide, the water will ſcarce allow them to be dug. Add, that the metallic veins always run either horizontal or oblique; and for that reaſon are eaſieſt found on the ſides of eminences.

According to Dr. Nicols's obſervations upon mines, they ſeem to be, or to have been, the channels through which the waters paſs within the earth, and, like rivers, have their ſmall branches opening into them, in all directions. Moſt mines have ſtreams of water running through them: and when they are found dry, it ſeems to be owing to the waters having changed their courſe, as being obliged to it, either becauſe the load has ſtopped up the ancient paſſages, or that ſome new and more eaſy ones are made. Mines, ſays Dr. Shaw, are liable to many contingencies; being ſometimes poor, ſometimes ſoon exhauſtible, ſometimes ſubject to be drowned, eſpecially when deep, and ſometimes hard to trace. Yet there are many inſtances of mines proving highly advantageous for hundreds of years: the mines of Potoſi are to this day worked with nearly the ſame ſucceſs as at firſt; the gold mines of Cremnitz have been worked almoſt theſe 1000 years; and our Corniſh tin mines are extremely ancient. The neat profit of the ſilver alone, dug in the Miſnian ſilver-mines in Saxony, is ſtill, in the ſpace of eight years, computed at a thouſand ſix hundred and forty-four millions, beſides ſeventy-three tons of gold. Many mines have been diſcovered by accident: a torrent firſt laid open a rich vein of the ſilver-mine at Friburg in Germany; ſometimes a violent wind, by blowing up trees, or overturning the parts of rocks, has diſcovered a mine; the ſame has happened by violent ſhowers, earthquakes, thunder, the firing of woods, or even the ſtroke of a ploughſhare or horſe's hoof.

But the art of mining does not wait for theſe favourable accidents, but directly goes upon the ſearch and diſcovery of ſuch mineral veins, ores, or ſands, as may be worth the working for metal. The principal inveſtigation and diſcovery of mines depend upon a particular ſagacity, or acquired habit of judging from particular ſigns, that metallic matters are contained in certain parts of the earth, not far below its ſurface. The principal ſigns of a latent metallic vein ſeems reducible to general heads; ſuch as, 1. The diſcovery of certain mineral waters. 2. The diſcolouration of the trees or graſs of a place. 3. The finding of pieces of ore on the ſurface of the ground. 4. The riſe of warm exhalations. 5. The finding of metallic ſands, and the like. All which are ſo many encouragements for making a ſtricter ſearch near the places where any thing of this kind appears; whence rules of practice might be formed for reducing this art to a greater certainty. But when no evident marks of a mine appear the ſkilful mineraliſt uſually bores into the earth, in ſuch places as, from ſome analogy of knowledge, gained by experience, or by obſerving the ſituation, courſe, or nature of other mines, he judges may contain metal.

MINE *Adventurers*, *Company of*, had its firſt riſe about the year 1690, when certain mines of lead and copper were found in South Wales, which were divided by the proprietors into twenty-four ſhares; and in 1693 ſubdivided into four thouſand and eight ſhares, for the term of twenty two years and a half; to which term five years more were added in 1698, and the affairs of the company regulated by a new conſtitution. In 1704, queen Anne granted a charter of incorporation to this company; in conſequence of which ſeveral new ſhares were added, ſo that the whole number amounted to ſix thouſand and twelve. However, the intereſts of this corporation were ſo ill managed, that the proprietors and creditors petitioned parliament in 1710, and a committee of the houſe of commons was appointed to enquire into its ſtate. The reſult of the enquiry was a cenſure on the principal managers: and though, in 1711, a law was paſſed for the better regulation of the company, and the relief of the creditors and proprietors, nothing could preſerve it from ſinking.

MINE, in the military art, denotes a ſubterraneous canal or paſſage, dug under the wall or rampart of a fortification, intended to be blown up by gun-powder. The alley or paſſage of a mine is commonly about four feet ſquare; at the end of this is the chamber of the mine, which is a cavity about five feet in width and in length, and about ſix feet in height; and here the gun-powder is ſtowed. The fauciſſe of the mine is the train, for which there is always a little aperture left. There are various kinds of mines, which acquire various names, as *royal mines*, *ſerpentine mines*, *forked mines*, according as their paſſages are ſtraight, oblique, winding, &c.

MINERAL, in natural hiſtory, is uſed in general for all foſſile bodies, whether ſimple or compound, dug out of a mine; from whence it takes its denomination.

MINERAL *Waters*. All waters naturally impregnated with any heterogeneous matter which they have diſſolved within the earth may be called *mineral waters*, in the moſt general and extenſive meaning of that name; in which are therefore comprehended almoſt all thoſe that flow within or upon the ſurface of the earth, for almoſt all theſe contain ſome earth or ſelenites. But waters containing only earth or ſelenites are not generally called *mineral*, but *hard* or *crude-waters*.

Hard waters, which are ſimply ſelenitic, when tried by the chymical proofs, ſhew no marks of an acid or of an alkali, nor of any volatile, ſulphureous, or metallic matters. Waters which contain diſengaged calcareous earth, change the colour of ſyrup of violets to a green; and thoſe that contain ſelenites, being mixed with a ſolution of mercury in nitrous acid, form a turbith mineral; and when a fixed alkala is added, they are rendered turbid, and a white ſediment is precipitated. Theſe waters alſo do not diſſolve ſoap well. From theſe we may know, that any water which produces theſe effects is a hard, earthy, or ſelenitic water. The waters impregnated with gas are alſo hard.

Although the waters of the ſea and ſaline ſprings be not generally enumerated amongſt mineral waters, they might nevertheleſs be juſtly conſidered as ſuch: for beſides earthy and ſelenitic matters, they alſo contain a large quantity of mineral ſalts. We ſhall therefore conſider them as ſuch in this article. Mineral waters, properly ſo called, are thoſe in which gas, or ſulphureous, ſaline, or metallic ſubſtances, are diſſolved by chymical trials. As many of theſe waters are employed ſucceſsfully in medicine, they are alſo called *medicinal waters*.

Mineral waters receive their peculiar principles by paſſing through earths containing ſalts, or pyritous ſubſtances that are in a ſtate of decompoſition. Some of theſe waters are valuable from the quantity of uſeful ſalts which they contain, particularly of common ſalt, great quantities of which are obtained from theſe waters; and others are chiefly valued for their medicinal qualities. The former kind of mineral waters is an object of manufacture, and from them is chiefly extracted that ſalt only which is moſt valuable in commerce. See SALT.

Many of theſe waters have been accurately analyſed by able chymiſts and phyſicians. But notwithſtanding theſe attempts, we are far from having all the certainty and knowledge that might be deſired on this important ſubject: for this kind of analyſis is perhaps the moſt difficult of any in chymiſtry. Almoſt all mineral waters contain ſeveral different ſubſtances, which being united with water may form with each other numberleſs compounds. Frequently ſome of the principles of mineral waters are in ſo ſmall quantity, that they can ſcarcely be perceived; although they may have ſome infiuence on the virtues of the water, and alſo on the other principles contained in the water. The chymical operations uſed in the analyſis of mineral waters, may ſometimes occaſion eſſential changes in the ſubſtances that are to be diſcovered. And alſo, theſe waters are capable of ſuffering very conſiderable changes by motion, by reſt, and by expoſure to air.

Probably alſo the variations of the atmoſphere, ſubterranean changes, ſome ſecret junction of a new ſpring of mineral or of pure water, laſtly the exhauſtion of the minerals whence waters receive their peculiar principles, are cauſes which may occaſionally change the quality of mineral waters. We need not therefore wonder that the reſults of analyſes of the ſame mineral waters made by different chymiſts, whoſe ſkill and accuracy are not queſtioned. ſhould be very different. The conſequences of what we have ſaid on this ſubject are, That the examination of mineral waters is a very difficult taſk; that it ought not to be attempted but by profound and experienced chymiſts; that it requires frequent repetitions, and at different times; and laſtly that no fixed general rules can be given concerning theſe analyſes. As this matter cannot be thoroughly explained without entering into details connected with all the parts of chymiſtry, we ſhall here mention only the principal reſults, and the moſt eſſential rules, that have been indicated by the attempts hitherto made on this ſubject.

We may admit the diviſion or arrangement of mineral waters into certain claſſes, propoſed by ſome of the beſt chymiſts and naturaliſts. Some of theſe waters are called *cold*, becauſe they are not naturally hotter than the atmoſphere. Some of them are even colder, eſpecially in ſummer. Thoſe are called *hot mineral waters*, which in all ſeaſons are hotter than the air. Theſe are of various degrees of heat, and ſome of them are almoſt as hot as boiling water. In ſome mineral waters certain volatile, ſpirituous, and elaſtic principles may be perceived, by a very ſenſible piquant taſte: this principle is called the *gas* or the *ſpirit of waters*.

The waters which contain this principle are generally lighter than pure water. They ſparkle and emit bubbles, at their ſpring, but eſpecially when they are ſhook, and poured from one veſſel into another. They ſometimes break the bottles containing them, when they are well corked, as fermenting wines ſometimes do. When mixed with ordinary wine, they give to it the piquancy and ſparkling quality of Champaigne wine. This volatile principle, and all the properties of the water dependent upon it, are loſt merely by expoſure to air, or by agitation. The waters containing this principle are diſtinguiſhed by the name of *ſpirituous mineral waters*, or *acidulous waters*.

MINERALOGY, teaches us the properties of mineral bodies, and by which we learn how to characteriſe, diſtinguiſh, and claſs them into a proper order. Mineralogy ſeems to have been in a manner coeval with the world. Precious ſtones of various kinds appear to have been well known among the Jews and Egyptians in the time of Moſes; and even the moſt rude and barbarous nations appear to have had ſome knowledge of the ores of different metals. As the ſcience is nearly allied to chymiſtry, it is probable that the improvements both in chymiſtry and mineralogy have nearly kept pace with each other; and indeed it is but of late, ſince the principles of chymiſtry were well underſtood, that mineralogy hath been advanced to any degree of perfection. The beſt way of ſtudying mineralogy, therefore, is by applying chymiſtry to it; and not contenting ourſelves merely with inſpecting the outſides of bodies, but decompounding them according to the rules of chymiſtry. This method hath been brought to the greateſt perfection by Mr. Pott of Berlin, and after him by Mr. Cronſtedt of Sweden. To obtain this end, chymical experiments in the large way are without doubt neceſſary; but as a great deal of the mineral kingdom has already been examined in this manner, we do not need to repeat all thoſe experiments in their whole extent, unleſs ſome new and particular phenomena ſhould diſcover themſelves in thoſe things we are examining; elſe the tediousneſs of thoſe proceſſes might diſcourage ſome from going farther, and take up much of the time of others that might be better employed. An eaſier way may therefore be adopted, which even for the moſt part is ſufficient, and which though made in miniature, yet is as ſcientifical as the common manner of proceeding in the laboratories, ſince it imitates that, and is founded upon the ſame principles. This conſiſts in making the experiments upon a piece of charcoal with the concentrated flame of a candle blown through a blowpipe. The heat occaſioned by this is very intenſe; and the mineral bodies may here be burnt, calcined, melted, and ſcorified, &c. as well as in any great works.

MINERVA, or **PALLAS**, in Pagan worſhip, the goddeſs of ſciences and of wiſdom, ſprung completely armed from Jupiter's brain. Minerva is uſually repreſented by the poets, painters, and ſculptors, completely armed, with a compoſed but agreeable countenance, bearing a golden breaſt plate, a ſpear in her right hand, and her ægis or ſhield in the left, on which is repreſented Meduſa's head encircled with ſnakes, and her helmet was uſually entwined with olives.

MINIATURE, a delicate kind of painting conſiſting of little points or dots, inſtead of lines; uſually done on vellum, ivory, or paper, with very thin, ſimple water-colours. Miniature is diſtinguiſhed from other kinds of painting by the ſmallneſs and delicacy of its figures, the weakneſs of their colours, and faintneſs of the colouring; and on this account it requires to be viewed very near. Thoſe colours that have the leaſt body are the beſt and moſt commodious for painting in miniature; ſuch are carmine, ultramarine, fine lakes, and green made of the juices of ſeveral kinds of herbs and flowers. The colours for miniature may be mixed up with a ſolution of gum Arabic, or gum tragacanth, in water, or with iſinglaſs ſize. For the method of preparing ivory for miniature, ſee IVORY.

MINIM, in muſic, a note, or character of time, equal to two crotchets, or half a ſemibreve. See the Syſtem.

MINISTER, a perſon who preaches, performs religious worſhip in public, adminiſters the ſacraments, &c.

MINISTER *of State*, a perſon to whom the prince intruſts the adminiſtration of government.

Foreign **MINISTER**, is a perſon ſent into a foreign country, to manage the affairs of his province, or of the ſtate to which he belongs. Of theſe there are two kinds: thoſe of the firſt rank are ambaſſadors, and envoys extraordinary, who repreſent the perſons of their ſovereigns; the miniſters of the ſecond rank are the ordinary reſidents.

MINOR, in law, denotes a perſon under age, or who, by the laws of the country, is not yet arrived at the power of adminiſtering his own affairs, or the poſſeſſion of his eſtate. Among us, a perſon is a minor till the age of twenty-one; before which time his acts are invalid. See AGE.

MINOR, in logic, is the ſecond propoſition of a formal or regular ſyllogiſm. See the Syſtem, Part III. Sect. IV.

MINT, the place where the king's money is coined. Anciently there were mints in moſt cities of England. The chief mint, at preſent, is the Tower of London.

MINUET, a very graceful kind of dance, conſiſting of a coupee, a high ſtep, and a ballance: it begins with a beat, and its motion is triple. The invention of the minuet ſeems generally to be aſcribed to the French, and particularly to the inhabitants of the province of Poictou. The word is ſaid to be derived from the French *monu, little*, and ſignifying a ſmall pace.

MINUS, a term in algebra. For explanation, ſee the Syſtem, Sect. I.

MINUTE, from the Latin *minutus, ſmall*, in geography and aſtronomy, is the ſixtieth part of a degree. See the reſpective Syſtems.

MIRACLE, is defined by Dr. Samuel Clarke, to be a work effected in a manner different from the common and regular method of providence, by the interpoſition either of God himſelf, or ſome intelligent agent ſuperior to man. It has been much controverted, whether true miracles can be worked by any leſs power than the immediate power of God; and whether to complete the evidence of a miracle, the nature of the doctrine pretended to be proved by it is neceſſary to be taken into the conſideration. The above learned author undertakes to ſet this matter in a clear light, as follows. In reſpect to the power of God, and the nature of the things themſelves, all things that are poſſible at all, are equally eaſy to be done: it is at leaſt as great an act of power to cauſe the ſun to move at all, as to cauſe it at any time to ſtand ſtill; yet this latter we call a *miracle*, the former not.

What degrees of power God may reaſonably be ſuppoſed to have communicated to created beings or ſubordinate intelligences, is impoſſible for us to determine: therefore a miracle is not rightly defined to be ſuch an effect as could not have been produced by any leſs power than the divine omnipotence. There is no inſtance of any miracle in ſcripture, which to an ordinary ſpectator would neceſſarily imply the immediate operation of original, abſolute, and underived power. All things that are done in the world, are done either immediately by God himſelf, or by created intelligent beings, matter not being at all capable of any laws or powers whatſoever; ſo that all thoſe things which we ſay are the effects of the natural powers of matter and laws of motion, are properly the effects of God acting upon matter continually and every moment, either immediately by himſelf, or mediately by ſome created intelligent beings. Conſequently it is no more againſt the courſe of nature for an angel to keep a man from ſinking in the water, than for a man to hold a ſtone from falling in the air, by overpowering the law of gravitation; and yet the one is a miracle, the other not ſo. The only poſſible ways by which a ſpectator may certainly and infallibly diſtinguiſh whether miracles be the works either immediately of God himſelf, or of ſome good angel employed by him; or whether, on the contrary, they are the works of evil ſpirits, are theſe: if the doctrine atteſted by miracles, be in itſelf impious, or manifeſtly tending to promote vice; then, without all queſtion, the miracles, how great ſoever they may appear to us, are neither worked by God himſelf, nor by his commiſſion. If the doctrine itſelf be indifferent, and at the ſame time there be worked other miracles more and greater than the former, then that doctrine which is atteſted by the ſuperior power muſt neceſſarily be believed to be divine: this was the caſe of Moſes and the Egyptian magicians. If, in the laſt place, the doctrine atteſted by miracles tends to promote the honour of God, and the practice of righteouſneſs among men; and yet nevertheleſs be not in itſelf demonſtrable, nor could without a revelation be diſcovered to be actually true, and there is no pretence of more and greater miracles to contradict it, which is the caſe of the doctrine and miracles of Chriſt; then the miracles are unqueſtionably divine, and the doctrine muſt, without all controverſy, be acknowledged as an immediate and infallible revelation from God.

The Lord Bacon obſerves, that a miracle was never wrought by God to convert an atheiſt, becauſe the light of nature might have led him to confeſs a God: but miracles, ſays he, are deſigned to convert idolaters and the ſuperſtitious, who have acknowledged a deity, but erred in the manner of adoring him; becauſe no light of nature extends ſo far as fully to declare the will and true worſhip of God. Acoſta inquiring into the cauſe why miracles are not wrought by the preſent miſſionaries for the converſion of heathen nations, as they were by the Chriſtians of the primitive ages, gives this as one reaſon: that the Chriſtians at firſt were ignorant men, and the Gentiles learned: but now, on the contrary, all the learning in the world is employed in the defence of the goſpel, and there is nothing but ignorance to oppoſe it; and there can be no need of farther miracles in ſo good a cauſe, when it is in the hands of ſuch able advocates againſt ſuch weak adverſaries.

MIRROR, a name for a looking-glaſs, or any poliſhed body, whoſe uſe is to form the images of diſtant objects by reflexion of the rays of light. See Reflexion.

Mirrors are either plain, convex, or concave. The firſt reflect the rays of light in a direction exactly ſimilar to that in which they fall upon them, and therefore repreſent bodies of their natural magnitude. The convex ones make the rays diverge much more than before reflexion, and therefore greatly diminiſh the images of thoſe objects which they ſhew: while the concave ones, by collecting the rays into a focus, not only magnify the objects they ſhow, but will burn very fiercely when expoſed to the rays of the ſun; and hence they are commonly known by the name of *burning mirrors*. See Burning *Glaſs*.

In ancient times the mirrors were made of ſome kind of metal; and from a paſſage in the Moſaic writings we learn that the mirrors uſed by the Jewiſh women were made of braſs. The Jews certainly had been taught to uſe that kind of mirrors by the Egyptians; from whence it is probable, that brazen mirrors were the firſt kind uſed in the world. Any kind of metal indeed, when well poliſhed, will reflect very powerfully; but of all others ſilver reflects the moſt, though it hath been in all countries too expenſive a material for common uſe. Gold alſo is very powerful; and metals, or even wood, gilded and poliſhed, will act very powerfully as burning mirrors. Even poliſhed ivory, or ſtraw nicely plaited together, will form mirrors capable of burning, if on a large ſcale. Since the invention of glaſs, and the application of quickſilver to it, became generally known, it hath been univerſally employed for thoſe plain mirrors uſed as ornaments to houſes; but in making reflecting teleſcopes, they have been found much inferior to metallic ones. It doth not appear that the ſame ſuperiority belongs to the metalline burning mirrors, conſidered merely as burning glaſſes; ſince the mirror with which Mr. Macquer melted platina, though only 22 inches diameter, and which was made of quickſilvered glaſs, produced much greater effects than M. Villette's metalline ſpeculum, which conſiderably exceeded it in ſize. It is very probable, however, that this mirror of M. Villette's was by no means ſo well poliſhed as it ought to have been: as the art of preparing the metal for taking the fineſt poliſh hath but lately been diſcovered and publiſhed in the Philoſophical Tranſactions by Mr. Mudge. See Glass *Grinding*, and the *Mechanical Part of* Optics.

MISANTHROPY, μισανθρωπια, formed of μισος, *hatred*, and ανθρωπος a *man*, a general diſlike or averſion to man, and mankind. In which ſenſe it ſtands oppoſed to *philanthropy*, or the love of mankind.

MISCARRIAGE. For the cauſes and methods of prevention, ſee the Syſtem of Midwifery, Part II. Sect. I, II, and III.

MISCHNAH, or Misnah, the code or collection of the civil law of the Jews. The Jews pretend, that when God gave the written law to Moſes, he gave him alſo another which was not written; and which was preſerved by tradition among the doctors of the ſynagogue, till Rabbi Judah, ſurnamed the *Holy*, ſeeing the danger they were in, through their diſperſion, of departing from the traditions of their fathers, judged it proper to reduce them to writing. The miſnah is divided in ſix parts: the firſt relates to the diſtinction of ſeeds in a field, to trees, fruits, tythes, &c. the ſecond regulates the manner of obſerving feſtivals; the third treats of women, and matrimonial caſes; the fourth of loſſes in trade, &c. the fifth is on obligations, ſacrifices, &c. and the ſixth treats of the ſeveral ſorts of purification.

MISEN-*Maſt* is the maſt upon which the miſen and its top-ſail and ſtay-ſails are ſupported, as the driver, ring-tail, &c.

MISSAL, the Romiſh maſs-book, containing the ſeveral maſſes to be ſaid on particular days. For repreſentation, ſee Treatiſe on Naval Affairs, and Plate II. *Fig.* 12, N°. 159.

MISSIONARIES, ſuch eccleſiaſtics as are ſent by any Chriſtian church into Pagan or Infidel countries, to convert the natives, and eſtabliſh the Chriſtian religion among them. There are in France, and other Popiſh countries, ſeveral congregations of miſſionaries, whoſe principal end is to be employed on miſſions, and to inſpire into the young clerks that ſpirit of piety and devotion which is neceſſary for the worthy diſcharge of their miniſtry. Such are the congregations of the prieſts of the miſſion, the Eudiſts, the miſſionaries of Lyons, and ſome others. The moſt remarkable of theſe congregations is that of the prieſts of the miſſion, which conſiſts of ſecular clergy; who neverthleſs make four ſimple vows, of poverty, chaſtity, obedience, and perſeverance. Their habit is diſtinguiſhed from that of other eccleſiaſtics only by a linen-collar four fingers broad, and by their wearing a little tuft of beard.

MIST, a meteor, called alſo *Fog*. See Fog.

MITRE, Mitra, from Μιτρα, which ſignifies the ſame; a pontifical ornament, worn on the head by biſhops, on ſolemn occaſions. For deſcription, ſee the Syſtem of Heraldry, Sect. VII. Art. III. For repreſentation, ſee Plate V.

MITTIMUS, in law, a writ by which records are ordered to be transferred from one court to another; ſometimes immediately, as out of the king's bench into the exchequer; and ſometimes by a certiorari into the chancery; and from thence, by a mittimus, into another court.

Mittimus is alſo uſed for a precept in writing, directed by a juſtice of peace to a joaler, for the receiving and ſafe keeping a felon, or other offender, by him committed to the goal. This is a warrant under the hand and ſeal of the juſtice, containing the cauſe of the commitment of the offender.

MIXT, or Mixt Body, in chymiſtry, that which is compounded of different elements or principles.

MIXTURE, a compound, or aſſemblage of ſeveral different bodies in the ſame maſs. Simple mixture, conſiſts only in the ſimple appoſition of parts of different bodies to each other. Thus, when powders of different kinds are rubbed together, the mixture is only ſimple, and each of the powders retains its particular characters. In like manner, when oil and water are mixed together, though the parts of both are confounded, ſo that the liquor may appear to be homogeneous, we cannot ſay that there is any more than a ſimple appoſition of the parts, as the oil and water may very eaſily be again ſeparated from each other. But the caſe is very different when bodies are chymically mixed; for then one or both bodies aſſume new properties, and can by no means be diſcovered in their proper form without a particular chymical proceſs adapted to this purpoſe. Hence chymical mixture is attended with many phenomena which are never obſerved in ſimple mixtures; ſuch as heat, effervefcence, &c. To chymical mixture belongs the union of acids and alkalies, the amalgamation of metals, ſolution of gums, &c. and upon it depend many of the principal operations of chymiſtry.

MOAT, in fortification, a deep trench dug round a town or fortreſs to be defended, on the outſide of the wall, or rampart. The depth and breadth of a moat often depend on the nature of the ſoil; according as it is marſhy, rocky, or the like. The brink of the moat next the rampart in any fortification is called the *ſcarp*, and the oppoſite one the *counterſcarp*.

MODE, *Modus*, in philoſophy, a manner of being; or a quality or attribute of a ſubſtance, or ſubject, which we conceive as neceſſarily depending on the ſubject, and incapable of ſubſiſting without it. Mr. Locke defines modes to be thoſe ideas (he ſhould have ſaid things) which do not imply any ſuppoſition of ſubſiſting by themſelves, but are conſidered as mere dependences, and affections of ſubſtances.

Our ideas of things may be reduced to two kinds: the one of things, which we conceive ſeparately, and by themſelves, called *ſubſtances*; and the other of things which we conceive as exiſting in others, in ſuch manner as that we cannot allow them exiſting without them, and theſe we call *modes*, or *accidents*. It is the characteriſtic, then, of a true mode, to have ſuch a relation to ſome ſubject, as not to be clearly and diſtinctly conceivable without conceiving the ſubject, whereof it is a mode, at the ſame time: when on the other hand, the conception of the ſubject does not at all infer or require that of the mode.

Thus, what gives us to know, that thought is not a mode of extended ſubſtance, or matter, is, that extenſion, and the other properties of matter, may be divided from thought, without ceaſing to conceive thought all the while. We always conſider things as cloathed with certain modes, except we reflect on them in the abſtract, or general; and it is the variety of modes, and the relations, that occaſions the great variety of denominations of the ſame thing. They are the various modes of matter, e. g. that make all the diverſity of bodies, or corporeal beings, in nature.

Mode, in muſic; a regular diſpoſition of the air and accompaniments relative to certain principal ſounds upon which a piece of muſic is formed, and which are called the *eſſential ſounds of the mode*. There is this difference between the mode and the tone, that the latter only determines the principal ſound, and indicates the place which is moſt proper to be occupied by that ſyſtem which ought to conſtitute the baſs of the air; whereas the former regulates the thirds, and modifies the whole ſcale agreeably to its fundamental ſounds. See the Syſtem.

MODEL, in a general ſenſe, an original pattern, propoſed for any one to copy or imitate. This word is particularly uſed, in building, for an artificial pattern made in wood, ſtone, plaſter, or other matter, with all its parts and proportions, in order for the better conducting and executing ſome great work, and to give an idea of the effect it will have in large. In all great buildings, it is much the ſureſt way to make a model in relievo, and not to truſt to a bare deſign or draught. There are alſo models for the building of ſhips, &c. and for extraordinary ſtair-caſes, &c. They alſo uſe models in painting and ſculpture; whence, in the academies, they give the term *model* to a naked man or woman, diſpoſed in ſeveral poſtures, to give an opportunity to the ſcholars to deſign him in various views and attitudes.

MODERATION, in ethics, is a virtue conſiſting in the proper government of our appetites, paſſions, and purſuits, with reſpect to honours, riches, and pleaſures; and in this ſenſe it is ſynonymous with temperance: it is alſo often uſed to denote candour.

MODERATOR, in the ſchools, the perſon who preſides at a diſpute, or in a public aſſembly. Such a doctor was the moderator, that is, the preſident, at ſuch a diſputation, in ſuch an aſſembly, &c.

MODERN, ſomething new, or of our time. In oppoſition to what is antique, or ancient. Modern authors, according to Naude, are all thoſe who have written ſince Boethius: the modern philoſophy commences with Galileo: and the modern aſtronomy with Copernicus.

MODESTY, in ethics, is ſometimes uſed to denote humility: and ſometimes to expreſs chaſtity or purity of ſentiment and manners.

MODIFICATION, in philoſophy, that which modifies a thing; that is, gives it this or that manner of being. Quantity and quality are accidents which modify all bodies.

MODILLIONS, from the Italian *modiglione*, *a little meaſure*, in architecture, ornaments in the corniche of the Ionic, Doric, Corinthian and Compoſite columns The modillions are little inverted conſoles, or brackets, in form of an S, under the ſoffit of the corniche ſeeming to ſupport the projecture in the larmier: though in reality they are no more than ornaments. See the Syſtem on the Orders in general. For repreſentation, ſee Plate VI.

MODULATION, in muſic, is the art of keeping in, and, on occaſion, changing, the mode or key; and returning to it again; without offence to the ear. Under this term it comprehended the regular progreſſion of the ſeveral parts through the ſounds that in the harmony of any particular key, as well as the proceeding naturally and regularly from one key to another. See the Syſtem.

MODULE, in architecture, a certain meaſure taken at pleaſure, for regulating the proportions of columns and the ſymmetry or diſtribution of the whole building. Architects uſually chooſe the diameter or ſemidiameter of the bottom of the column for their module; and this they ſubdivide into parts or minutes. See the Syſtem, Plates II, and III.

MOHAIR, in commerce, the hair of a kind of goat, frequent about Angora in Turkey; the inhabitants of which city are all employed in the manufacture of camblets made of this hair. Some give the name mohair to the camblets or ſtuffs made of this hair: of theſe there are two kinds; the one ſmooth and plain; the other watered like tabbies: the difference between the two only conſiſts in this, that the latter is calendered, the other not. There are alſo mohairs both plain and watered, whoſe woof is of wool, cotton, or thread.

MOIDORE, Moedore, or Moeda, a gold coin, ſtruck and current in Portugal, value 1l. 7s. ſterling.

MOISTURE. See Humidity. The moiſture of the air has conſiderable effects on the human body. For the quantity and quality of the food, and the proportion of the meat to the drink, being given, the weight of a human body is leſs, and conſequently its diſcharges greater in dry weather than in wet weather; which may be thus accounted for; the moiſture of the air moiſtens the fibres of the ſkin, and leſſens perſpiration, by leſſening their vibratory motion. When perſpiration is thus leſſened by the moiſture of the air, urine, indeed, is by degrees increaſed, but not equally. See Dr. Bryan Robinſon's Diſſ. on the Food and Diſcharges of the Human Bodies, p. 68, ſeq.

MOLARES, in anatomy, the *grinders*; an epithet given to the large teeth; as ſerving, like mill-ſtones, to grind the food. See the System, Part II. Sect. XIV.

MOLE. The Engliſh name of the genus talpa. See Talpa.

MOLINE', in heraldry. A *Croſs* Moline' is that which turns round both ways at all its extremities, though not ſo wide or ſharp as that ſaid to be *anchored*. In Upton the points are all cut off, which makes it very different from the croſs anchored.

MOLLUSCA, in the Linnæan ſyſtem of vermeology, is the denomination of the ſecond genus of *vermes* or worms. Theſe are ſimple naked animals, not included in a ſhell, but furniſhed with limbs, and comprehend eighteen ſubordinate genera, and one hundred and ten ſpecies.

MOLOCH, a falſe god of the Ammonites, who dedicated their children to him, by making them "paſs through the fire," as the ſcriptures expreſs it. There are various opinions concerning this method of conſecration. Some think, the children leaped over a fire ſacred to Moloch; others, that they paſſed between two fires; and others, that they were really burnt in the fire, by way of ſacrifice to this god. There is foundation for each of theſe opinions. For, firſt, it was uſual among the pagans to luſtrate or purify with fire; and, in the next place, it is expreſsly ſaid, that the inhabitants of Sepharvaim burnt their children in the fire to Anamalech and Adrammelech; much ſuch deities as Moloch of the Ammonites.

Moſes, in ſeveral places, forbids the Iſraelites to dedicate their children to this god, as the Ammonites did, and threatens death and utter extirpation to ſuch perſons as were guilty of this abominable idolatry. And there is great probability that the Hebrews were much addicted to the worſhip of this deity; ſince Amos, and after him St. Stephen, reproaches them with having carried along with them into the wilderneſs the tabernacle of their god Moloch.

Solomon built a temple to Moloch upon the mount of Olives; and Manaſſeh, a long time after, imitated his impiety, by making his ſon paſs through the fire in honour of Moloch. It was chiefly in the valley of Tophet and Hinnom, to the eaſt of Jeruſalem, that the Iſraelites paid their idolatrous worſhip to this falſe god of the Ammonites.

MOLOSSES, Molasses, or Melasses, that groſs, yet fluid matter remaining of ſugar, after refining, and which no boiling will bring to a conſiſtence more ſolid than that of ſyrup; hence alſo called *ſyrup of Sugar*. Properly, molaſſes are only the ſediment of one kind of ſugar called *chypre*, or brown ſugar, which is the refuſe of other ſugars not to be whitened, or reduced into loaves. Moloſſes are much uſed in Holland among poor people, for the preparation of tobacco, and alſo inſtead of ſugar. There is a kind of brandy or ſpirit made of moloſſes; but by ſome held exceedingly unwholeſome.

Molosses *Spirit*, a very clean and pure ſpirit, much uſed in England, and made from moloſſes, or common treacle diſſolved in water, and fermented in the ſame manner as malt or the common malt ſpirit. If ſome particular art is not uſed in the making this, it will not prove ſo vinous as the malt ſpirit, but more flat and leſs pungent and acid, though otherwiſe much cleaner taſted, as its eſſential oil is of a leſs nauſeous flavour. Whence if good freſh wine leys, abounding in tartar, be duly fermented in the ſolution made thin for that purpoſe, the ſpirit will by that means become much more vinous and briſk, and approach more to the nature of the foreign ſpirits.

MOMENT, in time, the moſt minute and indiviſible part of duration; or what we otherwiſe call an inſtant.

MOMENTUM, in mechanics, ſignifies the ſame with impetus, or the quantity of motion in a moving body; which is always equal to the quantity of matter multiplied into the velocity. For the general laws of motion, ſee Syſtem, Sect. II.

MOMUS, in fabulous hiſtory, the god of raillery, or the jeſter of the celeſtial aſſembly, and who ridiculed both gods and men.

MONADELPHIA, in botany, the ſixteenth claſs of plants whoſe ſtamina, or male parts, on account of their filaments running in among one another, are all formed into one body. Though authors in general have kept this claſs of plants together, they have been much divided in their opinions, as to the characters or parts of them, by which they ſhould divide them into genera. Some have had recourſe, on this occaſion, to the ſeed-veſſel; others, finding that inſufficient, have conſulted the leaves. Linnæus uſes the cup of the flower on this occaſion, which is a very eſſential part in this claſs of plants, and ſufficiently different in the different genera. It is obſerved, that all the plants of this claſs are mucilaginous and emollient, and have great virtues as diuretics, &c. The common marſhmallow deſervedly ſtands at the head of theſe, and is common in the preſcriptions of the phyſicians on theſe occaſions, as well as in many of the ſhop compoſitions, as the ſyrup of marſhmallows and the like. See the Syſtem, Sect. V. and Plate V.

MONANDRIA, in botany, the firſt claſs of plants which have hermaphrodite flowers, with only one ſtamen each. The word is formed of the Greek μονος, *ſingle*, and ανηρ, *male*. See the Syſtem, Sect. V, and Plate IV.

MONARCHY, μοναρχια, a large ſtate governed by one: or a ſtate where the ſupreme power is lodged in the hands of a ſingle perſon. The word comes from the Greek μοναρχης, *one who governs alone*; formed of μονος, *ſolus*, and αρχη, *imperium*, *government*. Of the three forms of government, viz. *democracy*, *ariſtocracy*, and *monarchy*, the laſt is the moſt powerful, all the ſinews of government being knit together, and united in the hand of the prince; but then there is imminent danger of his employing that ſtrength to improvident or oppreſſive purpoſes. As a democracy is the beſt calculated to direct the end of a law, and an ariſtocracy to invent the means by which that end ſhall be obtained, a monarchy is moſt fit for carrying thoſe means into execution. The moſt ancient monarchy was that of the Aſſyrians, which was founded ſoon after the deluge.

Of monarchies, ſome are abſolute and deſpotic, where the will of the monarch is uncontrolable; as Denmark, &c. others are limited, where the prince's authority is reſtrained by laws, and part of the ſupreme power lodged in other hands; as in England. See Government. Some monarchies, again, are hereditary, where the ſucceſſion devolves immediately from father to ſon; and others are elective, where on the death of the monarch, his ſucceſſor is appointed by election; as in Poland. According to Hobbes, monarchy, as well as ariſtocracy, derives all its authority from the people, who transfer all their right, v. gr. the ſupreme power, by a plurality of ſuffrages, &c. to ſome one perſon called a monarch; ſo that whatever the people could have done before this tranſlation, may be now rightfully done by him to whom the tranſlation is made. This done, the people are no longer to be looked upon as a body, but a diſſolved multitude; becauſe they were only one by virtue of the ſupreme power, which they have now transferred to another. Nor can the monarch, according to this author, oblige himſelf by any covenants, to any perſon, for the authority he has received; becauſe he receives the power from the people, which, as ſoon as that is done, ceaſes to be a body;

and the body ceaſing, the obligation to the body ceaſes of courſe. The people, therefore, are obliged to pay obedience to the monarch, by virtue of thoſe covenants, whereby they mutually oblige themſelves to what the people, as a body, enjoin to be done. He argues, farther, that as a monarch cannot be obliged by any covenants; ſo neither can he do any injury to his ſubjects: an injury being nothing elſe but a breach of covenant: and where there is no covenant, there can be no breach of one.

MONASTERY, a convent, or houſe, built for the reception and entertainment of monks, mendicant friars, or nuns, whether it be an abbey, priory, &c. Monaſteries are governed by different rules, according to the different regulations preſcribed by their founders. The firſt regular and perfect monaſteries were founded by St. Pachomius in Egypt: but St. Baſil is generally conſidered as the great father and patriarch of the eaſtern monks; ſince, in the fourth century, he preſcribed rules for the government of the monaſteries, to which the Anachorets and Cœnobites, and the other ancient fathers of the deſarts, ſubmitted. In like manner St. Benedict was ſtyled the *patriarch of the weſtern monks*. He appeared in Italy towards the latter end of the fifth century, and publiſhed his rule, which was univerſally received throughout the weſt. St. Auguſtine being ſent into England by St. Gregory the pope, in the year 596, to convert the Engliſh, he at the ſame time introduced the monaſtic ſtate into that kingdom; which made ſuch progreſs there, that, within the ſpace of 200 years, there were 30 kings and queens who preferred the religious habit to their crowns, and founded ſtately monaſteries, where they ended their days in retirement.

The houſes belonging to the ſeveral religious orders, which obtained in England and Wales, were cathedrals, colleges, abbies, priories, preceptories, commandries, hoſpitals, friaries, hermitages, chantries, and free chapels. Theſe were under the direction and management of various officers. The diſſolution of houſes of this kind began ſo early as the year 1312, when the Templars were ſuppreſſed; and in 1323, their lands, churches, advowſons, and liberties, here in England, were given, by 17 Ed. II. ſtat. 3. to the prior and brethren of the hoſpital of St. John at Jeruſalem. In the years 1390, 1437, 1441, 1459, 1497, 1505, 1508, and 1515, ſeveral other houſes were diſſolved, and their revenues ſettled on different colleges in Oxford and Cambridge. Soon after the laſt period, cardinal Wolſey, by licence of the king and pope, obtained a diſſolution of above thirty religious houſes, for the founding and endowing his colleges at Oxford and Ipſwich. About the ſame time a bull was granted by the ſame pope to cardinal Wolſey, to ſuppreſs *monaſteries*, where there were not above ſix monks, to the value of eight thouſand ducats a year, for endowing Windſor, and King's College in Cambridge; and two other bulls were granted to cardinals Wolſey and Campeius, where there were leſs than twelve monks, and to annex them to the greater *monaſteries*; and another bull to the ſame cardinals to enquire about abbies, to be ſuppreſſed, in order to be made cathedrals. Although nothing appears to have been done in conſequence of theſe bulls, the motive which induced Wolſey, and many others, to ſuppreſs theſe houſes, was the deſire of promoting learning; and archbiſhop Cranmer engaged in it with a view of carrying on the Reformation. There were other cauſes that concurred to bring on their ruin: many of the religious were looſe and vicious; the monks were generally thought to be, in their hearts, attached to the pope's ſupremacy; their revenues were not employed according to the intent of the donors; many cheats in images, feigned miracles, and counterfeit relics, had been diſcovered, which brought the monks into diſgrace; the Obſervant friars had oppoſed the king's divorce from queen Catharine; and theſe circumſtances operated, in concurrence with the king's wanting a ſupply, and the people's deſire to ſave their money, to forward a motion in parliament, that in order to ſupport the king's ſtate, and ſupply his wants, all the religious houſes might be conferred upon the crown, which were not able to ſpend above 200*l.* a year; and an act was paſſed for that purpoſe, 27 Henry VIII. c. 28. By this act about three hundred and eighty houſes were diſſolved, and a revenue of 30 or 32,000*l.* a year came to the crown; beſides about 100,000*l.* in plate and jewels. The ſuppreſſion of theſe houſes occaſioned diſcontent, and at length an open rebellion: when this was appeaſed, the king reſolved to ſuppreſs the reſt of the monaſteries, and appointed a new viſitation, which cauſed the greater abbies to be ſurrendered apace; and it was enacted by 31 Hen. VIII. c. 13. that all monaſteries, &c. which have been ſurrendered ſince the fourth of February, in the twenty-ſeventh year of his majeſty's reign, and which hereafter ſhall be ſurrendered, ſhall be veſted in the king. The knights of St. John of Jeruſalem were alſo ſuppreſſed by the 32 Hen. VIII. c. 24. The ſuppreſſion of theſe greater houſes by theſe two acts, produced a revenue to the king of above 100,000*l.* a year, beſides a large ſum in plate and jewels. The laſt act of diſſolution in this king's reign was the act of 37 Hen. VIII. c. 4. for diſſolving colleges, free chapels, chantries, &c. which act was farther enforced by 1 Ed. VI. c. 14. By this act were ſuppreſſed ninety colleges, a hundred and ten hoſpitals, two thouſand three hundred and ſeventy-four chanteries and free chapels. The number of houſes and places ſuppreſſed from firſt to laſt, ſo far as any calculations appear to have been made, ſeems to be as follows:

Of leſſer monaſteries, of which we have the valuation -	374
Of greater monaſteries - - - - - -	186
Belonging to the hoſpitallers - - - - -	48
Colleges - - - - - - - -	90
Hoſpitals - - - - - - - -	110
Chantries and free chapels - - - - -	2374
Total	3182

Beſides the friars houſes, and thoſe ſuppreſſed by Wolſey, and many ſmall houſes, of which we have no particular account. The ſum total of the clear yearly revenue of the ſeveral houſes at the time of their diſſolution, of which we have any account, ſeems to be as follows:

	£.	s.	d.
Of the greater monaſteries - - -	104919	13	3½
Of all thoſe of the leſſer monaſteries, of which we have the valuation - - -	29702	1	10½
Knights Hoſpitallers head houſe in London -	2385	12	8
We have the valuation of only 28 of their houſes in the country - - -	3026	9	5
Friars houſes, of which we have the valuation	751	2	0¼
Total	140784	19	3¼

If proper allowances are made for the leſſer monaſteries, and houſes not included in this eſtimate, and for the plate, &c. which came into the hands of the king by the diſſolution, and for the value of money at that time, which was at leaſt ſix times as much as at preſent; and we alſo conſider that the eſtimate of the lands was generally ſuppoſed to be much under the real worth, we muſt conclude their whole revenues to have been immenſe. It doth not appear that any computation hath been made of the number of perſons contained in the religious houſes.

Thoſe of the leſſer *monaſteries* diſſolved by 27 Hen. VIII. were reckoned at about	10000
If we ſuppoſe the colleges and hoſpitals to have contained a proportionable number, theſe will make about — — —	5347
If we reckon the number in the greater *monaſteries*, according to the proportion of their revenues, they will be about 35000; but as probably they had larger allowances in proportion to their number than thoſe of the leſſer *monaſteries*, if we abate upon that account 5000, they will then be — — —	30000
One for each chantry and free chapel — -	2374
Total	47721

But as there were probably more than one perſon to officiate in ſeveral of the free chapels, and there were other houſes which are not included within this calculation, perhaps they may be computed in one general eſtimate at about 50,000. As there were penſions paid to almoſt all thoſe of the greater *monaſteries*, the king did not immediately come into the full enjoyment of the whole revenues: however, by means of what he did receive, he founded ſix new biſhoprics, viz. thoſe of Weſtminſter (which was changed by Queen Elizabeth into a deanry, with twelve prebends and a ſchool), Peterborough, Cheſter, Glouceſter, Briſtol, and Oxford. And in eight other ſees he founded deanries and chapters, by converting the priors and monks into deans and prebendaries, viz. Canterbury, Wincheſter, Durham, Worceſter, Rocheſter, Norwich, Ely, and Carliſle. He founded alſo the colleges of Chriſt-church in Oxford, and Trinity in Cambridge, and finiſhed King's college there. He likewiſe founded profeſſorſhips of divinity, law, phyſic, and of the Hebrew and Greek tongues, in both the ſaid univerſities. He gave the houſe of Grey Friars, and St. Bartholomew's hoſpital, to the city of London; and a perpetual penſion to the poor knights of Windſor, and laid out great ſums in building and fortifying many ports in the channel. It is obſervable, upon the whole, that the diſſolution of their houſes was an act, not of the church, but of the ſtate: in the period preceding the Reformation, by a king and parliament of the Roman catholic communion, in all points except the king's ſupremacy; to which the pope himſelf, by his bulls and licenſes, had led the way. See Tanner's Notitia Monaſtica.

MONASTIC, ſomething belonging to monks, or the monkiſh life. The *monaſtic* profeſſion is a kind of civil death, which in all wordly matters has the ſame effect with the natural death.

MONEY, or Mony, *moneta*, a piece of metal marked for coin, with the arms of a prince, or ſtate, who make it circulate or paſs, at a fixed rate, for things of different value; to facilitate the buſineſs of commerce.

Money may be defined an univerſal medium, or common ſtandard, by compariſon with which the value of all merchandize may be aſcertained; or, it is a ſign, which repreſents the reſpective value of all commodities. Metals are well calculated for this ſign, becauſe they are durable, and are capable of many ſubdiviſions; and a precious metal is ſtill better calculated for this purpoſe, becauſe it is the moſt portable. A metal is alſo the moſt proper for a common meaſure, becauſe it can eaſily be reduced to the ſame ſtandard in all nations; and every particular nation fixes on it its own impreſſion, that the weight and ſtandard, wherein conſiſts the intrinſic value, may both be known by inſpection only. And as *money* is the medium of commerce, it is the king's prerogative, as the arbiter of domeſtic commerce, to give it authority, or make it current. It is evident, that, as the quantity of precious metals increaſes, i. e. the more of them there is extracted from the mine, this univerſal medium, or common ſign, will ſink in value, and become leſs precious. Above a thouſand millions of bullion are calculated to have been imported into Europe from America within leſs than three centuries; and the quantity is daily increaſing, the conſequence is, that more *money* muſt be given now for the ſame commodity than was given a hundred years ago. And if any accident was to diminiſh the quantity of gold and ſilver, their value would proportionably riſe.

The æra of the invention of *money* is not eaſy to be ſettled. There is no room to doubt, but that, in the earlieſt ages, the ordinary way of traffic among men was, by trucking, or exchanging commodity for commodity. Thus, in Homer, Glaucus's golden armour was valued at one hundred oxen; and Diomedes's armour at ten.

But in courſe of time it was found neceſſary, in the way of commutative juſtice, to have ſome common meaſure, or ſtandard, according to which all other things ſhould be eſtimated. This, as ſome gather from Joſephus, was firſt invented by Cain; though the firſt tidings we hear of it are, in the time of Abraham, who paid four hundred ſhekels for a burying place. On the foot *money* now ſtands, it may be divided into *real*, or *effective* and *imaginary*.

Real MONEY, includes all coins, or ſpecies, of gold, ſilver, copper, and the like; which have courſe in commerce, and do really exiſt. Such are *guineas*, *crowns*, *piſtoles*, *pieces of eight*, *ducats*, &c.

Real Money, civilians obſerve, has three eſſential qualities; viz. *matter*, *form*, and *weight*, or *value*. For *matter*, copper is that thought to have been firſt coined; afterwards, ſilver; and, laſtly, gold, as being the moſt beautiful, ſcarce, cleanly, diviſible, and pure of all metals. The degrees of goodneſs are expreſſed in gold for carats, and in ſilver by penny-weights, &c. for there are ſeveral reaſons for not coining them pure, and without alloy.

Among the ancient Britons, iron rings, or, as ſome ſay, iron plates, or tin plates and rings, were uſed for *money*; among the Lacedæmonians, iron bars. Seneca obſerves, that there was anciently ſtamped *money* of leather, *coriam forma publica impreſſum*; and the ſame thing was put in practice by Frederic II. at the ſiege of Milan; to ſay nothing of an old tradition among ourſelves, that, in the confuſed time of the barons wars, the like was done in England. In 1360, king John of France, who agreed to pay our Edward III. for the ranſom of his perſon three millions of gold crowns, was reduced to the neceſſity of paying for the neceſſaries of his houſhold in leather *money*, in the middle whereof there was a little nail of ſilver. The Hollanders, we know, coined great quantities of paſteboard in the year 1574. Numa Pompilius made *money* of wood and leather; nor does it appear, that the Romans were much acquainted with the art of ſtriking *money* in metal, during the time of their kings. There is reaſon to believe, that both gold and ſilver *money* were very early in uſe in Egypt and Aſia, and thence ſoon afterwards, introduced into Carthage and Greece. From Greece it was brought to Rome, and thence gradually weſtward into all the Roman provinces. The firſt ſilver *money* coined by the Romans was in the year of Rome 484, and their firſt gold *money* in 546.

With regard to the materials of Engliſh *money*, Sir Edward Coke lays it down, that the *money* of England muſt either be of gold or ſilver: and none other was ever iſſued by the royal authority till 1672, when copper farthings and halfpence were coined by king Charles the ſecond, and ordered by proclamation to be current in all payments, under the value of ſix-pence, and not otherwiſe. But this copper coin is not upon the ſame footing with the other in many reſpects, particularly with regard to the offence of counterfeiting it.

After the arrival of the Romans in this iſland, the Britons imitated them, coining both gold and ſilver with the images of their kings ſtamped on them; when the Romans had ſubdued the kings of the Britons, they alſo ſuppreſſed their coins, and brought in their own, which were current here from the time of Claudius to that of Valentinian the younger, this being about the ſpace of five hundred years.

Mr. Camden obſerves that the moſt ancient Engliſh coin he had known, was that of Ethelbert, king of Kent, the firſt Chriſtian king in the iſland; in whoſe time all *money* accounts began to paſs by the names of *pounds*, *ſhillings*, *pence*, and *mancuſes*. The penny ſeems borrowed from the Latin *pecunia*, or rather from *pendo*, on account of its juſt weight, which till king Edward the Third's reign contained as much ſilver as about three pence of our *money*: theſe were coarſely ſtamped with the king's image on the one ſide, and either the mint maſter's name, or the city's where it was coined, on the other: five of theſe pence made their ſcilling, probably ſo called from *ſcilingus*, which the Romans uſed for the fourth part of an ounce; forty of theſe ſcillings made their pound, and four hundred of theſe pounds were a legacy, or a portion for a king's daughter; as appears by the laſt will of king Alfred.

Though the coining of *money* be a ſpecial prerogative of the king, yet the ancient Saxon princes communicated it to their ſubjects; inſomuch, that in every good town there was, at leaſt, one mint, but at London eight; at Canterbury four for the king, two for the archbiſhop, one for the abbot at Wincheſter; ſix at Rocheſter, at Haſtings two, &c.

The Norman kings continued the ſame cuſtom of coining only pence, with the prince's image on one ſide, and on the other the name of the city where it was coined, with a croſs ſo deeply impreſſed that it might be eaſily parted, and broken into two halves, which, ſo broken, they call half-pence; or into four parts, which they called *furthings*, or FARTHINGS.

About the year 1320, the ſtates of Europe firſt began to coin gold; and, among the reſt, our king Edward III. The firſt pieces he coined were called *Florences*, as being coined by Florentines; afterwards he coined nobles; then roſe-nobles, current at ſix ſhillings and eight pence; half-nobles, called *halfpennies*, at three ſhillings and four pence of gold; and quarters at twenty pence, called *farthings of gold*. The ſucceeding kings coined roſe-nobles, and double roſe-nobles, great ſovereigns, and half Henry nobles, angels, and ſhillings.

King James I. coined units, double crowns, Britain crowns; then crowns, half-crowns, &c.

Imaginary MONEY, or MONEY *of Account*, is that which has never exiſted, or, at leaſt, which does not exiſt in real ſpecies, but is a denomination invented, or retained to facilitate the ſtating of accounts, by keeping them ſtill on a fixed footing, not to be changed, like current coins, which the authority of the ſovereign ſometimes raiſes, or lowers, according to the exigencies of ſtate. Of which kinds are, *pounds*, *livres*, *marks*, *maravedies*, &c.

MONEY-*Bills*, in parliamentary language, comprehend all bills, by which *money* is directed to be raiſed upon the ſubject, for any purpoſe or in any ſhape whatſoever; either for the exigencies of government, and collected from the kingdom in general, as the LAND-*Tax*; or for private benefit, and collected in any particular diſtrict, as by turnpikes, pariſh-rates, and the like. With reſpect to theſe bills the commons are ſo reaſonably jealous of their privilege of framing new taxes for the ſubject, that they will not ſuffer the other houſe to exert any other power but that of rejecting; they will not permit the leaſt alteration or amendment to be made by the lords to the mode of taxing the people by bills of this nature.

MONGOOSE, or MONGOOZ, the ſecond ſpecies of the 3d Genus, LEMUR, in the Linnæan ſyſtem. For deſcription ſee LEMUR; for claſſification ſee the ſyſtem of MAMMALIA; for repreſentation ſee the Plates.

MONK, a perſon who wholly dedicates himſelf to the ſervice of religion, in ſome monaſtery, under the direction of particular ſtatutes and rules. The moſt probable account of the original of the monks is, that in the Decian perſecution, in the middle of the third century, many perſons in Egypt, to avoid the fury of the ſtorm, fled to the neighbouring deſarts and mountains, where they not only found a ſafe retreat, but alſo more time and liberty to exerciſe themſelves in acts of piety and divine contemplations; which ſort of life became ſo agreeable, that, when the perſecution was over, they refuſed to return to their habitations again, chooſing rather to continue in thoſe cottages and cells which they had made for themſelves in the wilderneſs. From that time to the reign of Conſtantine, monachiſm was confined to the hermits or anachorets, who lived in private cells in the wilderneſs: but when Pachomius had erected MONASTERIES, other countries preſently followed the example.

The manner of admiſſion to the monaſtic life was uſually by ſome change of habit; not to ſignify any religious myſtery, but only to expreſs their gravity and contempt of the world. Long hair was always thought an indecency in men, and ſavouring of ſecular vanity; and therefore they polled every monk at his admiſſion, to diſtinguiſh him from ſeculars; but they never ſhaved them, leſt they ſhould look like the prieſts of Iſis. St. Jerom, ſpeaking of the habits of the monks, intimates that it differed from that of others only in this, that it was cheaper, coarſer, and meaner raiment. We read of no ſolemn vow, or profeſſion, required at their admiſſion; but they underwent a triennial probation, during which time they were inured to the exerciſes of the monaſtic life. If, after that time was expired, they choſe to continue the ſame exerciſes, they were then admitted, without any farther ceremony, into the community. As the monaſteries had no ſtanding revenues, all the monks were obliged to maintain themſelves by their daily labour: they had no idle mendicants among them; but looked upon a monk who did not work, as a covetous defrauder. Every ten monks were ſubject to one, who was called the *decanus*, or *dean*, from his preſiding over ten; and every hundred had another officer called *centenarius*, from his preſiding over an hundred; and above theſe were the fathers of the monaſteries, alſo called *abbots*. The buſineſs of the deans was to exact every man's daily taſk, and carry it to the ſteward, who gave a monthly account of it to the abbot. See ABBOT. For a particular account of the preſent monaſtic orders, ſee BENEDICTINES, CARMELITES, DOMINICANS, FRANCISCANS, &c.

MONKEY, the Engliſh name of a ſpecies of the Genus Simia. For deſcription, ſee SIMIA, for claſſification, ſee the *Syſtem of* MAMMALIA, for repreſentation of the ſeveral families and ſpecies, ſee Plate I.

MONOCULUS, in entomology, the name of a genus of inſects, of the order of *aptera*, in the Linnæan ſyſtem. For claſſification, ſee the SYSTEM, Order VII. Genus 83.

Of this genus, many of which have been reckoned among the microſcopic animals, authors enumerate a great number of ſpecies. Linnæus enumerates nine.

MONODON, in the Linnæan ſyſtem, the 37 genus, and belonging to the 7th order of Mammalia, called *Cete*. This genus has but one ſpecies called *monoceros*, or the *ſea unicorn*; it has a long wreathed tooth in the upper jaw, which perforates the upper lip, and has the appearance of a horn; from this circumſtance it has got the name of the *unicorn-fiſh*. It is of the whale kind. Sometimes it grows to 25 feet in length; but the uſual ſize is from 16 to 20. For claſſification, ſee the *Syſtem of* MAMMALIA, for repreſentation, ſee the Plates.

MONODY, in ancient poetry, a mournful kind of ſong, ſung by a perſon all alone, to give vent to his grief. The word is derived from μονος "alone," and αιδω "I ſing."

MONOECIA, from μονος "alone," and οικια "a houſe;" the name of the 21ſt claſs in Linnæus's ſexual method. See ſyſtem of BOTANY, Sect. V. and Plate IV.

MONOGYNIA, from μονος "alone," and γυνη "a woman;" the name of the firſt order or ſubdiviſion in the firſt 13 claſſes of Linnæus's ſexual method; conſiſting of plants which, beſides their agreement in their claſſic character, generally derived from the number of their ſtamina, have only one ſtile, or female organ. See ſyſtem of BOTANY, Sect. V. and Plate IV.

MONOSYLLABLE, MONOSYLLABUM, a word of a ſingle ſyllable; or, that conſiſts of one or more letters which are pronounced together. The French language abounds in *monoſyllables* more than any other. This renders it the more perplexing to foreigners, and yet the beauty of the language ſeems to conſiſt in it. One of the beſt and ſmootheſt lines in Malherbe conſiſts of twelve *monoſyllables*: ſpeaking of Caliſta, he ſays,—*Et moi je ne voi rien quand je ne la voi pas.* In this the genius of the Engliſh tongue differs very much from the French, an uninterrupted ſeries of *monoſyllables* in the former having always an ill effect. This Mr. Pope both intimates and exemplifies in the ſame verſe. *And ten low words oft creep in one dull line.*

MONSOON, a regular or periodical wind, in the Eaſt Indies, blowing conſtantly the ſame way, during ſix months of the year, and the contrary way the remaining ſix. In the Indian ocean, the winds are partly *general*, and blow all the year round the ſame way, as in the Ethiopic ocean; and partly *periodical*, i. e. half the year blow one way, and the other half near on the oppoſite points: and thoſe points and times of ſhifting, differ in different parts of this ocean. Theſe latter are what we call *monſoons*. The ſhifting of theſe *monſoons* is not all at once: and in ſome places the time of the change is attended with calms, in others with variable winds, and particularly thoſe of China, at ceaſing to be weſterly, are very ſubject to be tempeſtuous; and ſuch is their violence, that they ſeem to be of the nature of the Weſt Indian HURRICANES, and render the navigation of thoſe ſeas very unſafe at that time of the year. Theſe tempeſts the ſeamen call the *breaking up of the monſoons*. *Monſoons*, then, are a ſpecies of what we otherwiſe call TRADE-*winds*. They take the denomination *monſoon* from an ancient pilot, who firſt croſſed the Indian ſea by means hereof. Though others derive the name from a Portugueſe word, ſignifying *motion*, or change of wind, and ſea.

MONSTER, MONSTRUM, a birth or production of a living thing, degenerating from the proper and uſual diſpoſition of parts, in the ſpecies it belongs to. As, when there are too many members, or too few; or ſome of them are extravagantly out of proportion, either on the ſide of defect or exceſs. See the Syſtem of MIDWIFERY, Part VIII. Sect. II.

The French Academicians have of late diſputed whether *monſters*, that is creatures born with their organs preternaturally formed or ſituated, ſupernumerary or defective, were originally ſo formed in their firſt ſtamina; or whether this deformity has been owing to ſome accidental change upon them. The arguments for theſe opinions, are remarks upon particular hiſtories of ſuch *monſters*, which we cannot abridge, and therefore muſt refer to the Memoirs de l'Acad. des Sciences, 1733, 1734, 1738, 1739.

MONTH, in the computation of time, the twelfth part of the year. There are divers kinds of years, and months, according to the particular luminary by whoſe revolutions they are determined, and the particular purpoſes they are deſtined for; as *ſolar months*, *lunar months*, *aſtronomical months*, &c.

Solar MONTH, is the ſpace of time wherein the ſun moves through one entire ſign of the ecliptic. Hence, if regard be had to the ſun's true motion, the *ſolar months* will be unequal; ſince the ſun is longer in paſſing through the ſummer ſigns, than through thoſe of the winter. But as he conſtantly travels through all the twelve in 365 days, 5 hours, and 49 minutes, the quantity of a mean month will be had by dividing that number by 12. On this principle the quantity of a *ſolar month* will be found 30 days, 10 hours, 29 minutes, 5 ſeconds. See the Syſtem of ASTRONOMY, Sect. III. and IV. and Plate III. *Fig.* 2 and 3.

Lunar MONTHS, are either *ſynodical*, *periodical*, or *illuminative*.

Lunar ſynodical MONTH, called alſo, abſolutely, *lunar month*, and *lunation*, is the ſpace of time between two conjunctions of the moon with the ſun; or between two new moons. The quantity of the *ſynodical month*, is 29 days, 12 hours, 44′, 3″, 11‴. See MOON.

Lunar Periodical MONTH, is the ſpace of time wherein the moon makes her round through the zodiac; or wherein ſhe returns to the ſame point. The quantity of this month is 27 days, 7 hours, 43′, 8″. The ancient Romans made uſe of *lunar months*, and made them alternately 29 and 30 days: and they marked the days of each month by three terms, viz. *calends*, *nones*, and *ides*.

Lunar illuminative MONTH, is the ſpace from the firſt time of the moon's appearance after new moons, to her firſt appearance after the new moon following. Hence, as the moon appears ſometimes ſooner after the new moon, and ſometimes later; the quantity of the *illuminative month* is not always the ſame. By this month the Turks and Arabs reckon.

Aſtronomical or *natural* MONTH, is that meaſured by ſome exact interval correſponding to the motion of the ſun, or moon. Such are the lunar and ſolar months before mentioned. Where note, that theſe months can be of no uſe in civil life, where it is required that the months begin and end on ſome certain day. For this reaſon, recourſe is had to another form of months.

MONUMENT, *monumentum*, of *monere*, to *adviſe*, *advertiſe*, in architecture, a building deſtined to preſerve the memory of the perſon who raiſed it, or of him for whom it was raiſed: ſuch are, a triumphal arch, a mauſoleum, a pyramid, &c.

The MONUMENT, abſolutely ſo called among us, denotes a magnificent pillar, deſigned by Sir Chriſtopher Wren, erected by order of parliament, in memory of the burning of the city of London, anno 1666, in the very place where the fire began. This pillar was begun in 1671, and finiſhed in 1677. It is of the Doric order, fluted, 202 feet high from the ground, and fifteen feet in diameter, of ſolid Portland ſtone, with a ſtair-caſe in the middle of black marble, containing 345 ſteps. The loweſt part of the pedeſtal is 28 feet ſquare, and its altitude 40 feet; the front being enriched with curious baſſo relievos. It has abalcony within 32 feet of the top, where is a curious and ſpacious blazing urn of gilt braſs.

MOOD, or MODE, in logic, called alſo *Syllogiſtic* MOOD, is a proper diſpoſition of the ſeveral propoſitions of a ſyllogiſm, in reſpect of quantity and quality. See the Syſtem, Part III. Sect. IV.

MOOD, or MODE, in grammar, is uſed to ſignify the different manners of conjugating verbs, agreeably to the different actions or affections to be expreſſed; as ſhewing, commanding, wiſhing, &c. Hence ariſe five moods; viz. the *indicative*, *imperative*, *optative*, *ſubjunctive*, and *infinitive*. See the Syſtem, Part II. Claſs III. ART. V.

MOON, *luna*, ☾, in aſtronomy, one of the heavenly bodies, uſually ranked among the planets; but with more propriety accounted a ſatellite, or ſecondary planet. The moon is an attendant of our earth, which ſhe reſpects as a centre, and in whoſe neighbourhood ſhe is conſtantly found; inſomuch as, if viewed from the ſun, ſhe would never appear to depart from us by an angle greater than ten minutes. For explanation of the phenomena, phaſes, motions, and every other particular relative to this ſubject, ſee the Syſtem, Sect. III. and IX.

MOORING, at ſea, is the act of confining and ſecuring a ſhip in a particular ſtation, by chains or cables, which are either faſtened to the adjacent ſhore, or to anchors in the bottom.

MOOSE-*Deer*. The firſt mention we find of this remarkable animal, is in a tract of Mr. Joſſelyn's, entitled, New England Rarities. That author ſays, it is a very fine creature, growing to twelve feet high; the horns are extremely beautiful, with broad palms, ſome of thoſe full grown being two fathom from the tip of one horn to the tip of the other. The ſame author, in another work, entitled, Two Voyages to New England, calls this creature a monſter of ſuperfluity; and ſays, that when full grown, it is many times larger than an ox. What Neal ſays of this animal ſeems copied from Joſſelyn. But the beſt account we have of it, is from Mr. Paul Dudley. This gentleman ſays, that they are of two kinds; the common light gray mooſe-deer, called by the Indians wampooſe, and the larger black mooſe. The grey mooſe is the ſame animal which Mr. Clayton, in his account of the Virginian quadrupeds, publiſhed in the Philoſophical Tranſactions, calls the elk; and this is the creature deſcribed in the Anatomical Diſcoveries of the Paris Academy, under the name of the ſtag of Canada. Horns of this creature have been ſent from Virginia, and called elks horns: they are wholly the ſame with thoſe of our red deer, except in ſize; weighing about twelve pounds, and meaſuring from the burr to the tip about ſix feet long. Phil. Tranſ. N° 444. p. 386. Abr. vol. vii. p. 447.

MORAI, is the name given at Otaheite, in the South Sea, to their burying grounds, which are alſo places of worſhip. The foundation was of rock ſtones, which were alſo ſquared. In the middle of the top ſtood an image of a bird, carved in wood, and near it lay the broken one of a fiſh, carved in ſtone. The whole of this pyramid made part of one ſide of a ſpacious area or ſquare, 360 feet by 354, which was walled in with ſtone, and paved with flat ſtones in its whole extent. About a hundred yards to the weſt of this building was another paved area or court, in which were ſeveral ſmall ſtages raiſed on wooden pillars, about ſeven feet high, which are called by the Indians *ewattas*, and ſeem to be a kind of altars, as upon theſe are placed proviſions of all kinds, as offerings to their gods. On ſome of them were ſeen whole hogs, and on others the ſculls of above fifty, beſides the ſculls of many dogs. The principal object of ambition among the natives is to have a magnificent morai. The male deities, for they have them of both ſexes, are worſhipped by the men; and the female by the women; and each have morais to which the other ſex is not admitted, though they have alſo morais common to both. See the Article EATOOAS, and *Bankes's Geography*, Page 55 to 58.

MORALS, or MORAL PHILOSOPHY, is the ſcience of manners or duty; which it traces from man's nature and condition, and ſhews to terminate in his happineſs. In other words, it is, The knowledge of our duty and felicity; or, The art of being virtuous and happy. It is denominated an art, as it contains a ſyſtem of rules for becoming virtuous and happy. Whoever practiſes theſe rules, attains an habitual power or facility of becoming virtuous and happy. It is likewiſe called a ſcience, as it deduces thoſe rules from the principles and connections of our nature, and proves that the obſervance of them is productive of our happineſs. It is an art, and a ſcience, of the higheſt dignity, importance, and uſe. Its object is man's duty, or his conduct in the ſeveral moral capacities and connections which he ſuſtains. Its office is to direct that conduct; to ſhew whence our obligations ariſe, and where they terminate. Its uſe, or end, is the attainment of happineſs; and the means it employs are rules for the right conduct of our moral powers.

Moral Philoſophy has this in common with Natural Philoſophy, that it appeals to nature or fact; depends on obſervation: and builds its reaſonings on plain uncontroverted experiments, or upon the fulleſt induction of particulars of which the ſubject will admit. We muſt obſerve, in both theſe ſciences, how nature is affected, and what her conduct is in ſuch and ſuch circumſtances. Or, in other words, we muſt collect the appearances of nature in any given inſtance; trace theſe to ſome general principles, or laws of operation; and then apply theſe principles or laws to the explaining of other phænomena. Therefore Moral Philoſophy inquires, not how man might have been, but how he is, conſtituted: not into what principles or diſpoſitions his actions may be artfully reſolved; but from what principles and diſpoſitions they actually flow: not what he may, by education, habit, or foreign influence, come to be, or do; but what, by his nature, or original conſtituent principles, he is formed to be and do. We diſcover the office, uſe, or deſtination of any work, whether natural or artificial, by obſerving its ſtructure, the parts of which it conſiſts, their connection or joint action. It is thus we underſtand the office and uſe of a watch, a plant, an eye, or hand. It is the ſame with a living creature; of the rational, or brute kind. Therefore, to determine the office, duty, or deſtination of man; or, in other words, what his buſineſs is, or what conduct he is obliged to purſue; we muſt inſpect his conſtitution, take every part to pieces, examine their mutual relations one to the other, and the common effort or tendency of the whole.

The beſt leſſon of morals is contained in the Chriſtian Scheme, which clearly and fully lays open the *connections* of our nature, both *material* and *immaterial*, and *future* as well as *preſent!* What an ample and beautiful detail does it preſent of the *duties* we owe to *God*, to *ſociety*, and *ourſelves*, promulgated in the moſt ſimple, intelligible, and popular manner; diveſted of every partiality of ſect or nation; and adapted to the general ſtate of mankind! With what bright and alluring *examples* does it illuſtrate and recommend the practice of thoſe duties; and with what mighty *ſanctions* does it enforce that practice! How ſtrongly does it deſcribe the *corruptions* of our nature; the *deviations* of our life from the *rule* of *duty*, and the *cauſes* of both! How marvellous and benevolent a plan of *redemption* does it unfold, by which thoſe corruptions may be remedied, and our *nature* reſtored from its *deviations* to tranſcendent heights of *virtue* and *piety!* Finally, what a fair and comprehenſive proſpect does it give us of the *adminiſtration* of *God*, of which it repreſents the *preſent ſtate* only as a *ſmall period*, and a *period* of *warfare* and *trial!* How ſolemn and unbounded are the ſcenes which it opens beyond it! the *reſurrection* of the *dead*, the *general judgment*, the *equal diſtribution* of *rewards* and *puniſhments* to the *good* and the *bad*; and the full *completion* of *divine wiſdom* and *goodneſs* in the *final eſtabliſhment* of *order*, *perfection*, and *happineſs!* How glorious then is that SCHEME OF RELIGION, and how worthy of *affection* as well as of *admiration*, which, by making ſuch *diſcoveries*, and affording ſuch *aſſiſtances*, has diſcloſed the unfading fruits and triumphs of VIRTUE, and ſecured its intereſts beyond the power of TIME and CHANCE!

MORALITY, a conformity, in things and actions, to thoſe unalterable obligations which reſult from the nature of our exiſtence, and the neceſſary relations of life; whether to God as our Creator, or to mankind as our fellow-creatures.

MORASS, a marſh, fen, or low moiſt ground, which receives the waters from above, without having any deſcent to carry them off again. See BOG; and for the method of draining, ſee the Syſtem of AGRICULTURE, Sect. VIII.

MORBID, among phyſicians, ſignifies "diſeaſed or corrupt;" a term applied either to an unſound conſtitution, or to thoſe parts or humours that are affected by a diſeaſe.

MORDELLA, in entomology, the name of a genus of four-winged flies, of the *coleoptera* order of inſects. For claſſification, ſee the Syſtem, Order I. Genus 28.

MOROCCO, or MARROQUIN, the ſkin of a goat, or ſome other animal reſembling it, dreſſed in ſumach or galls, and coloured of any colour at pleaſure; much uſed in book-binding, &c. The name is ordinarily derived from the kingdom of *Morocco*, whence it is ſuppoſed the manner of preparing theſe ſkins was firſt borrowed. We have *Morocco* ſkins brought from the Levant, Barbary, Spain, Flanders, and France; red, black, yellow, blue, &c.

MORSE, the Engliſh name of a ſpecies of the genus Trichecus in the Syſtem of Mammalia. For deſcription, ſee TRICHECUS. For claſſification, ſee the Syſtem. For repreſentation, ſee the Plates.

MORTALITY, a term frequently uſed to ſignify a contagious diſeaſe, which deſtroys great numbers of either men, or beaſts.

Bills of MORTALITY, are accounts or regiſters ſpecifying the numbers born, married, and buried in any pariſh, town, or diſtrict. In general, they contain only theſe numbers; and, even when thus limited, are of great uſe, by ſhewing the degrees of healthineſs and prolifickneſs, and the progreſs of population in the places where they are kept. It is therefore much to be wiſhed, that ſuch accounts had been always correctly kept in every kingdom, and regularly publiſhed at the end of every year. We ſhould then have had under our inſpection the comparative ſtrength of every kingdom, as far as it depends on the number of inhabitants, and its increaſe or decreaſe at different periods. But ſuch accounts are rendered more uſeful, when they include the ages of the dead, and the diſtempers of which they have died. In this caſe they convey ſome of the moſt important inſtruction, by furniſhing us with the means of aſcertaining the law which governs the waſte of human life, the values of annuities dependent on the continuance of any lives, or any ſurvivorſhip between them, and the favourableneſs or unfavourableneſs of different ſituations to the duration of human life. See the Syſtem of ANNUITIES.

MORTAR, a compoſition of lime, ſand, &c. mixed up with water; ſerving, as a cement to bind the ſtones, &c. of a building. The ancients had a kind of *mortar* ſo very hard and binding, that, after ſo long a duration as to this time, it is next to impoſſible to ſeparate the parts of ſome of their buildings; though there are ſome who aſcribe that exceſſive ſtrength to time, and the influence of certain properties in the air, which is, indeed, found to harden ſome bodies very ſurpriſingly. See the Article CEMENT.

MORTAR-PIECE, in the military art, a ſhort piece of ordinance, thick and wide, proper for throwing bombs, carcaſes, ſhells, ſtones, bags filled with grape ſhot, &c. The uſe of mortars is brought to be older than that of CANNON: for they were employed in the wars of Italy, to throw balls of red-hot iron and ſtones, long before the invention of ſhells. It is generally believed that the Germans were the firſt inventors. See BOMB.

MORTGAGE, in law, an obligation, whereby lands or tenements of a debtor are pawned or bound over to the creditor for money, or other effects, borrowed; peremptorily to be the creditor's for ever, if the money be not repaid at the day agreed on. The creditor holding ſuch land on ſuch agreement, is in the mean time called *tenant in mortgage*. He who lays the pawn or gage, is called the *mortgager*; and he that takes it, the *mortgagee*. If a *mortgage* includes exceſſive uſury, it is prohibited by a ſtatute 37 Henry VIII.

If a man borrows of another a ſpecific ſum (e. g. 200*l.*) and grants him an eſtate in fee, on condition that if he, the mortgager, ſhall repay the mortgagee the ſaid ſum of 200*l.* on a certain day, mentioned in the deed, that then the mortgager may re-enter on the eſtate ſo granted in pledge; or, as is now the more uſual way, that the mortgagee ſhall re-convey the eſtate to the mortgager; in this caſe the land, which is ſo put in pledge, is by law, in caſe of non-payment at the time limited, for ever dead and gone from the mortgager; and the mortgagee's eſtate in the lands is then no longer conditional, but abſolute. But as it was formerly a doubt, whether, by taking ſuch eſtate in fee, it did not become liable to the wife's dower, and other incumbrances of the mortgage (though that doubt has been long ago over-ruled by our courts of equity) it, therefore, became uſual to grant only a long term of years, by way of *mortgage*; with condition to be void on repayment of the *mortgage*-money: which courſe has been ſince continued, principally becauſe, on the death of the mortgagee, ſuch term becomes veſted in his perſonal repreſentatives, who alone are intitled in equity to receive the money lent, of whatever nature the *mortgage* may happen to be. As ſoon as the eſtate is created, the mortgagee may immediately enter on the lands; but is liable to be diſpoſſeſſed, upon performance of the condition by payment of the *mortgage*-money at the day limited. And, therefore, the uſual way is to agree that the mortgager ſhall hold the land till the day aſſigned for payment; when, in caſe of failure, whereby the eſtate becomes abſolute, the mortgagee may enter upon it, and take poſſeſſion, without any poſſibility, at *law*, of being afterwards evicted by the mortgager, to whom the land is now for ever dead. But here again the courts of equity interpoſe: and, though a *mortgage* be thus forfeited, and the eſtate abſolutely veſted in the mortgagee, at the common law, yet they will conſider the real value of the tenements compared with the ſum borrowed. And, if the eſtate be of greater value than the ſum lent thereon, they will allow the mortgager at any reaſonable time to recall and redeem his eſtate; paying to the mortgagee his principal, intereſt, and expences: for, otherwiſe, in ſtrictneſs of law, an eſtate worth 1000*l.* might be forfeited for non-payment of 100*l.* or a leſs ſum. This reaſonable advantage, allowed to mortgagers, is called the *equity* of REDEMPTION. And this enables a mortgager to call on the mortgagee, who has poſeſſion of his eſtate, to deliver it back and account for the rents and profits received, on payment of his whole debt and intereſt; thereby turning the *mortuum* into a kind of *vivum vadium*. But, on the other hand, the mortgagee may either compel the ſale of the eſtate, in order to get the whole of his money immediately, or elſe call upon the mortgager to redeem his eſtate preſently, or in default thereof to be for ever FORECLOSED from redeeming the ſame i. e. to loſe his equity of redemption without poſſibility of recall.

MORTIFICATION, *necroſis*, in medicine, a total extinction of the natural heat of the body, or a part thereof. Some define mortification a diſeaſe wherein the natural juices of any part quite loſe their proper motion; and by that means fall into a fermentative one, and corrupt and deſtroy the texture of the part.

There are two ſpecies, or rather degrees of mortification: the one called a GANGRENE, which is a mortification in its firſt or beginning ſtate: the other, a ſphacelus, which is a perfect or finiſhed mortification. In caſes of a perfect ſphacelus, or mortification, where the parts are become abſolutely dead, and wholly without ſenſe, and ſoft, ſo as to retain the impreſſions of one's fingers ends, and are plainly fetid and corrupted, all the medicines in the world will be ineffectual to reſtore the part to its life and ſenſe again; and all that remains to be done, is the one miſerable remedy of preſerving the reſt of the body, by cutting off that part, to prevent the mortification from ſpreading farther. See Syſtem of SURGERY.

MORTMAIN, or ALIENATION in *Mortain*, (*in mortua manu*), is an alienation of lands or tenements to any corporation, ſole or aggregate, eccleſiaſtical or temporal: but theſe purchaſes having been chiefly made by religious houſes, in conſequence whereof the lands became perpetually inherent in one dead hand, this hath occaſioned the general appellation of *mortmain* to be applied to ſuch alienations, aad the religious houſes themſelves to be principally conſidered in forming the ſtatutes of mortmain: in deducing the hiſtory of which ſtatutes, it will be matter of curioſity to obſerve the great addreſs and ſubtile contrivance of the eccleſiaſtics in eluding from time to time the laws in being, and the zeal with which ſucceſſive parliaments have purſued them through all their fineſſes; how new remedies were ſtill the parents of new evaſions; till the legiſlature at laſt, though with difficulty, hath obtained a deciſive victory.

Yet ſtill it was found difficult to ſet bounds to eccleſiaſtical ingenuity: for when they were driven out of all their former holds, they deviſed a new method of conveyance, by which the lands were granted, not to themſelves directly, but to nominal feoffees to the uſe of the religious houſes; thus diſtinguiſhing between the poſſeſſion and the uſe, and receiving the actual profits, while the ſeiſin of the land remained in the nominal feoffee; who was held by the courts of equity (then under the direction of the clergy) to be bound in conſcience to account to his *ceſtuy que uſe* for the rents and emoluments of the eſtate. And it is to theſe inventions that our practiſers are indebted for the introduction of uſes and truſts, the foundation of modern conveyancing. But, unfortunately for the inventors themſelves, they did not long enjoy the advantage of their new device; for the ſtatute 15 Richard II. c. 5. enacts, that the lands which had been ſo purchaſed to uſes ſhould be amortiſed by licence from the crown, or elſe be ſold to private perſons; and that for the future uſes ſhall be ſubject to the ſtatutes of mortmain, and forfeitable like the lands themſelves. And whereas the ſtatutes had been eluded by purchaſing large tracts of land adjoining to churches, and conſecrating them by the name of *church-yards*, ſuch ſubtile imagination is alſo declared to be within the compaſs of the ſtatutes of mortmain. And civil or lay corporations, as well as eccleſiaſtical, are alſo declared to be within the miſchief, and of courſe within the remedy provided by thoſe ſalutary laws. And, laſtly, as during the times of popery, lands were frequently given to ſuperſtitious uſes, though not to any corporate bodies; or were made liable in the hands of heirs and deviſees to the charge of obits, chauntries, and the like, which were equally pernicious in a well-governed ſtate as actual alienations in mortmain; therefore at the dawn of the Reformation, the ſtatute 23 Hen. VIII. c. 10. declares, that all future grants of lands for any purpoſes aforeſaid, if granted for any longer term than 20 years, ſhall be void.

As it was apprehended from recent experience, that perſons on their deathbeds might make large and improvident diſpoſitions even for theſe good purpoſes, and defeat the political ends of the ſtatutes of mortmain; it is therefore enacted by the ſtatute 9 Geo. II. c. 36. that no lands or tenements, or money to be laid out thereon, ſhall be given for or charged with any charitable uſes whatſoever, unleſs by deed indented, executed in the preſence of two witneſſes 12 kalendar months before the death of the donor, and enrolled in the court of chancery within ſix months after its execution, (except ſtocks in the public funds, which may be tranſferred within ſix months previous to the donor's death), and unleſs ſuch gift be made to take effect immediately, and be without power of revocation: and that all other gifts ſhall be void. The two univerſities, their colleges, and the ſcholars upon the foundation of the colleges of Eton, Wincheſter, and Weſtminſter, are excepted out of this act: but ſuch exemption was granted with this proviſo, that no college ſhall be at liberty to purchaſe more advowſons than are equal in number to one moiety of the fellows or ſtudents upon the reſpective foundations.

MOSAIC, MOSAIC *Work*, or, as ſome chooſe to call it, MUSAIC, an aſſemblage of little pieces of glaſs, marble, ſhells, precious ſtones, woods, or the like, of various colours, cut ſquare, and cemented on a ground ſtucco, &c. imitating the natural colours and degradations of painting. In this ſenſe, *moſaic work* includes *marquetry* or *inlaid work*, *veneering*, &c.

MOSCHUS, in the Syſtem of MAMMALIA, a genus of quadrupeds of the order of Pecora, having no horns: the canine teeth of the upper jaw are ſolitary and exſerted. There are three ſpecies. 1. The moſchiferus, or muſk animal, hath been conſidered by ſome authors as a ſtag, a roebuck, a goat; and by others as a large cherrotain, a ſpecies of antelope; but M. Buffon hath determined it to be an ambiguous animal, participating of the nature of all theſe, but differing effectually from every one of them, and from all other animals. It is of the ſize of a ſmall roebuck, but has no horns; it has long coarſe hair, a ſharp muzzle, and tuſks like thoſe of a hog. The hair of the muſk is ſofter than in moſt animals, and exceeding light and rare; for, being ſplit, they appear to be made up of little bladders, like thoſe in the plume or ſtalk of a quill; ſo that it is ſomething betwixt a common hair and a quill. On each ſide of his lower chop, almoſt under the corner of his mouth, there is a peculiar tuft, (about three-fourths of an inch long), of ſhort, thick, and hard hairs, or rather briſtles, of equal length, as in a ſcrubbing-bruſh. The muſk-bladder or bag which holds the perfume, is on the belly near the navel. It is about three inches long, and two over; ſtanding out from the belly one and a half, and before the groin as much. The creature hath 26 teeth, 16 in the lower chop; of which there are eight little cutters before; behind four grinders on each ſide, rugged and continuous, with as many grinders in the upper jaw. From the teſtimony of a number of travellers it appears that the perfume is produced only in the body of the male. The female hath indeed a pouch of the ſame kind near the navel, but the humour ſecreted in it has not the ſame odour; and this tumour of the male is not filled with muſk except in the rutting ſeaſon; at other times the quantity of this humour is ſmaller, and its odour weaker. See MUSK. 2. The grimmia, grimm, or Guinea antelope, is a moſt beautiful animal, with ſtraight black horns, ſlender and ſharp pointed, not three inches long, and ſlightly annulated at the baſe. Its height is about 18 inches; the ears are large and the eyes duſky; below the eyes is a large cavity, into which exudes a ſtrong ſcented oily liquid; between the horns is a tuft of black hairs. The colour of the neck and body is brown, mixed with an aſh-colour, and a tinge of yellow; the belly is white; the tail ſhort, white beneath, and black above. Dr. Herman Grimm tells us, that the fat, viſcid, yellow humour, which is ſecreted in the cavities above the eyes of this animal, has an odour that participates of muſk and caſtoreum; but M. Voſmaer remarks, that in his live ſubject this viſcid matter has no odour of any kind. 3. The pygmæus has feet narrower than a man's finger, and is found in Africa and Aſia. For repreſentation of the ſeveral ſpecies of this Genus, ſee the Plates.

MOSQUE, a temple or place of religious worſhip among the Mahometans. All moſques are ſquare buildings, generally conſtructed of ſtone. Before the chief gate there is a ſquare court paved with white marble; and low galleries round it, whoſe roof is ſupported by marble pillars. In theſe galleries the Turks waſh themſelves before they go into the moſque. In each moſque there is a great number of lamps; and between theſe hang many cryſtal rings, oſtriches eggs, and other curioſities, which, when the lamps are lighted, make a fine ſhew. As it is not lawful to enter the moſque with ſtockings or ſhoes on, the pavements are covered with pieces of ſtuff ſewed together, each being wide enough to hold a row of men kneeling, ſitting, or proſtrate. The women are not allowed to enter the moſque, but ſtay in the porches without.

Moſt of the moſques have a kind of hoſpital belonging to them, in which travellers, of what religion ſoever, are entertained three days. Each moſque has alſo a place called *tarbe*, which is the burying-place of its founders; within which is a tomb ſix or ſeven feet long, covered with green velvet or ſattin; at the ends of which are two tapers, and round it ſeveral ſeats for thoſe who read the koran, and pray for the ſouls of the deceaſed.

MOSS is alſo a name given by ſome to the boggy ground in many parts of England, more uſually called a *fen* and *bog*. See BOG.

MOTACILLA, or WAGTAIL, in ornithology, according to Linnæus the 74th Genus of Birds, and of the 6th order Paſſeres. The moſt remarkable ſpecies are: The alba, or white wagtail, which frequents the ſides of ponds and ſmall ſtreams, and feeds on inſects and worms. The head, back, and upper and lower ſide of the neck, as far as the breaſt, are black; in ſome the chin is white, and the throat marked with a black creſcent: the breaſt and belly are white; the quill-feathers are duſky; the coverts black, tipt and edged with white. The tail is very long, and always in motion. Mr. Willoughby obſerves, that this ſpecies ſhifts its quarters in the winter; moving from the north to the ſouth of England during that ſeaſon.

In ſpring and autumn it is a conſtant attendant on the plough, for the ſake of the worms thrown up by that inſtrument.

The flava, or yellow wagtail, migrates in the north of England, but in Hampſhire continues the whole year. The male is a bird of great beauty: it makes its neſt on the ground, in corn-fields: the outſide is compoſed of decayed ſtems of plants, and ſmall fibrous roots; the inſide is lined with hair: it lays five eggs. The regulus, or gold-coloured wren, is a native of Europe, and of the correſponding latitudes of Aſia and America. It is the leaſt of all the European birds, weighing only a ſingle drachm. Its length is about four inches and an half; and the wings, when ſpread out, meaſure little more than ſix inches. On the top of its head is a beautiful orange-coloured ſpot called its *creſt*, which it can hide at pleaſure; the margins of the creſt are yellow, and it ends in a pretty broad black line; the ſides of the neck are of a beautiful yellowiſh green; the eyes ſurrounded with a white circle: the neck and back of a dark green mixed with yellow; the breaſt of a dirty white; the tail compoſed of 12 feathers of a brown colour, an inch and an half long, but not forked. In America it aſſociates with the titmice, running up and down the bark of lofty oaks with them, and collecting its food in their company, as if they were all one brood. It feeds on inſects lodged in their winter dormitories in a torpid ſtate.

The ſialis, or blue-bird, is a native of moſt parts of North America; and is about the bigneſs of a ſparrow. The eyes are large; the head and upper part of the body, tail, and wings, are of a bright blue. It flies ſwiftly, having very long wings; ſo that the hawk generally purſues it in vain. It makes its neſt in holes and trees; reſembles our robbin-red breaſt in its diſpoſition, and feeds only on inſects.

The ſutoria, or taylor-bird, is a native of the Eaſt Indies. It is remarkable for the art with which it makes its neſt, ſeemingly in order to ſecure itſelf and its young in the moſt perfect manner poſſible againſt all danger from voracious animals. It picks up a dead leaf, and ſews it to the ſide of a living one; its ſlender bill is the needle, and its thread is formed of ſome fine fibres; the lining is compoſed of feathers, goſſamer, and down: its eggs are white, the colour of the bird light-yellow; its length three inches; and its weight only three ſixteenths of an ounce, ſo that the materials of the neſt and its own ſize are not likely to draw down a habitation depending on ſo ſlight a tenure. Latham in his improved arrangement makes Motacilla the 40th Genus of the 3d Order Paſſerine. For the repreſentation according to this arrangement, ſee Plate III. Genus 40.

MOTH. The Engliſh name of the Genus Phalena in entomology. See PHALENA.

MOTION, primarily ſo called, or *local* MOTION, is a continued and ſucceſſive change of place; or that ſtate of a body whereby it correſponds ſucceſſively to ſeveral different places; or is preſent ſucceſſively in different parts of ſpace. In this ſenſe the doctrine and laws of *motion* make the ſubject of mechanics, or ſtatics.

General Laws of **MOTION**, are thoſe laws of nature which bodies in motion obſerve, or which regulate and determine the operations of moving bodies. On theſe, as a ſuperſtructure, reſts the whole fabric of *Mechanics*, and *Mathematical Philoſophy*.

In the Syſtem of Mechanics, Sect. II. we have given the neceſſary definitions, poſtulata, and axioms; and we ſhall here, according to the reference there made, and as a ſupplement to that Section, treat of ſuch Propoſitions as ſerve more particularly to explain and demonſtrate the effects of moving bodies, regard being had to their quantities of matter, magnitudes, denſities, velocities, &c.

N. B. The Definitions, &c. referred to, are thoſe contained in the Syſtem of Mechanics beforementioned.

PROP. I. The quantities of matter in all bodies, are in the compound ratio of their magnitudes and denſities. For (by Definition 2) in bodies of the ſame magnitudes, the quantities of matter will be as the denſities. Increaſe the magnitudes in any ratio, and the quantities of matter, are increaſed in the ſame ratio, conſequently the quantities of matter are as expreſſed in this Propoſition. Hence the following Corollaries or Inferences.

1. In ſimilar bodies, the quantities of matter are as the denſities and cubes of the diameters; for the magnitudes of bodies are as the cubes of the diameters.

2. The quantities of matter are as the magnitudes and ſpecific gravities. For (by Definitions 2 and 10) the denſities of bodies are as the ſpecific gravities.

PROP. II. The quantities of motion in all moving bodies, are in the compound ratio of the velocities and quantities of matter. For if the velocities are equal, the quantities of motion will manifeſtly be as the quantities of matter. Increaſe the velocities in any ratio, and the quantities of motion are increaſed in the ſame ratio. Wherefore the quantities of motion are in the compound ratio of the quantities of the velocities and quantities of matter.

COR. I. Hence in bodies of equal quantities of matter, the motions are as the velocities; and when the velocities are the ſame, the motions are as the quantities of matter.

COR. II. The quantities of motion are as the velocities, magnitudes, and denſities, or as the velocities, magnitudes, and ſpecific gravities.

COR. III. The velocities are as the quantities of motion directly, and the quantities of matter reciprocally, or as the quantities of motion divided by the quantities of matter.

PROP. III. In all bodies moving uniformly, the ſpaces deſcribed are in the compound ratio of the velocities, and the times of their deſcription. For if the times are equal, the ſpaces will be as velocities, (by Definition 4) and ſince the bodies in twice, thrice, &c. the time, with the ſame velocities, will generate or run twice, thrice, &c. the ſpaces, therefore, univerſally, the ſpaces deſcribed, are in the compound ratio of the velocities and times of deſcription.

COR. I. The times of deſcribing any ſpaces, are as the ſpaces directly, and the velocities reciprocally, viz. as the ſpaces divided by the velocities; and if the velocities are the ſame, the times are as the ſpaces. If the ſpaces are equal, the times are reciprocally as the velocities.

COR. II. The velocities are as the ſpaces directly, and times reciprocally, viz. as the ſpaces divided by the times: and if the times are the ſame, the velocities are as the ſpaces deſcribed: and the ſpaces being equal, the velocities are reciprocally as the times of deſcription.

PROP. IV. In moving bodies, the motions generated by momentary forces, or ſingle impulſes, are as the forces that generate them. For double forces will produce double motions, treble forces, treble motions, and ſo on.

COR. I. Hence the forces are in the compound ratio of the velocities and quantities of matter.

COR. II. The velocities generated are as the forces directly, and quantities of matter reciprocally. Therefore the bodies being equal, the velocities are as the forces. And the forces being equal, the velocities are as the bodies or quantities of matter.

COR. III. The quantities of matter are as the forces directly, and velocities reciprocally. Hence when the velocities are equal, the bodies or quantities of matter are as the forces; or if the forces are equal, the quantities of matter are reciprocally as the forces.

PROP. V. In any moving body, the quantity of motion generated, by a conſtant and uniform force, is in the compound ratio of the force and time of acting. For the motion generated in a given time will be proportional to the force by the laſt Propoſition, and in twice the time the motion will be double; in thrice, treble, and ſo on. Wherefore the whole motion will be as the force and time of acting.

COR. I. The motion loſt in any time is in the compound ratio of the force and time.

COR. II. The velocity generated, or deſtroyed, in any time, is as the force and time directly, and quantity of matter reciprocally. The ſame is true of the *increaſe* or *decreaſe* of velocity. For the motion is as the force and time. Conſequently the velocity is as the force and time directly, and quantity of matter reciprocally.

COR. III. Hence if the force be as the quantity of matter the velocity is as the time; or if the force and quantity of matter be given, the velocity is as the time. If the time and quantity of matter be given, the velocity is as the force. If the force and line be given, the velocity is reciprocally as the quantity of matter.

COR. IV. The time is as the velocity and quantity of matter directly, and the force reciprocally. Hence if the force and velocity be given, the time is as the quantity of matter. If the quantity of matter and velocity be given, the time is reciprocally as the force.

COR. V. The force is as the quantity of matter and velocity directly, and the time reciprocally. Whence if the velocity is as the time, or if the velocity be given, then the force is as the quantity of matter. If the velocity and quantity of matter be given, the force is reciprocally as the time.

COR. VI. The quantity of matter is as the force and time directly, and the velocity reciprocally. Hence if the force and time be given, the quantity of matter is reciprocally as the velocity.

COR. VII. If the quantity of matter be given, the velocity is in the compound ratio of the force and time. If therefore the force be given, the time is in the compound ratio of the quantity of matter and velocity, or as the quantity of motion.

PROP. VI. If a given body be urged by a conſtant and uniform force, the ſpace deſcribed by the body from the beginning of motion, will be as the force and ſquare of the time. Suppoſe the time divided into an infinite number of equal parts or moments; then on each of theſe moments of time, the ſpace deſcribed will (by inference from Prop. III. Cor. II.) be as the velocity acquired, that is (by Prop. V. Cor. VII) as the force and time from the beginning. Alſo the ſum of all the ſpaces, or the whole ſpace deſcribed, will be as the force and ſum of all the moments of time from the beginning. Therefore if $t =$ whole time, then the whole ſpace deſcribed will be as the force and ſum of the times, 1, 2, 3, 4, &c. to t. But the ſum of the arithmetical progreſſion $1+2+3+4$ to $t = \frac{t+1}{2} \times t = \frac{1}{2} tt$, becauſe t is infinite, or conſiſts of an infinite number of moments, wherefore the whole ſpace deſcribed will be as the force and $\frac{1}{2} tt$; that is (becauſe $\frac{1}{2}$ is a given quantity) as the force and ſquare of the time of deſcription.

COR. I. If a body is impelled by a conſtant and uniform force, the ſpace deſcribed from the beginning of the motion is as the velocity acquired, and the time of moving. For the ſpace is as the force and ſquare of the time, but the product of the force and time is as the velocity, therefore the ſpace is as the product of the velocity and time, or as the velocity and time directly.

Cor. II. If a body urged by any conſtant and uniform force, deſcribes any ſpace, it will deſcribe twice that ſpace in the ſame time by the velocity acquired. For the ſum of all the ſpaces deſcribed by that force has been ſhewn to be $\frac{1}{2}tt$. Alſo the ſum of all the ſpaces deſcribed by the laſt velocity, will be $t+t+t$, &c. to t terms, viz. tt; and tt being double $\frac{1}{2}tt$, it is manifeſt, the ſpace that would be deſcribed by the laſt velocity, was it to continue uniform for the ſame time, would be double the ſpace that would be deſcribed by the accelerating force.

Cor. III. In all bodies urged by conſtant and uniform forces, the ſpace deſcribed is as the force and ſquare of the time directly, and the quantity of matter reciprocally. For the ſpace is as the time and velocity, and the velocity as the force and time divided by the quantity of matter; wherefore the inference is manifeſt.

Cor. IV. The product of the force and ſquare of the time, is as the product of the body and ſpace deſcribed.

Cor. V. The product of the force and time, is as the product of the quantity of matter and velocity.

Cor. VI. The product of the body or quantity of matter by the ſquare of the velocity, is as the product of the force and ſpace deſcribed.

The following Propoſitions relative to the motion of bodies, uſually termed the method of compoſition and reſolution of forces, we here preſent as a farther Supplement to our Syſtem of Mechanics.

COMPOSITION AND RESOLUTION OF FORCES, AND THE COLLISON OF BODIES.

Prop. I. If ABCD be a parallelogram: (ſee Plate of miſcellaneous Mathematics, *Fig.* 47) and if a body at A be acted upon ſeparately by two forces, in the directions AB and AC, whereby the body is driven through the ſpaces AB and AC in the ſame time; then both forces acting at once will cauſe the body to move through the diagonal AD of the parallelogram.

For let the line CD be ſuppoſed to move parallel to itſelf, whilſt the body at the ſame time moves from A, along the line AC, or bg, and comes to d at the ſame inſtant that AC comes to bg; then ſince the lines AB and AC are deſcribed in the ſame time, and Ab, and Ad, are alſo deſcribed in the ſame time; and as the motions are uniform, it will be as $Ab : bd :: AB : BD$; and therefore AdD, is a ſtreight line coinciding with the diagonal of the parallelogram.

Cor. I. The three forces in the directions AB, AC, AD, are reſpectively as the lines AB, AC, AD.

Cor. II. Any ſingle force AD, denoted by the diagonal of a parallelogram, is equivalent to two forces denoted by the ſides AB, AC.

Cor. III. Any ſingle force AD may therefore be reſolved into two forces, an infinite number of ways, by drawing any two lines, AB, BD, for their quantities and directions: this practice of finding two forces equivalent to one, or dividing one force into two, is called the *Compoſition and Reſolution of Forces.*

Prop. II. If three forces, A,B,C, (*fig.* 48) keep one another in equilibrio, they will be proportional to three ſides of a triangle, draw nparallel to their ſeveral directions, DI, CI, CD.

For produce AD to I, and BD to H, and complete the parallelogram DICH, then (by the laſt Prop.) the force in direction DC, is equal to the forces DH, DI, in the directions DH, DI. Take away the force DC, and put thereto the forces DH, DI, and the equilibrium will ſtill remain. Therefore, (by Axiom 10.) DI is equal to the force A oppoſite to it, and DH, or CI, equal to its oppoſite force B. And as CD repreſents the force of D, the three forces A, B, C, will be to one another as DI, CI, and CD.

Cor. I. Hence, if three forces, acting againſt one another, keep each other in equilibrio, theſe forces will be perfectly as the three ſides of a triangle drawn perpendicular to their lines of direction, or making any given angle with them on the ſame ſide.

Cor. II. If three active forces, A, B, C, keep one another in equilibrio, they will be reſpectively as the ſines of the angles, which their lines of direction paſs through.

Cor. III. If ever ſo many forces acting againſt one another are kept in equilibrio, they may all be reduced to two equal and oppoſite forces.

Prop. III. If a body impinges or acts againſt any plain ſurface, it exerts its force in a line perpendicular to that ſurface.

Let a body A, (*fig.* 49) moving in direction AB, with a given velocity, impinge on the ſmooth plain FG, at the point B. Draw AC parallel, and BC perpendicular to FG, and let AB repreſent the force of the moving body. Then the force AB is equivalent to AC and BC; the force AC is parallel to the plane, and therefore has no effect upon it. Conſequently the ſurface FG is only acted upon by the force CB, in a direction perpendicular to the ſurface FG.

Cor. I. If a body impinges upon another body with a given velocity, the quantity of the ſtroke is as the ſine of the angle of incidence; for the abſolute force is AB, and the force acting on the ſurface FG is CB; but AB : CB :: rad. : ſine CAB or ABF.

Cor. II. If an elaſtic body A impinges upon a hard or elaſtic plane FG, the angle of reflection will be equal to the angle of incidence. For if AD be parallel to FG, the motion of A in direction AD, parallel to the plane, is not at all changed by the ſtroke; and by the elaſticity of one or both bodies, the body A is reflected back to AD in the ſame time it moved from A to B; let it paſs to D, then will AC = CD, being deſcribed in equal time; conſequently the angle ABC = angle CDB, and therefore the angle DBG = angle ABF.

Cor. III. If a non-elaſtic body ſtrikes another non-elaſtic body, it loſes but half the motion that it would loſe if the bodies were elaſtic. For non-elaſtic bodies only ſtop without receding from one another, but elaſtic bodies recede with the ſame velocity.

Prop. IV. The ſum of the motions of two or more bodies in any direction towards the ſame part, cannot be changed by any action of the bodies upon each other. Here progreſſive motions are reckoned affirmative, and regreſſive ones negative. Firſt then, if two bodies move the ſame way, action and re-action being equal and contrary, what one body gains the other loſes, and the ſum remains the ſame as before; and the caſe is the ſame if there were more bodies. Second, if bodies ſtrike one another obliquely, they will act on one another in a line perpendicular to the ſurface acted on, and therefore there is no change made in that direction. Third, Alſo in a direction parallel to the ſtriking ſurface, there is no action of the bodies, therefore the motion remains the ſame in that direction. Whence the motions will remain the ſame in any one line of direction.

Cor. Motion can neither be increaſed nor decreaſed conſidered in any one direction, but muſt remain invariably the ſame for ever.

Scholium. This Propoſition does not include ſuch motions as are eſtimated in all directions; for upon that ſuppoſition, motion may be increaſed or decreaſed an infinite number of ways. For inſtance, if two equal and non-elaſtic bodies meet each other with equal velocities, both their motions are deſtroyed by the ſtroke. Here, at the beginning of the motion they had both of them a certain quantity of motion, but to be taken in contrary directions: after the ſtroke they had none.

Animal Motion, is that whereby the ſituation, figure, magnitude, &c. of the parts, members, &c. of animals are changed. Under theſe *motions* come all the animal functions; as *reſpiration, circulation of the blood, excretion, walking,* &c. *Animal motions* are uſually divided into two ſpecies; viz. *ſpontaneous,* and *natural.*

Spontaneous, or *Muſcular* Motion, is that performed by means of the muſcles, at the command of the will; hence alſo called *voluntary motion.*

Natural or *Involuntary* Motion is that effected without ſuch command of the will; by the mere mechaniſm of the parts. Such is the *motion* of the heart and pulſe; the periſtaltic *motion* of the inteſtines, &c.

Motion, in aſtronomy, is peculiarly applied to the orderly courſes of the heavenly bodies. For explanation, ſee the Syſtem, Sect. III. and Plate III. *Fig.* 2.

Motion *in Court.* In the courts of chancery, king's bench, &c. *motions* are made by barriſters and counſellors at law, for what concerns their clients cauſes; and where any *motion* is made in chancery, that is not of courſe, generally an affidavit of the facts alledged muſt be read in court; and if *motions* are founded on the general rules or uſage of the court, and are not of courſe, but granted or denied as the court thinks fit, on hearing counſel on both ſides, notice is to be given in writing to the ſolicitor of the other party, or his clerk in court, expreſſing every thing to be moved for, which muſt be ſerved two days at leaſt before the day on which the *motion* is to be made; whereof affidavit muſt alſo be made.

MOTTO *of an Armoury,* is a ſhort ſentence or phraſe carried in a ſcroll generally over, ſometimes under the arms; ſometimes alluding to the name of the bearer, ſometimes to the bearing, and ſometimes to ſome remarkable atchievement of the bearer.

The uſe of *mottos* is very ancient; hiſtory, both ſacred and profane, furniſhing inſtances thereof. Our anceſtors made choice of *mottos* to expreſs their predominant paſſions; as of piety, love, war, &c. or ſome extraordinary adventure befallen them: moſt of which, from ſome ſuch original, have become hereditary in divers families. The *motto* of the royal family of England is *Dieu & mon droit*; of the royal family of Bourbon, *Eſperance*; of the order of Garter, *Honi ſoit qui mal y penſe*, &c. See the Syſtem of Heraldry, Sect. VII. Art. IX.

MOVEABLE, ſomething ſuſceptible of *motion*, or that is diſpoſed to be moved.

Moveable *Feaſts* are ſuch as are not always held on the ſame day of the year, or month; though they be on the ſame day of the week. Thus Eaſter is a *moveable* feaſt; being always held on the Sunday which falls upon or next after the firſt full moon following the 21ſt of March. All the other *moveable* feaſts follow Eaſter, i. e. they keep their diſtance from it: ſo that they are fixed with reſpect thereto. Such are Septuageſima, Sexageſima, Aſh-Wedneſday, Aſcenſion-day, Pentecoſt, Trinity-Sunday, &c.

MOVEABLES, or Moveable *Goods*, by civilians called *bona mobilia*, are thoſe which are capable of being removed from one place to another; or which may be concealed or perverted; as not being fixed to the ground, &c. See Chattels.

MOVEMENT, in mechanics, a machine that is moved by clock-work.

Perpetual Movement. Many have attempted to find a perpetual movement, but without ſucceſs; and there is reaſon to think, from the principles of mechanics, that ſuch a movement is impoſſible: for though, in many caſes of bodies acting upon one another, there is a gain of abſolute motion, yet the gain is always equal in oppoſite directions; ſo that the quantity of direct motion is never increaſed. To make a perpetual movement, it appears neceſſary that a certain ſyſtem of bodies, of a determined number and quantity, ſhould move in a certain ſpace for ever, and in a certain way and manner; and for this there muſt be a ſeries of actions returning in a circle, otherwiſe the movement will not be perpetual; ſo that any action by which the abſolute quantity of force is increaſed, of which there are ſeveral ſorts, muſt have its correſponding counter-action, by which the gain is deſtroyed, and the quantity of force reſtored to its firſt ſtate. Thus by theſe actions there will never be any gain of direct force to overcome the friction and reſiſtance of the medium; ſo that every motion being diminiſhed by theſe reſiſtances, they muſt at length languiſh and ceaſe.

MOULD, or **Mold**, in the mechanic arts, &c. a cavity artfully cut, with deſign to give its form, or impreſſion to ſome ſofter matter applied therein. Moulds are implements of great uſe in ſculpture, foundery, &c.

Mould or **Mold**, in agriculture, that kind of earth every where obvious to the ſurface of the ground; called alſo natural or mother earth. For an account of the nature and properties of this earth, ſee the Syſtem of Agriculture, Sect. I.

MOULDINESS, a term applied to bodies which corrupt in the air, from ſome hidden principle of humidity therein; and whoſe corruption ſhews itſelf by a certain white down, or lanugo, on their ſurface. This *mouldineſs*, when viewed with a microſcope, affords a curious ſpectacle: being a kind of meadow, out of which ariſe herbs and flowers; ſome only in the bud, others full blown, and others decayed; each having its little root, ſtalk, and other parts; the figure whereof may be ſeen in Hook's Micrographia. The ſame may be obſerved of the *mouldineſs* which gathers on the ſurface of liquid bodies. Mr. Bradley obſerved this *mouldineſs* in a melon very accurately, and found the vegetation of theſe little plants to be exceedingly quick Each plant had its ſeeds in great abundance, which did not ſeem to be three hours before they began to ſhoot up; and in ſix hours more the new plant was complete and mature, and the ſeed ready to fall. When the fruit had been covered with a mould for ſix days, its vegetative quality began to abate, and it was entirely gone in two days more; then came on a putrefaction, and the fleſhy parts of the melon yielding nothing but a ſtinking water, which began to have a gentle motion on its ſurface; and in two days time maggots appeared, which in ſix more laid themſelves up in their bags, where they continued four days, and then came out flies. Theſe maggots were owing to the eggs of flies depoſited in the putrefaction.

Mouldings, in architecture, are jettings, or projectures beyond the naked of a wall, column, or wainſcot, &c. the aſſemblage whereof form cornices, door-caſes, and other decorations of architecture. See the Syſtem, on the principles of the Art according to modern practice, and Plate VI.

MOUND, a term uſed for a bank, rampart, or other fence, particularly of earth.

Mound, or **Mond**, in heraldry, is a ball or globe with a croſs upon it; ſuch as our kings are uſually drawn with, holding it in their left hand, as they do the ſceptre in the right.

MOUNT, an elevation of earth, called alſo *mountain*. The words *mount* and *mountain* are ſynonimous; but the former is ſcarce ever uſed in proſe, unleſs when accompanied with ſome proper name; as *mount* Ætna, *mount* Gibel, *mount* Lebanon, *mount* Sinai, *mount* Atlas, *mount* Parnaſſus, &c.

MOUNTAIN, Mons, a part of the earth riſing to a conſiderable height above the level of the ſurrounding ſurface. The origin of *mountains* is variouſly aſſigned by philoſophers; ſome will have them coeval with the world, and created along with it. Others, among whom is Dr. Burnet, will have them to take their riſe from the deluge; urging, that the extreme irregularity and diſorder viſible in them, plainly ſhew, they do not come immediately out of the hand of God, but are the wrecks of the old world broken into the abyſs. See the Article Deluge, and for the opinion of divers Philoſophers ancient and modern, on the ſubject at large, ſee the Article Earth. Others, again, alledge from hiſtory, that the foundations of many hills being gradually deſtroyed, the hills themſelves have ſubſided, and ſunk into plains: whence they conclude, that where the corruption is natural, the generation is ſo too.

It appears to many, that ſome *mountains* muſt have been generated gradually, and have grown up in proceſs of time, from the ſea-ſhells, &c. found in many of them; which they ſuppoſe may be accounted for from a violent wind blowing the ſand, &c. into huge heaps, which are afterwards made into a maſs by the rain, &c. Some among the divines tell us, that the earth was created perfectly even; and that when God ſeparated the water from the land, he dug channels in the earth; and the earth ſcooped out he threw up in *mountains*: but whether all the *mountains* be ſufficient to fill all the channels of the ocean, they muſt decide.

The origin of *mountains*, according to Mr. Ray, ſeems to have been exploſions by means of ſubterraneous fires; and it is very probable that they have all vaſt hollows beneath them; that this might have been the means uſed at the creation, to make the dry land appear, is no way diſſonant to reaſon, ſince hiſtory proves, that fires have raged in ſubterraneous caverns under the ſeas, and there is no natural impoſſibility in fire's ſubſiſting in ſuch caverns, even when the earth was all over covered with water, as at the firſt creation.

Mountains appear, to many, defects and blemiſhes in the earth; but they are truly of the utmoſt uſe and neceſſity to the well-being both of man and other animals. Many creatures cannot live but in particular ſituations, and even the tops of the higheſt and the coldeſt *mountains* are the only places wherein ſome creatures, as well birds as quadrupeds, will live: of this kind are the ibex and chamois among beaſts, and the lagopus among birds.

They ſerve as ſkreens to keep off the cold and nipping blaſts of the northern and eaſtern winds; they alſo ſerve for the production of a great number of vegetables and minerals, which are not found in any other ſoil; they enable us to keep thoſe mines dry, which furniſh the moſt uſeful metals; beſides, the long ridges and chains of lofty and topping *mountains*, being generally found to run from eaſt to weſt, ſerve to ſtop the evagation of the vapours towards the poles, without which they would all run from the hot countries, and leave them deſtitute of rain.

Mr. Ray adds, that they condenſe thoſe vapours, like alembic heads, into clouds; and ſo by a kind of external diſtillation, give origin to ſprings and rivers; and, by amaſſing, cooling, and condenſing them, turn them into rain; and, by that means, render the fervid regions of the torrid zone habitable. Thus the more we conſider nature, the more we muſt admire her works; and what ſeems to be a defect or blemiſh in them, on a ſlight view, often proves, on more juſt obſervation, a great benefit and beauty. In hiſtory we have inſtances of *mountains* travelling conſiderable diſtances. To meaſure the height of a *mountain*, ſee Altitude, &c. Though there is another way uſed by Dr. Halley in the meaſure of Snowdon hill in Wales, by means of a Barometer, the different height of whoſe mercury at the top and bottom of the *mountain* gives its perpendicular altitude; accounting eighty-two feet perpendicular aſcent for every inch varied in the height of the mercury.

The difficulty of breathing at the tops of high *mountains* is a thing ſo plainly felt, that there are none who have ever been in the way of making the experiment, who are not well convinced of the certainty of the fact. Acoſta deſcribes what he felt on the tops of the high *mountains* of Pariacaca very judiciouſly. The *mountains* of Armenia, and that particularly on which Noah's ark is ſuppoſed to have reſted, have been alſo made famous on the like accounts; though the ſnows that lie on the tops of theſe *mountains* make it impracticable to aſcend their tops; the people who climb as high as they can, always find that they breathe with more difficulty, and are compelled to fetch their breath oftener than when on the plains; and on travellers complaining of this, their guides always tell them, that is a known thing, and is what every body ſuffers there.

The *mountains* in Languedoc and the Pyreneans have the ſame effect. People of curioſity have ſometimes remained hours on the ſummit of theſe *mountains*, and always found the ſame ſort of difficulty in breathing; but it is poſſible that this may be owing to the exhalations of certain ſteams from the earth in theſe places, leſs loaded with a weight of air than below; and this appears the more probable, as in going up the *mountain*, Teneriffe, if many people are in company, and aſcend different ways, ſome uſually bear it better than others; and the very complexions of ſome are turned yellow by the exhalations, which are very plainly perceived by their ſmell and ſharpneſs, while others, who aſcend to the ſame height by different tracts, eſcape.

The moſt remarkable *mountain* in the world, in ſhape, is that called the *needle mountain*, or the *inacceſſible mountain*, in Dauphiny. This is a vaſt hill, placed as it were bottom upwards, or ſet on its ſummit on the earth with its broad baſe elevated in the air; it is about a thouſand paces in circumference at the bottom, and is above two thouſand at the top. On the centre of the plain at the top there ſtands another ſmall and very narrow, but very high hill.

It obtained the name of the *needle*, as it got the other, by its being ſuppoſed impracticable to the aſcent of any one, by reaſon of its projecting ſo greatly outwards. Some hardy perſons, however, once ventured to climb it, and found at the top a number of the chamois, animals by no means qualified for climbing, and which doubtleſs had never either aſcended or deſcended the *mountain*, and which muſt be ſuppoſed to have bred there for many ages, though it is very difficult to account for their firſt getting to the place. Hiſt. Acad. Par. 1700.

Attraction of Mountains. This is a late diſcovery, and a very conſiderable confirmation of Sir Iſaac Newton's theory of univerſal gravity. According to the Newtonian ſyſtem, an attractive power is not only exerted between thoſe large maſſes of matter which conſtitute the ſun and planets; but likewiſe between all comparatively ſmaller bodies, and even between the ſmalleſt particles of which they are compoſed. Agreeably to this hypotheſis, a heavy body, which ought to gravitate or tend toward the centre of the earth, in a direction perpendicular to its ſurface, ſuppoſing the ſaid ſurface to be perfectly even and ſpherical, ought likewiſe, though in a leſs degree, to be attracted and tend towards a mountain placed on the earth's ſurface: ſo that a plumb-line, for inſtance, of a quadrant, hanging in the neighbourhood of ſuch a mountain, ought to be drawn from a perpendicular ſituation, in conſequence of the attractive power of the quantity of matter of which it is compoſed, acting in a direction different from that exerted by the whole maſs of matter in the earth, and with a proportionably inferior degree of force.

Though Sir Iſaac Newton had long ago hinted at an experiment of this kind; and had remarked, that "a mountain of an hemiſpherical figure, three miles high and ſix broad, would not, by its attraction, draw the plumb-line two minutes out of the perpendicular:" yet no attempt to aſcertain this matter, by actual experiment, was made till about the year 1738; when the French academicians, particularly Meſſrs. Bouguer and Condamine, who were ſent to Peru to meaſure a degree under the equator, attempted to diſcover the attractive power of Chimboraço, a mountain in the province of Quito. According to their obſervations, which were however made under circumſtances by no means favourable to an accurate ſolution of ſo nice and difficult a problem, the mountain Chimboraço exerted an attraction equal to eight ſeconds. Though this experiment was not perhaps ſufficient to prove ſatisfactorily even the reality of an attraction, much leſs the preciſe quantity of it; yet it does not appear that any ſteps had been ſince taken to repeat it.

Through the munificence of his Britannic majeſty, the royal ſociety was enabled to undertake the execution of this delicate and important experiment; the aſtronomer royal was choſen to conduct it. After various inquiries, the mountain Schehallien, ſituated nearly in the centre of Scotland, was pitched upon as the moſt proper for the purpoſe that could be found in this iſland. The obſervations were made by taking the meridian zenith diſtances of different fixed ſtars, near the zenith, by means of a zenith ſector of ten feet radius; firſt on the ſouth, and afterwards on the north ſide of the hill, the greateſt length of which extended in an eaſt and weſt direction.

It is evident, that if the maſs of matter in the hill exerted any ſenſible attraction, it would cauſe the plumb-line of the ſector, through which an obſerver viewed a ſtar in the meridian, to deviate from its perpendicular ſituation, and would attract it contrary ways at the two ſtations, thereby doubling the effect. On the ſouth ſide the plummet would be drawn to the northward, by the attractive power of the hill placed to the northward of it; and on the north ſide, a contrary and equal deflection of the plumb-line would take place, in conſequence of the attraction of the hill, now to the ſouthward of it. The apparent zenith diſtances of the ſtars would be affected contrarywiſe; thoſe being increaſed at the one ſtation which were diminiſhed at the other; and the correſpondent quantities of the deflection of the plumb-line would give the obſerver the ſum of the contrary attractions of the hill, acting on the plummet at the two ſtations; the half of which will of courſe indicate the attractive power of the hill.

The various operations requiſite for this experiment laſted about four months; and from them it appears, that the ſum of the two contrary attractions of the mountain Schehallien, in the two temporary obſervations which were ſucceſſively fixed half-way up the hill (where the effect of its attraction would be greateſt) was equal to 11″. 6. From a rough computation, founded on the known law of gravitation, and on an aſſumption that the denſity of the hill is equal to the mean denſity of the earth; it appears that the attraction of the hill ſhould amount to about the double of this quantity. From thence it was inferred, that the denſity of the hill is only about half the mean denſity of the earth. It does not appear, however, that the mountain Schehallien has ever been a volcano, or is hollow; as it is extremely ſolid and denſe, and ſeemingly compoſed of an entire rock.

The inference drawn from theſe experiments may be reduced to the following:

"1. It appears, that the mountain Schehallien exerts a ſenſible attraction; therefore, from the rules of philoſophiſing, we are to conclude, that every mountain, and indeed every particle of the earth, is endued with the ſame property, in proportion to its quantity of matter.

2. The law of the variation of this force, in the inverſe ratio of the ſquares of the diſtances, as laid down by Sir Iſaac Newton, is alſo confirmed by this experiment. For if the force of attraction of the hill had been only to that of the earth as the matter in the hill to that of the earth, and had not been greatly increaſed by the near approach to its centre, the attraction thereof muſt have been wholly inſenſible. But now, by only obſerving the mean denſity of the earth to be double to that of the hill, which ſeems very probable from other conſiderations, the attraction of the hill will be reconciled to the general law of the variation of attraction in the inverſe duplicate ratio of the diſtances, as deduced by Sir Iſaac Newton from the compariſon of the motion of the heavenly bodies with the force of gravity at the ſurface of the earth; and the analogy of nature will be preſerved.

3. We may now, therefore, be allowed to admit this law, and to acknowledge, that the mean denſity of the earth is at leaſt double of that at the ſurface; and conſequently that the denſity of the internal parts of the earth is much greater than near the ſurface. Hence alſo, the whole quantity of the matter in the earth will be at leaſt as great again as if it had been all compoſed of matter of the ſame denſity with that at the ſurface; or will be about four or five times as great as if it were all compoſed of water. This concluſion, Mr. Maſkelyne adds, is totally contrary to the hypotheſis of ſome naturaliſts, who, ſuppoſe the earth to be only a great hollow ſhell of matter; ſupporting itſelf from the property of an arch, with an immenſe vacuity in the midſt of it. But, were that the caſe, the attraction of mountains, and even ſmaller inequalities in the earth's ſurface, would be very great, contrary to experiment, and would affect the meaſures of the degrees of the meridian much more than we find they do; and the variation of gravity, in different latitudes, in going from the equator to the poles, as found by pendulums, would not be near ſo regular as it has been found by experiment to be.

4. As mountains are, by theſe experiments, found capable of producing ſenſible deflections of the plumb-lines of aſtronomical inſtruments, it becomes a matter of great importance, in the menſuration of degrees in the meridian, either to chooſe places where the irregular attractions of the elevated parts may be ſmall; or where, by their ſituation, they may compenſate or counteract the effects of each other."

MOURNING, a particular dreſs or habit, worn to ſignify grief, on ſome melancholy occaſion. The modes of *mourning* are various in various countries; as alſo are the colours that obtain for that end. In Europe, the ordinary colour for *mourning* is black; in China, it is white; in Turkey blue or violet; in Egypt, yellow; in Ethiopia, brown. The ancient Spartan and Roman ladies mourned in white: and the ſame colour obtained formerly in Caſtile, on the death of their princes. Herrera obſerves, that the laſt time it was uſed was in 1498, at the death of prince John. Kings and cardinals always mourn in purple. Each people pretend to have their reaſons for the particular colour of their *mourning*: white is ſuppoſed to denote purity: yellow, that death is the end of human hopes, in regard to leaves when they fall, and flowers when they fade, become yellow; brown denotes the earth, whither the dead return; black, the privation of life, as being the privation of light; blue expreſſes the happineſs which it is hoped the deceaſed does enjoy; and purple or violet, ſorrow on the one ſide, and hope on the other, as being a mixture of black and blue. *Mourning*, among the ancients, was expreſſed various ways, as by tearing their cloaths, by wearing ſackcloth, laying aſide crowns, and every other mark of joy. Plutarch, in his Life of Cato, relates, that from the time of his leaving the city with Pompey, he neither ſhaved his head, nor, as uſual, wore the crown or garland. Sometimes public grief was teſtified by a general faſt.

MOUSE, the Engliſh name of the genus Mus. For deſcription of the ſeveral ſpecies belonging to this genus, ſee the article Mus.

MOUTH, in anatomy, a part of the face, conſiſting of the lips, the gums, the inſides of the cheeks, the palate, the ſalival glands, the os hyoides, the uvula, and the tonſils. For deſcription of theſe ſeveral parts, ſee the Syſtem, Sect. XIII. and XIV.

MUCILAGE, in pharmacy, is in general any viſcid or glutinous liquor.

MUCILAGE alſo imports the liquor which principally ſerves to moiſten the ligaments and cartilages of the articulations; and is ſupplied by the mucilaginous glands.

MUCOUS *Glands*, are three glands which empty themſelves into the urethra; ſo called from the tenacity of the liquor which they ſeparate. See the Syſtem of ANATOMY, Plate I. Sect. VI.

MUCRO *Cordis*, in anatomy, the lower or pointed end of the heart. The word is Latin, *mucro*, where it properly ſignifies *the point of a ſpear*. Hence, MUCRONATED is applied to whatever tends to or terminates in a point like that of a ſpear; as *mucronata cartilago*, &c.

MUCUS, a mucilaginous liquor ſecreted by certain glands, and ſerving to lubricate many of the internal cavities of the body. In its natural ſtate it is generally limpid and colourleſs; but, from certain cauſes, will often aſſume a thick conſiſtence and whitiſh colour like pus. As it is ſometimes of very great importance in medicine to diſtinguiſh theſe two fluids from each other, this was lately propoſed as the ſubject of a prize-diſputation by the Æſculapian Society of Edinburgh. The prize was gained by Mr. Charles Darwin ſtudent of medicine from Litchfield. The concluſions drawn from his experiments were,

1. Pus and mucus are both ſoluble in the vitriolic acid, though in very different proportions, pus being by far leaſt ſoluble. 2. The addition of water to either of theſe compounds decompoſes it. The mucus thus ſeparated, either ſwims in the mixture, or forms large flocculi in it; whereas the pus falls to the bottom, and forms, on agitation, an uniform turbid mixture. 3. Pus is diffuſible through a diluted vitriolic acid, though mucus is not. The ſame alſo occurs with water, or with a ſolution of ſea ſalt. 4. Nitrous acid diſſolves both pus and mucus. Water added to the ſolution of pus produces a precipitate, and the fluid above becomes clear and green, while water and the ſolution of mucus form a turbid dirty-coloured fluid. 5. Alkaline lixivium diſſolves, though ſometimes with difficulty, mucus, and generally pus

6. Water precipitates pus from ſuch a mixture, but does not mucus. 7. Where alkaline lixivium does not diſſove pus, it ſtill diſtinguiſhes it from mucus, as it then prevents its diffuſion through water. 8. Coagulable lymph is neither ſoluble in concentrated nor diluted vitriolic acid. 9. Water produces no change, on a ſolution of ſerum in alkaline lixivium, until after long ſtanding, and then only a very ſlight ſediment appears. 10. Corroſive ſublimate coagulates mucus, but does not pus.

From the above experiments it appears, that ſtrong vitriolic acid and water, diluted vitriolic acid, and cauſtic alkaline lixivium and water will ſerve to diſtinguiſh pus from mucus; that the vitriolic acid can ſeparate it from coagulable lymph, and alkaline lixivium from ſerum.

Hence, when a perſon has any expectorated matter, the compotion of which he wiſhes to aſcertain, let him diſſolve it in vitriolic acid, and in cauſtic alkaline lixivium. And let him add pure water to both ſolutions. If there be a fair precipitation in each, he may be aſſured that ſome pus is preſent. But if there be a precipitation in neither, it is a certain teſt that the mixture is entirely mucus. If the matter cannot be made to diſſolve in alkaline lixivium by time and trituration, we have alſo reaſon to believe it to be pus.

MUERDUM, among the Turks, an officer belonging to their moſques, who with his voice calls the people to prayers; thereby ſupplying the want of bells, which the Mahometans will not uſe. See Mosque.

MUFFLE, in metallurgy, is an arched cover, reſiſting the ſtrongeſt fire, and made to be placed over copels and teſts in the operation of aſſaying, to preſerve them from the falling of coals or aſhes into them; though at the ſame time of ſuch a form, as not to hinder the action of the air and fire on the metal, nor prevent the inſpection of the aſſayer.

MUFTI, the chief of the eccleſiaſtical order, or primate of the muſſulman religion. The authority of the mufti is very great in the Ottoman empire; for even the ſultan himſelf, if he would preſerve any appearance of religion, cannot, without hearing his opinion, put any perſon to death, or ſo much as inflict any corporal puniſhment. In all actions, eſpecially criminal ones, his opinion is required, by giving him a writing in which the caſe is ſtated under feigned names; which he ſubſcribes with the words, *He ſhall*, or, *Shall not be puniſhed*. Such outward honour is paid to the mufti, that the grand ſignior himſelf riſes up to him, and advances ſeven ſteps to meet him when he comes into his preſence. He alone has the honour of kiſſing the ſultan's left ſhoulder, whilſt the prime vizier kiſſes only the hem of his garment. When the grand ſignior addreſſes any writing to the mufti, he gives him the following titles: *To the eſad, the wiſeſt of the wiſe, inſtructed in all knowledge, the moſt excellent of excellents, abſtaining from things unlawful, the ſpring of virtue and of true ſcience, heir of the prophetic doctrines, reſolver of the problems of faith, revealer of the orthodox articles, key of the treaſures of truth, the light to the doubtful allegories, ſtrengthened with the grace of the ſupreme Legiſlator of mankind, may the Moſt High God perpetuate thy virtues!* The election of the mufti is ſolely in the grand ſignior, who preſents him with a veſt of rich ſables, &c. If he is convicted of treaſon, or any great crime, he is put into a mortar kept for that purpoſe in the Seven Towers at Conſtantinople, and pounded to death.

MUGIL, the MULLET; in ichthyology, a genus of fiſhes belonging to the order of abdominales. The lips are membranaceous, the inferior one being carinated inwards; they have no teeth; the branchioſtege membrane has ſeven crooked rays; the opercula are ſmooth and round; and the body is of a whitiſh colour. There are two ſpecies, diſtinguiſhed by the number of rays in the black-fin.

The mullet is juſtly ranked by Ariſtotle among the *piſces littorales*, or thoſe that preſer the ſhores to the full ſea; they are found in great plenty on ſeveral of the ſandy coaſts of our iſland, and haunt in particular thoſe ſmall bays that have influxes of freſh water. They come in great ſhoals, and keep rooting like hogs in the ſand or mud, leaving their traces in form of large round holes. Theſe fiſh ſometimes ſwarm on the coaſts of the Mediterranean. Near Martegues, in the ſouth of France, abundance of mullets are taken in weres made of reeds placed in the ſhallows. Of the milts of the males, which are called *alletants*, and of the roes of females, which are called *botar*, is made botargo. The materials are taken out entire, covered with ſalt for four or five hours, then preſſed a little between two boards or ſtones, waſhed, and at laſt dried in the ſun for 13 or 14 days.

The mullet is an excellent fiſh for the table, but at preſent not a faſhionable one. For claſſification, ſee the System, Order V. Genus 56, for repreſentation, ſee the Plate.

MULATTO, a name given in the Indies, to thoſe who are begotten by a Negro man on a Indian woman; or an Indian man on a Negro woman. The word is originally Spaniſh, *mulata*, formed of *mula, a mule*, as being begotten of two different ſpecies. Thoſe begotten of a Spaniſh woman and an Indian man, are called *metis*; and thoſe begotten of a ſavage by a *metis* are called *jambos*. Theſe are all very different in colour, and in their hair.

MULE, in the Syſtem of Mammalia, a mongrel quadruped, generated between an aſs and a mare, and ſometimes between a horſe and a ſhe-aſs; but the ſignification of the word is commonly extended to every kind of animal produced by a mixture of two different ſpecies. There are two kinds of theſe animals; one from the he-aſs and mare, the other from the horſe and the ſhe-aſs. We call them indifferently *mules*, but the Romans diſtinguiſhed them by proper appellations. The firſt kind are the beſt and moſt eſteemed; as being larger, ſtronger, and having leaſt of the aſs in their diſpoſition. The largeſt and ſtouteſt aſſes, and the faireſt and fineſt mares, are choſen in thoſe countries where theſe creatures are moſt in uſe; as in Spain, Italy, and Flanders. In the laſt eſpecially, they ſucceeded in having very ſtately mules from the ſize of their mares, ſome of them 16, and ſome 17 hands high, which are very ſerviceable as ſumpter-mules in the army. But, ſince the Low Countries are no longer under the dominion of Spain, they breed fewer mules. Theſe creatures are very much commended for their being ſtronger, ſurer footed, going eaſier, being more cheaply maintained, and laſting longer than horſes. They are commonly of a black-brown, or quite black, with that ſhining liſt along the back and croſs the ſhoulders, which diſtinguiſhes aſſes. In former times they were much more common in this country than at preſent. But they are commonly found to be vicious, ſtubborn, and obſtinate to a proverb. According to Linnæus, the mule is a variety of the ſecond ſpecies Aſſinus, belonging to the Genus Equus. For repreſentation, ſee the Plates of Mammalia.

Mules, among gardiners, denote a ſort of vegetable monſters produced by putting the farina fœcundans of one ſpecies of plant into the piſtil, or utricle of another. The carnation and ſweet william, being ſomewhat alike in their parts, particularly their flowers; the *farina* of the one will impregnate the other: and the ſeed ſo enlivened will produce a plant differing from either. An inſtance of this we firſt had in Mr. Fairchild's garden at Hoxton; where a plant is ſeen neither ſweet-william, nor carnation, but reſembling both equally: this was raiſed from the ſeed of a carnation that had been impregnated by the farina of the ſweet-william. Theſe couplings being not unlike thoſe of the mare with the aſs, which produce the *mule*, the ſame name is given them: and they are, like the others, incapable of multiplying their ſpecies.

This gives us a hint for altering the property and taſte of any fruit, by impregnating one tree with the *farina* of another of the ſame claſs; e. gr. a codlin with a pear-main, which will occaſion the codlin ſo impregnated to laſt a longer time than uſual, and to be of a ſharper taſte. Or if the winter fruits be fecundated with the duſt of the ſummer kinds, they will ripen before their uſual time. And from this accidental coupling of the *farina* of one with another, it may poſſibly be, that in an orchard where there is variety of apples, even the fruit gathered from the ſame tree differ in their flavour, and in the ſeaſon of maturity. It is alſo from the ſame accidental coupling that the numberleſs varieties of fruits and flowers raiſed every day from ſeed proceed.

MULLET, or Mollet, in heraldry, a bearing in form of a flat, or rather of the rowel of a ſpur, which it originally repreſented. The *mullet* has but five points; when there are ſix, it is called a *ſtar*. Though others make this difference, that the *mullet* is, or ought to be, always pierced, which a ſtar is not. The *mullet* is uſually the difference, or diſtinguiſhing mark for the fourth ſon, or third brother, or houſe. See the Syſtem, Sect. V. Plate II.

MULLUS, in ichthyology a genus of fiſhes belonging to the order of Thoracici. The barbatus, or red ſurmullet, was highly eſteemed by the Romans, and bore an exceeding high price. The capricious epicures of Horace's days valued it in proportion to its ſize; not that the larger were more delicious, but that they were more difficult to be got. The price that was given for one in the time of Juvenal and Pliny, is a ſtriking evidence of the luxury and extravagance of the age:

> Mullum *ſex millibus emit*
> *Æquantem ſane paribus ſeſtertia libris.* Juv. Sat. IV.
> The laviſh ſlave
> Six thouſand pieces for a mullet gave,
> A ſeſterce for each pound. Dryden.

But Aſinius Celer, a man of conſular dignity, gave a ſtill more unconſcionable ſum; for he did not ſcruple beſtowing 8000 nummi, or 64l. 11s. 8d. for a fiſh of ſo ſmall a ſize as the mullet: for, according to Horace, a *mullus trilibris*, or one of 3lb. was a great rariety; ſo that Juvenal's ſpark muſt have had a great bargain in compariſon of what Celer had. For claſſification, ſee the Syſtem, Order IV. Genus 43. For repreſentation, ſee the Plate.

MULTIPLE, in arithmetic, a number which comprehends ſome other ſeveral times: thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3; comprehending the firſt twice, the ſecond thrice, &c.

MULTIPLICAND, in arithmetic, the number to be multiplied by another.

MULTIPLICATION, in general, the act of increaſing the number of any thing. *Multiplication*, in arithmetic, is a rule by which any given number may be ſpeedily increaſed, according to any propoſed number of times. *Multiplication*, in algebra. For a full explanation and definitions of the terms and rules appertaining to the four foregoing articles, ſee the Syſtem of Arithmetic, Art. IV; and the Syſtem of Algebra, Sect. I, and Sect. II. Art. III.

MULTIPLYING, in the ancient oeconomy, the producing of one's like. Mankind *multiplied* at a prodigious rate before the flood. Rabbits, fiſh, and moſt inſects *multiply* incredibly; the ſingle milt of a cod, examined with M. Leewenhoeck's microſcope, was found to contain more ova than there are animals on the face of the earth. See *Fecundity of* Fish. M. Dodart has ſeveral diſcourſes on the multiplication of plants, in the Memoirs of the Royal Academy of Sciences. He has examined the beech-tree, particularly, with this view, and found its increaſe to ſurpaſs all imagination.

Multiplying-*Glaſs*, in optics, a lens or glaſs, in which objects appear increaſed in number. For deſcription, ſee the System, for repreſentation, ſee the Plates.

MULTIVALVES, in conchology, the name of the 1ſt order of ſhell-fiſh, diſtinguiſhed from the univalves, which conſiſt of only one ſhell, and the bivalves, which conſiſt of two, by their conſiſting of three or more ſhells. For a deſcription of the ſeveral genera of this order, together with the ſpecies belonging to each genus, ſee the Syſtem of Conchology, Order I. for claſſification, ſee the *Synoptical Table*.

MUM, a wholeſome kind of malt liquor chiefly prepared in Germany. The proceſs of making *mum*, as recorded in the town-houſe of Brunſwick, the place of moſt note for this liquor, is as follows. Take ſixty-three gallons of water that has been boiled to the conſumption of a third part; brew it with ſeven buſhels of wheaten malt, one buſhel of oat malt, and one buſhel of ground beans: when it is turned, let not the hogſhead be too full at firſt; and as ſoon as it begins to work, put into it of the inner rind of fir three pounds, tops of fir and birch each one pound, carduus benedictus three handfuls, flowers of roſa ſolis one handful or two; burnet, betony, marjoram, avens, pennyroyal, wild thyme, of each a handful and a half; of elder-flowers two handfuls, or more; ſeeds of cardamom bruiſed thirty ounces, barbaries bruiſed one ounce; put the herbs and ſeeds into the veſſel when the liquor has worked a while; and, after they are added, let the liquor work over the veſſel as little as may be; then fill it up. Laſtly, when it is ſtopped, put into the hogſhead ten new-laid eggs unbroken or cracked, ſtop it up cloſe, and drink it at two years end. Our Engliſh brewers uſe cardamom, ginger, and ſaſſafras, inſtead of the inner rind of fir; and add alſo walnut-rinds, madder, red ſanders, and elecampane.

Every barrel of *mum* imported pays a duty of 25s. and by 12 Ann. ſtat. 1. c. 2. and 13 Geo. c. 7. every barrel of *mum* made or imported is liable to an additional duty of 10*s*.

MUMMY, *mumia*, a carcaſe, or body, embalmed or dried in the manner of the ancient Egyptians. Properly ſpeaking, *mummy* is not the fleſh of the deceaſed, but the compoſition wherewith it is embalmed; but, in common acceptation, *mummy* is alſo uſed for the body. The preparation of *mummy* is of ſo old a ſtanding, that it was in uſe in Egypt before the time of Moſes. The coffin in which the *mummy* is contained was to be of ſycamore wood, which is found to keep ſound for the ſpace of three thouſand years; but the tree, properly thus called, was very different from our ſycamore. *Mummy* is ſaid to have been firſt brought into uſe in medicine, by a Jewiſh phyſician, who wrote, that fleſh thus embalmed was good for the cure of divers diſeaſes, and particularly for bruiſes, to prevent the blood's gathering and coagulating. The Turks prevent the exportation of *mummy* into Europe, as much as poſſible. There are two kinds of bodies denominated mummies. The firſt are only carcaſes, dried by the heat of the ſun, and by that means kept from putrefaction; theſe are frequently found in the dry ſands of Lybia. Some ſay, they are the bodies of diſeaſed people buried there on purpoſe to keep them entire without embalming; others, that they are the carcaſes of travellers, &c. who have been overwhelmed with clouds of ſand raiſed by the hurricanes frequent in thoſe deſarts. Be that as it will, theſe mummies are of no uſe in medicine, and are only preſerved as curioſities.

The ſecond kind of mummies are bodies taken out of the pits or catacombs near Cairo, wherein the Egyptians depoſited their dead after Embalming. Theſe conſtitute the *mummy* once ſo much valued, and to which ſuch extraordinary virtues are aſcribed. It is ſaid, that all the *mummy* ſold in the ſhops, whether brought from Venice or Lyons, or even directly from the Levant by Alexandria, is factitious, and the work of certain Jews, who knowing the value the Europeans ſet on the Egyptian *mummy*, counterfeit it by drying carcaſes in ovens, after having prepared them with powder of myrrh, caballin, aloes, Jews pitch, black pitch, and other coarſe or unwholeſome drugs. The French charletans, it ſeems, have likewiſe got the art of preparing mummies. Their method is ſimple enough; out of the carcaſe of a perſon hanged, they take the brain and entrails, and dry the reſt in an oven, ſteeping it in pitch, and other drugs; and this they ſell for right Egyptian *mummy*. There are found at this time in Poland a kind of natural mummies, or human bodies, preſerved without the aſſiſtance of art. Theſe lie in conſiderable numbers in ſome of the vaſt caverns in that country. They are dried, with the fleſh and ſkin ſhrunk up almoſt cloſe to the bones, and are of a blackiſh colour. In the wars which ſeveral ages ago laid waſte that country, it was common for parties of the weaker ſide to retire into theſe caves, where their enemies, if they found it out, ſuffocated them by burning ſtraw, &c. at the mouth of the cavern, and then left the bodies; which, being out of the way of injuries from common accidents, have lain there ever ſince. Paræus has a very curious treatiſe of mummies, wherein he ſhews the abuſes thereof; and makes it appear, that they can never be of any real medicinal uſe. Matthiolus is of the ſame opinion, after Serapion. Both theſe authors take even the Egyptian mummies to be no more than bodies embalmed with piſſaſphaltum.

MUNICIPAL, is applied to the cuſtomary laws, that obtain in any particular city or province, and which have no authority in the neighbouring places. See Law.

Municipal *Officers* are thoſe elected to defend the intereſts of cities, their rights and privileges, and to maintain order and good policy: as mayors, ſheriffs, conſuls, bailiffs, &c. In Spain, the *municipal* officers are bought; in England, they are obtained by election.

MURÆNA, or Eel, in ichthyology; a genus of fiſhes, belonging to the order of apodes. The head is ſmooth; there are ten rays in the membrane of the gills; the eyes are covered with a common ſkin; and the body is cylindrical and ſlimy. There are ſeven ſpecies, diſtinguiſhed by their fins, tail, &c. The moſt remarkable are:

1. The *anguilla*, or common eel, is very frequent in all our freſh waters, ponds, ditches, and rivers: according to Mr. Pennant, it is the moſt univerſal of fiſh, yet is ſcarce ever found in the Danube, though very common in the lakes and rivers of Upper Auſtria. There is ſcarce any animal the generation of which has puzzled the learned more than this. Ariſtotle firſt broached an opinion that eels were of no ſex, nor did propagate their ſpecies like other animals, but were equivocally gendered of the mud; and as wild and abſurd a ſyſtem as this is, there have not been wanting many, even in theſe latter and more enlightened times, who have given into it. But there is now no room to doubt that all animals are produced by the copulation of parents like themſelves; and the finding of eels in new ponds is eaſily accounted for from the abovementioned circumſtance of their migration. Dr. Plot, and many others, have given accounts of whole droves of them leaving one ditch or pond to go to another.

Though the learned world at this time generally allows that eels are produced like other animals, by parents of their own kind, yet there remain many doubts about the manner in which the generation is performed. Some allow the eels to be, like the generality of other animals, of different ſexes in the different individuals; and others affirming that they are all hermaphrodites; each having the parts of generation of both ſexes. Rondeletius affirms that they are of both ſexes; and Mr. Allan, who has given a very curious paper concerning them in the Philoſophical Tranſactions, is of the ſame opinion; and both ſay, that the parts of the ſexes may be diſcovered on a careful inſpection; and ſome are found to be males, and other females; but theſe parts are, in both ſexes, they ſay, buried in a large quantity of fat; and they are of opinion, that hence proceeded the miſtake of Ariſtotle and his followers, who, not being able to find thoſe parts, concluded that they did not exiſt at all. Among thoſe who allow the eel to be produced, like other animals, from animal-parents which have the ſexes, ſome are of opinion that they are viviparous, and others that they are oviparous: but Mr. Chartwynd ſeems to have determined this controverſy by obſerving, that if the aperture under the belly of the eel, which looks red in the month of May, be cut open at that time, the young eels will be ſeen to come forth alive after the operation. Mr. Lewenhoeck ſays, that he found an uterus in every eel he examined; and therefore concludes, that they are hermaphrodites: and he ſuppoſes that they have no male parts of generation like thoſe of other animals; but that the office of theſe is performed by a liquor analogous to the male ſeed of animals, which is contained in certain glands, ſituated on the inſide of the uterus itſelf.

Eels have ſometimes been met with in recent ponds, made at ſuch a diſtance from any other water that we cannot reaſonably ſuppoſe them to have migrated thither over land. But in theſe caſes there is reaſon to believe, that the ponds have been ſupplied with them by the aquatic fowl of prey, in the ſame manner as vegetation is ſpread by many of the land-birds, either by being dropped, as they carry them to feed their young, or by paſſing quick through their bodies, as is the caſe with herons. Theſe fiſh are extremely voracious, and deſtructive to the fry of others. No fiſh lives ſo long out of water as the eel: and it is extremely tenacious of life, inſomuch that its parts will move a conſiderable time after they are flayed and cut in pieces. They vary much in their colours, from a ſutty hue to a light olive green; and thoſe which are called *ſilver eels* have their bellies white, and a remarkable clearneſs throughout.

Beſides theſe, there is a variety of this fiſh known in the river Thames by the name of *grigs*, and about Oxford by that of *grigs* or *gluts*. Theſe are ſcarce ever ſeen near Oxford in the winter; but appear in ſpring, and bite readily at the hook, which common eels in that neighbourhood will not. They have a larger head, a blunter noſe, thicker ſkin, and leſs fat, than the common ſort; neither are they ſo much eſteemed, nor do they often exceed three or four pounds in weight. Common eels grow to a large ſize, ſometimes weighing 15 or 20 pounds; but that is extremely rare. Mr. Dale indeed, in the Philoſophical Tranſactions, and ſome others, bring inſtances of eels much exceeding that ſize; but nant ſuſpects them to have been congers, ſince the enormous fiſh they deſcribe have all been taken at the mouths of the Thames or Medway. The Romans held eels very cheap, probably on account of their likeneſs to ſnakes. On the contrary, the luxurious Sybarites were ſo fond of theſe fiſh, as to exempt from tribute of every kind thoſe perſons who ſold them.

The *conger*, or conger-ell, grows to a vaſt ſize. Dr. Borlaſe informs us, that they are ſometimes taken near Mount's-bay of 100lb. weight; and Mr. Pennant aſſures us, that he has heard of ſome taken near Scarborough that were 10 feet and a half long, and 18 inches in circumference in the thickeſt part.

They differ from the common eel in the following particulars: 1. Their colour in general is more dark. 2. Their eyes much larger in proportion. 3. The irides of a bright ſilvery colour. 4. The lower jaw is rather ſhorter than the upper. 5. The ſide-line is broad, whitiſh, and marked with a row of ſmall ſpots. 6. The edges of the dorſal and anal fins are black. 7. They have more bones than the common eel, eſpecially along the back quite to the head. 8. They grow to a much larger ſize.

As to the diſtinction that Mr. Ray and other writers make of the ſmall beards at the end of the noſe, Mr. Pennant thinks it not to be depended on, being ſometimes found in both kinds, and ſometimes entirely wanting. Probably they generate like the freſh-water ſpecies. Innumerable quantities of what are ſuppoſed to be their fry, come up the Severn about the month of April, preceding the ſhads, which it is conjectured migrate into that river to feed on them: they are called *elvers*. They ſwarm during their ſeaſon, and are taken in a kind of ſieve made of hair-cloth, fixed to a long pole; the fiſherman ſtanding on the edge of the water during the tide, puts in his net as far as he can reach, and drawing it out again, takes multitudes at every ſweep, and will take as many during one tide as will fill a buſhel. They are dreſſed, and reckoned very delicate.

Congers are extremely voracious, preying on other fiſh, and on crabs at the time they have loſt their ſhell and are in a ſoft ſtate. They and eels in general are alſo particularly fond of carcaſes of any kind, being frequently found lodged in ſuch as are accidentally taken up. Theſe fiſh are an article of commerce in Cornwall; numbers are taken on that coaſt, and exported to Spain and Portugal, particularly to Barcelona. Some are taken by a ſingle hook and line, but (becauſe that way is tedious, and does not anſwer the expence of time and labour) they are chiefly caught by *bulters*, which are ſtrong lines 300 feet long, with 60 hooks, each eight feet aſunder, baited with pilchards or mackarel; the bulters are ſunk to the ground by a ſtone faſtened to them; ſometimes ſuch a number of theſe are tied together as to reach a mile. The fiſhermen are very fearful of a large conger, leſt it ſhould endanger their legs by clinging round them; they therefore kill them as ſoon as poſſible by ſtriking them on the navel. They are afterwards cured in this manner. They are ſlit, and hung on a frame till they dry, having a conſiderable quantity of fat, which it is neceſſary ſhould exude before they are fit for uſe. It is remarkable that a conger of 100 weight will waſte by drying to 24 lb.; the people therefore prefer the ſmalleſt, poſſibly becauſe they are ſooneſt cured. During the proceſs there is a conſiderable ſtench; and it is ſaid, that in the fiſhing villages the poultry are fed with the maggots that drop from the fiſh. The Portugueſe and Spaniards uſe thoſe dried congers after they have been ground into a powder, to thicken and give a reliſh to their ſoups. They are ſold for about 40 ſhillings the quintal, which weighs 126 lb. A fiſhery of congers, ſays Mr. Pennant, would be of great advantage to the inhabitants of the Hebrides. Perhaps they would at firſt undertake it with repugnancy, from their abſurd averſion to the eel kind. For claſſification, ſee the SYSTEM, Order II. Genus 75.

MURDER, or MURTHER, in law, is thus defined, or rather deſcribed, by Sir Edward Coke: "when a perſon, of ſound memory, and diſcretion, unlawfully killeth any reaſonable creature in being, and under the king's peace, with malice aforethought, either expreſs or implied." The beſt way of examining the nature of this crime will be by conſidering the ſeveral branches of this definition.

1. It muſt be committed by a perſon *of ſound memory and diſcretion:* for lunatics or infants are incapable of committing any crime; unleſs in ſuch caſes where they ſhew a conſciouſneſs of doing wrong, and of courſe a diſcretion or diſcernment between good and evil.

2. Next, it happens when a perſon of ſuch ſound diſcretion *unlawfully killeth*. The unlawfulneſs ariſes from the killing without warrant or excuſe: and there muſt alſo be an actual killing to conſtitute murder; for a bare aſſault, with intent to kill, is only a great miſdemeſnor, though formerly it was held to be murder. The killing may be by poiſoning, ſtriking, ſtarving, drowning, and a thouſand other forms of death, by which human nature may be overcome. Of theſe the moſt deteſtable of all is poiſon; becauſe it can of all others be the leaſt prevented, either by manhood or forethought. And therefore, by the ſtat. 22 Hen. VIII. c. 9. it was made treaſon, and a more grievous and lingering kind of death was inflicted on it than the common law allowed: namely, *boiling to death:* but this act did not live long, being repealed by 1 Edw. VI. c. 12. There was alſo, by the ancient common law, one ſpecies of killing held to be murder, which may be dubious at this day, as there hath not been an inſtance wherein it has been held to be murder for many ages paſt, viz. bearing falſe witneſs againſt another, with an expreſs premeditated deſign to take away his life, ſo as the innocent perſon be condemned and executed. The Gothic laws puniſhed in this caſe both the judge, the witneſſes, and the proſecutor: and, among the Romans, the *lex Cornelia de ſicariis*, puniſhed the falſe witneſs with death, as being guilty of a ſpecies of aſſaſſination. And there is no doubt but this is equally murder *in foro conſcientiæ* as killing with a ſword; though the modern law (to avoid the danger of deterring witneſſes from giving evidence upon capital proſecutions, if it muſt be at the peril of their own lives) has not yet puniſhed it as ſuch. If a man, however, does ſuch an act, of which the probable conſequence may be, and eventually is, death; ſuch killing may be murder, although no ſtroke be ſtruck by himſelf, and no killing may be primarily intended: if a man hath a beaſt that is uſed to do miſchief; and he, knowing it, *ſuffers* it to go abroad, and it kills a man; even this is manſlaughter in the owner: but if he had purpoſely *turned it looſe*, though barely to frighten people, and make what is called *ſport*, it is with us (as in the Jewiſh law) as much murder as if he had incited a bear or a dog to worry them. If a phyſician or ſurgeon gives his patient a potion or plaſter to cure him, which, contrary to expectation, kills him, this is neither murder nor manſlaughter, but miſadventure; and he ſhall not be puniſhed criminally, however liable he might formerly have been to a civil action for neglect or ignorance; but it hath been holden, that if it be not a *regular* phyſician or ſurgeon who adminiſters the medicine, or performs the operation, it is manſlaughter at the leaſt. Yet Sir Matthew Hale very juſtly queſtions the law of this determination; ſince phyſic and ſalves were in uſe before licenſed phyſicians and ſurgeons: wherefore he treats this doctrine as apocriphal, and fitted only to gratify and flatter licentiates and doctors in phyſic; though it may be of uſe to make people cautious and wary how they meddle too much in ſo dangerous an employment. In order alſo to make the killing murder, it is requiſite that the party die within a year and a day after the ſtroke received, or cauſe of death adminiſtered; in the computation of which the whole day upon which the hurt was done ſhall be reckoned the firſt.

3. Farther: The perſon killed muſt be "*a reaſonable creature in being, and under the king's peace*," at the time of the killing. Therefore to kill an alien, a Jew, or an outlaw, who are all under the king's peace or protection, is as much murder as to kill the moſt regular-born Engliſhman; except he be an alien-enemy, in time of war. To kill a child in its mother's womb, is now no murder, but a great miſpriſon: but if the child be born alive, and dieth by reaſon of the potion or bruiſes it received in the womb, it ſeems, by the better opinion, to be murder in ſuch as adminiſtered or gave them.

4. Laſtly, the killing muſt be committed "*with malice aforethought*," to make it the crime of murder. This is the grand criterion which now diſtinguiſhes murder from other killing: and this malice prepenſe, *malitia præcogitata*, is not ſo properly ſpite or malevolence to the deceaſed in particular, as any evil deſign in general; the dictate of a wicked, depraved, and malignant heart; *un diſpoſition à faire un male choſe:* and it may be either *expreſs*, or *implied*, in law. Expreſs malice is when one, with a ſedate deliberate mind and formed deſign, doth kill another: which formed deſign is evidenced by external circumſtances diſcovering that inward intention; as lying in wait, antecedent menaces, former grudges, and concerted ſchemes to do him ſome bodily harm. This takes in the caſe of deliberate duelling, where both parties meet avowedly with an intent to murder: thinking it their duty, as gentlemen, and claiming it as their right, to wanton with their own lives and thoſe of their fellow-creatures; without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man: and therefore the law has juſtly fixed the crime and puniſhment of murder on them, and on their ſeconds alſo. Yet it requires ſuch a degree of paſſive valour to combat the dread of even undeſerved contempt, ariſing from the falſe notions of honour too generally received in Europe, that the ſtrongeſt prohibitions and penalties of the law will never be entirely effectual to eradicate this unhappy cuſtom, till a method be found out of compelling the original aggreſſor to make ſome other ſatisfaction to the affronted party, which the world ſhall eſteem equally reputable as that which is now given at the hazard of the life and fortune, as well of the perſon inſulted, as of him who hath given the inſult. Alſo, if even upon a ſudden provocation one beats another in a cruel and unuſual manner, ſo that he dies, though he did not intend his death, yet he is guilty of murder by expreſs malice: *i. e.* by an expreſs evil deſign, the genuine ſenſe of *malitia*. As when a park-keeper tied a boy that was ſtealing wood to a horſe's tail, and dragged him along the park; when a maſter corrected his ſervant with an iron bar, and a ſchoolmaſter ſtamped on his ſcholar's belly, ſo that each of the ſufferers died: theſe were juſtly held to be murders, becauſe the correction being exceſſive, and ſuch as could not proceed but from a bad heart, it was equivalent to a deliberate act of ſlaughter. Neither ſhall he be guilty of a leſs crime who kills another in conſequence of ſuch a wilful act as ſhews him to be an enemy to all mankind in general;

as going deliberately, and with an intent to do miſchief, upon a horſe uſed to ſtrike, or cooly diſcharging a gun among a multitude of people. So if a man reſolves to kill the next man he meets, and does kill him, it is murder, although he knew him not; for this is univerſal malice. And if two or more come together to do an unlawful act againſt the king's peace, of which the probable conſequence might be bloodſhed; as to beat a man, to commit a riot, or to rob a park, and one of them kills a man: it is murder in them all, becauſe of the unlawful act, the *malitia præcogitata*, or evil intended beforehand.

Alſo in many caſes where no malice is expreſſed, the law will imply it: as, where a man wilfully poiſons another, in ſuch a deliberate act the law preſumes malice, though no particular enmity can be proved. And if a man kills another ſuddenly, without any, or without a conſiderable provocation, the law implies malice; for no perſon, unleſs of an abandoned heart, would be guilty of ſuch an act upon a ſlight or no apparent cauſe. No affront, by words, or geſtures only, is a ſufficient provocation, ſo as to excuſe or extenuate ſuch acts of violence as manifeſtly endanger the life of another. But if the perſon ſo provoked had unfortunately killed the other, by beating him in ſuch a manner as ſhewed only an intent to chaſtiſe and not to kill him, the law ſo far conſiders the provocation of contumelious behaviour, as to adjudge it only manſlaughter, and not murder. In like manner, if one kills an officer of juſtice, either civil or criminal, in the execution of his duty, or any of his aſſiſtants endeavouring to conſerve the peace, or any private perſon endeavouring to ſuppreſs an affray or apprehend a felon, knowing his authority or the intention with which he interpoſes, the law will imply malice, and the killer ſhall be guilty of murder. It were endleſs to go through all the caſes of homicide, which have been adjudged, either expreſsly or impliedly, malicious: theſe therefore may ſuffice as a ſpecimen; and we may take it for a general rule, that all homicide is malicious, and of courſe amounts to murder, unleſs where juſtified by the command or permiſſion of the law; excuſed on a principle of accident or ſelf-preſervation; or alleviated into manſlaughter, by being either the involuntary conſequence of ſome act, not ſtrictly lawful, or (if voluntary) occaſioned by ſome ſudden and ſufficiently violent provocation. And all theſe circumſtances of juſtification, excuſe, or alleviation, it is incumbent upon the priſoner to make out, to the ſatisfaction of the court and jury: the latter of whom are to decide whether the circumſtances alleged are proved to have actually exiſted; the former, how far they extend to take away or mitigate the guilt. For all homicide is preſumed to be malicious, until the contrary appeareth upon evidence.

The puniſhment of murder, and that of manſlaughter, were formerly one and the ſame; both having the benefit of clergy: ſo that none but unlearned perſons, who leaſt knew the guilt of it, were put to death for this enormous crime. But now, by ſeveral ſtatutes, the benefit of clergy is taken away from murderers through malice prepenſe, their abettors, procurers, and counſellors. In atrocious caſes it was frequently uſual for the court to direct the murderer, after execution, to be hung upon a gibbet in chains near the place where the fact was committed; but this was no part of the legal judgment; and the like is ſtill ſometimes practiſed in the caſe of notorious thieves. But now, in England, it is enacted by ſtatute 25 Geo. II. c. 37. that the judge, before whom any perſon is found guilty of wilful murder, ſhall pronounce ſentence immediately after conviction, unleſs he ſees cauſe to poſtpone it; and ſhall in paſſing ſentence direct him to be executed on the next day but one (unleſs the ſame ſhall be Sunday, and then on the Monday following), and that his body be delivered to the ſurgeons to be diſſected and anatomized; and that the judge may direct his body to be afterwards hung in chains, but in nowiſe to be buried without diſſection. And, during the ſhort but awful interval between ſentence and execution, the priſoner ſhall be kept alone, and ſuſtained with only bread and water. But a power is allowed to the judge, upon good and ſufficient cauſe, to reſpite the execution, and relax the other reſtraints of this act. See further, PARRICIDE, and PETIT *Treaſon*.

MUREX, in conchology, the 26th genus belonging to the third order univalves. For the genera and ſpecific characters, ſee the Syſtem, Order III. For the claſſification, ſee the *Synoptical Table*.

MURRAIN, or GARGLE, a contagious diſeaſe among cattle. The ſymptoms are, a hanging down and ſwelling of the head, abundance of gum in the eyes, rattling in the throat, a ſhort breath, palpitation at the heart, ſtaggering, a hot breath, and a ſhining tongue. In order to prevent this diſeaſe, the cattle ſhould ſtand cool in ſummer, and have plenty of good water: all carrion ſhould be ſpeedily buried; and as the feeding of cattle in wet places, on rotten graſs and hay, often occaſions this diſeaſe, dry and ſweet fodder ſhould be given them. The antidote for this diſeaſe were equal parts of ſoot, gunpowder, brimſtone and ſalt, with as much water as would waſh it down; a ſpoonful was the doſe.

MURREY, in heraldry, a kind of purple colour; generally called *ſanguine*. See the Syſtem, Sect. III, and Plate II.

MUS, in the Linnæan Syſtem of Mammalia, the 24th genus and belonging to the 4th order *glires*. There are twenty one ſpecies; but we ſhall only enumerate the following, which are moſt remarkable. The Porcellus, or Guiney-pig, ſo called from its being ſuppoſed to come only from Guinea, is a native of Brazil as well as Guinea. It is about the ſize of a young pig, and hath erect hair not unlike it. The colour is white or white varied with orange and black in irregular blotches; hath no tail, but very large broad ears rounded at the ſides. Theſe animals are of ſuch a hot conſtitution, that they copulate five or ſix weeks after birth. They acquire not, however, their full growth before the eighth or ninth month. But this increaſe of ſize conſiſts only of fat; for the ſolid parts are fully unfolded before the age of ſix months. The females go with young only three weeks: the firſt litter conſiſts of four or five; the ſecond of five or ſix; and the ſucceeding ones of ſeven or eight, and ſometimes of 10 or 12. The mother ſuckles her young 12 or 15 days: ſhe baniſhes them as ſoon as ſhe receives the male, which happens at fartheſt three weeks after her delivery; and if any of them perſiſt in following her, they are maltreated and killed by the male. As they breed ſo faſt, their multitudes would be innumerable, if there were not ſo many enemies which deſtroy them. They cannot reſiſt either cold or moiſture; when cold, they aſſemble and crowd cloſe together, in which caſe they often all periſh together. They are alſo devoured in great numbers by cats, and many are killed by the males. Though perpetually throwing out urine, they never drink. They feed on all kinds of herbs; but eſpecially on parſley, which they prefer to grain or bread; and they are likewiſe fond of apples and other fruits. They eat precipitately like the rabbit, little at a time but very often; make a grunting noiſe like a little pig, and are very reſtleſs. No mention is made by natural hiſtorians of the manners of this animal in a wild ſtate. Their ſkin is hardly of any value; and their fleſh, though eatable, is not ſo good as to be much demanded: but it might be improved by keeping them in warrens, where they would have the benefit of the freſh air, and the liberty of chooſing herbs agreeable to their taſte. Thoſe kept in houſes have nearly the ſame bad taſte with warren-rabbits; and thoſe kept in gardens during the ſummer, have an inſipid, but leſs diſagreeable flavour.

2. The aguti, is about the ſize of a hare, has a ſhort tail; four toes on the fore-feet, three on the hind ones; and a yellowiſh belly. According to M. Buffon, it is an animal peculiar to the ſouthern parts of America, being never found in the old world. It is common in Brazil, Guiana, St. Domingo, and all the iſlands; and ſeems to require a warm climate in order to ſubſiſt and multiply. However, they can live in France, if kept in a dry place, and ſheltered from winter-froſts. The aguti is a very miſchievous animal, and bites cruelly: he grunts like a pig; is very voracious; ſits on his hind-legs, and holds his food with the forefeet when he eats: hides what he cannot conſume: hops like a hare, and runs very faſt both on plain and riſing grounds: but as his fore-legs are much ſhorter than the hind-ones, he would tumble headlong if he did not ſlacken his courſe in deſcending. Both his eye and his ear are fine; he ſtops and liſtens to the ſound of muſic: the fleſh of thoſe which are fat and well fed is not very bad, though it be hard, and not very agreeable to the taſte. They ſcald the aguti, and make him ready in the ſame manner as a pig. He is hunted with dogs. When forced among the cut ſugar-canes, he is ſoon taken; becauſe theſe grounds being generally covered a foot thick with ſtraw and leaves, at each leap he ſinks in this litter, ſo that a man may overtake and ſlay him with a baton. He commonly runs very nimbly before the dogs; and when he gains his retreat, he lies ſquat, and remains obſtinately in his concealment. The hunters are obliged to chace him out by filling his hole with ſmoke. The animal, half ſuffocated, utters mournful cries; but never iſſues forth, unleſs when puſhed to the laſt extremity. His cry, which he often repeats when diſturbed or irritated, reſembles that of a ſmall hog. If taken young he is eaſily tamed, and goes out and returns of his own accord. Theſe animals commonly reſide in the woods and hedges, where the females chooſe a place well covered and buſhy, and there prepare a bed of leaves and hay for their young. They annually produce two or three, but generally two. Like the cats, they tranſport their young, two or three days after birth, into the hollow of trees, where they ſuckle them for a ſhort time; the young are ſoon in a condition to follow their mother, and to ſearch for food.

3. The leporinus, or Java hare, is about the ſize of an ordinary hare: the hair of a reddiſh brown-colour; the head ſmall in proportion to the body; the eyes large and prominent; the ears like thoſe of a rat; in other reſpects the head reſembles both a deer and hare; the hind-part of the body and thighs remarkably big; the legs long; four toes on the fore-feet, and three on the hind-feet: is a native of Java and Sumatra. The above deſcription was taken from an animal of this kind in the poſſeſſion of the duke of Richmond. It was very tame and inoffenſive, and fed only on fruit and other vegetables.

4. The citellus, or earleſs marmot, hath a ſhort tail, an aſh-coloured body, and no ears. It inhabits Bohemia, Auſtria, Hungary, and Siberia. They whiſtle like the marmot; are very irraſcible, and bite very ſeverely: their furs were once uſed by the ladies of Bohemia to make cloaks.

5. The lemmus, or lemming, hath a ſhort tail, five toes on both fore and hind feet, and the body is variegated with green and yellow. This creature, which is one of the moſt ſingular that we know of, is ſaid to be a native of the mountains of Kolin in Lapland.

land. They appear not every year; but at certain unforeſeen periods they come in ſuch numbers, that they ſpread every where, and cover the whole ſurface of the earth. The arrival of the lemmings is conſidered as a terrible ſcourge, the effects of which it is impoſſible to avoid. They make dreadful devaſtations in the fields; lay waſte the gardens; ruin the crops; and leave nothing, except what is ſhut up in houſes, where they never enter. They bark nearly like ſmall dogs. When attacked, they neither fear clubs nor halberds, but dart againſt thoſe who ſtrike them, outrageouſly biting, and fixing upon the weapons employed to kill them. When ſtruck at with a ſtick, they ſeize it ſo forcibly with their teeth, that they allow themſelves to be carried to a conſiderable diſtance without quitting their hold. They dig holes in the earth, and make roads like the moles in queſt of roots. They ſometimes make war, and divide themſelves into two armies along the lakes and meadows. Their enemies are foxes and ermines, who devour great numbers of them. Graſs that has been ate down, and ſprings again, is ſaid to kill them: and they ſeem likewiſe to commit ſuicide; for they are often found ſuſpended on the branches of trees; and they probably throw themſelves in troops into the waters like the ſwallows. It would alſo appear, that the lemmings, like the rats, mutually deſtroy and eat each other, when paſture fails them; and that this is the reaſon why their deſtruction is as ſudden as their multiplication. At particular times they aſſemble together, and the whole die in company. They are very courageous, and defend themſelves againſt other animals. It is not certainly known whence they come. Upon the renewal of the graſs they infallibly die. In fine weather they take to the water in vaſt multitudes; but when a breeze of wind ariſes, they are all drowned. The number of theſe animals is ſo prodigious, that when they die the air is infected, and produces many diſeaſes. They even ſeem to infect the plants which they gnaw; for the paſture then kills the cattle. The fleſh of the lemmings is not good to eat; and their ſkin, though the hair be fine, does not anſwer for making furs, becauſe it is too thick.

6. The Paca, or ſpotted cavy, is an animal peculiar to the new world, particularly Brazil. It has a ſhort tail, five toes on each foot, and three yellowiſh lines on each ſide. It reſembles a pig of two months old; and its fleſh is fat, and makes excellent food. Even the ſkin is eat, like that of a pig. For theſe reaſons this animal is in perpetual requeſt. It is difficult for the hunters to take him alive. When ſurpriſed in his hole, which they lay open both before and behind, he defends himſelf, and even bites fiercely. His ſkin, though covered with coarſe ſhort hair, makes a very good fur, becauſe it is regularly ſpotted on both ſides. Theſe animals produce often and in great numbers; many of them are deſtroyed by men and beaſts of prey, and yet the ſpecies is always numerous.

When kept in a wooden cage or box, this animal remains perfectly tranquil during the day, eſpecially when plentifully ſupplied with food. He ſeems even to have an affection for his retreat as long as the day laſts; for, after feeding, he retires ſpontaneouſly into it. But when night approaches, by perpetual reſtleſſneſs and agitation, and by tearing the bars of his priſon with his teeth, he diſcovers a violent deſire of getting out. Nothing of this kind happens during the day, unleſs he has occaſion for ſome natural evacuation; for he cannot endure the ſmalleſt degree of dirtineſs in his little apartment; and when about to void his excrements, always retires to the moſt diſtant corner he can find. When his ſtraw begins to ſmell, he often throws it out, as if he meant to demand freſh litter. This old ſtraw he puſhes out with his muzzle, and goes in queſt of rags or paper to replace it. In a female cavy, the following extraordinary inſtance of cleanlineſs was obſerved. A large male rabbit being ſhut up with her when ſhe was in ſeaſon, ſhe took an averſion to him the moment he voided his excrement in their common apartment. Before this ſhe was very fond of him; licked his noſe, ears, and body; and allowed him to take almoſt the whole food that was given her. But as ſoon as the rabbit had infected the cage with his ordure, ſhe retired into the bottom of an old preſs where ſhe made a bed with paper and rags, and returned not to her old lodging, till ſhe ſaw it neat, and freed from the unclean gueſt which had been preſented to her.

The ſpotted cavy is eaſily accuſtomed to a domeſtic life. Unleſs induſtriouſly irritated, he is gentle and tractable. He is fond of adulation, and licks the hands of the perſon who careſſes him. He knows thoſe who take care of him, and readily diſtinguiſhes their voices. When gently ſtroaked on the back, he ſtretches himſelf out, lies down on his belly, by a ſmall cry expreſſes his acknowledgment, and ſeems to aſk a continuance of the favour. When ſeized in a rough manner, however, he makes violent efforts to eſcape.

7. The marmota, or marmot, has a ſhort hairy tail, round ears, and gibbous cheeks. It is found only on the tops of the higheſt mountains, and is more ſubject to be rendered torpid by cold than any other. In the end of September, or beginning of October, he retires into his hole, from which he comes not out till the beginning of April. His retreat is capacious, broader than long, and very deep, ſo that it can contain ſeveral marmots, without any danger of corrupting the air. With their feet and claws, which are admirably adapted for the purpoſe, they dig the earth with ſurpriſing quickneſs, and throw it behind them. It is not a hole, or a ſtraight or winding tube, but a ſpecies of gallery made in the form of a Y, each branch of which has an aperture, and both terminate in one where the animal lodges. As the whole is made on the declivity of a mountain, the innermoſt part alone is on a level. Both branches of the Y are inclined, and the one is uſed for depoſiting the excrements of the animals, and the other for their going out and coming in. The place of their abode is well lined with moſs and hay, of which they make ample proviſion during the ſummer. They dwell together, and work in common at their habitations, where they paſs three-fourths of their lives. Thither they retire during rain, or upon the approach of danger; and never go out but in fine weather, and even then to no great diſtance. One ſtands centinel upon a rock, while the others ſport on the graſs, or are employed in cutting it to make hay. When the centinel perceives a man, an eagle, a dog, &c. he alarms the reſt with a loud whiſtle, and is himſelf the laſt to enter the hole. They make no proviſions for winter; nor have they in that ſeaſon any occaſion for them, as lying aſleep all that time. As ſoon as they perceive the firſt approaches of the ſleeping ſeaſon, they ſet to work in ſhutting up the two entrances of their habitation; and this they perform with ſuch labour and ſolidity, that it is eaſier to dig the earth any where elſe than in the parts they have fortified. They are at this time very fat, weighing ſometimes 20 pounds; and they continue to be plump for three months; but afterwards they gradually decay, and are extremely emaciated at the end of winter. When diſcovered in their retreats, they are found rolled up in the form of a ball, covered with hay; and they are carried off in ſo torpid a ſtate, that they may be killed without ſeeming to feel pain. The fatteſt are choſen for eating, and the young ones for taming. When taken young, they may be rendered nearly as tame as our other domeſtic animals. They learn to ſeize a ſtick, to dance, to perform various geſticulations, and to obey the voice of their maſter. Like the cat, the marmot has an antipathy againſt dogs. When he begins to be familiar in the houſe, and perceives that he is protected by his maſter, he attacks and bites dogs of the moſt formidable kind. Though not ſo large as a hare, he is ſtouter, and his ſtrength is aided by a peculiar ſuppleneſs and dexterity. With his fore-teeth, which are pretty long, he bites moſt cruelly; he attacks not, however, either dogs or men, unleſs previouſly irritated. If not prevented, he gnaws furniture and ſtuffs; and when confined, pierces even through wood. His voice reſembles the murmuring of a young dog when careſſed or in a ſporting humour; but, when irritated or frighted, he makes a whiſtling noiſe, ſo loud and piercing, that it hurts the ear. The marmots eat every thing preſented to them; as fleſh, bread, fruit, roots, pot-herbs, may-bugs, graſshoppers, &c. but milk and butter they prefer to every other aliment. Milk is alſo the only liquor that is agreeable to them; for they rarely drink water. They produce but once a-year, and the litter generally conſiſts of three or four. The growth of their young is very quick; they live only nine or ten years; and the ſpecies is neither numerous nor much diffuſed. The marmot would make very good eating, if it had not always a diſagreeable flavour, which cannot be concealed but by ſtrong ſeaſonings.

8. The monax, or marmot of Canada, has a hairy tail, an aſh-coloured body, roundiſh ears, and four toes on the fore-feet, and five on the hind-ones. It is a native of America, and differs very little from the former. Its fleſh is good and well taſted.

9. The cricetus, hamſter, or German marmot, is the moſt famous as well as the moſt deſtructive of all the rats. It has a tail of a moderate length, round ears, a black belly, and reddiſh ſides, with three white ſpots. This creature ſleeps during the winter like the marmots; when in a torpid ſtate, neither reſpiration, nor any kind of feeling, can be perceived. The heart, however, beats 15 times in a minute, which has been diſcovered by opening the cheſt. The blood continues to be fluid, but the inteſtines are not irritable; even an electrical ſhock does not awake him; but in the open air he never becomes torpid. When dug up in his ſtate of torpidity, the hamſter is found with his head bent under his belly between the two fore-legs, and thoſe behind reſt upon his muzzle. The eyes are ſhut; and when the eye-lids are forced open, they inſtantly cloſe again. The members are ſtiff, like thoſe of a dead animal, and the whole body feels as cold as ice. When diſſected during this ſtate, he ſeems to feel very little; ſometimes indeed he opens his mouth as if he wanted to reſpire; but his lethargy is too ſtrong to admit of his awakening entirely. This lethargy hath been aſcribed ſolely to a certain degree of cold; which indeed may be true with regard to dormice, bats, &c. But experience ſhews, that, in order to render the hamſter torpid, he muſt alſo be excluded from all communication with the external air; for when he is ſhut up in a cage filled with earth and ſtraw, and expoſed in winter to a degree of cold ſufficient to freeze the water, he never becomes torpid: but when the cage is ſunk four or five feet under ground, and well ſecured againſt the acceſs of the air, at the end of eight or ten days he is equally torpid as if he had been in his own burrow. If the cage is brought up to the ſurface, the hamſter will awake in a few hours, and reſume his torpid ſtate when put below the earth. The experiment may be repeated with the ſame ſucceſs as long as the froſt continues. We have a farther proof that the abſence of the air is one of the cauſes of torpidity in the hamſter; for when brought up from his hole in the coldeſt weather, and expoſed to the air, he

infallibly awakes in a few hours. This experiment ſucceeds as well in the night as in the day; which ſhews that light has no ſhare in producing the effect. It is curious to obſerve the hamſter paſſing from a torpid to an active ſtate. He firſt loſes the rigidity of his members, and then makes a profound reſpiration, but at long intervals. His legs begin to move, he opens his mouth, and utters diſagreeable and rattling ſounds. After continuing theſe operations for ſome time, he opens his eyes, and endeavours to raiſe himſelf on his legs. But all theſe movements are ſtill reeling and unſteady, like thoſe of a man intoxicated with liquor. He, however, reiterates his efforts till he is enabled to ſtand on his legs. In this attitude he remains fixed, as if he meant to reconnoitre and repoſe himſelf after his fatigue; but he gradually begins to walk, eat, and act in his uſual manner. This paſſage from a torpid to an active ſtate, requires more or leſs time, according to the temperature of the air. When expoſed to a cold air, he ſometimes requires more than two hours to awake; and in a more temperate air he accompliſhes his purpoſe in leſs than one hour. It is probable that, when the hamſter is in his hole, this change is performed imperceptibly, and that he feels more of the inconveniencies which ariſe from a ſudden and forced reviviſcence.

The hamſter is a very miſchievous animal; and ſo exceedingly fierce, that he ſeems to have no other paſſion but rage. In conſequence of this, he attacks every other animal that comes in his way, without regarding the ſuperior ſize or ſtrength of his antagoniſt; nay as if he was ignorant of the method of ſaving himſelf by flight, he allows himſelf to be beat to pieces with a ſtick, rather than yield. If he ſeizes a man's hand, he muſt be killed before he quits his hold. When the hamſter perceives a dog at a diſtance, he begins with emptying his cheek-pouches if they happened to be filled with grain, and which are ſo capacious as to hold a quarter of a pint Engliſh. He then blows them up ſo prodigiouſly, that the ſize of the head and neck greatly exceeds that of the body. Laſtly, he raiſes himſelf on his hind-legs, and in this attitude darts on his enemy. If he catches hold, he never quits it but with the loſs of life. But the dog generally ſeizes him behind, and ſtrangles him. This ferocious temper prevents the hamſter from being at peace with any other animal. He even makes war againſt his own ſpecies, not excepting the females. When two hamſters encounter, they never fail to attack each other, and the ſtronger always devours the weaker. A combat between a male and a female, laſts longer than between two males. They begin by purſuing and biting each other; then each of them retires to a ſide as if to take breath; a little after, they renew the combat, and continue to fly and to fight till one of them falls. The vanquiſhed uniformly ſerves for a repaſt to the conqueror.

The hamſters copulate about the end of April; when the males enter the apartments of the females, where they remain only a few days. If two males happen to meet in the ſame hole, a furious combat enſues, which generally terminates in the death of the weakeſt. The conqueror takes poſſeſſion of the female, and both, though at every other period they perſecute and kill each other, lay aſide their natural ferocity during the few days their amours continue. They even mutually defend each other againſt agreſſors; and if a hole is opened about this time, the female defends her huſband with the utmoſt fury. The females bring forth twice or thrice every year. Their litter is never fewer than ſix, and more frequently than from 16 to 18. Their growth is very rapid. At the age of 15 days they begin to dig the earth: and ſoon after, the mother baniſhes them from her habitation; ſo that at the age of about three weeks they are abandoned to their own management. The mother in general diſcovers little affection for her offspring; and when her hole is opened, flies in the moſt daſtardly manner, leaving her young ones to periſh. Her only ſolicitude at that time is to provide for her own defence. With this view ſhe digs deeper into the earth, which ſhe performs with amazing quickneſs. The young would willingly follow her; but ſhe is deaf to their cries, and even ſhuts the hole which ſhe had made.

As the hamſter lives on grains, and dwells under the earth, ſome kinds of ſoils are inconvenient for him. In Thuringia, the ſoil of which poſſeſſes all theſe qualities, the hamſters are more numerous than in any other country. The habitations are dug to the depth of three or four feet, and conſiſt of more or fewer apartments, according to the age of the animal.

The hamſter feeds upon all kinds of herbs, roots, and grains, which the different ſeaſons produce. To facilitate the tranſportation of his food, nature has furniſhed him with two pouches in the inſide of each cheek. On the outſide, theſe pouches are membranous, ſmooth, and ſhining; and in the inſide there are a great many glands, which ſecrete a certain fluid, to preſerve the flexibility of the parts, and to enable them to reſiſt any accidents which may be occaſioned by the roughneſs or ſharpneſs of particular grains. Each of theſe receptacles is capable of containing an ounce aud an half of grain, which, on his return to his lodging, he empties, by preſſing his two fore-feet againſt his cheeks. When we meet a hamſter having his cheeks filled with proviſions, it is eaſy to ſeize him with the hand, without the riſk of being bitten: becauſe in this condition he has not the free motion of his jaws. But if he is allowed a little time, he ſoon empties his pouches, and ſtands upon his defence. The quantity of proviſions found in the holes depends on the age and ſex of the inhabitant. The old hamſters frequently amaſs 100 pounds of grain; but the young, and the females, content themſelves with a quantity much ſmaller. Their object in laying up proviſions, is not to nouriſh them during winter, which they paſs in ſleep, and without eating; but to ſupport them after they awake in the ſpring, and previous to their falling into a torpid ſtate, which reſembles a profound ſleep. At the approach of winter, the hamſters retire into their ſubterraneous abodes, the entrance to which they ſhut up with great addreſs. Here the animal repoſes, in the ſituation already deſcribed, upon a bed of ſtraw; and in this ſtate he is commonly dug up. In winter the peaſants generally go a *hamſter-neſting* as they call it; the retreat is known by a ſmall eminence of earth raiſed near the oblique paſſage formerly deſcribed. The peaſants dig down till they diſcover the hoard, and are generally well paid for their trouble; as they often find two buſhels of corn, beſides the ſkins of the animals, which are valuable furs; and it is remarkable that the hair ſticks ſo faſt to the ſkin, that it cannot be plucked off without the utmoſt difficulty. In ſome ſeaſons the hamſters are ſo numerous, that they occaſion a dearth of corn. Pole-cats are their greateſt enemies; for they purſue them into their holes, and deſtroy great numbers.

10. The terreſtris, or ſhort-tailed field-mouſe, has a hairy tail, with four toes on the fore-feet, and five on the hind-ones, and ears ſhorter than the hair. It inhabits Europe, and is found in great numbers in Newfoundland. It digs holes in the earth, where it amaſſes grain, filberts, and acorns: but it appears to prefer corn to every other food. When the grain is ripe, the ſhort-tailed field-mice aſſemble from all quarters, and often do great damage by cutting the ſtalks of corn, in order to come at the ears. They follow the reapers and eat up all the fallen and neglected grain. When the gleanings are devoured, they flock to the new ſown fields, and deſtroy the crop of the enſuing year. In winter moſt of them retire into the woods, where they feed upon filberts, acorns, and the ſeeds of trees. In particular years they appear in numbers ſo immenſe, that they would deſtroy every thing if they continued long: but they always kill and eat one another during a ſcarcity of proviſions. They beſides are devoured by the long-tailed field-mice, by foxes, wild-cats, and weaſels. Theſe creatures are often carried home in the ſheaves of corn, and 100 of them have been found in houſing a rick. This animal makes its neſt in moiſt meadows, and brings eight young at a time: it has a ſtrong affection for them; one that was ſeduced into a wire-trap by placing its brood in it, was ſo intent on foſtering them, that it appeared quite regardleſs of its captivity. In Newfoundland, theſe mice are very deſtructive to gardens; but ſeldom do much damage in this way in Britain.

11. The amphibious, or water-rat, has a long hairy tail, but not palmated feet, as is ſaid by Linnæus. It is about the ſize of a rat, but in its manners reſembles the otter much more than the rat. Like the otter, it frequents the freſh water, and is found on the banks of rivers, brooks, and pools. Gudgeons, minnows, blays, and the fry of carps, pikes, and barbels, are its ordinary food. It likewiſe eats frogs, water-inſects, and ſometimes the roots of plants. He ſwims with great eaſe, keeps long under water, and carries off his prey to be devoured on the graſs or in his hole. He is ſometimes ſurpriſed by the fiſhermen when ſearching for craw-fiſh; and he endeavours to eſcape by biting their fingers, or leaping into the water. Like the otter, he avoids large rivers, or rather thoſe which are much frequented. He never viſits houſes nor barns; but keeps upon the margins of waters, from which he wanders not upon dry land ſo far as the otter, who is ſometimes found at the diſtance of a league from water. Water-rats are ſeldom met with in elevated places or dry plains, but are extremely numerous in moiſt and marſhy valleys. The females come in ſeaſon about the end of winter, and bring forth in the month of April, the litter generally conſiſting of ſix or ſeven. Perhaps they bring forth more than once a-year; but of this we have no proper knowledge. This animal, as well as the otter, is eaten by the French peaſants on *maigre*-days. Water-rats are found all over Europe, excepting in the polar regions. According to Bellon, they inhabit the banks of the Nile; but the figure he gives of them has ſo little reſemblance to our water-rat, that it is probable the Nile-rats belong to another ſpecies of animals.

12. The rattus, or common rat, is the moſt pernicious of any of our ſmaller quadrupeds. Meat, corn, paper, cloaths, furniture, in ſhort every conveniency of life, is a prey to this deſtructive creature. Nor are its devaſtations confined to theſe; for it will make equal havock among poultry, rabbits, or young game; nay, it hath been known to gnaw the extremities of infants when aſleep. It is a domeſtic animal, reſiding very frequently in houſes, barns or granaries; and it is furniſhed with fore-teeth of ſuch ſtrength as enable it to force its way through the hardeſt wood or the oldeſt mortar. Several ſmall animals have been confounded under the general name of *rat*; but the appellation ſeems properly to belong only to two; namely, the common black, and the brown rats. The black rats are not of a perfectly black colour, but of a deep iron grey, with an aſh-coloured belly, the legs duſky, and almoſt naked; they have a claw, in the place of a fifth toe, on the fore-feet; the length from the noſe to the tail ſeven inches, the tail nearly eight. It inhabits moſt parts of Europe, but of late the numbers have

been very much leſſened by the other kind. It makes a lodge either for its day's reſidence, or a neſt for its young, near a chimney; and improves the warmth of it, by forming there a magazine of wool, bits of cloth, hay, or ſtraw. It lodges alſo in cielings, and in the void ſpaces between the wall and the wainſcotting. From theſe lurking places the rats iſſue in queſt of food, and tranſport thither every ſubſtance they can drag, forming conſiderable magazines, eſpecially when they have young to provide for. The female brings forth ſeveral times in a year, but always in the ſummer ſeaſon. The litter generally conſiſts of five or ſix; and in ſpite of poiſon, traps, and cats, they thus multiply to ſuch a degree as ſometimes to do a great deal of damage. In old country-houſes where grain is kept, and where the vicinity of barns and magazines facilitates their retreats, they often increaſe ſo prodigiouſly, that the poſſeſſors are obliged to remove and deſert their habitations, unleſs the rats happen to deſtroy each other. This, however, frequently happens; for theſe creatures, when pinched for food, deſtroy each other. When a famine happens by reaſon of too many being crowded into one place, the ſtrong kill the weak, open their heads, and firſt eat the brain, and then the reſt of the body. Next day the war is renewed, and continues in the ſame manner till moſt of them are deſtroyed; which is the reaſon why theſe animals, after being extremely troubleſome for ſome time, diſappear all of a ſudden, and do not return for a long time.

Rats are extremely laſcivious; they ſqueak during their amours, and cry when they fight. They ſoon learn their young to eat; and when they begin to iſſue from the hole, their mother watches, defends, and even fights with the cats, in order to ſave them. The weaſel, though ſmaller, is a much more dangerous and formidable enemy to the rat, becauſe he can follow it into its retreat. Their ſtrength being nearly equal, the combat often continues for a long time, but the method of uſing their arms is very different. The rat wounds only by reiterated ſtrokes with his fore-teeth, which are better formed for gnawing than biting; and being ſituated at the extremity of the lever or jaw, they have not much force. But the weaſel bites cruelly with the whole jaw, and inſtead of letting go its hold, ſucks the blood from the wounded part, ſo that the rat is always killed. The rat was firſt introduced into America by the Europeans in 1544, and is now the peſt of all that continent.

The brown or Norway rat is much larger than the black kind; being nine inches from the end of the noſe to the beginning of the tail; the length of the tail itſelf is the ſame, the uſual weight 11 ounces. Notwithſtanding its name, however, it is not known in Norway, nor in any part of Scandinavia. It was never known in Britain till about 45 years ago; and made its appearance in the neighbourhood of Paris only about 22 years ago. Mr. Pennant ſuſpects, that this rat came originally in ſhips from the Eaſt Indies; a large brown ſpecies being found there, called *bandicotes* by the natives, which burrow under ground. Barbot alſo mentions a ſpecies inhabiting the fields in Guinea, and probably the ſame with this. Wherever this creature has taken up its reſidence, it hath totally extirpated the black kind: however, it is to be feared we ſhall reap little benefit by the exchange; for the Norway rat hath the ſame diſpoſition, with greater abilities for doing miſchief than the common kind. It burrows, like the water-rat, in the banks of rivers, ponds, and ditches; it takes the water very readily, and ſwims and dives with great celerity: like the black ſpecies, it preys on rabbits, poultry, and all kinds of game. It increaſes moſt amazingly faſt, producing from 14 to 18 young at a time. Its bite is not only ſevere but dangerous; the wound being immediately attended with great ſwelling, and is a long time in healing. Theſe creatures are ſo bold as to turn upon thoſe who purſue them, and faſten on the ſtick or hand of ſuch as offer to ſtrike them.

13. The muſculus, or common mouſe, has the ſame inſtinct, and the ſame conſtitution and natural diſpoſitions with the rat, differing only in the mere circumſtances of ſize and ſtrength. He hath many enemies, from whom he can eſcape only by his agility and minuteneſs. Owls, birds of prey, cats, weaſels, and even rats, make war upon the mice, ſo that they are deſtroyed by millions; yet the ſpecies ſtill ſubſiſts by its amazing fecundity. They bring forth at all ſeaſons, and ſeveral times in the year: the litter generally conſiſts of five or ſix; and in leſs than 15 days the young diſperſe, and are able to provide for themſelves. Ariſtotle tells us, that having ſhut up a pregnant mouſe in a veſſel, along with plenty of grain, he found in a ſhort time after 120 mice, all ſprung from the ſame mother.

14. The avellanarius, or dormouſe, is equal in ſize to the former, but of a plumper appearance; the noſe is more blunt. Dormice inhabit woods, or very thick hedges; forming their neſts in the hollow of ſome low tree, or near the bottom of a cloſe ſhrub: they form little magazines of nuts, and eat in an upright poſture like the ſquirrel. The conſumption of their hoard, however, during the rigour of the ſeaſon, is but ſmall; for they ſleep moſt of the time, retiring into their holes; at the approach of winter, they roll themſelves up, and become torpid. Sometimes they experience a ſhort revival in a warm ſunny day; when they take a little food, and relapſe into their former ſtate. Theſe animals ſeldom appear far from their retreats, or in any open place; for which reaſon they ſeem leſs common in Britain than they really are. They make their neſts of moſs, graſs, and dead leaves; and bring uſually three or four young at a time.

15. The quercinus, or garden-ſquirrel, has a long hairy tail, with a black ring under the eyes. It is a native of the ſouth of Europe, where it live chiefly in gardens though it ſometimes is found in houſes. They are very deſtructive to fruit, particularly peaches, which they ſeem to prefer to every other kind. They alſo eat peaſe, apricots, and plums; and when ſoft fruits are not to be had, they will eat almonds, filberts, nuts, and even leguminous plants. Of theſe they carry off great quantities into their retreats, which they dig in the earth, and particularly in well cultivated gardens; for in old orchards they are often found in hollow trees, where they make beds of herbs, moſs, and leaves. Eight or ten of them are frequently found in the ſame place, all benumbed, and rolled up in the midſt of their proviſion of fruits and nuts. They copulate in ſpring, and bring forth in ſummer. The litter conſiſts of five or ſix young, who grow very quickly, but are not fertile till the next year. Their fleſh is not eatable, but has the ſame diſagreeable odour with the domeſtic rat.

16. The gregarius, or gregarious mouſe, has a tail about one-third the length of its body, and ſomewhat hairy; the body is of a greyiſh colour, and the legs white. It is a native of Germany and Sweden, is ſomewhat larger than the common mouſe; eats ſitting up; burrows, and lives under ground.

17. The ſylvaticus, or long-tailed field-mouſe, meaſures, from the end of the noſe to the ſitting on of the tail, four inches and an half; the tail is four inches long; the upper part of the body of a yellowiſh brown mixed with ſome duſky hairs: the breaſt is of an ochre colour, the reſt of the under ſide is white; the tail is covered with ſhort hair. Theſe animals are found only in fields and gardens; in ſome places they are called *bean-mice*, from the havock they make among beans when firſt ſown. They feed alſo on nuts, acorns, and grain, of which they amaſs quantities, not proportioned to their wants, but to the capacity of the place where it is depoſited, inſomuch that a ſingle animal will collect more than a buſhel. Thus they provide for other animals as well as themſelves: the hog comes in for a ſhare; and the great damage done to the fields by theſe creatures, in rooting up the ground, is chiefly owing to their ſearch after the concealed hoards of the field-mice.

The holes of the field-mice are generally a foot under ground, and often divided into two apartments, the one for living in with their young, and the other for a magazine. M. Buffon informs us, that he has often ſeen great damage done to the plantations by theſe animals. They carry off the new-ſown acorns; by following the furrow of the plough, they dig up one after another, not leaving a ſingle ſeed. The only way to prevent this damage is, to lay traps at ten paces aſunder, through the extent of the ſown field. No other apparatus is neceſſary than a roaſted walnut placed under a flat ſtone, ſupported by a ſtick. The animals come to eat the walnut, which they prefer to acorns; and as it is fixed to the ſtick, whenever they touch it, the ſtone falls down, and cruſhes them to death.

The ſame expedient M. Buffon alſo made uſe of with ſucceſs againſt the ſhort-tailed field-mouſe, which alſo deſtroys acorns. In this way he found that upwards of 100 were taken each day, from a piece of ground conſiſting only of about 40 French arpents. From the 15th of November to the 8th of December, above 2000 were caught in this manner. Their numbers gradually diminiſhed till the froſt became ſevere, which is the time they retire into their holes, to feed on their magazines. In autumn they are moſt numerous; for if proviſions fail during the winter, they devour one another. The long-tailed mice eat alſo the ſhort-tailed ſpecies; and even thruſhes, blackbirds, &c. which they find entangled in ſnares. They firſt eat the brain, and then the reſt of the body. M. Buffon once kept a dozen of theſe mice in a cage, and furniſhed them with food every morning at eight o'clock. One day they were neglected for about a quarter of an hour, when one of their number was eaten up by the reſt; next day another ſuffered the ſame fate; and in a few days only one remained: all the others had been killed, and partly devoured; and even the ſurviver himſelf had his feet and tail mutilated. Theſe animals are very prolific, producing more than once a-year, and bringing nine or ten at a birth. They generally make the neſt for their young very near the ſurface, and often in a thick tuft of graſs.

18. The ſtriatus, or ſtreaked mouſe, has four toes on the fore-feet, and five on the hind-ones, longitudinal ſtreaks on the body, with white ſpots. It is a native of India.

19. The longipes has a long covered tail, four toes on the fore-feet, five on the hind-ones, and very long thighs. It is found in the torrid zone, and is mentioned only by Linnæus.

20. The jaculus, or jerboa, inhabits Barbary, Paleſtine, Egypt, and the deſarts between Balſora and Aleppo. The head hath a great reſemblance to that of the rabbit; but its eyes are larger, and its ears ſhorter, higher, and broader, in proportion to its ſize. The noſe is fleſh-coloured and naked, and the muzzle is thick and ſhort. The opening of the mouth is very ſmall, the upper jaw broad, and the under jaw narrow and ſhort. The teeth are like thoſe of the rabbit, and the whiſkers round the mouth are compoſed of long black and white hairs. The fore-feet are extremely ſhort, and never touch the ground; being uſed only as hands to convey victuals to the mouth. Theſe hands have four fingers armed with claws, and the rudiments of a fifth without any claw. The hind-feet have only three

toes, the middle one of which is the longeſt, and all three are armed with claws. The legs are naked and fleſh-coloured, as well as the noſe and ears. The top of the head and back are covered with reddiſh hair; and the flanks, the under-part of the head, the throat, the belly, and the inſides of the thighs, are white. Below the reins, and near the tail, there is a large, black, tranſverſe band, in the form of a creſcent. Theſe animals generally conceal their hands or fore-feet among the hair, ſo that at firſt ſight they ſeem to have only two feet. In tranſporting themſelves from place to place, they do not walk, or advance one foot before the other, but leap nimbly to the diſtance of five or ſix feet from the ground. When repoſing themſelves, they ſit on their knees, and ſleep only during the day. They eat grain and herbage like the hare. Their diſpoſitions are mild, and yet they can never be perfectly tamed. They dig holes in the earth like rabbits, and in a much ſhorter time. Two that were kept in a houſe in London, burrowed almoſt through the brick-wall of the room where they were: they came out of their hole at night for food, and when caught were much fatter and ſleeker than when confined to their box. This animal is eaten by the Arabs, who call it the *lamb of the children of Iſrael*. Bochart thinks it is the *Saphon* of holy writ, and diſplays a vaſt deal of learning on the ſubject.

MUSCADINE, a rich wine, of the growth of Provence, Languedoc, Cividad, &c. The word, as well as the liquor, is French: ſome fetch its origin from *muſk*, the wine being ſuppoſed to have a little of the ſmell of that perfume: others from *muſca*, a *fly*, becauſe the flies are extremely fond of its grapes; as the Latins had their *vinum apinum*, ſo called, *ab apibus*, from the bees which fed on the grapes it was made of. The way of making *muſcadine* at Frontinac is as follows: they let the *muſcadine* grapes grow half dry on the vine, and, as ſoon as they are gathered, they tread and preſs them immediately, and tun up the liquor, without letting it ſtand and work in the vat; the lee occaſioning its goodneſs. Phil. Tranſ. abr. vol. ii. p. 657.

MUSCÆ *Volitantes*, in optics, dark irregular veins and ſpots, ſeeming to fly before the eyes of many people, eſpecially on looking at bright objects, ſuch as white paper, the ſky-light, the candle, &c. Theſe have only the appearance of cobwebs, ſometimes that of ſmoke, duſt, &c. The reſemblance of many of theſe ſpots to flies has given them the name of *muſcæ volitantes*, q. d. *flies flying about*. This phenomenon is not eaſy to account for. Some will have its cauſe to lie in the aqueous humour; others in the retina The ſpots that appear fixed in reſpect to the axis of the eye, muſt be cauſed by ſome diſorder in a correſponding part of the retina, or in ſome part of the vitreous humour lying pretty cloſe to the retina. For an opacity of the coats or humours in any part remoter from the retina, by intercepting ſome part of the rays of every pencil, could only cauſe an uniform obſcurity or faintneſs of light in every place of the retina, and not a total defect of it in any particular place. Hence M. de la Hire attributes the cauſe of theſe permanent ſpots to ſmall drops of extravaſated blood upon the retina.

Pitcarn denies the cauſe of the *muſcæ volitantes* to lie in the aqueous humour, and ſays it is owing to, and a ſign of, an internal inflammation of the veſſels of the retina. Heiſter thinks them owing to ſome obſtruction of thoſe veſſels; and both theſe authors, and many others, think them fore-runners of a gutta ſerena, or a cataract; and propoſe a cure by mercurials and decoctions of guaiacum. See Pitcairn's Elem. Medic. & Heiſter's Compend. Medic. Practic. Plempius has given a deſcription of the *muſcæ volitantes*, in his Ophthalmographia.

It cannot be denied, that many who have fallen into thoſe terrible diſorders have had thoſe appearances before their eyes; and hence they might have been taken for prognoſtics. But as it is no leſs certain, that many thouſands have the ſame appearances, and yet preſerve their ſight very well to the laſt, there ſeems to be no great reaſon to be alarmed about them; and far leſs ſhould people be running to quacks, and injuring their ſtomachs and conſtitutions by ill-judged phyſic on ſuch occaſions. St. Yves denies theſe appearances to be at all dangerous, and he thinks them owing to the ſeparation of ſome parts of the retina from the choroid. However, as the diſorder is troubleſome and alarming to the patient, he adviſes purgatives from time to time, and mellipedes. We can ſay, from experience, that neither mercurials, nor ſea-water, nor other purgatives, nor mellipedes, nor again Tunbridge or other chalybeate waters, have had any effect towards removing or diminiſhing theſe diſorders. A greater doſe of wine than uſual has been known to increaſe it for a little time; and Plempius has made the like obſervation. We ſhall only add, that ſeveral of theſe flying appearances reſemble little globules joined by threads; and theſe globules appear in different numbers, and at different diſtances.

MUSCI, MOSSES, one of the ſeven families into which all vegetables are divided by Linnæus in the *Philoſophia Botanica*; viz. *Fungi, Algæ, Muſci, Filices, Gramina, Palmæ, Plantæ*. The characteriſtics of theſe plants, according to the ſexual ſyſtem, are,

1. Tops, without filaments or threads. 2. The male flower, conſtituted by the preſence of the *antheræ* or tops, placed apart from the female, either on the ſame or diſtinct roots. 3. The female flowers deprived of the *piſtillum*, or pointal. 4. The ſeeds devoid of both lobes (*cotyledones*) and proper coverings; ſo that they exhibit the naked embryo.

This tribe of plants, as well as the muſhrooms, ferns, and ſea-weed, is ſtill imperfectly known. Dillenius, profeſſor of botany at Oxford, was the firſt who attempted an arrangement of them. In his *Catalogus Plantarum circa Giſſam* publiſhed at Francfort in 1719, and afterwards in his *Hiſtoria Muſcorum* publiſhed at Oxford in 1741, he divides the moſſes into 16 genera. This arrangement, however, includes the lichens, ſome of the fuci, and other plants which belong to very different families. The work in queſtion is, notwithſtanding, valuable, in having introduced the knowledge of upwards of 200 plants, which were unknown before Dillenius: it is, beſides, of all his works of this kind, the beſt executed, both for the deſcriptions and figures, and ſhould ſerve as a model to ſuch authors as intend to publiſh in detail the hiſtory of any particular family of plants. Micheli, in a work intitled *Nova Plantarum Genera*, publiſhed at Florence in folio in 1629, divides the moſſes into two ſections, from the figure and ſituation of their flowers. Theſe ſections comprehend together 16 genera, amongſt which are improperly arranged, like thoſe of Dillenius, ſeveral of the lichens and other ſea-weed. The diſcovery of the ſeeds of the moſſes though made by Dillenius in 1719, is arrogated by Linnæus to himſelf, who did not begin to write till 1735.

In Ray's method, the moſſes form the third claſs: in Tournefort's they conſtitute a ſingle genus, by the name of *muſcus*, in the firſt ſection of the 17th claſs, which comprehends the moſſes, muſhrooms, and ſome of the algæ or ſea-weed, and is diſtinguiſhed by the name of *aſpermæ*, or plants without ſeed; the ſeeds of the moſſes not having been detected by Tournefort.

In the ſexual ſyſtem, theſe plants conſtitute the ſecond order of the claſs *cryptogamia*, which contains all the plants in which the parts of the flower and fruit are wanting, or not conſpicuous. This order is ſubdivided into 11 genera, from the preſence or abſence of the calix, which in theſe plants, is a veil or cover like a monk's cawl, that is placed over the male organs, or tops of the ſtamina, and is denominated *calyptra*; from the ſexes of the plants, which bear male and female flowers, ſometimes on the ſame, ſometimes on diſtinct roots; and from the manner of growth of the female flowers, which are ſometimes produced ſingly, ſometimes in bunches or cones. Theſe diſtinctions are moſtly borrowed from Dillenius, whoſe excellence in developing this part of the vegetable kingdom Linnæus very readily acknowledges.

MUSCICAPA, or FLY-CATCHER, in the Linnæan Syſtem, the 73d genus of birds, and belonging to the 6th order, paſſeres. The moſt remarkable ſpecies is the griſola, or ſpotted fly-catcher. It is a bird of paſſage, appears in the ſpring, breeds with us, and retires in Auguſt. It builds its neſt on the ſides of trees, towards the middle: Morton ſays, in the corners of walls where ſpiders weave their webs. Mr. Pennant has ſeen them followed by four or five young, but never ſaw their eggs. When the young can fly, the old ones withdraw with them into thick woods, where they frolic among the top-branches; dropping from the boughs frequently quite perpendicular on the flies that ſport beneath, and riſe again in the ſame direction. It will alſo take its ſtand on the top of ſome ſtake or poſt, from whence it ſprings forth on its prey, returning ſtill to the ſame ſtand for many times together. They feed alſo on cherries, of which they ſeem very fond.

The head is large, of a browniſh hue ſpotted obſcurely with black; the back of a mouſe-colour; the wings and tail duſky; the interior edges of the quill-feathers edged with pale yellow: the breaſt and belly white; the ſhafts of the feathers on the former duſky: the throat and ſides under the wings are daſhed with red: the bill is very broad at the baſe, is ridged in the middle, and round the baſe are ſeveral ſhort briſtles; the inſide of the mouth is yellow; the legs and feet are ſhort and black. Latham in his improved arrangement, makes it the 38th genus and belonging to the Paſſerine order. For repreſentation according to this arrangement, ſee the Syſtem of ORNITHOLOGY, and Plate III.

MUSCLE, in anatomy. For a full and copious deſcription of the muſcular part of the Human Syſtem, ſee the SYSTEM, Part III. which comprehends their definitions, attachments, names, origin, inſertion and uſes; for their reſpective repreſentations, ſee Plates II. III. and IV.

MUSCLES *of Vegetables*. The muſcles in animal bodies have been the ſubject of numerous diſſertations; but thoſe in vegetables have been leſs regarded. Mr. Tournefort, however, has plainly proved, that many of the veſſels of plants become in the drying fibres capable of tenſion; that in many plants there are great numbers of theſe fibres which have all the ſame direction, and always act all together, and can only ſhorten or contract themſelves in one particular direction; wherefore the parts compoſed of theſe fibres are very properly compared to the *muſcles* of animals. By the word *muſcle* we underſtand a part compoſed of fibres ſo determinately arranged, that by their contraction they can only move the part in ſome certain and determinate manner; and in this, which ſeems the received ſenſe of the word, there are many inſtances in which it may be applied to parts of plants, with the ſtricteſt juſtice.

MUSCLE, the Engliſh name of the *mytulus*, or *mytilus*, a genus of ſhell-fiſh, in the Linnæan ſyſtem of vermeology. For deſcription of the generic and ſpecific characters, ſee MYTULUS. For the claſſification, ſee Syſtem of VERMEOLOGY. For the ſhell, as forming a diſtinct branch of Natural Hiſtory, ſee the Syſtem of CONCHOLOGY. For the claſſification, ſee the *Synoptical Table*.

Thoſe who have eat muſcles have ſometimes, but very rarely, been affected with eryſipelatous inflammations, cutaneous eruptions, inſupportable itching all over the body, great reſtleſſneſs and agitation; and though theſe complaints are eaſily removed, by oil, milk, and emetics, and have ſeldom or never proved mortal, yet they have an alarming aſpect, and make the patient ſuffer grievouſly. Some authors have pretended, that theſe noxious effects never have place but between the vernal and autumnal equinox: and M. Beunie, phyſician at Antwerp, in a memoir on this ſubject, ſeems inclined to adopt this opinion; for he recommends abſtinence from muſcles during the months of May, June, July, and Auguſt. The cauſe of theſe noxious effects in the muſcles is, according to this author, altogether accidental. They are occaſioned, he ſays, by a kind of *ſtella marina*, a little ſea-inſect, pretty common about the mouth of the Scheld, which ſometimes lodges itſelf in the muſcle, in queſt of food, and whoſe ſpawn is ſo cauſtic and inflammatory, that even when applied outwardly to the ſkin, it produces itchings and ſwellings that are painful and diſagreeable in a high degree.

The itching occaſioned by touching the ſpawn of the *ſtella marina* is removed by vinegar; and this known fact induced Dr. Bennie to preſcribe the internal uſe of vinegar, after bleeding, evacuations and emetics. His method conſiſts in recommending a large quantity of refreſhing beverage, and, every hour, three ounces of vinegar diluted in water. This remedy, however, ſeems rather to confirm the opinion of thoſe who impute the diſorder in queſtion to an unperceived commencement of putrefaction in the *muſcle*; as vinegar is known to be a powerful antiſeptic, and there is no ſort of putrefaction more noxious and offenſive than that of fiſh. Mem. de l'Academie Imp. & Roy. des Scienc. & Belles Lettres de Bruxelles, &c. vol. i. mem. 8.

MUSEUM, a name which originally ſignified a part of the palace of Alexandria, which took up at leaſt one fourth of the city. This quarter was called the *muſeum*, on account of its being ſet apart for the muſes and the ſtudy of the ſciences. Here were lodged and entertained the men of learning; who were divided into many companies or colleges, according to the ſciences of which they were the profeſſors; and to each of theſe houſes or colleges was allotted a handſome revenue. The foundation of this eſtabliſhment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word *muſeum* is now applied to any place ſet apart as a repoſitory for things that have an immediate relation to the arts.

The muſeum at Oxford, called the *Aſhmolean muſeum*, is a noble pile of building, erected at the expence of the univerſity, at the weſt end of the theatre, at which ſide it has a magnificent portal, ſuſtained by pillars of the Corinthian order. The front, which is to the ſtreet, extends about 60 feet, where there is this inſcription over the entrance in gilt characters, *Muſeum Aſhmoleanum ſchola naturalis hiſtoriæ, officina chymica*. It was begun in 1679, and finiſhed in 1683, when a valuable collection of curioſities was preſented to the univerſity by Elias Aſhmole, Eſq; which were the ſame day repoſited there; ſeveral acceſſions have been ſince made to the muſeum; among which are hieroglyphics, and other Egyptian antiquities, an entire mummy, Roman antiquities, altars, medals, lamps, &c. and a variety of natural curioſities.

The Britiſh muſeum in London is a large, beautiful, and magnificent building, the nobleſt cabinet of curioſities in the world. This edifice was erected in 1677; and was called *Montague-houſe*, from having been the town-reſidence of the dukes of Montague. In the year 1753, the Britiſh parliament paſſed an act for purchaſing the muſeum of the late Sir Hans Sloane, and the collection of manuſcripts of the late Lord Oxford, called the *Harleian library*, for the uſe of the public, by which it may be rendered of no leſs general benefit to trade, than to the advancement of natural knowledge and experimental philoſophy. Twenty-ſix truſtees were appointed and incorporated, to provide a repoſitory for thoſe and ſome other collections, which repoſitory was to be called the Britiſh Muſeum. Theſe truſtees elected 15 other truſtees; and, having bought Montague-houſe, fitted it up for the reception of theſe collections: they alſo appointed officers to ſuperintend the muſeum; and having ordained certain ſtatutes with reſpect to viewing the collection contained in it, the public were admitted to view it in 1757.

Fifteen perſons are allowed to view it in one company; the time allotted is two hours; and when any number, not exceeding 15, are inclined to ſee it, they muſt ſend a liſt of their Chriſtian names and ſurnames, additions, and places of abode, to the porter's lodge, in order to their being entered in the book; in a few days the reſpective tickets will be made out, ſpecifying the day and hour when they are to come; which, on being ſent for, will be delivered. If by any accident ſome of the parties are prevented from coming, it is proper they ſend their ticket back to the lodge, as no body can be admitted with it but themſelves. It is to be remarked, that the fewer names there are in a liſt, the ſooner they are likely to be admitted to ſee it.

MUSES, certain fabulous deities among the Pagans, ſuppoſed to preſide over the arts and ſciences: for this reaſon it is uſual for the poets, at the beginning of a poem, to invoke theſe goddeſſes to their aid. The muſes were originally only ſingers and muſicians in the ſervice of Oſiris, or the great Egyptian Bacchus, under the inſtruction and guidance of his ſon Orus; but in ſucceding times they were called *daughters of Jupiter and Mnemoſyne* or *Memory*. Theſe are the only pagan divinities whoſe worſhip has been continued through all ſucceeding changes in the religion and ſentiments of mankind. Profeſſors of every liberal art in all the countries of Europe ſtill revere them; particularly the poets, who ſeldom undertake the ſlighteſt work without invoking their aid. Sir Iſaac Newton tells us, that the ſinging women of Oſiris were celebrated in Thrace by the name of the *muſes*; and that the daughters of Pierus, a Thracian, imitating them, were celebrated by the ſame name. Diodorus Siculus informs us, that Alcman of Meſſene, a lyric poet who flouriſhed in the 27th Olympiad, 670 years before Chriſt, makes them the daughters of Uranus and Terra. It has been aſſerted by ſome ancient writers, that at firſt they were only three in number: but Homer, Heſiod, and other profound mythologiſts, admit of nine.

In his hymn to Apollo, Homer ſays,

——— By turns the *nine* delight to ſing.

And Heſiod, in his theogony, names them all. They are ſaid ſeverally to preſide over ſome art or ſcience, as muſic, poetry, dancing, aſtronomy. By ſome they are called *virgins*, becauſe the virtues of education appear unalterable: they are called *muſes* from a Greek word which ſignifies to explain myſteries, becauſe they have taught things the moſt curious and important to know, and which are above the comprehenſion of vulgar minds. Each of their names is ſaid to include ſome particular allegory; *Clio*, for inſtance, has been thus called, becauſe thoſe who are praiſed in verſe acquire immortal fame; *Euterpe*, on account of the pleaſure accruing to thoſe who hear learned poetry; *Thalia* implies for ever flouriſhing; *Melpomene*, that her melody inſinuates itſelf into the inmoſt receſſes of the ſoul; *Terpſichore* marks the pleaſure which thoſe receive who are verſed in the liberal arts; *Erato* ſeems to indicate, that the learned command the eſteem and friendſhip of all mankind; *Polyhymnia*, that many poets are become immortal by the number of hymns which they have addreſſed to the gods; *Urania*, that thoſe whom ſhe inſtructs elevate their contemplations and celebrity to the heavens and the ſtars; and laſtly, the exquiſite voice of *Calliope* has acquired her that appellation, as the inventreſs and guardian of eloquence and rhetoric.

An epigram of Callimacus gives the attributes of the muſes in as many lines.

Calliope the deeds of heroes ſings;
Great *Clio* ſweeps to hiſtory the ſtrings;
Euterpe teaches mimes their ſilent ſhow;
Melpomene preſides o'er ſcenes of woe;
Terpſichore the flute's ſoft pow'r diſplays;
And *Erato* gives hymns the gods to praiſe;
Polymnia's ſkill inſpires melodious ſtrains;
Urania wiſe, the ſtarry courſe explains;
And gay *Thalia*'s glaſs points out where folly reigns.

This epigram does not, however, exactly correſpond with the ideas of other poets, or of the ancient painters, in characteriſing the attributes of the muſes. The ancients had numberleſs ingenious and fanciful ideas concerning the muſes. Fulgentius informs us, from the teſtimony of various ancient authors, that Apollo was painted with a cithara of *ten ſtrings*, as a ſymbol of the union of the god with the nine muſes, and to ſhew that the human voice is compoſed of *ten parts*; of which the four firſt are the front-*teeth*, placed one againſt the other, ſo uſeful for the appulſe of the tongue in forming ſounds, that, without any one of them, a whiſtle would be produced inſtead of a voice; the fifth and ſixth are the two *lips*, like cymbals, which, by being ſtruck againſt each other greatly facilitate ſpeech; the ſeventh is the *tongue* which ſerves as a plectrum to articulate ſounds; the eighth is the *palate*, the concave of which forms a belly to the inſtrument; the ninth is the *throat*, which performs the part of a flute; and the tenth the *lungs*, which ſupply the place of bellows. Pythagoras, and afterwards Plato, make the muſes the ſoul of the planets in our ſyſtem; from whence the imaginary muſic of the ſpheres.

MUSHROOM, in botany. See AGARIUS and FUNGUS. Phyſicians have diſputed much about the qualities of muſhrooms; ſome conſidering them as a rich nouriſhment, and perfectly innocent, when properly choſen; and others aſſerting them to be extremely deleterious. Moſt of the fungi are indeed of a hurtful quality; and, with reſpect to the whole tribe, the eſculent are very few. Eſculent muſhrooms are very nutritive, very readily alkaleſcent, and more ſo without intermediate aceſcency than any other vegetable: they are therefore a rich nouriſhment, and much akin to animal food; on which account they may be indulged in conſiderable quantity to ſtrong perſons. It requires, however, ſkill to diſtinguiſh this eſculent kind; and very few, eſpecially of thoſe who are commonly employed to gather them, viz. the ſervants, have ſtudied Cluſius, or other authors who have been at the pains to diſtinguiſh them. Perhaps our eſculent muſhrooms, if old, acquire a dangerous acrimony; aud for theſe reaſons Dr. Cullen is of opinion that it is for the moſt part prudent to avoid them. In the warmer climates they may be uſed as light food; but here it is prepoſterous to uſe them along with animal-food, as they do not correct its alkaline tendency.

SYSTEM OF MUSIC.

INTRODUCTION.

MUSIC is the art of combining ſounds in a manner agreeable to the ear. This combination may be either co-exiſting or ſucceſſive: in the firſt caſe, it conſtitutes *harmony*; in the laſt, *melody*. But though the ſame ſounds, or intervals of ſound, which give pleaſure when heard in ſucceſſion, will not always produce the ſame effect in harmony; yet the principles which conſtitute the ſimpler and more perfect kinds of harmony, are almoſt, if not entirely, the ſame with thoſe of melody. By *perfect harmony*, we do not here mean thoſe complex modifications of harmonic ſound which are admired in practice; but that harmony which reſults from the coaleſcence of coexiſting ſounds produced by vibrations in the proportions of thirds, fifths, and octaves, or their duplicates. The principles on which Muſic is founded, and the rules by which it is conducted, conſtitute a ſcience. The ſame maxims when applied to practice form an art: hence its firſt and moſt capital diviſion is into *Theoretical* and *Practical* muſic. *Theoretical* muſic is, if we may be permitted to uſe the expreſſion, the knowledge of the nature and uſe of thoſe materials which compoſe it; or, in other words, of all the different relations between the high and low, between the harſh and the ſweet, between the quick and the ſlow, between the ſtrong and the weak, of which ſounds are ſuſceptible: relations which, comprehending all the poſſible combinations of muſic and ſounds, ſeem likewiſe to comprehend all the cauſes of the impreſſions which their ſucceſſion can make upon the ear and upon the ſoul.

Practical muſic is the art of applying and reducing to practice thoſe principles which reſult from the theory of agreeable ſounds, whether co-exiſting or ſucceſſive; or, in other words, to conduct or arrange ſounds according to the proportions reſulting from conſonance, from duration and ſucceſſion, in ſuch a manner as to produce upon the ear the effect which the compoſer intends. This is the art which we call *compoſition.* With reſpect to the actual production of ſounds by voices or inſtruments, which is called *execution*, this department is merely mechanical and operative; which, only preſuppoſing the powers of ſounding the intervals true, of exactly proportioning their degrees of duration, of elevating or depreſſing ſounds according to theſe gradations which are preſcribed by the tone, and to the value required by the time, demands no other knowledge but a familiar acquaintance with the characters uſed in muſic, and a habit of expreſſing them with promptitude and facility.

Theoretical muſic is likewiſe divided into two apartments; viz. the knowledge of the proportions of ſounds or their intervals, and that of their relative durations; that is to ſay, of meaſure and time. The firſt is what among the ancients ſeems to have been called *harmonical* muſic. It ſhews in what the nature of air or melody conſiſts; and diſcovers what is conſonant or diſcordant, agreeable or diſagreeable, in the modulation. It diſcovers, in a word, the effects which ſounds produce in the ear by their nature, by their force, and by their intervals; which is equally applicable to their conſonance and their ſucceſſion.

The ſecond has been called *rhythmical*, becauſe it treats of ſounds with regard to their time and quantity. It contains the explication of their continuance, of their proportions, of their meaſures whether long or ſhort, quick or ſlow, of the different modes of time and the parts into which they are divided, that to theſe the ſucceſſion of ſounds may be conformed.

Practical muſic is likewiſe divided into two departments, which correſpond to the two preceding. That which anſwers to *harmonical* muſic, and which the ancients called *melopée*, teaches the rules for combining and varying the intervals, whether conſonant or diſſonant, in an agreeable and harmonious manner. The ſecond, which anſwers to the *rhythmical* muſic, and which they called *rhythmopée*, contains the rules for applying the different modes of time, for underſtanding the feet by which verſes were ſcanned, and the diverſities of meaſure; in a word, for the practice of the rhythmus. Muſic is at preſent divided more ſimply into *melody* and *harmony*; or ſince the introduction of *harmony* the proportion between the length and ſhortneſs of ſounds, or even that between the diſtance of returning cadences, are of leſs conſequence among us. For it often happens in modern languages, that the verſes aſſume their meaſures from the muſical air, and almoſt entirely loſe the ſmall ſhare of proportion and quantity which in themſelves they poſſeſs. By melody the ſucceſſions of ſound are regulated in ſuch a manner as to produce pleaſing airs. Harmony conſiſts in uniting to each of the ſounds, in a regular ſucceſſion, two or more different ſounds, which ſimultaneouſly ſtriking the ear ſoothe it by their concurrence. See HARMONY.

Muſic was originally formed to be the vehicle of poetry; and of conſequence, though the voice might be ſupported and accompanied by inſtruments, yet muſic was never intended for inſtruments alone. We are told by ancient authors, that all the laws whether human or divine, exhortations to virtue, the knowledge of the characters and actions of gods and heroes, the lives and atchievements of illuſtrious men, were written in verſe, and ſung publicly by a choir to the ſound of inſtruments; and it appears from the Scriptures, that ſuch from the earlieſt times was the cuſtom among the Iſraelites. Nor was it poſſible to find means more efficacious for impreſſing on the mind of man the principles of morals, and inſpiring the love of virtue. Perhaps, however, this was not the reſult of a premeditated plan; but inſpired by ſublime ſentiments and elevation of thought, which in accents that were ſuited and proportioned to their celeſtial nature endeavoured to find a language worthy of themſelves and expreſſive of their grandeur. It merits attention, that the ancients were ſo ſenſible of the value and importance of this divine art, not only as a ſymbol of that univerſal order and ſymmetry which prevails through the whole frame of material and intelligent nature, but as productive of the moſt momentous effects both in moral and political life. Plato and Ariſtotle, who diſagreed almoſt in every other maxim of politics, are unanimous in their approbation of muſic, as an efficacious inſtrument in the formation of the public character; and it was the general opinion, that whilſt the gymnaſtic exerciſes rendered the conſtitution robuſt and hardy, muſic humanized the character, and ſoftened thoſe habits of roughneſs and ferocity by which men might otherwiſe have degenerated into ſavages.

The muſic now moſt generally celebrated and practiſed is that of the Italians, or their ſucceſsful imitations. The Engliſh, from the invaſion of the Saxons, to that more late though lucid æra in which they imbibed the art and copied the manner of the Italians, had a muſic which neither pleaſed the ſoul nor charmed the ear. The primitive muſic of the French deſerves no higher panegyric. Of all the rude nations, the Scots and Iriſh ſeem to have poſſeſſed the moſt affecting original muſic. The firſt conſiſts of a melody characteriſed by tenderneſs: it melts the ſoul to a pleaſing penſive langour. The other is the native expreſſion of grief and melancholy. The primitive muſic of the Scots may be divided into the *martial*, the *paſtoral*, and the *feſtive*. The firſt conſiſts either in marches, which were played before the chieftains, in imitation of the battles which they fought, or in lamentations for the cataſtrophes of war and the extinction of families. Theſe wild effuſions of natural melody preſerve ſeveral of the rules preſcribed for compoſition.

Thus far we have purſued the general idea of muſic. We ſhall, after the hiſtory, give a more particular detail of the ſcience from Monſieur D'Alembert.

HISTORY OF MUSIC.

The ancient hiſtory of muſic, even among the moſt cultivated nations, is now either ſo entirely loſt, or ſo unhappily obſcured, that we can make but few certain, and perhaps no ſatisfactory diſcoveries in it. And as no annals could be tranſmitted to poſterity of that muſic which prevailed among ſuch people as are called *barbarous*, our accounts of it muſt be ſtill leſs authentic and ſatisfactory, than thoſe of the former. Even at periods which are more recent, and may for that reaſon be thought more within the ſphere of our inveſtigation, we are equally at a loſs both for the æras and the authors of ſome eſſential improvements in muſic. Yet thoſe parts of its hiſtory, which are either already known, or may be diſcovered, if related at full length with proper illuſtrations, would produce a work little inferior in ſize to the whole extent of that *Encyclopædia* of which it only conſtitutes a part. All, therefore, which can be expected from this preliminary account, is to give a ſhort and curſory detail of its primary ſtate, and its moſt important revolutions, ſo far as hiſtory will enable us, by enlightening our reſearches, to accompliſh this deſign. But if our accounts are thought conciſe and imperfect, we ſhall all along direct the views of our readers to ſources which may prove more copious and more adequate to their curioſity.

It has been pretended by Father Kircher and others, that muſic prevailed in Egypt before it was known in Greece. The origin of inſtrumental muſic appears to have been at a period much prior to the date of authentic hiſtory; and when we look for its epoch or its diſcoverer, we are carried at once into the wild regions of fable and mythology. The god Mercury, or Hermes, is ſaid to be the inventor of the lyre, by diſtending ſtrings of different tenſions and diameters upon the ſhell of a tortoiſe which he found upon the ſhore. The firſt exhibition of the fiſtula, or ſhepherd's pipe, is aſcribed to Pan. But of theſe beings, and their actions, little or nothing can be aſcertained with proper evidence. We muſt therefore content ourſelves with ſuch later accounts as merit any degree of confidence.

The Grecian lyre, *Fig.* 1. in the following Plate, in its original ſtate, ſeems to have been an inſtrument of the utmoſt ſimplicity: according to ſome, the Mercurian lyre conſiſted of three, and according to others only of four, ſtrings. Theſe being touched open, could only produce the ſame number of ſounds: from whence we may eaſily conclude, that the powers of this inſtrument could not be very extenſive. This tetrachord, as ſome ſay, was conjoined; others maintain that it was disjoined, and that its intervals were not even diatonic. It is, however, allowed, that its two extremes produced an octave; and that the two intermediate ſtrings divided it by a fourth on each ſide, with a tone in the midſt, in the following manner: C. G. F. C. This is what Boëtius calls the tetrachord of Mercury. This Syſtem did not long remain confined to ſo ſmall a number of ſounds. Chorebus, the ſon of Athis king of Lydia, added to it a fifth ſtring; Hyagnis, a ſixth; Terpander, a ſeventh, to equal the number of the planets; and at laſt, Lychaon of Samos the eighth. Nichomachus the Geraſenian attributes this eighth chord to Pythagoras, the ninth to Theophraſtus of Piereus, afterwards the tenth to Hyſteus of Colophon. The ſyſtem of the Greeks was inſenſibly extended as well above as below, till it reached, and even ſurpaſſed, the compaſs of a diſdiapaſon or double octave; a ſeries which they call a *perfect Syſtem*, and which was likewiſe termed the *greateſt* and the *moſt unchangeable*; becauſe, between its two extremes, which betwixt themſelves formed a perfect conſonance, were contained all the ſimple, the double, the direct, or the inverted chords, every particular ſyſtem, and according to them the greateſt intervals, which can take place in melody. This whole Syſtem conſiſts of four tetrachords, three conjoined and one disjoined; and of a ſingle note redundant, which was added below the whole to complete the double octave.

In Rouſſeau's Muſical Dictionary, Plate H. *fig.* 12. will be found a table of the general ſyſtem amongſt the Greeks. The curious may alſo conſult thoſe of Meibomius, placed at the front of the work of Ariſtoxenus. Such, in its perfection, was the general ſyſtem of the Greeks; which remained almoſt in the ſame ſtate till the eleventh century, the time when Guy d'Arezzo made conſiderable changes in it. He added below a new ſtring, which he called *hypoproſlambanomene*, or "ſubadded," and above a fifth tetrachord. Beſides this, he invented, as they ſay, a flat, to diſtinguiſh the ſecond ſound of a conjunctive tetrachord from the firſt of the ſame tetrachord when disjunctive. For aſcertaining with accuracy the diverſity of intervals, Pythagoras, the philoſopher of Samos, invented the monochord, or the different diviſions of one ſingle ſtring by which the conſonances were produced, and found the ſame ratios which are given in the ſubſequent elements of muſic, in Malcolm's account of the ſcale, and in ſeveral other authors unneceſſary to be enumerated.

Had ſucceeding writers upon the ſcience been more attentive to the real conſtitution of the ſcale, and the principles derived from a monochord properly divided, we might have expected their account of the other phænomena in muſic to have been more preciſe and more perſpicuous; but for a conſiderable time after that philoſopher, the accounts of ancient muſic tranſmitted to us are either ſuperficial and curſory, or unintelligible. The province to which our efforts are neceſſarily confined, directs our attention not ſo much to the hiſtory of thoſe who cultivated the art, as to the art itſelf, and its various revolutions.

The diſcovery of the monochord and its diviſions, was not the only ſpeculation in muſic peculiar to Pythagoras. He likewiſe thought the earth and ſeven planets, or ſolar ſyſtem, reſembled a muſical diapaſon; and from thence formed the romantic idea of the muſic of the ſpheres. For a more ſatisfactory account of this celeſtial concert, the curious reader may peruſe the *Somnium Scipionis*, a fragment of Cicero, and the *Obſervations upon numbers* by his commentator Macrobius. Pythagoras, who taught in Italy, was the firſt who inveſtigated the relations of ſound by meaſuring a muſical ſtring, and obſerving the tones produced by the vibrations of its different parts, whilſt the others were at reſt. Theſe he expreſſed by numbers, and thus aſcertained the ratio which one ſound bears to another. This inveſtigation was afterwards carried farther, and delineated more diſtinctly, by Euclid; Nicomachus the Geraſenian lived A. C. 60, and wrote a book called *Introduction to Harmony*, which ſeems to be one of the cleareſt and moſt intelligible of the Greeks.

After exploring what can be known concerning the ancient muſic, from the theories and writings of thoſe whoſe works have been tranſmitted to us, the forms and powers of their inſtruments occur next to be examined. Theſe can only be collected from verbal deſcriptious, or from deſigns either expreſſed in colours or by ſculpture. From theſe, modern muſicians have not ſcrupled to form a moſt contemptible idea of practical muſic among the ancients. But are we ſure, that the deſcriptions are perfectly complete and thoroughly underſtood? If they were, does there not ſtill remain a poſſibility, that they might be tuned and handled in a manner productive of effects to which we are ſtrangers? Of our inſtruments now in uſe, the difference between one manner of performing and another is ſo aſtoniſhing, that one ſhould imagine it might render us cautious in forming any concluſions concerning inſtruments, which are perhaps neither perfectly deſcribed nor exactly delineated, deſcribed by authors of a period ſufficiently diſtant to render the idioms of the language in which they wrote obſcure. And though the forms exhibited in colours or by ſculpture may be thought more permanent and more univerſally intelligible, they are yet ſufficiently ſubjected to the injuries of time to render their repreſentations ſuſpicious.

EXPLANATION OF FIG. 1. TO 15. IN THE FIRST PLATE OF MISCELLANEOUS SUBJECTS.

The lyre of the Greeks may be conſidered as the parent of the fidicinal or ſtringed inſtruments, and the ſucceſſive improvements of theſe inſtruments merit peculiarly our attention, on account of their more immediate connection with the progreſſive ſtate of muſic, which in a great meaſure depended on their modification, and alſo from theſe inſtruments having by the different degrees of tenſion and modes of tuning the ſtrings ſuggeſted the firſt ideas of a ſyſtem of muſic, as founded in the laws of nature, and connected with mathematical principles.

After increaſing the power of the lyre, by increaſing the number of ſtrings, each of which produced but a ſingle note, the next material improvement was to render each ſtring ſuſceptible of ſeveral notes, which was effected by adding a neck, by which each ſtring by taking different portions of it, might be made to produce different notes more or leſs acute as the vibrating part was more or leſs abridged, *Vide fig.* 3.

After the decline of the Roman empire, about the year 600, in a manuſcript in the monaſtery of St. Blaſius, there are repreſentations of ſeveral muſical inſtruments then in uſe, and the Cithara of a triangular form like the Greek *delta*, *Fig.* 4. the Cithara Teutonica, or German, *fig.* 5. the Monochord, with a bow, *fig.* 6. and the Cithara Anglica, or Harp, *fig.* 7.

About the æra of the Cruſades, the Cithara of the ancients began to aſſume the appearance of the Guittar of more modern times, which is nothing more than an improvement of the former by the addition of a finger board, graduated by tones and ſemitones, which rendered the inſtrument more perfect in point of compaſs, though perhaps inferior in point of tone to more ancient inſtruments. *Vide fig.* 8 and 9, the laſt of which was the figure of the Spaniſh guittar, about two centuries ago, and has continued with little or no alteration to this time.

The next great improvement in ſtringed inſtruments was the effecting a continuation of tone, by the invention of the bow. This inſtrument was wholly unknown to the ancients, at leaſt as applied to practical muſic; it ſeems probable that it was by them applied to the monochord, which, though uſed in making muſical experiments, can never be ſuppoſed capable of general uſe as a muſical inſtrument being totally incapable of harmony.

The introduction of the bow into general practice was with the Rebec, about the 11th century, and continued with progreſſive improvements to the laſt century. The Rebec, in its more ſimple ſtate, was formed with 2 or 3 ſtrings. *Vide fig.* 10 and 11. which deſerves our attention, as being the parent of our modern violin, tenor and violincello.

The firſt improvement of the principle of the Rebec was, in the formation of viols, which took place about the beginning of the 12th century, and continued to the middle of the 16th century; for their ſhape, *vide fig.* 12. Theſe continued in general uſe to the middle of the 16th century.

About the year 1520 we find the firſt mention of violins, which however were not carried to any conſiderable degree of perfection, until after the year 1601; ſhortly after which time its ſuperior powers were diſcovered, and the inſtrument was carried to a degree of perfection which has not ſince been ſurpaſſed. *Vide fig.* 13.

The tenor and violincello are exactly ſimilar in principle to the violin, but upon a larger ſcale; the tenor being a medium between the violincello and violin. *Vide fig.* 14 and 15.

Almoſt in every period ſince the reſtitution of literature, an important controverſy has been agitated by virtuoſi of different opinions in the theory of muſic. Some have maintained that harmony was, and others that it was not, known to the ancients. By ſome of theſe it was contended, that the knowledge of harmony naturally reſults from the knowledge of conſonances; that by tuning their inſtruments the ancients muſt have been familiar to the various coaleſcences of ſounds, and that of conſequence they could not be ignorant of the pleaſure which they produce. Several paſſages likewiſe from ſuch diſſertations or fragments as have eſcaped the rage of time, are collected to prove that the ancients muſt have been acquainted with harmony or ſymphonical muſic.

The opponents of this hypotheſis have alleged, that from the ſenſations or ideas of ſimple chords no conception could be formed of the effects produced by their conjunction or ſucceſſion. It is on all hands agreed, that ſeveral voices and inſtruments were uſed by the Greeks and Romans in performing the ſame piece of muſic; but the antiharmoniſts, as we may term them, will not admit that the intervals of theſe voices or inſtruments were varied: nay, it is affirmed that they performed always in octave or uniſon one to the other; and from thence it is pretended, that all the paſſages which ſeem to import the acquaintance of the ancienrs with practical harmony may be rationally and conſiſtently explained. This, however, notwithſtanding the labours of French critics, will ſtill remain extremely doubtful to any perſon who has either peruſed the dialogue aſcribed to Plutarch, or other paſſages to the ſame purpoſe. Nor can it be reaſonably thought, that, at a period ſo barbarous as the 12th century, harmony, though rude and ſimple, ſhould have been the creature of naked invention in places where every other branch of literature and degree of culture were unknown. Yet it is clear from the monkiſh hiſtorians of that æra, that harmony was even then in practice, where it could hardly be ſuppoſed to be immediately tranſmitted by a progreſs ſo rapid from other parts of the world, where the finer organization of the natives, the more propitious aſpect of nature, and the more obvious veſtiges of ancient improvement, might be thought favourable to the invention, culture, and propagation of the fine arts. Nor is it a weak preſumption, in favour of the knowledge of antiquity in harmony, that the adherence of a contrary opinion can neither aſcertain the epoch nor the parent of ſymphonic muſic. Yet had it been, as they pretend, a modern invention, barbarous and ignorant as the general character of human nature was during that gloomy interval from the decline of the Roman empire to the revival of letters, the author of an improvement ſo new and extraordinary could not have eſcaped the public notice. We cannot therefore ceaſe to think with the author of *The principles and power of harmony*, p. 133. that the ancients were acquainted with this ſpecies of muſic; though perhaps it may be admitted, that its powers were neither ſo thoroughly known, nor ſo generally and ſucceſsfully practiſed, as afterwards.

After the long and cruel devaſtation of the Goths and Vandals, muſic ſeems firſt to have been revived for the ſervice of the church. It was this religious obſervation of determined and regular quantities in ancient poetry, which preſerved aud regulated the due proportion of ſounds, and which, when abandoned, left the value of notes, with reſpect to their duration, impoſſible to be determined, till other characters and ſigns were ſuperadded, which diſcovered the real eſtimate of every note, and ſhewed to what degree it ſhould be protracted, or by what quantity of duration limited. This ſeems to have been the next advance in muſical improvement; but it had one pernicious effect, which was, to render muſic independent of poetry. Yet theſe ſiſter-arts ſeem to be twin-born from heaven; and perhaps, in no caſe could the laws of nature have ſuffered a more cruel and impious violation than in ſeparating the one from the other. Modulated ſound is a more genuine, powerful, and univerſal vehicle of ſentiment, than any articulate or arbitrary ſigns can poſſibly be. But articulate ſigns may be ſo happily adjuſted by convention, as to expreſs the degrees, varieties, and modes of ſentiment or emotion, which in modulated ſounds are leſs definitely ſignified, if ſignified at all. Thus ſounds give energy and ſweetneſs to words, words variety and definiteneſs to ſounds. Guy d'Arezzio, otherwiſe named *Guido Aretinus*, was the inventor of that diſpoſition of the muſical ſcale which is now in uſe. He could not, therefore, be the author of harmony, which we know to have been practiſed ſome centuries before his time, but only of a new ſet of characters by which it was expreſſed. This muſician, by changing the tetrachords into hexachords, highly improved the ſcale, diſcovered more accurately the poſition of ſemitones, and rendered its intonation much more practicable. He likewiſe adapted the ſyllables *ut, re, mi, fa, ſol, la*, to the various ſounds which compoſe it, from the following Sapphic verſes in a hymn to St. John.

UT queant laxis *REſonare fibris*
MIra geſtorum *FAmuli tuorum*
SOLve polluti *LAbii reatum.* SANCTE JOANNES.

The rhythmus in muſic, or the regular diviſion and meaſures of ſound, had formerly been determined by the quantities of the feet in poetry; and, independent of theſe, ſeems to have been entirely indefinite. The invention of a rythmus capable of ſubſiſting by itſelf, is aſcribed to one *Johannes de Muris*. Yet there is conſiderable reaſon to believe that it had been invented by one *Franco*, who lived a number of years before him. In theſe times there was a ſecular as well as ſacred muſic. The Troubadours, or Provençal poets, compoſed ſongs of different kinds, which they ſung to their harps or violins for public entertainment. Hence it happened, that harmony, melody, and rhythmus, admitted of immenſely greater varieties than they had hitherto done. We have formerly ſaid, that in ancient muſic, the quantities or values of every note were determined by thoſe of the ſyllables to which they anſwered. It is, however, by no means improbable, that at a very early period, in their private rehearſals, or practice for improvement, whether in taſte or execution, the muſicians frequently played the inſtrumental parts without being accompanied either by the voice or the words to which they had been ſet. The impreſſions of thoſe poetical meaſures to which the parts correſponded, were abundantly ſufficient to preſerve in the memory of the performer the idea of the rhythmus, and of courſe to determine the value of each particular note. But when airs were either ſet to pieces in proſe, or compoſed without any regard to ſyllabical duration, the quantity of each note was abſolutely indefinite. When therefore muſic begun to be ſet in parts, it was indiſpenſably neceſſary that the points which mark the notes intended to correſpond one with another, ſhould be ſet in direct oppoſition. Hence the denomination of *counterpoint*. But when characters, or different forms of characters, were invented for expreſſing the different durations of ſounds, or their relative proportions one to another, the ſame preciſion in oppoſing note to note became leſs neceſſary, and was on that account leſs ſcrupulouſly obſerved.

The airs into which ſecular muſic was originally diſtinguiſhed ſeem to have been the madrigal, the ſong, the cantata, the canon. Theſe were vocal, or at leaſt common to voices and inſtruments; but the ſolo, the phantaſia, the concerto, were progreſſive changes in inſtrumental muſic.

It is generally agreed, that the Greeks and Romans ſung their tragedies and comedies from beginning to end; but no monument of theſe compoſitions remains to us: ſo that the muſic of the drama is as really a modern invention as if no ſuch thing had ſubſiſted among the ancients, ſince the mere knowledge of a fact could by no means throw any light upon the manner in which it was produced. All that has been tranſmitted to us concerning the ancient theatrical muſic, can only inform us, that it was pathetic and imitative to a high degree. But upon theſe hints few compoſers will think themſelves ſufficiently inſtructed to proceed. This arduous enterpriſe, however, was nobly begun and ſucceſsfully proſecuted by one *Jacapo Peri*. A poet, whoſe name was *Ottavio Rinuccino* in the city of Florence, having compoſed a dramatic paſtoral upon the ſtory of Apollo and Daphne, engaged this excellent muſician to ſet it. Both being warmed with the ſame ideas, and animated by the ſame deſign, ſo happily ſucceeded, that other poets and muſicians were generally approved and admired in proportion as they purſued the veſtiges of theſe great maſters. A ſecond performance of the ſame kind, called *Eurydice*, compoſed by the authors of the former paſtoral, was repreſented in Florence in the year 1600, upon occaſion of the marriage of Mary de Medicis with Henry IV. of France. But a detail of the gradations by which theatrical muſic roſe to its preſent perfection, would be a taſk too extenſive for the limits by which we are circumſcribed. Nor is it in our power, for the ſame reaſon, to enter more minutely and critically into the nature of thoſe compoſitions called *operas*. Let it ſuffice to add, that in common with tragedy and comedy, they are repreſentations of action. In conſequence of this, they require the ſame unity of deſign, the ſame diverſity of characters and paſſions, with the former. Hence it follows, that ſome parts of them will be ſimply narrative, ſome pathetic, and others more emphatically deſcriptive. Muſic ſuited to the firſt of theſe is called *recitative*. Its diſtinguiſhing characteriſtics are, to expreſs the nature and degree of ſentiment exhibited by the ſpeaker, to be ſcrupulouſly adapted to the peculiar genius of that language which it is deſigned to accompany; and to be exactly modelled according to the accents of that nation, for which it was formed. Such parts of the muſic as are intended for more pathetic declamations may be called *airs*. In theſe the words, both with reſpect to their quantity and order, may be treated with greater freedom. The melody is leſs in the tone of converſation, and the harmony more complex. In this, however, there is no ſmall hazard leſt ſentiment ſhould be loſt in ſound; and it requires no ſmall degree of judgment, delicacy, and taſte in the compoſer, at once to fill the harmony and preſerve the ſentiment. The chorus is intended to expreſs ſome emphatic event, to celebrate ſome diſtinguiſhed hero, or to praiſe ſome beneficent god. It is properly the voice of triumph and exultation. The harmony ſhould therefore be as full and expreſſive as poſſible. But for the rules of ſuch compoſitions, one muſt refer the reader to ſuch theoretical and practical muſicians as have been moſt ſucceſsful in deſcribing and cultivating dramatic muſic. What remains for us is to ſubjoin a liſt of thoſe who have been moſt remarkable for their accuracy in the theory, or for their excellence in the practice, of muſic in general.

Of John de Muris we have already ſpoken, who lived in the year 1330, and to whom, by miſtake, has been attributed the invention of thoſe characters by which, in modern times, the value of notes, and their relative proportions one to another, have been aſcertained. But this expedient for making viſible the different durations of notes as conſtituent of one rhythmus or particular movement, we have found to be firſt introduced by one Franco, who lived prior to John de Muris. Laſus was the firſt who wrote on muſic; but his work is loſt, as well as ſeveral other books of the Greeks and Romans upon the ſame ſubject. Ariſtoxenus, the diſciple of Ariſtotle, and leader of a ſect in muſic, is the moſt ancient author who remains to us upon this ſcience. After him came Euclid of Alexandria. Ariſtidis Quintilianus wrote after Cicero. Alyphus afterwards ſucceeded; then Guadentius, Nicomachus, and Bacchius. Marchus Meibomius has favoured us with a beautiful edition of theſe ſeven Greek authors, with a Latin tranſlation and notes. Plutarch wrote a dialogue upon muſic. Ptolemy, a celebrated mathematician, wrote in Greek a treatiſe intitled *The Principles of Harmony*, about the time of the emperor Antoninus. This author endeavoured to preſerve a medium between the Pythagoreans and the Ariſtoxenians. A long time afterwards, Manuel Pryennius wrote likewiſe upon the ſame ſubject. Among the Latins, Boetius wrote in the times of Theodoric; and not diſtant from the ſame period Martianus, Caſſiodorus, and St. Auguſtine. The number of the moderns is almoſt indefinite. The moſt diſtinguiſhed are, Zarlino, Salinas, Valgulio, Galileo, Doni, Kircher, Merſenne, Parran, Perault, Wallis, Deſcartes, Holden, Mengoli, Malcolm, Baretti, Vallotti, Marcus Meibomius, Chriſtopher Simpſon; Tartini, whoſe book is full of deep reſearches and of genius, but tedious from its prodigious length, and perplexed with obſcurity; and M. Rameau, whoſe writings have had this ſingular good luck, to have produced a great fortune without being read almoſt by any one. Beſides, the world may now be ſpared the pains of peruſing them, ſince M. d'Alembert has taken the trouble of explaining to the public the ſyſtem of the fundamental baſs, the only uſeful and intelligible diſcovery which we find in Rameau's writings. To theſe we may add Dr. Smith, author of a learned and mathematical treatiſe, intitled, *Harmonics*, or *The Philoſophy of Muſical Sounds*; Mr. Stillingfleet author of the *Principles and the Power of Harmony*, or *An Explanation of Tartini's Syſtem*; Dr. Pepuſch, and his noble pupil Lord Abercorn; Mr. Aviſon, late organiſt at Newcaſtle, who wrote a treatiſe on *Muſical Expreſſion* with the politeneſs and elegance of a gentleman, the depth and preciſion of a ſcholar, the ſpirit and energy of a genius. The names of Rouſſeau and d'Alembert have been ſo often repeated during the courſe of theſe muſical lucubrations, that it would be ſuperfluous to reſume their characters in this place. Among the anthors already mentioned, it would be unpardonable to omit the names of Sir John Hawkings and Dr. Burney, each of whom has favoured the world with a hiſtory of muſic: The firſt protracted to five volumes in quarto, replete with muſical erudition, but ſeldom original; frequently careleſs, and ſometimes too circumſtantial and inelegant to be entertaining. Of the laſt the world has only as yet ſeen one volume. This abounds with deſcriptions, events, and diſquiſitions, highly worthy of attention: but, on account of the limits which the author has preſcribed to himſelf, many things have been omitted which would have been equally acceptable to literary curioſity, and explicative of muſical ſcience. Dr. Young alſo in a very learned work entitled, *Doctrina Sonorum*, throws conſiderable light on the theory of Muſic.

ELEMENTS OF MUSIC.

THEORETICAL AND PRACTICAL.

Preliminary Diſcourſe.

Muſic may be conſidered, either as an art, which has for its object one of the greateſt pleaſures of which our ſenſes are ſuſceptible; or as a ſcience, by which that art is reduced to principles. This is the double view in which we mean to treat of muſic in this Syſtem. There are two departments in muſic, melody and harmony. Melody is the combination of *ſucceſſive*; Harmony the union of *coexiſting* ſounds. Melody has been known and felt through all ages: perhaps the ſame cannot be affirmed of harmony, we know not whether the ancients made any uſe of it or not, nor at what period it began to be practiſed.

The firſt compoſitions upon the laws of harmony which we know, are of no higher antiquity than two ages prior to our own; and they were followed by many others. But none of theſe eſſays was capable of ſatisfying the mind concerning the principles of harmony: they confined themſelves almoſt entirely to the ſingle occupation of collecting rules, without endeavouring to account for them; neither had their analogies one with another, nor their common ſource, been perceived; a blind and unenlightened experience was the only compaſs by which the artiſt could direct and regulate his courſe. M. Rameau was the firſt who began to transfuſe light and order through this chaos. In the different tones produced by the ſame ſonorous body, he found the moſt probable origin of harmony, and the cauſe of that pleaſure which we receive from it. His principle he unfolded, and ſhewed how the different phænomena of muſic were produced by it: he reduced all the conſonances to a ſmall number of ſimple and fundamental chords, of which the others are only combinations or various arrangements. He has, in ſhort, been able to diſcover, and render ſenſible to others, the mutual dependence between melody and harmony. Every ſonorous body, beſides its principal ſound, likewiſe exhibits to the ear the 12th and 17th major of that ſound. This multiplicity of different, yet concordant, ſounds, known for a conſiderable time, conſtitutes the baſis of the whole theory of M. Rameau, and the foundation upon which he builds the whole ſuperſtructure of a muſical ſyſtem.

Though theſe different topics may be contained in the writings of this celebrated artiſt, and in theſe writings may be underſtood by philoſophers who are likewiſe adepts in the art of muſic; ſtill, however, ſuch muſicians as were not philoſophers, and ſuch philoſophers as were not muſicians, have long deſired to ſee theſe objects brought more within the reach of their capacity: ſuch is the intention of the ſyſtem now preſented to the public.

But though this ſyſtem is intended to explain the theory of muſic, and to reduce it to a ſyſtem more complete and more luminous than has hitherto been done, we ought to caution thoſe who ſhall read this ſyſtem, that they may be careful not to deceive themſelves, either by miſapprehending the nature of our object, or the end which our endeavours purſue.

We muſt not here look for that ſtriking evidence which is peculiar to geometrical diſcoveries alone, and which can be ſo rarely obtained in theſe mixed diſquiſitions, where natural philoſophy is likewiſe concerned: into the theory of muſical phænomena there muſt always enter a particular kind of metaphyſics, which theſe phænomena implicitly take for granted, and which brings along with it its natural obſcurity. In this ſubject, therefore, it would be abſurd to expect what is called *demonſtration:* it is an atchievement of no ſmall importance, to have reduced the principal facts to a ſyſtem conſiſtent with itſelf, and firmly connected in its parts; to have deduced them from one ſimple experiment; and to have eſtabliſhed upon this foundation the moſt common and eſſential rules of the muſical art. But in another view, if here it be improper to require that intimate and unalterable conviction which can only be produced by the ſtrongeſt evidence, we remain in the mean time doubtful whether it is poſſible to elucidate this ſubject more ſtrongly.

Thus, though the greateſt number of the phænomena in the art of muſic appear to be deducible in a ſimple and eaſy manner from the protracted tone of ſonorous bodies, one ought not perhaps with too much temerity to affirm as yet, that this mixed and protracted tone is *demonſtratively* the only original principle of harmony. But in the mean time it would not be leſs unjuſt to reject this principle, becauſe certain phænomena appear to be deduced from it with leſs ſucceſs than others. It is only neceſſary to conclude from this, either that by future ſcrutinies means may be found for reducing theſe phænomena to this principle; or that harmony has perhaps ſome other unknown principle, more general than that which reſults from the protracted and compounded tone of ſonorous bodies, and of which this is only a branch; or laſtly, that we ought not perhaps to attempt the reduction of the whole ſcience of muſic to one and the ſame principle; which, however, is the natural effect of an impatience ſo frequent even among philoſophers themſelves, which induces them to take a part for the whole, and to judge of objects in their full extent by the greateſt number of their appearances.

We would the more willingly perſuade thoſe who are ſkilled in theory and eminent in practice to extend and improve the views of him who before them purſued and pointed out the career, becauſe many amongſt them have already made laudable attempts, and have even been in ſome meaſure ſucceſsful in diffuſing new light through the theory of this enchanting art. It was with this view that the celebrated Tartini has preſented us in 1754 with a treatiſe of harmony, founded on a principle different from that of M. Rameau. This principle is the reſult of a moſt beautiful experiment. If at once two different ſounds are produced from two inſtruments of the ſame kind, theſe two ſounds generate a third different from both the others. They have inſerted in the *Encyclopædie* under the article *Fundamental*, a detail of this experiment according to M. Tartini; and we owe to the public an information of which in compoſing this article we were ignorant: M. Rameau, a member of the Royal Society at Montpellier, had preſented to that ſociety in the year 1753, before the work of M. Tartini had appeared, a memorial printed the ſame year, and where may be found the ſame experiment diſplayed at full length. In relating this fact, which it was neceſſary for us to do, it is by no means our intention to detract in any degree from the reputation of M. Tartini; we are perſuaded that he owes this diſcovery to his own reſearches alone: but we think ourſelves obliged in honour to give a public teſtimony in favour of him who was the firſt in exhibiting this diſcovery.

But whatever be the caſe, it is in this experiment that M. Tartini attempts to find the origin of harmony: his book, however, is written in a manner ſo obſcure, that it is impoſſible for us to form any judgment of it; and we are told that others diſtinguiſhed for their knowledge of the ſcience are of the ſame opinion. It were to be wiſhed that the author would engage ſome man of letters, equally practiſed in muſic and ſkilled in the art of writing, to unfold theſe ideas which he has not diſcovered with ſufficient perſpicuity, and from whence the art might perhaps derive conſiderable advantage if they were placed in a proper light.

The famous diſcovery made by Sig. Tartini, is as follows: If two ſounds be produced at the ſame time properly tuned, and with due force, from their conjunction a third ſound is generated, ſo much more diſtinctly to be perceived by delicate ears as the relation between the generating ſounds is more ſimple; yet from this rule we muſt except the uniſon and octave. From the fifth is produced a ſound uniſon with its loweſt generator; from the fourth, one which is an octave lower than the higheſt of its generators; from the third major, one which is an octave lower than its loweſt; and from the ſixth minor (whoſe higheſt note forms an octave with the loweſt in the third formerly mentioned) will be produced a ſound lower by a double octave than the higheſt of the leſſer ſixth; from the third minor, one which is double the diſtance of a greater third from its loweſt; but from the ſixth major (whoſe higheſt note makes an octave to the loweſt in the third minor), will be produced a ſound only lower by double the quantity of a greater third, than the higheſt; from the ſecond major, a ſound lower by a double octave than the loweſt; from a ſecond minor, a ſound lower by triple the quantity of a third major than the higheſt; from the interval of a diatonic or greater ſemitone, a ſound lower by a triple octave than the higheſt; from that of a minor or chromatic ſemitone, a ſound lower by the quantity of a fifth four times multiplied than the loweſt, &c. &c. But that theſe muſical phænomena may be tried by experiments proper to aſcertain them, two hautboys tuned with ſcrupulous exactneſs muſt be procured, whilſt the muſicians are placed at the diſtance of ſome paces one from the other, and the hearers in the middle. The violin will likewiſe give the ſame chords, but they will be leſs diſtinctly perceived, and the experiment more fallacious, becauſe the vibrations of other ſtrings may be ſuppoſed to enter into it. If our readers ſhould be curious to examine theſe experiments and the deductions made from them in the theory of muſic, he will find them clearly explained and illuſtrated in a treatiſe called *Principles and Power of Harmony*, printed at London in the year 1771.

Philoſophical muſicians ought not to loſe their time in ſearching for mechanical explications for the phænomena in muſic, explications will always be found vague and unſatisfactory; nor is it their province to exhauſt their powers in vain attempts to riſe above their ſphere into a region ſtill more remote from the proſpect of their faculties, and to loſe themſelves in a labyrinth of metaphyſical ſpeculations upon the cauſes of that pleaſure which we feel from harmony. In vain would they accumulate hypotheſis on hypotheſis, to find a reaſon why ſome chords ſhould pleaſe us more than others. Some aſcribe the different degrees of pleaſure which we feel from chords, to the more or leſs frequent coincidence of vibrations; others to the relations which theſe vibrations have among themſelves as they are more or leſs ſimple. But why ſhould this coincidence of vibrations, that is to ſay, their ſimultaneous impulſe

pulſe on the ſame organs of ſenſation, and the accident of beginning frequently at the ſame time, prove ſo great a ſource of pleaſure. We may conceive without difficulty how the eye judges of relations; but how does the ear form ſimilar judgments? Let us in ſincerity confeſs our ignorance concerning the genuine cauſes of theſe effects. The metaphyſical conjectures concerning the auditory organs are probably in the ſame predicament with thoſe which are formed concerning the organs of viſion, if one may ſpeak ſo, in which philoſophers have even till now made ſuch inconſiderable progreſs, and in all likelihood will not be ſurpaſſed by their ſucceſſors.

The rules which we have attempted to eſtabliſh concerning the track which every one ought to purſue in the theory of the muſical art, may ſuffice to ſhew our readers the end which we have endeavoured to attain in this Syſtem. We have nothing to do here (for it is proper that we repeat it), we have nothing to do with the mechanical principles of protracted and harmonic tones produced by ſonorous bodies; principles which, till now, have been explored in vain, and which perhaps may be long explored with the ſame ſucceſs: we have ſtill leſs to do with the metaphyſical cauſes of thoſe pleaſing ſenſations which are impreſſed on the mind by harmony; cauſes which are ſtill leſs diſcovered, and which, according to all appearances, will remain latent in perpetual obſcurity. We are alone concerned to ſhow how the chief and moſt eſſential laws of harmony may be deduced from one ſingle experiment; and for which, if we may ſpeak ſo, preceding artiſts have been under a neceſſity of groping in the dark.

With an intention to render this Syſtem as generally uſeful as poſſible, we have endeavoured to adapt it to the capacity even of thoſe who are abſolutely uninſtructed in muſic. To accompliſh this deſign, it appeared neceſſary to purſue the following plan. To begin with a ſhort introduction, in which are defined the technical terms moſt frequently uſed in this art; ſuch as *chord, harmony, tone, third, fifth, octave*, &c.

Afterwards to enter into the theory of harmony, which is explained according to M. Rameau, with all poſſible perſpicuity. This is the ſubject of the *Firſt Part*; which, as well as the introduction, preſuppoſes no other knowledge of muſic than that of the names and powers of the notes C, D, E, F, G, A, B, which all the world knows.

We ſhall not imitate thoſe muſicians who, believing themſelves geometers, or thoſe geometers who, believing themſelves muſicians, fill their writings with figures upon figures; imagining, perhaps, that this apparatus is neceſſary to the art. The propenſity of adorning their works with a falſe air of ſcience, can only impoſe upon credulity and ignorance, and ſerve no other purpoſe but to render their treatiſes more obſcure and leſs inſtructive.

This we may do with ſo much more reaſon, that in this ſubject the foundations of thoſe calculations are in ſome meaſure hypothetical, and can never ariſe to a degree of certainty above hypotheſis. The relation of the octave as 1 to 2, that of the fifth as 2 to 3, that of the third major as 4 to 5, &c. are not perhaps the genuine relations eſtabliſhed in nature; but only relations which approach them, and ſuch as experience can diſcover. For are the reſults of experience any thing more but mere approaches to truth?

But happily theſe approximated relations are ſufficient, though they ſhould not be exactly agreeable to truth, for giving a ſatisfactory account of thoſe phænomena which depend on the relations of ſound; as in the difference between the notes in the gammut, of the alterations neceſſary in the fifth and third, of the different manner in which inſtruments are tuned, and other facts of the ſame kind. If the relations of the octave, of the fifth, and of the third, are not exactly ſuch as we have ſuppoſed them, at leaſt no experiments can prove that they are not ſo; and ſince theſe relations are ſignified by a ſimple expreſſion, ſince they are beſides ſufficient for all the purpoſes of theory; it would not only be uſeleſs, but even contrary to ſound philoſophy, ſhould any one incline to invent other relations, to form the baſis of any ſyſtem of muſic leſs eaſy and ſimple than that which we have delineated in this ſyſtem.

The *Second Part* of this Syſtem contains the moſt eſſential rules of compoſition, or in other words the practice of harmony. Theſe rules are founded on the principles laid down in the *firſt part*; yet thoſe who wiſh to underſtand no more than is neceſſary for practice, without exploring the reaſons why ſuch practical rules are neceſſary, may limit the objects of their ſtudy to the *introduction* and the *ſecond part*. This ſecond part, ſtrictly ſpeaking, preſuppoſes no more than the firſt, any habit of ſinging, nor even any knowledge of muſic; it only requires that one ſhould know, not even the rules and manner of intonation, but merely the poſition of the notes in the cliff, F or *fa*, on the fourth line, and of that of G or *ſol* upon the ſecond: and even this knowledge may be acquired from the ſyſtem itſelf; for in the beginning of the ſecond part we explain the poſitions of the cleffs and of the notes. Nothing elſe is neceſſary but to render it a little familiar to our memory, and we ſhall have no more difficulty in it.

It would be wrong to expect here all the rules of compoſition, and eſpecially thoſe which direct the compoſition of muſic in ſeveral parts, and which, being leſs ſevere and indiſpenſable, may be chiefly acquired by practice, by ſtudying the moſt approved models, by the aſſiſtance of a proper maſter, but above all by the cultivation of the ear and of the taſte. This Syſtem is intended for explaining to beginners the fundamental principles, not the practical detail of compoſition. Thoſe who wiſh to enter more deeply into this detail, will either find it in Mr. Rameau's treatiſe of harmony, or in the code of muſic which he publiſhed more lately, (from our general recommendation of this code, we except the reflections on the principles of ſound which are at the end, and which we ſhould not adviſe any one to read) or laſtly in the explication of the theory and practice of muſic by M. Bethini, printed at Paris by Lambert in the year 1754: this laſt book appears to us clear and methodical.

Is it neceſſary to add, that, in order to compoſe muſic in a proper taſte, it is by no means enough to have familiarized with much application the principles explained in this ſyſtem? Here can only be learned the mechaniſm of the art; it is the province of nature alone to accompliſh the reſt. Without her aſſiſtance, it is no more poſſible to compoſe agreeable muſic by having read theſe elements, than to write verſes in a proper manner by a poetical dictionary. In one word, it is the elements of muſic alone, and not the principles of genius, that the reader may expect to find in this Syſtem.

Such was the aim purſued in its compoſition, and ſuch ſhonld be the ideas of the reader in its peruſal. Once more let us add, that to the diſcovery of its fundamental principles we have not the remoteſt claim. The ſole end which we propoſed was to be uſeful; to reach that end, we have omitted nothing which appeared neceſſary, and we ſhould be ſorry to find our endeavours unſucceſsful.

DEFINITIONS OF SEVERAL TECHNICAL TERMS.

I. *What is meant by Melody, by Chord, by Harmony, by Interval.*

1. Melody is nothing elſe but a ſeries of ſounds which ſucceed one to another in a manner agreeable to the ear.

2. That is called a *chord* which ariſes from the mixture of ſeveral ſounds heard at the ſame time; and harmony is properly a ſeries of chords which in their ſucceſſion one to another delights the ear. A ſingle chord is likewiſe ſometimes called *harmony*, to ſignify the coaleſcence of ſounds which that chord creates, and the ſenſation produced in the ear by that coaleſcence. We ſhall occaſionally uſe the word *harmony* in this laſt ſenſe, but in ſuch a manner as never to leave our meaning ambiguous.

3. In melody and harmony, the diſtance between one ſound and another is called an *interval*; and this is increaſed or diminiſhed as the ſounds between which it intervenes are higher or lower one than the other.

4. That we may learn to diſtinguiſh the intervals, and the manner of perceiving them, let us take the ordinary ſcale

ut, re, mi, fa, ſol, la, ſi, UT,
C, D, E, F, G, A, B, C,

which every perſon whoſe ear or voice is not extremely falſe naturally modulates. Theſe are the obſervations which will occur to us in ſinging this gammut. The ſound D is higher or ſharper than the ſound C, the ſound E higher than the ſound D, the ſound F higher than the ſound E, &c. and ſo through the whole octave; ſo that the interval or the diſtance from the ſound C to the ſound D, is leſs than the interval or diſtance between the ſound C and the ſound E, the interval from C to E, is leſs than that between C and F, &c. and in ſhort that the interval from the firſt to the ſecond C is the greateſt of all.

5. In general, the interval between two ſounds is proportionably greater, as one of theſe ſounds is higher or lower with relation to the other: but it is neceſſary to obſerve, that two ſounds may be equally high or low, though unequal in their force. The ſtring of a violin touched with a bow produces always a ſound equally high, whether ſtrongly or faintly ſtruck; the ſound will only have a greater or leſſer degree of ſtrength. It is the ſame with vocal modulation; let any one form a ſound by gradually impelling or ſwelling the voice, the ſound may be perceived to increaſe in its energy, whilſt it continues always equally low or equally high.

6. We muſt likewiſe obſerve concerning the ſcale, that the intervals between C and D, between D and E, between F and G, between G and A, between A and B, are equal, or at leaſt nearly equal; and that the intervals between E and F, and between B and C, are likewiſe equal among themſelves, but conſiſt almoſt only of half the former. This fact is known and recogniſed by every one: the reaſon for it ſhall be given in the ſequel; in the mean time every one may aſcertain its reality by the aſſiſtance of an experiment.

This experiment may be eaſily tried. Let any one ſing the ſcale of C, D, E, F, G, A, B, C, it will be immediately obſerved without difficulty, that the laſt four notes of the octave G, A, B, C, are quite ſimilar to the firſt C, D, E, F; inſomuch, that if, after having ſung this ſcale, one would chooſe to repeat it, beginning with C in the ſame tone which was occupied by G in the former ſcale, the note D of the laſt ſcale would have the ſame ſound with the note A in the firſt, the E with the B, and the F with the C.

From whence it follows, that the interval between C and D, is the ſame as between G and A; between D and E, as between A and B; and E and F, as between B and C. It will likewiſe be found, that from D to E, from F to G, there is the ſame interval as from C to D. To be convinced of this, we need only ſing the ſcale once more; then ſing it again, beginning with C, in this laſt ſcale, in the ſame tone which was given to D in the firſt; and it will be perceived, that the D in the ſecond ſcale will have the ſame ſound, at leaſt as far as the ear can diſcover, with the E, in the former ſcale; from whence it follows, that the interval between D and E is, at leaſt as far as the ear can perceive, equal to that between C and D. It will alſo be found, that the interval between F and G is, ſo far as our ſenſe can determine, the ſame with that between C and D.

This experiment may perhaps be tried with ſome difficulty by thoſe who are not inured to form the notes and change the key; but ſuch may very eaſily perform it by the aſſiſtance of an harpſichord, by means of which the performer will be ſaved the trouble of retaining the ſounds in one intonation whilſt he performs another. In touching upon this harpſichord the keys G, A, B, C, and in performing with the voice at the ſame time C, D, E, F, in ſuch a manner that the ſame ſound may be given to C in the voice with that of the key G in the harpſichord, it will be found that D in the vocal intonation ſhall be the ſame with A upon the harpſichord, &c.

It will be found likewiſe by the ſame harpſichord, that if one ſhould ſing the ſcale beginning with C in the ſame tone with E on the inſtrument, the D which ought to have followed C, will be higher by an extremely perceptible degree than the F which follows E: thus it may be concluded, that the interval between E and F is leſs than that between C and D; and if one would riſe from F to another ſound, which is at the ſame diſtance from F as F from E, he would find in the ſame manner, that the interval from E to this new ſound is almoſt the ſame as that between C and D. The interval then from E to F is nearly half of that between C and D.

Since then, in the ſcale thus divided, $\begin{matrix}\text{C, D, E, F,}\\ \text{G, A, B, C,}\end{matrix}$ the firſt diviſion is perfectly like the laſt; and ſince the intervals between C and D, between D and E, and between F and G, are equal; it follows, that the intervals between G and A, and between A and B are likewiſe equal to every one of the three intervals between C and D, between D and E, and between F and G; and that intervals between E and F and between B and C are alſo equal, but that they only conſtitute one half of the others.

7. It is for this reaſon that they have called the interval from E to F, and from B to C, a ſemitone; whereas thoſe between C and D, D and E, F and G, G and A, A and B, are tones. The *tone* is likewiſe called a *ſecond major*, and the *ſemitone* a *ſecond minor*.

8. To deſcend or riſe diatonically, is to deſcend or riſe from one ſound to another by the interval of a tone or of a ſemitone, or in general by ſeconds, whether major or minor; as from D to C, or from C to D; from F to E, or from E to F.

II. *The Terms by which the different Intervals of the Gammut are denominated.*

9. An interval compoſed of a tone and a ſemitone, as from E to G, from A to C, or from D to F, is called a *third minor*. An interval compoſed of two full tones, as from C to E, from F to A, or from G to B is called a *third major*. An interval compoſed of two tones and a ſemitone, as from C to F, or from G to C, is called a *fourth*. An interval conſiſting of three full tones, as from F to B, is called a *triton*, or *fourth redundant*. An interval conſiſting of three tones and a ſemitone, as from C to G, from F to C, from D to A, or from E to B, &c. is called a *fifth*. An interval compoſed of three tones and two ſemitones, as from E to C, is called a *ſixth minor*. An interval compoſed of four tones and a ſemitone, as from C to A, is called a *ſixth major*. An interval conſiſting of four tones and two ſemitones, as from D to C, is called a *ſeventh minor*. An interval compoſed of five tones and two ſemitones, as from C to B, is called a *ſeventh major*. And in ſhort, an interval conſiſting of five tones and two ſemitones, as from C to C, is called an *octave*. Many of the intervals which have now been mentioned, are ſtill ſignified by other names, as may be ſeen in the beginning of the ſecond part; but thoſe which we have now given are the moſt common, and the only terms which our preſent purpoſe demands.

10. Two ſounds equally high, or equally low, however unequal in their force, are ſaid to be in *uniſon* one with the other.

11. If two ſounds form between them any interval, whatever it be, we ſay, that the higheſt when aſcending is in that interval with relation to the loweſt; and when deſcending, we pronounce the loweſt in the ſame interval with relation to the higheſt. Thus in the third minor E, G, where E is the loweſt and G the higheſt ſound, G is a third minor from E *aſcending*, and E is third minor from G *in deſcending*.

12. In the ſame manner, if, ſpeaking of two ſonorous bodies, we ſhould ſay, that the one is a fifth above the other *in aſcending*, this infers that the ſound given by the one is at the diſtance of a fifth *aſcending* from the ſound given by the other.

III. *Of Intervals greater than the Octave.*

13. If after having ſung the ſcale C, D, E, F, G, A, B, C, one would carry this ſcale ſtill farther in aſcent, it would be diſcovered without difficulty, that a new ſcale would be formed, C, D, E, F, &c. entirely ſimilar to the former, and of which the ſounds will be an octave aſcending, each to its correſpondent note in the former ſcale; thus D, the ſecond note of the ſcale, will be an octave in aſcent to the D of the firſt ſcale; in the ſame manner E ſhall be the octave to E, &c. and ſo of the reſt.

14. As there are nine notes from the C firſt to the ſecond D, the interval between theſe two ſounds is called a *ninth*, and this ninth is compoſed of ſix full tones and two ſemitones. For the ſame reaſon the interval from C to F is called an *eleventh*, and the interval between C and G, a *twelfth*, &c. It is plain that the *ninth* is the octave of the *ſecond*, the *eleventh* of the *fourth*, and the *twelfth* of the *fifth*, &c. The octave above the octave of any ſound is called a *double octave*; the octave of the double octave is called a *triple octave*; and ſo of the reſt. The double octave is likewiſe called a *fifteenth*; and for the ſame reaſon the double octave of the third is called a *ſeventeenth*, the double octave of the fifth a *nineteenth*, &c.

Let us ſuppoſe two vocal ſtrings formed of the ſame matter, of the ſame thickneſs, and equal in their tenſion, but unequal in their length, it will be found by experience. 1. That if the ſhorteſt is equal to half the longeſt, the ſound which it will produce muſt be an octave above the ſound produced by the longeſt. 2. That if the ſhorteſt conſtitutes a third part of the longeſt, the ſound which it produces muſt be a twelfth above the ſound produced by the longeſt. 3. That if it conſtitutes the fifth part, its ſound will be a ſeventeenth above.

Beſides, it is a truth demonſtrated and generally admitted, that in proportion as one muſical ſtring is leſs than another, the vibrations of the leaſt will be more frequent (that is to ſay, its departures and returns through the ſame ſpace), in the ſame time; for inſtance, in an hour, a minute, a ſecond, &c. in ſuch a manner that one ſtring which conſtitutes a third part of another, forms three vibrations, whilſt the largeſt has only accompliſhed one. In the ſame manner a ſtring which is one half leſs than another, performs two vibrations, whilſt the other only completes one; and a ſtring which is only the fifth part of another, will perform five vibrations in the ſame time which is occupied by the other in one. From thence it follows, that the ſound of a ſtring is proportionally higher or lower, as the number of its vibrations is greater or ſmaller in a given time; for inſtance, in a ſecond. It is for that reaſon that if we repreſent any ſound whatever by 1, one may repreſent the octave above by 2, that is to ſay, by the number of vibrations formed by the ſtring which produces the octave, whilſt the longeſt ſtring only vibrates once; in the ſame manner we may repreſent the twelfth above the ſound 1 by 3, the ſeventeenth major above by 5, &c. But it is very neceſſary to remark, that by theſe numerical expreſſions, we do not pretend to compare ſounds as ſuch; for ſounds in themſelves are nothing but mere ſenſations, and it cannot be ſaid of any ſenſation that it is double or triple to another: thus the expreſſions 1, 2, 3, &c. employed to denominate a ſound, its octave above, its twelfth above, &c. ſignify only, that if a ſtring performs a certain number of vibrations, for inſtance, in a ſecond, the ſtring which is in the octave above ſhall double the number in the ſame time, the ſtring which is in the twelfth above ſhall triple it, &c. Thus to compare ſounds among themſelves is nothing elſe than to compare among themſelves the numbers of vibrations which are formed in a given time by the ſtrings that produce theſe ſounds.

IV. *What is meant by Sharps and Flats.*

15. It is plain that one may imagine the five tones which enter into the ſcale, as divided each into two ſemitones; thus one may advance from C to D, forming in its progreſs an intermediate ſound, which ſhall be higher by a ſemitone than C, and lower in the ſame degree than D. A ſound in the ſcale is called *ſharp*, when it is raiſed by a ſemitone; and it is marked with this character ✕: thus C ✕ ſignifies C *ſharp*; that it is to ſay, C raiſed by a ſemitone above its pitch in the natural ſcale. A ſound in the ſcale depreſſed by a ſemitone is called *flat*, and is marked thus, ♭: thus A ♭ ſignifies A *flat*, or A depreſſed by a ſemitone.

V. *What is meant by Conſonances and Diſſonances.*

16. A chord compoſed of ſounds whoſe union or coaleſcence pleaſes the ear is called a *conſonance*; and the ſounds which form this chord are ſaid to be conſonant one with relation to the other. The reaſon of this denomination is, that a chord is found more perfect, as the ſounds which form it coaleſce more cloſely among themſelves.

17. The octave of a ſound is the moſt perfect of conſonances of which that ſound is ſuſceptible; then the fifth, afterwards the third, &c. This is a fact founded on experiment.

18. A number of ſounds at the ſame time produced whoſe union is diſpleaſing to the ear is called a *diſſonance*, and the ſounds which form it are ſaid to be diſſonant one with relation to the other. The ſecond, the triton, and the ſeventh of a ſound, are diſſonants with relation to it. Thus the ſound C D, C B, or F B, &c. heard at the ſame time, form a diſſonance. The reaſon which renders diſſonance diſagreeable, is, that the ſounds which compoſe it ſeem by no means coaleſcent to the ear, and are heard each of them by itſelf as diſtinct ſounds, though produced at the ſame time.

PART I. THEORY OF HARMONY.

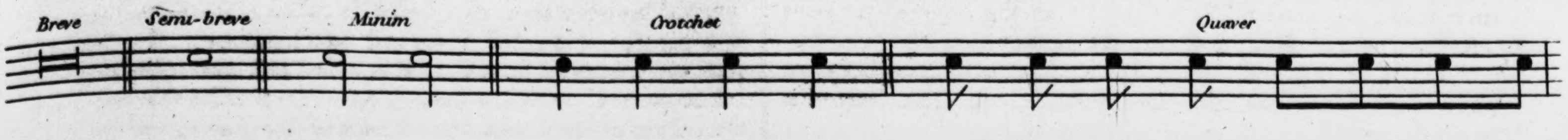
SECT. I. *Preliminary and Fundamental Experiments.*

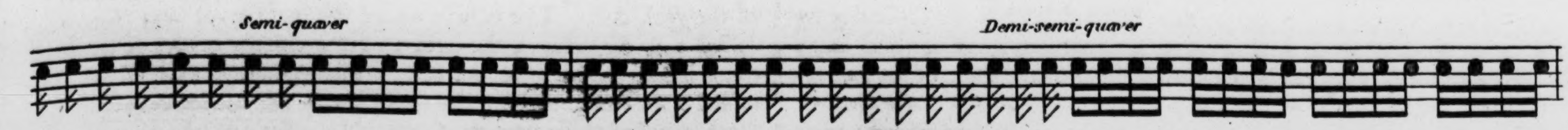
EXPERIMENT I.

19. When a ſonorous body is ſtruck till it gives a ſound, the ear, beſides the principal ſound and its octave, perceives two other ſounds

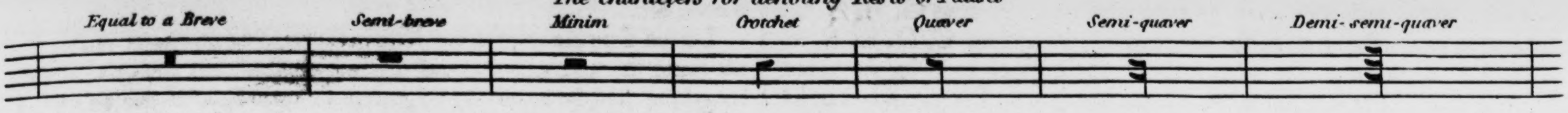
Principles of Music. See the System.

The Seven Characters or ways of Writing the Notes according to their value or length of Time with the Marks of their several Rests or Pauses.

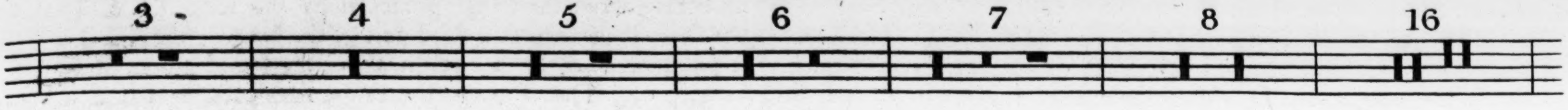

Breve
Semi-breve
Minim
Crotchet
Quaver


Semi-quaver
Demi-semi-quaver

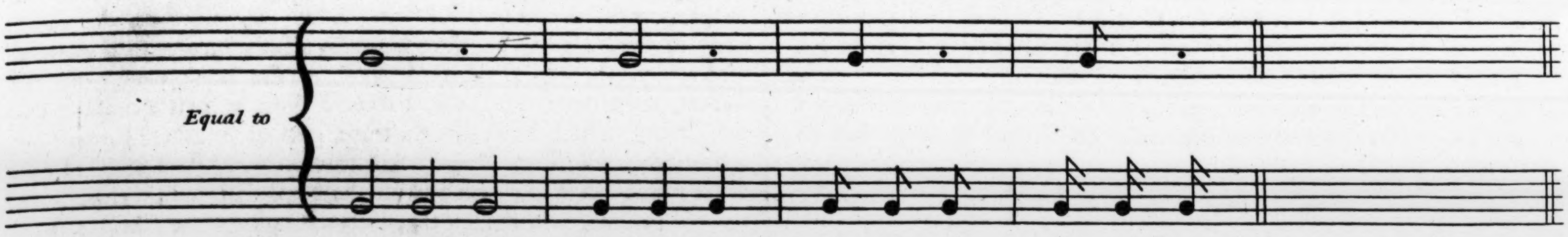
The Characters for denoting Rests or Pauses


Equal to a Breve
Semi-breve
Minim
Crotchet
Quaver
Semi-quaver
Demi-semi-quaver

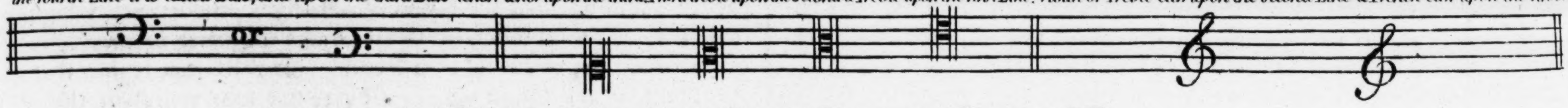
When more Bars than one are to be rested it is commonly marked thus.



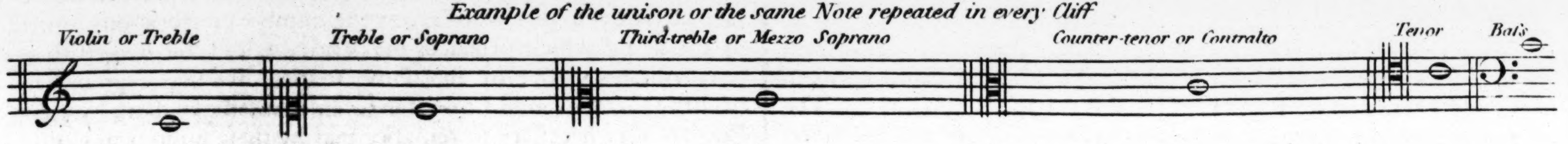
A Dot added to any Note increases its value one half



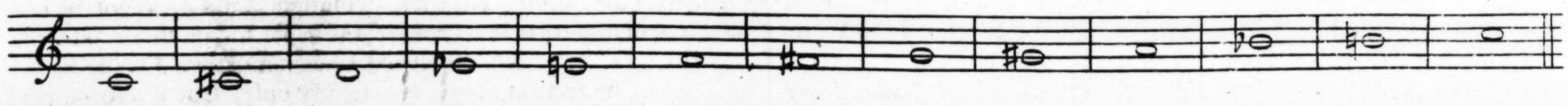
There are three Cliffs The lowest 𝄢 is called Baſs or F. Cliff & is placed either upon the fourth or third Line. When it is upon the fourth Line it is called Baſs, and upon the third Baſs-tenor. The next 𝄡 is the Tenor or C. Cliff and is placed upon the first, second, third & fourth Line It is called Tenor upon the fourth Line Counter-tenor upon the third, Third-treble upon the second & Treble upon the first Line. The last Cliff 𝄞 is the Treble or G Cliff being five Notes higher than the C Cliff and is placed upon the second and first Line and called Violin or Treble Cliff upon the second Line & French Cliff upon the first.



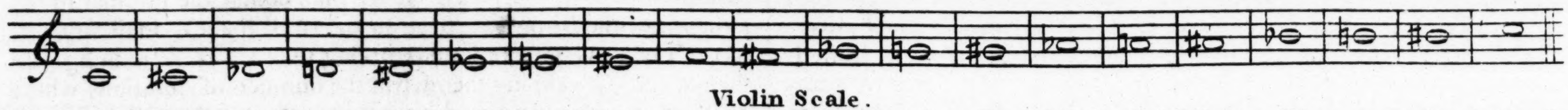
Example of the unison or the same Note repeated in every Cliff


Violin or Treble
Treble or Soprano
Third-treble or Mezzo Soprano
Counter-tenor or Contralto
Tenor
Baſs

Chromatic Scale.

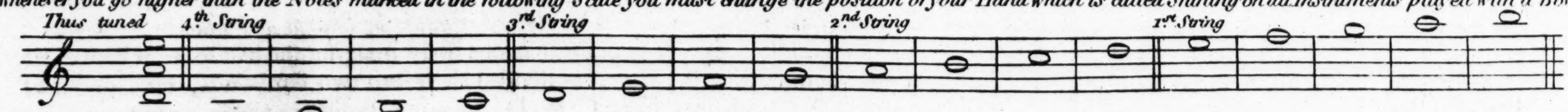


Enharmonick Scale

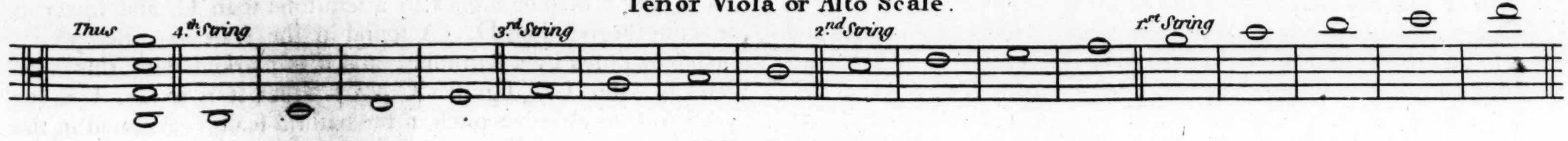


Violin Scale.

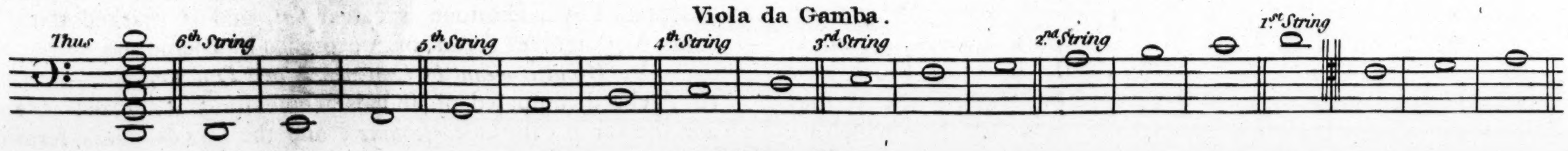
Whenever you go higher than the Notes marked in the following Scale you must change the position of your Hand which is called Shifting on all Instruments played with a Bow


Thus tuned
4th String
3rd String
2nd String
1st String

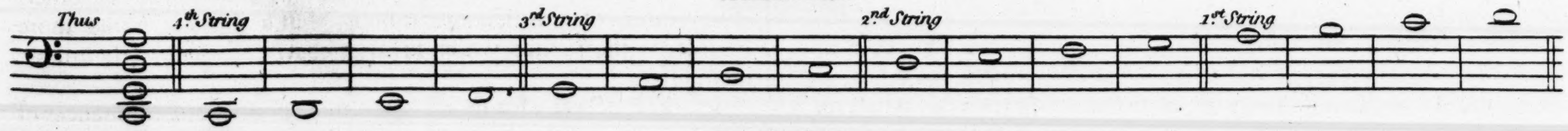
Tenor Viola or Alto Scale.


Thus
4th String
3rd String
2nd String
1st String

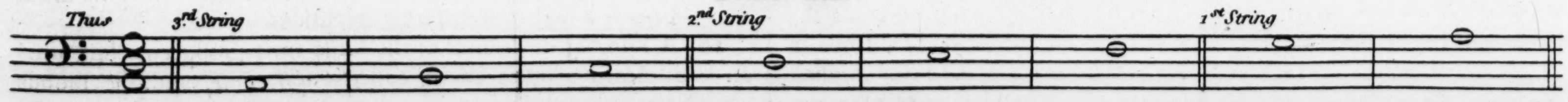
Viola da Gamba.


Thus
6th String
5th String
4th String
3rd String
2nd String
1st String

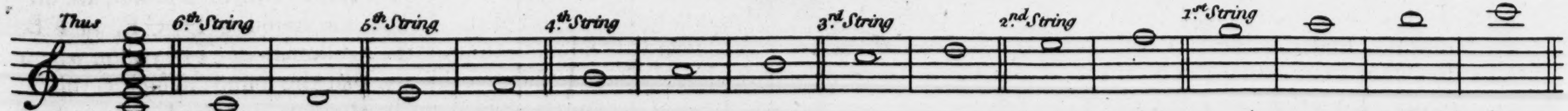
Violoncello.


Thus
4th String
3rd String
2nd String
1st String

Double Baſs.

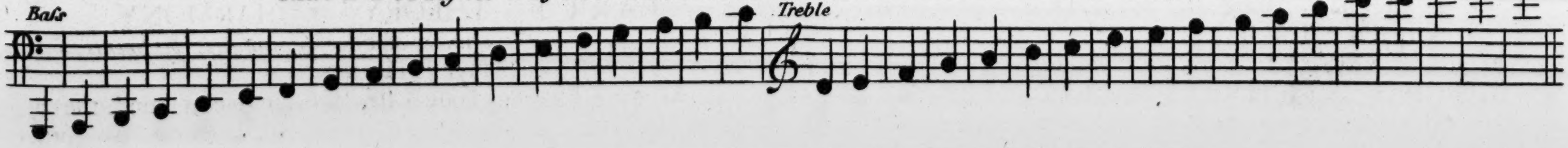

Thus
3rd String
2nd String
1st String

Guitar.


Thus
6th String
5th String
4th String
3rd String
2nd String
1st String

Harp.

There is a String for every Note and when half a one is wanted it must be made with the Pedal


Baſs
Treble

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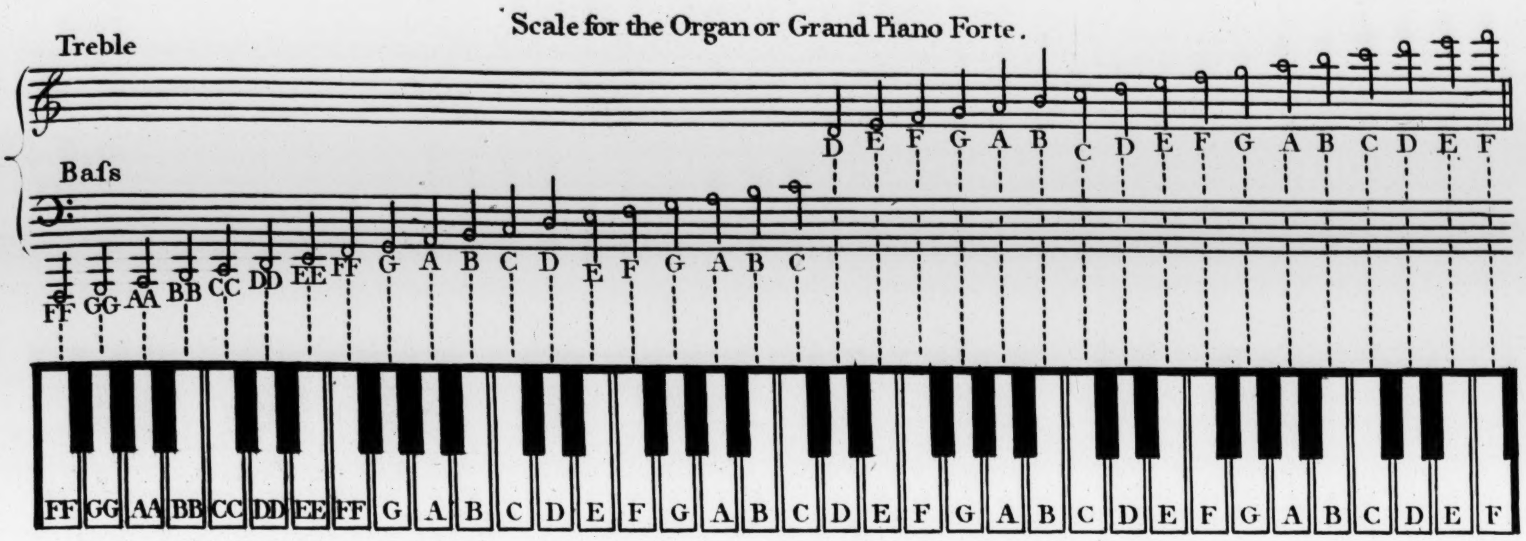
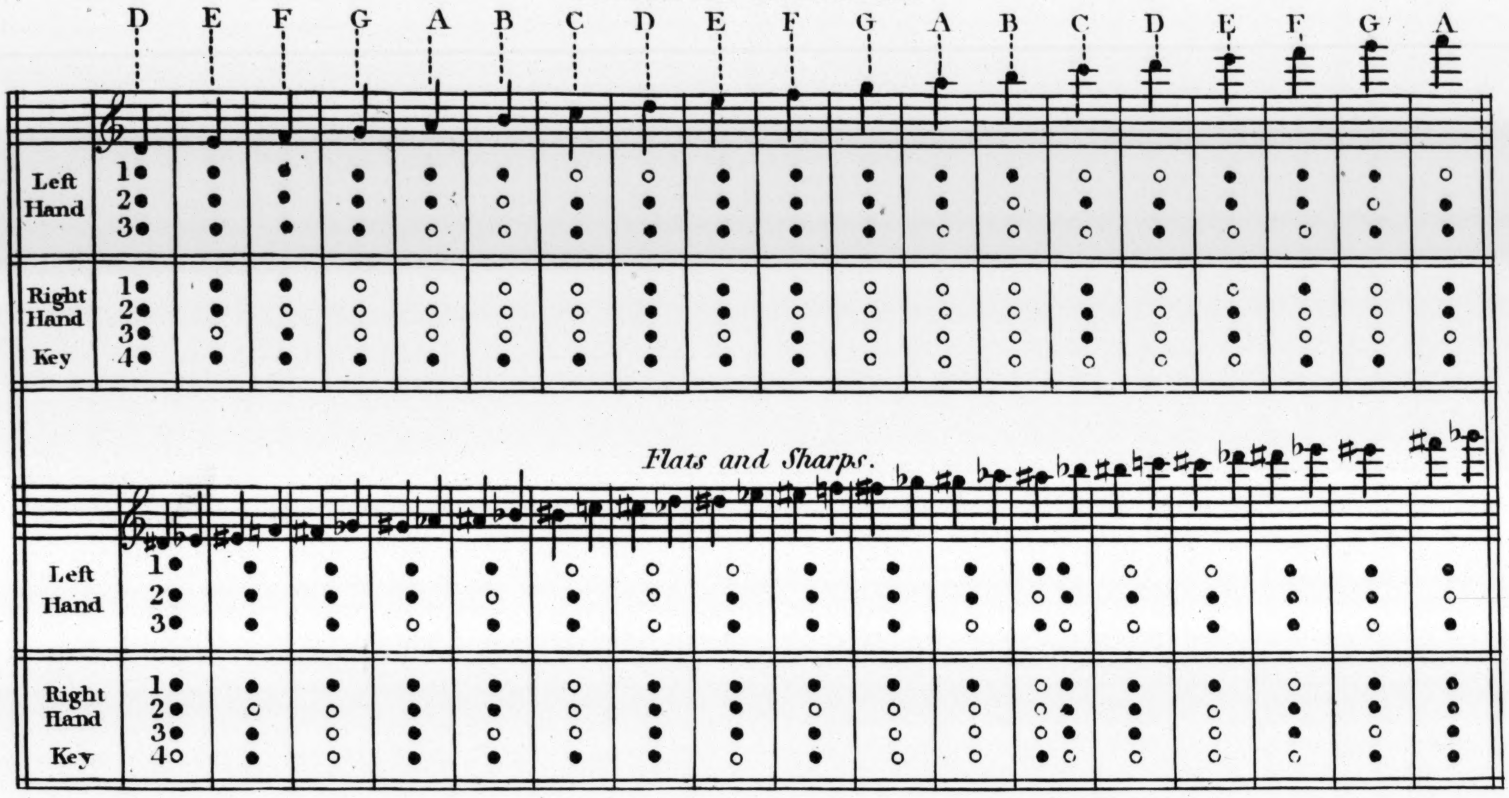
Principles of Music. See the System.

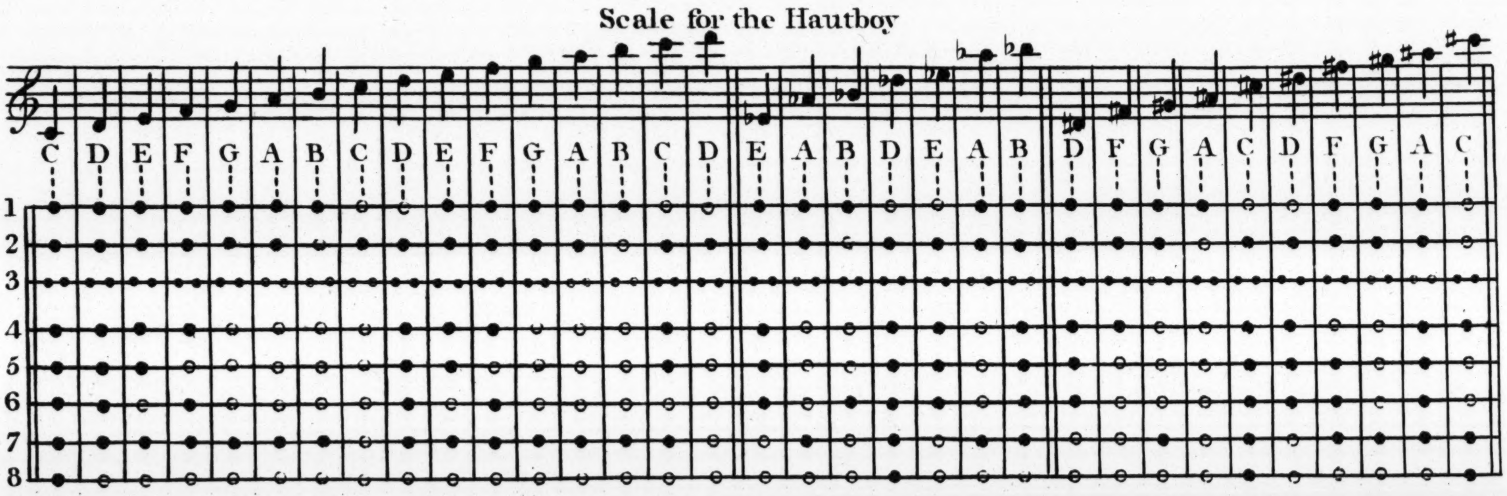
Scale for the Organ or Grand Piano Forte.


Treble
Baſs
D E F G A B C D E F G A B C D E F
FF GG AA BB CC DD EE FF G A B C D E F G A B C
FF GG AA BB CC DD EE FF G A B C D E F G A B C D E F G A B C D E F G A B C D E F

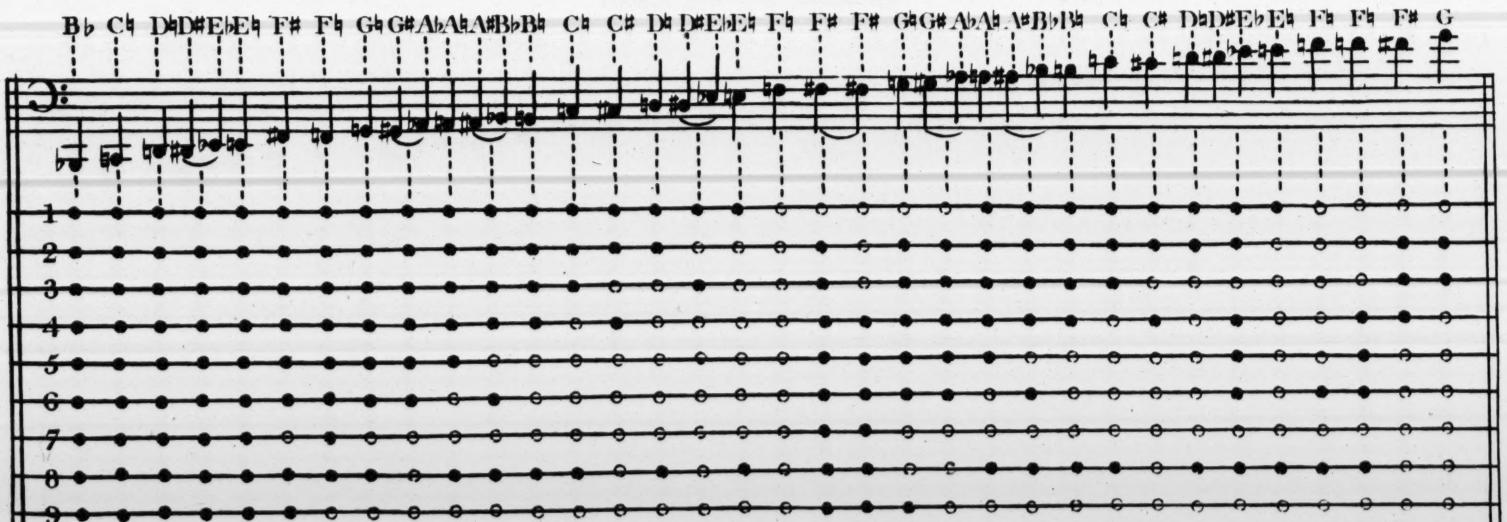
Scale for the German Flute


D E F G A B C D E F G A B C D E F G A
Left Hand 1 2 3
Right Hand 1 2 3
Key 4
Flats and Sharps.
Left Hand 1 2 3
Right Hand 1 2 3
Key 4

Scale for the Hautboy


C D E F G A B C D E F G A B C D
E A B D E A B
D F G A C D F G A C
1 2 3 4 5 6 7 8

Scale for the Baſsoon


B♭ C♮ D♮ D♯ E♭ E♮ F♯ F♮ G♮ G♯ A♭ A♮ A♯ B♭ B♮ C♮ C♯ D♮ D♯ E♭ E♮ F♮ F♯ F♯ G♮ G♯ A♭ A♮ A♯ B♭ B♮ C♮ C♯ D♮ D♯ E♭ E♮ F♮ F♮ F♯ G
1 2 3 4 5 6 7 8 9 10 11 12

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ſounds very high, of which one is the twelfth above the principal ſound, that is to ſay, the octave to the fifth of that ſound ; and the other is the ſeventeenth major above the ſame ſound, that is to ſay, the double octave of its third major.

20. This experiment is peculiarly ſenſible upon the thick ſtrings of the violincello, of which the ſound being extremely low, gives to an ear, though not very much practiſed, an opportunity of diſtinguiſhing with ſufficient eaſe and clearneſs the twelfth and ſeventeenth now in queſtion. Since the octave above the ſound 1 is 2, the octave below that ſame ſound ſhall be $\frac{1}{2}$; that is to ſay, that the ſtring which produces this octave ſhall have performed half its vibration whilſt the ſtring which produces the ſound 1 ſhall have completed one. To obtain therefore the octave above any ſound, the operator muſt multiply the quantity which expreſſes the ſound by 2; and to obtain the octave below, he muſt on the contrary divide the ſame quantity by 2.

It is for that reaſon that if any ſound whatever, for inſtance C, is denominated -	1
Its octave above will be - - -	2
Its double octave above - - -	4
Its triple octave above - - -	8
In the ſame manner its octave below will be -	$\frac{1}{2}$
Its double octave below - - -	$\frac{1}{4}$
Its triple octave below - - -	$\frac{1}{8}$
And ſo of the reſt.	
Its twelfth above - - - -	3
Its twelfth below - - - -	$\frac{1}{3}$
Its ſeventeeth major above - - -	5
Its ſeventeenth major below - - -	$\frac{1}{5}$

The fifth then above the ſound 1 being the octave beneath the twelfth, ſhall be, as we have immediately obſerved, $\frac{3}{2}$; which ſignifies that this ſtring performs $\frac{3}{2}$ vibrations, that is to ſay one vibration and a half, during a ſingle vibration of the ſtring which gives the ſound 1. To obtain the fourth above the ſound 1, we muſt take the twelfth below that ſound, and the double octave above that twelfth. In effect, the twelfth below C, for inſtance, is F, of which the double octave F is the fourth above C. Since then the twelfth below 1 is $\frac{1}{3}$, it follows that the double octave above this twelfth, that is to ſay, the fourth from the ſound 1 in aſcending, will be $\frac{1}{3}$ multiplied by 4, or $\frac{4}{3}$. In ſhort, the third major being nothing elſe but the double octave beneath the ſeventeenth, it follows, that the third major above the ſound 1 will be 5 divided by 4, or in other words $\frac{5}{4}$. The third major of a ſound, for inſtance the third major E, from the ſound C, and its fifth G, form between them a third minor E, G ; now E is $\frac{5}{4}$, and G $\frac{3}{2}$, by what has been immediately demonſtrated : from whence it follows, that the third minor, or the interval between E and G, ſhall be expreſſed by the relation of the fraction $\frac{5}{4}$ to the fraction $\frac{3}{2}$.

To determine this relation, it is neceſſary to remark, that $\frac{5}{4}$ are the ſame thing with $\frac{10}{8}$, and that $\frac{3}{2}$ are the ſame thing with $\frac{12}{8}$: ſo that $\frac{5}{4}$ ſhall be to $\frac{3}{2}$ in the ſame relation as $\frac{10}{8}$ to $\frac{12}{8}$; that is to ſay, in the ſame relation as 10 to 12, or as 5 to 6. If, then, two ſounds form between themſelves a third minor, and that the firſt is repreſented by 5, the ſecond ſhall be expreſſed by 6 ; or what is the ſame thing, if the firſt is repreſented by 1, the ſecond ſhall be expreſſed by $\frac{6}{5}$: Thus the third minor, an harmonic ſound which is even found in the protracted and coaleſcent tones of a ſonorous body between the ſound E and G, an harmonic of the principal ſound, may be expreſſed by the fraction $\frac{6}{5}$.

One may ſee by this example, that in order to compare two ſounds one with another, which are expreſſed by fractions, it is neceſſary firſt to multiply the numerator of the fraction which expreſſes the firſt by the denominator of the fraction which expreſſes the ſecond, which will give a primary number ; as here the numerator 5 of the fraction $\frac{5}{4}$, multiplied by 2 of the fraction $\frac{3}{2}$ has given 10. Afterwards may be multiplied the numerator of the ſecond fraction by the denominator of the firſt which will give a ſecondary number, as here 12 is the product of 4 multiplied by 3 ; and the relation between theſe two numbers (which in the preceding example are 10 and 12), will expreſs the relation between theſe ſounds, or, what is the ſame thing, the interval which there is between the one and the other ; in ſuch a manner, that the farther the relation between theſe ſounds departs from unity, the greater the interval will be. Such is the manner in which we may compare two ſounds one with another whoſe numerical value is known. We ſhall now ſhow the manner how the numerical expreſſion of a ſound may be obtained, when the relation which it ought to have with another ſound is known whoſe numerical expreſſion is given. Let us ſuppoſe, for example, that the third major of the fifth $\frac{3}{2}$ is ſought. That third major ought to be, by what has been ſhown above, the $\frac{5}{4}$ of the fifth ; for the third major of any ſound whatever is the $\frac{5}{4}$ of that ſound. We muſt then look for a fraction which expreſſes the $\frac{5}{4}$ of $\frac{3}{2}$; which is done by multiplying the numerators and denominators of both fractions one by the other, from whence reſults the new fraction $\frac{15}{8}$. It will likewiſe be found that the fifth of the fifth is $\frac{9}{4}$, becauſe the fifth of the fifth is the $\frac{3}{2}$ of $\frac{3}{2}$. Thus far we have only treated of fifths, fourths, thirds major and minor, in aſcending ; now it is extremely eaſy to find by the ſame rules the fifths, fourths, thirds major and minor in deſcending. For ſuppoſe C equal to 1, we have ſeen that its fifth, its fourth, its third, its major and minor in aſcending, are $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{6}{5}$. To find its fifth, its fourth, its third major and minor in deſcending, nothing more is neceſſary than to reverſe theſe fractions, which will give $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$.

21. The principal ſound is called the *generator* ; and the two other ſounds which it produces, and with which it is accompanied, are, incluſive of its octave, called its *harmonics*.

EXPERIMENT II.

22. There is no perſon inſenſible of the reſemblance which ſubſiſts between any ſound and its octave, whether above or below. Theſe two ſounds, when heard together, almoſt entirely coaleſce in the organ of ſenſation. We may beſides be convinced (by two facts which are extremely ſimple) of the facility with which one of theſe ſounds may be taken for the other.

Let it be ſuppoſed that any perſon has an inclinatirn to ſing a tune, and having at firſt begun this air upon a pitch too high or too low for his voice, ſo that he is obliged, leſt he ſhould ſtrain himſelf too much, to ſing the tune in queſtion on a key higher or lower than the firſt; without being initiated in the art of muſic, he will naturally take his new key in the octave below or the octave above the firſt; and in order to take this key in any other interval except the octave, he will find it neceſſary to exert a ſenſible degree of attention. This is a fact of wbich we may eaſily be perſuaded by experience. Another inſtance, Let any perſon ſing a tune in our preſence, and let it be ſung in a tone too high or too low for our voice ; if we wiſh to join in ſinging this air, we naturally take the octave below or above, and frequently, in taking this octave, we imagine it to be the uniſon. It is not then imagined that we change the value of a ſound in multiplying or dividing it by 2, by 4, or by 8, &c. the number which expreſſes theſe ſounds, ſince by theſe operations we do nothing but take the ſimple, double, or triple octave, &c. of the ſound in queſtion, and that a ſound coaleſces with its octave.

SECT. II. *The Origin of the Modes Major and Minor* ; *of the moſt natural Modulation, and the moſt perfect Harmony.*

23. To render our ideas ſtill more preciſe and permanent, we ſhall call the tone produced by the ſonorous body C : it is evident, by the firſt experiment, that this ſound is always attended by its 12th and 17th major ; that is to ſay, with the octave of G, and the double octave of E.

24. This octave of G then, and this double octave of E, produce the moſt perfect chord which can be joined with C, ſince that chord is the work and choice of nature.

25. For the ſame reaſon, the modulation formed by C with the octave of G and the double octave of E, ſung one after the other, would likewiſe be the moſt ſimple and natural of all modulations which do not deſcend or aſcend directly in the diatonic order, if our voices had ſufficient compaſs to form intervals ſo great without difficulty: but the eaſe and freedom with which we can ſubſtitute its octave to any ſound, when it is more convenient for the voice, afford us the means of repreſenting this modulation.

26. It is on this account that, after having ſung the tone C, we naturally modulate the third E, and the fifth G, inſtead of the double octave of E, and the octave of G; from whence we form, by joining the octave of the ſound C, this modulation, C, E, G, C, which in effect is the ſimpleſt and eaſieſt of them all ; and which likewiſe has its origin even in the protracted and compounded tones produced by a ſonorous body.

27. The modulation C, E, G, C, in which the chord C, E, is a third major, conſtitutes that kind of harmony or melody which we call the *mode major* ; from whence it follows, that this mode reſults from the immediate operation of nature.

28. In the modulation C, E, G, of which we have now been treating, the ſounds E and G are ſo proportioned one to the other, that the principal ſound C (art. 19.) cauſes both of them to reſound; but the ſecond tone E does not cauſe G to reſound, which only forms the interval of a third minor.

29. Let us then imagine, that, inſtead of this ſound E, one ſhould ſubſtitute between the ſounds C G, another note which (as well as the ſound C) has the power of cauſing G to reſound, and which is, however, different from the ſound C; the ſound which we explore ought to be ſuch, by art. 19. that it may have for its 17th major G, or one of the octaves of G ; of conſequence the ſound which we ſeek ought to be a 17th major below G, or, what is the ſame thing, a third major below the ſame G. Now the ſound E being a third minor beneath G, and the third major being (art. 9.) greater by a ſemitone than the third minor, it follows, that the ſound of which we are in ſearch ſhall be a ſemitone beneath the natural E, and conſequently E ♭.

30. This new arrangement, C, E♭, G, in which the ſounds C, and E♭ have both the power of cauſing G, to reſound, though C does not cauſe E♭ to reſound, is not indeed equally perfect with the firſt arrangement C, E, G ; becauſe in this the two ſounds E and G are both the one and the other generated by the principal ſound C; whereas, in the other, the ſound E♭, is not generated by the ſound C ; but this arrangement C, E♭, G, is likewiſe dictated by nature (art. 19.), though leſs immediately than the former; and accordingly experience evinces that the ear accommodates itſelf almoſt as well to the latter as to the former.

31. In this modulation or chord C, E♭, G, C, it is evident that

the third from C to E♭ is minor; and ſuch is the origin of that mode which we call *minor*.

32. The moſt perfect chords then are. 1. All chords related one to another, as C, E, G, C, conſiſting of any ſound of its third major, of its fifth, and of its octave. 2. All chords related to one another, as C, E♭, G, C, conſiſting of any ſound, of its third minor, of its fifth, and of its octave. In effect, theſe two kinds of chords are exhibited by nature; but the firſt more immediately than the ſecond. The firſt are called *perfect chords major*, the ſecond *perfect chords minor*.

SECT. III. *Of the Series which the Fifth requires, and of the Laws which it obſerves.*

33. Since the ſound C, cauſes the ſound G to be heard, and is itſelf heard in the ſound F, which ſounds G and F are its two twelfths, we may imagine a modulation compoſed of that ſound C and its two-twelfths, or, which is the ſame thing (art. 22), of its two-fifths, F and G, the one below, the other above; which gives the modulation or ſeries of fifths F, C, G, which we call the *fundamental baſs* of C by fifths.

We ſhall find in the ſequel, that there may be ſome fundamental baſes by thirds, deduced from the two ſeventeenths, of which the one is an attendant of the principal ſound, and of which the other includes that ſound. But we muſt advance ſtep by ſtep, and ſatisfy ourſelves at preſent to conſider immediately the fundamental baſs by fifths.

34. Thus, from the ſound C, one may make a tranſition indifferently to the ſound G, or to the ſound F.

35. One may, for the ſame reaſon, continue this kind of fifths in aſcending, and in deſcending, from C, in this manner:

E♭, B♭, F, C, G, D, A, &c.

And from this ſeries of fifths, one may paſs to any ſound which immediately precedes or follows it.

36. But it is not allowed in the ſame manner to paſs from one ſound to another which is not immediately contiguous to it; for inſtance, from C to D, or from D to C; for this very ſimple reaſon, that the ſound D is not contained in the ſound C, nor the ſound C in that of D; and thus theſe ſounds have not any alliance the one with the other, which may authoriſe the tranſition from one to the other.

37. And as theſe ſounds C and D, by the firſt experiment, naturally bring along with them the perfect chords conſiſting of greater intervals C, E, G, C, D, F♯, A, D; hence may be deduced this rule, That two perfect chords, eſpecially if they are major, cannot ſucceed one another diatonically in a fundamental baſs; we mean, that in a fundamental baſs two ſounds cannot be diatonically placed in ſucceſſion, each of which, with its harmonics, forms a perfect chord, eſpecially if this perfect chord be major in both.

SECT. IV. *Of Modes in general.*

38. A *mode*, in muſic, is nothing elſe but the order of ſounds preſcribed, as well in harmony as melody, by the ſeries of fifths. Thus the three ſounds F, C, G, and the harmonics of each of theſe three ſounds, that is to ſay, their thirds major and their fifths, compoſe all the major modes which are proper to C.

39. The ſeries of fifths then, or the fundamental baſs F, C, G, of which C holds the middle ſpace, may be regarded as repreſenting the mode of C. One may likewiſe take the ſeries of fifths, or fundamental baſe, C, G, D, as repreſenting the mode of G; in the ſame manner B♭, F, C, will repreſent the mode of F. By this we may ſee, that the mode of G, or rather the fundamental baſs of that mode, has two ſounds in common with the fundamental baſs of the mode of C. It is the ſame with the fundamental baſs of the mode F.

40. The mode of C, (F, C, G,) is called the *principal mode* with reſpect to the modes of theſe two fifths, which are called its two *adjuncts*.

41. It is then, in ſome meaſure, indifferent to the ear whether a tranſition be made to the one or to the other of theſe adjuncts, ſince each of them has equally two ſounds in common with the principal mode. Yet the mode of G ſeems a little more eligible; for G is heard amongſt the harmonics of C, and of conſequence is implied and ſignified by C; whereas C does not cauſe F to be heard, though C is included in the ſame ſound F. It is hence that the ear, affected by the mode of C, is a little more prepoſſeſſed for the mode of G, than for that of F. Nothing likewiſe is more frequent, nor more natural, than to paſs from the mode of C to that of G.

42. It is for this reaſon, as well as to diſtinguiſh the two fifths one from the other, that we call G, the fifth above the generator the *dominant* ſound, and the fifth F beneath the generator the *ſubdominant*.

43. It remains to add, as we have ſeen in the preceding ſection, that, in the ſeries of fifths, we may indifferently paſs from one ſound to that which is contiguous: in the ſame manner, and for the ſame reaſon, one may paſs from the mode of G, to the mode of D, after having made a tranſition from the mode of C to the mode of G, as from the mode of F to the mode of B♭. But it is neceſſary, however, to obſerve, that the ear in which has been immediately affected with the principal mode feels always a ſtrong propenſity to return to it. Thus the further the mode to which we make a tranſition is removed from the principal mode, the leſs time we ought to dwell upon it.

SECT. V. *Of Temperament.*

44. The alterations which we have obſerved in the intervals between particular ſounds of the diatonic ſcale, naturally lead us to ſpeak of temperament. To give a clear idea of this, and to render the neceſſity of it palpable, let us ſuppoſe that we have before us an inſtrument with keys, a harpſichord, for inſtance, conſiſting of ſeveral octaves or ſcales, of which each includes its twelve ſemitones.

Let us chooſe in that harpſichord one of the ſtrings which will ſound the note C, and let us tune the ſtring G to a perfect fifth with C in aſcending; let us afterwards tune to a perfect fifth with this G the D which is above it; we ſhall evidently perceive that this D will be in the ſcale above that from which we ſet out; but it is alſo evident that this D muſt have in the ſcale a D which correſponds with it, and which muſt be tuned a true octave below D; and between this and G there ſhould be the interval of a fifth; ſo that the D in the firſt ſcale will be a true fourth below the G of the ſame ſcale. We may afterwards tune the note A of the firſt ſcale to a juſt fifth with this laſt D; then the note E in the higheſt ſcale to a true fifth with this new A, and of conſequence the E in the firſt ſcale to a true fourth beneath this ſame A: having finiſhed this operation, it will be found that the laſt E, thus tuned, will by no means form a juſt third major from the ſound C; it is impoſſible for E to conſtitute at the ſame time the third major of C, and the true fifth of A; or, what is the ſame thing, the true fourth of A in deſcending.

The A conſidered as the fifth of D is $\frac{27}{16}$, and the fourth beneath this A will conſtitute $\frac{3}{4}$ of $\frac{27}{16}$, that is to ſay, $\frac{81}{64}$; $\frac{81}{64}$ then ſhall be the value of E, conſidered as a true fourth from A in deſcending: now E, conſidered as the third major of the ſound C, is $\frac{5}{3}$, or $\frac{80}{64}$: theſe two E's then are between themſelves in the proportion of 81 to 80; thus it is impoſſible that E ſhould be at the ſame time a perfect third major from C, and a true fourth beneath A.

45. What is ſtill more, if, after having ſucceſſively and alternately tuned the ſtrings C, G, D, A, E, in perfect fifths and fourths one from the other, we continue to tune ſucceſſively by true fifths and fourths the ſtrings E, B, F♯, C♯, G♯, D♯, E♯, B♯; we ſhall find, that, though B♯, being a ſemitone higher than the natural note, ſhould be equivalent to C natural, it will by no means form a juſt octave to the firſt C in the ſcale, but be conſiderably higher; yet this B♯ upon the harpſichord ought not to be different from the octave above C; for every B♯ and every C is the ſame ſound, ſince the octave or the ſcale only conſiſts of twelve ſemitones.

46. From thence it neceſſarily follows, 1. That it is impoſſible that all the octaves and all the fifths ſhould be juſt at the ſame time, particularly in inſtruments which have keys, where no intervals leſs than a ſemitone are admitted. 2. That, of conſequence, if the fifths are juſtly tuned, ſome alteration muſt be made in the octaves; now the ſympathy of ſound which ſubſiſts between any note and its octave, does not permit us to make ſuch an alteration: this perfect coaleſcence of ſound is the cauſe why the octave ſhould ſerve as limits to the other intervals, and that all the notes which riſe above or fall below the ordinary ſcale, are no more than replications, *i. e.* repetitions, of all that have gone before them. For this reaſon, if the octave were altered, there could be no longer any fixed point either in harmony or melody. It is then abſolutely neceſſary to tune the C, or B♯ in a juſt octave with the firſt; from whence it follows, that, in the progreſſion of fifths, or, what is the ſame thing in the alternate ſeries of fifths and fourths, C, G, D, A, E, B, F♯, C♯, G♯, D♯, A♯, E♯, B♯, it is neceſſary that all the fifths ſhould be altered, or at leaſt ſome of them. Now, ſince there is no reaſon why one ſhould rather be altered than another, it follows, that we ought to alter them all equally. By theſe means, as the alteration is made to influence all the fifths, it will be in each of them almoſt imperceptible; and thus the fifth, which, after the octave, is the moſt perfect of all conſonances, and which we are under a neceſſity of altering, muſt only be altered in the leaſt degree poſſible.

47. It is true, that the thirds will be a little harſh: but as the interval of ſounds which conſtitutes the third, produces a leſs perfect coaleſcence than that of the fifth, it is neceſſary, ſays M. Rameau, to ſacrifice the juſtice of that chord to the perfection of the fifth; for the more perfect a chord is in its own nature, the more diſpleaſing to the ear is any alteration which can be made in it. In the octave the leaſt alteration is inſupportable.

48. This change in the intervals of inſtruments, which have, or even which have not, keys, is that which we call *temperament*.

49. It reſults then from all that we have now ſaid, that the theory of temperament may be reduced to this queſtion. The alternate ſucceſſion of fifths and fourths having been given, C, G, D, A, E, B, F♯, C♯, G♯, D♯, A♯, E♯, B♯, in which B♯ or C is not the true octave of the firſt C, it is propoſed to alter all the fifths equally, in ſuch a manner that the two C's may be in a perfect octave the one to the other.

50. For a ſolution of this queſtion, we muſt begin with tuning the two C's in a perfect octave the one to the other; in conſequence

of which, we will render all the ſemitones which compoſe the octave as equal as poſſible. By this means the alteration made in each fifth will be very inconſiderable, but equal in all of them.

51. In this, then, the theory of temperament conſiſts: but as it would be difficult in practice to tune a harpſichord or organ by thus rendering all the ſemitones equal, M. Rameau, in his *Generation Harmonique*, has furniſhed us with the following method, to alter all the fifths as equally as poſſible.

52. Take any key of the harpſichord which you pleaſe, but let it be towards the middle of the inſtrument; for inſtance, C: then tune the note G a fifth above it, at firſt with as much accuracy as poſſible; this you may imperceptibly diminiſh: tune afterwards the fifth to this with equal accuracy, and diminiſh it in the ſame manner; and thus proceed from one fifth to another in aſcent: and as the ear does not appretiate ſo exactly ſounds that are extremely ſharp, it is neceſſary, when by fifths you have riſen to notes extremely high, that you ſhould tune in the moſt perfect manner the octave below the laſt fifth which you had immediately formed; then you may continue always in the ſame manner; till in this proceſs you arrive at the laſt fifth from E✕ to B✕, which ſhould of themſelves be in tune; that is to ſay, they ought to be in ſuch a ſtate, that B✕, the higheſt note of the two which compoſe the fifth, may be identical with the ſound C, with which you began, or at leaſt the octave of that ſound perfectly juſt: it will be neceſſary then to try if this C, or its octave, forms a juſt fifth with the laſt ſound E✕ or F which has been already tuned. If this be the caſe, we may be certain that the harpſichord is properly tuned. But if this laſt fifth be not true, in this caſe it will be too ſharp, and it is an indication that the other fifths have been too much diminiſhed, or at leaſt ſome of them; or it will be too flat, and conſequently diſcover that they have not been ſufficiently diminiſhed. We muſt then begin and proceed as formerly, till we find the laſt fifth in tune of itſelf, and without our immediate interpoſition.

All that remains, is to acknowledge, with M. Rameau, that this temperament is far remote from that which is now in practice: you may here ſee in what this laſt temperament conſiſts as applied to the organ or harpſichord. They begin with C in the middle of the keys, and they flatten the four firſt fifths G, D, A, E, till they form a true third major from E to C; afterwards, ſetting out from this E, they tune the fifths B, F✕, C✕, G✕, but flattening them ſtill leſs than the former, ſo that G✕ may almoſt form a true third major with E. When they have arrived at G✕, they ſtop; they reſume the firſt C, and tune to it the fifth F in deſcending, then the fifth B♭, &c. and they heighten a little all the fifths till they have arrived at A♭, which ought to be the ſame with the G✕ already tuned. If, in the temperament commonly practiſed, ſome thirds are found to be leſs altered than in that preſcribed by M. Rameau, in return, the fifths in the firſt temperament are much more falſe, and many thirds are likewiſe ſo; inſomuch, that upon a harpſichord tuned according to the temperament in common uſe, there are five or ſix modes which the ear cannot endure, and in which it is impoſſible to execute any thing. On the contrary, in the temperament ſuggeſted by M. Rameau, all the modes are equally perfect: which is a new argument in its favour, ſince the temperament is peculiarly neceſſary in paſſing from one mode to another, without ſhocking the ear; for inſtance, from the mode of C to that of G, from the mode of G to that of D, &c. It is true, that this uniformity of modulation will to the greateſt number of muſicians appear a defect: for they imagine, that by tuning the ſemitones of the ſcale unequal, they give each of the modes a peculiar character; ſo that, according to them, the ſcale of C,

C, D, E, F, G, A, B, C,

is not perfectly ſimilar to the gammut of the mode of E

E, F✕, G✕, A✕, B, C✕, D✕, E,

which, in their judgment, renders the modes of C and E proper for different manners of expreſſion. But after all that we have ſaid in this Syſtem on the formation of diatonic intervals, every one ſhould be convinced, that, according to the intention of nature, the diatonic ſcale ought to be perfectly the ſame in all its modes: the contrary opinion, ſays M. Rameau, is a mere prejudice of muſicians. The character of an air ariſes chiefly from the intermixture of the modes; from the greater or leſſer degrees of vivacity in the movement; from the tones, more or leſs grave, or more or leſs acute, which are aſſigned to the generator of the mode; and from the chords more or leſs beautiful, as they are more or leſs deep, more or leſs flat, more or leſs ſharp, which are found in it. In ſhort, the laſt advantage of this temperament is, that it will be found conformed, or at leaſt very little different from that which they practiſe upon inſtruments without keys; as the baſs-viol, the violin, in which true fifths and fourths are preferred to thirds and ſixths tuned with equal accuracy; a temperament which appears incompatible with that commonly uſed in tuning the harpſichord.

By this method all the twelve ſounds which compoſe one of the ſcales ſhall be tuned: nothiug is neceſſary but to tune with the greateſt poſſible exactneſs their octaves in the other ſcales, and the harpſichord ſhall be well tuned. We have given this rule for temperament, from M. Rameau; and it belongs only to diſintereſted artiſts to judge of it. However this queſtion be determined, and whatever kind of temperament may be received, the alterations which it produces in harmony will be but very ſmall, or not perceptible to the ear, whoſe attention is entirely engroſſed in attuning itſelf with the fundamental baſs, and which ſuffers, without uneaſineſs, theſe alterations, or rather takes no notice of them, becauſe it ſupplies from itſelf what may be wanting to the truth and perfection of the intervals.

Simple and daily experiments confirm what we now advance. Liſten to a voice which is accompanied, in ſinging, by different inſtruments; though the temperament of the voice, and the temperaments of each of the inſtruments, are all different one from another, yet you will not be in the leaſt affected with the kind of cacophony which ought to reſult from theſe diverſities, becauſe the ear ſuppoſes theſe intervals true of which it does not appreciate the differences. We may give another experiment. Strike upon an organ the three keys E, G, B, you will hear nothing but the minor perfect chord; though E, by the conſtruction of that inſtrument, muſt cauſe G✕, likewiſe to be heard; though G ſhould have the ſame effect upon D, and B upon F✕; inſomuch, that the ear is at once affected with all theſe ſounds, D, E, F✕, G, G✕, B: how many diſſonances perceived at the ſame time, and what a jarring multitude of diſcordant ſenſations, would reſult from thence to the ear, if the perfect chord with which it is preoccupied had not power entirely to abſtract its attention from ſuch ſounds as might offend!

SECT. VI. *Of Repoſes or Cadences.*

[That the reader may have a clear idea of the term before he enters upon the ſubject of this ſection, it may be neceſſary to caution him againſt a miſtake into which he may be too eaſily led, by the ordinary ſignification of the word *repoſe*. In muſic, therefore, it is far from being ſynonimous with the word *reſt*. It is, on the contrary, the termination of a muſical *phraſe* which ends in a cadence more or leſs emphatic, as the ſentiment implied in the phraſe is more or leſs complete. Thus a repoſe in muſic anſwers the ſame purpoſe as punctuation in language. See Repos in Rouſſeau's Muſical Dictionary.]

53. In a fundamental baſs whoſe procedure is by fifths, there always is, or always may be, a *repoſe*, or criſis, in which the mind acquieſces in its tranſition from one ſound to another: but a repoſe may be more or leſs diſtinctly ſignified, and of conſequence more or leſs perfect. If one ſhould riſe by fifths; if, for inſtance, we paſs from C to G; it is the generator which paſſes to one of theſe fifths, and this fifth was already pre-exiſtent in its generator: but the generator exiſts no longer in this fifth; and the ear, as this generator is the principle of all harmony and of all melody, feels a deſire to return to it. Thus the tranſition from a ſound to its fifth in aſcent, is termed an *imperfect repoſe*, or *imperfect cadence*; but the tranſition from any ſound to its fifth in deſcent, is denominated a *perfect cadence*, or an *abſolute repoſe*: it is the offspring which returns to its generator, and as it were recovers its exiſtence once more in that generator itſelf, with which when ſounding it reſounds (ſect. i.)

54. Amongſt abſolute repoſes, there are ſome, if we may be allowed the expreſſion, more abſolute, that is to ſay, more perfect, than others. Thus in the fundamental baſs

C, G, C, F, C, G, D, G, C,

which forms, as we have ſeen, the diatonic ſcale of the moderns, there is an abſolute repoſe from D to G, as from G to C: yet this laſt abſolute repoſe is more perfect than the preceding, becauſe the ear, prepoſſeſſed with the mode of C by the multiplied impreſſion of the ſound C which it has already heard thrice before, feels a deſire to return to the generator C; and it accordingly does ſo, by the abſolute repoſe G, C.

55. We may ſtill add, that what is commonly called *cadence*, in melody, ought not to be confounded with what we name *cadence* in harmony. In the firſt caſe, this word only ſignifies an agreeable and rapid alternation between two contiguous ſounds, called likewiſe a *trill* or *ſhake*; in the ſecond, it ſignifies a repoſe or cloſe. It is however true, that this ſhake implies, or at leaſt frequently enough preſages, a repoſe, either preſent or impending, in the fundamental baſs. M. Rouſſeau, in his letter on French muſic, has called this alternate undulation of different ſounds a *trill*, from the Italian word *trillo*, which ſignifies the ſame thing; and ſome French muſicians already appear to have adopted this expreſſion.

56. Since there is a repoſe in paſſing from one ſound to another in the fundamental baſs, there is alſo a repoſe in paſſing from one note to another in the diatonic ſcale, which is formed from it, and which this baſs repreſents: and as the abſolute repoſe G C, is of all others the moſt perfect in the fundamental baſs, the repoſe from B to C, which anſwers to it in the ſcale, and which is likewiſe terminated by the generator, is for that reaſon the moſt perfect of all others in the diatonic ſcale aſcending.

57. It is then a law dictated by nature itſelf, that if you would aſcend diatonically to the generator of a mode, you can only do this by means of the third major from the fifth of that very generator. This third major, which with the generator forms a ſemitone, has for that reaſon been called the *ſenſible note*, as introducing the generator, and preparing us for the moſt perfect repoſe. We have already proved, that the fundamental baſs is the principle of melody. We ſhall beſides make it appear in the ſequel, that the effect of a repoſe in melody ariſes ſolely from the fundamental baſs.

SECT. VII. *The Minor Mode and its Diatonic Series.*

58. In the ſecond ſection, we have explained (art. 29. 30. 31. and 32.) by what means, and upon what principle the minor chord C, E♭, D, C, may be formed; which is the characteriſtical chord of the minor mode. Now what we have there ſaid, taking C for the principal and fundamental ſound, we might likewiſe have ſaid of any other note in the ſcale, aſſumed in the ſame manner as the principal and fundamental ſound: but as in the minor chord C, E♭, G, C, there occurs an E♭ which is not found in the ordinary diatonic ſcale, we ſhall immediately ſubſtitute, for greater eaſe and conveniency, another chord, which is likewiſe minor and exactly ſimilar to the former, of which all the notes are found in the ſcale.

59. The ſcale affords us three chords of this kind, viz. D, F, A, D, A, C, E, A, and E, G, B, E. Amongſt theſe three we ſhall chooſe A, C, E, A; becauſe this chord, without including any ſharp or flat, has two ſounds in common with the major chord C, E, G, C; and beſides, one of theſe two ſounds is the very ſame C: ſo that this chord appears to have the moſt immediate, and at the ſame time the moſt ſimple, relation with the chord C, E, G, C. Concerning this we need only add, that this preference of the chord A, C, E, A, to every other minor chord, is by no means in itſelf neceſſary for what we have to ſay in this ſection upon the diatonic ſcale of the minor mode. We might in the ſame manner have choſen any other minor chord; and it is only, as we have ſaid, for greater eaſe and conveniency, that we fix upon this.

60. Let us now remark, that in every mode, whether major or minor, the *principal* ſound which implies the perfect chord, whether major or minor, may be called the *tonic note* or *key*; thus C is the key in its proper mode, A in the mode of A, &c. Having laid down this principle,

61. We have ſhewn how the three ſounds F, C, G, which conſtitutes (art. 38) the mode of C, of which the firſt F and the laſt G are the two fifths of C, one deſcending the other riſing, produce the ſcale B, C, D, E, F, G, A, of the major mode, by means of the fundamental baſs G, C, G, C, F, C, F: let us in the ſame manner take the three ſounds D, A, E, which conſtitute the mode of A, for the ſame reaſon that the ſounds F, C, G, conſtitute the mode of C; and of them let us form this fundamental baſs, perfectly like the preceding, E, A, E, A, D, A, D: let us afterwards place below each of theſe ſounds one of their harmonics, as we have done for the firſt ſcale of the major mode; with this difference, that we muſt ſuppoſe D and A as implying their thirds minor in the fundamental baſs to characteriſe the minor mode; and we ſhall have the diatonic ſcale of that mode.

G♯, A, B, C, D, E, F.

62. The G♯ which correſponds with E in the fundamental baſs, forms a third major with that E, though the mode be minor; for the ſame reaſon that a third from the fifth of the fundamental ſound ought to be major (art. 57.) when that third riſes to the fundamental ſound A.

63. It is true, that, in cauſing E to imply its third major G, one might alſo riſe to A by a diatonic progreſs. But that manner of riſing to A would be leſs perfect than the preceding; for this reaſon (art. 56.), that the abſolute repoſe or perfect cadence E, A, which is found in the fundamental baſs, ought to be repreſented in the moſt perfect manner in the two notes of the diatonic ſcale which anſwer to it, eſpecially when one of theſe two notes is A, the key itſelf upon which the repoſe is made. From whence it follows, that the preceding note G ought rather to be ſharp than natural; becauſe G♯, being included in E (art. 19.) much more perfectly repreſents the note E in the baſs, than the natural note G could do, which is not included in E.

64. We may remark this firſt difference between the ſcale

G♯, A, B, C, D, E, F,

and the ſcale which correſponds with it in the major mode

B, C, D, E, F, G, A,

that from E to F, which are the two laſt notes of the former ſcale, there is only a ſemitone; whereas from G to A, which are the two laſt ſounds of the latter ſeries, there is the interval of a complete tone: but this is not the only diſcriminatiou which may be found between the ſcales of the two modes.

65. To inveſtigate theſe differences, and to diſcover the reaſon for which they happen, we ſhall begin by forming a new diatonic ſcale of the minor mode, ſimilar to the ſecond ſcale of the major mode,

C, D, E, F, G, G, A, B, C.

That laſt ſeries, as we have ſeen, was formed by means of the fundamental baſs F, C, G, D, diſpoſed in this manner,

F, C, G, C, F, C, G, D, G, C.

Let us take in the ſame manner the fundamental baſs D, A, E, B, and arrange it in the following order,

A, E, A, D, A, E, B, E, A,

and it will produce the ſcale immediately ſubjoined,

A, B, C, D, E, E, F♯, G♯, A,

in which C forms a third minor with A, which in the fundamental baſs correſponds with it, which denominates the minor mode: and on the contrary G♯ forms a third major with E in the fundamental baſs, becauſe G♯ riſes towards A, (art. 62. and 63.)

66. We ſee beſides a F♯, which does not occur in the former,

G♯, A, B, C, D, E, F,

where F is natural. It is becauſe, in the firſt ſcale, F is a third minor from D in the baſs; and in the ſecond, F♯ is the fifth from B in the baſs.

67. Thus the two ſcales of the minor mode are ſtill in this reſpect more different one from the other, than the two ſcales of the major mode; for we do not remark this difference of a ſemitone between the two ſcales of the major mode. We have only obſerved ſome difference in the value of A as it ſtands in each of theſe ſcales, but this amounts to much leſs than a ſemitone.

68. From thence it may be ſeen why F and G are ſharp when aſcending in the minor mode; nay, beſides, the F is only natural in the firſt ſcale G♯, A, C, D, E, F, becauſe this F cannot riſe to G♯.

69. It is not the ſame caſe in deſcending. For E, the fifth of the generator, ought not to imply the third major G♯. but in the caſe when that E deſcends to the generator A to form a perfect repoſe, (art. 57. and 63.); and in this caſe the third major G♯ riſes to the generator A: but the fundamental baſs A E may, in deſcending, give the ſcale A G natural, provided G does not riſe towards A.

70. It is much more difficult to explain how the F, which ought to follow this G in deſcending, is natural and not ſharp; for the fundamental baſs

A, E, B, E, A, D, A, E, A,

produces in deſcending,

A, G, F♯, E, E, D, C, B, A,

And it is plain that the F cannot be otherwiſe than ſharp, ſince F♯ is the fifth of the note B of the fundamental baſs. In the mean time, experience evinces that the F is natural in deſcending in the diatonic ſcale of the major mode of A, eſpecially when the preceding G is natural; and it muſt be acknowledged, that here the fundamental baſs appears in ſome meaſure defective. M. Rameau has invented the following means for obtaining a ſolution of this difficulty. According to him, in the diatonic ſcale of the minor mode in deſcending, A, G, F, E, D, C, B, A, G, may be regarded ſimply as a note of paſſage, merely added to give ſweetneſs to the modulation, and as a diatonic gradation by which we may deſcend to F natural. It is eaſily perceived, according to M. Rameau, by this fundamental baſs,

A, D, A, D, A, E, A,

which produces

A, F, E, D, C, B, A;

which may be regarded, as he ſays, as the real ſcale of the minor mode in deſcending; to which is added G natural between A and F, to preſerve the diatonic order. This anſwer appears the only one which can be given to the difficulty above propoſed: but we know not whether it will fully ſatisfy the reader; whether he will not ſee with regret, that the fundamental baſs does not produce, to ſpeak properly, the diatonic ſcale of the minor mode in deſcent, when at the ſame time this ſame baſs ſo happily produces the diatonic ſcale of that identical mode in aſcending, and the diatonic ſcale of the major mode whether in riſing or deſcending.

For what remains when G is ſaid to be natural in deſcending the diatonic ſcale of the minor mode of A, this only ſignifies, that this G is not neceſſarily ſharp in deſcending as it is in riſing; for this G, beſides, may be ſharp in deſcending to the minor mode of A, as may be proved by numberleſs examples, of which all muſical compoſers are full. It is true, that when the ſound G is found ſharp in deſcending to the minor mode of A, ſtill we are not ſure that the mode is minor till the F or C naturally is found; both of which impreſs a peculiar character on the minor mode, viz. C natural, in riſing and in deſcending, and the F natural in deſcending.

SECT. VIII. *Relative Modes.*

71. Two modes which are of ſuch a nature that we can paſs from the one to the other, are called *relative modes*. Thus we have already ſeen, that the major mode of C is relative to the major mode of F and to that of G. It may likewiſe appear from what goes before, how many intimate connections there are between the *ſpecies* or major mode of C, and the *ſpecies* or minor mode of A. For, 1. The perfect chords, one major C E G C, the other minor A C E A, which characteriſe each of thoſe two kinds of modulation or harmony, have two ſounds in common, C or E. 2. The diatonic ſcale of the minor mode of A in deſcent, abſolutely contains the ſame ſounds with the gammut or diatonic ſcale of the major mode of C. It is for this reaſon that the tranſition is ſo natural and eaſy from the major mode of C to the minor mode of A, or from the minor mode of A to the major mode of C, as experience proves.

72. In the minor mode of E, the minor perfect chord E G B E, which characteriſes it, has likewiſe two ſounds, E, G, in common with the perfect chord major C E G C, which characteriſes the major mode of C. But the minor mode of E is not ſo cloſely related nor allied to the major mode of C as to the minor mode of A; becauſe the diatonic ſcale of the minor mode of E in deſcent has not, like the ſeries of the minor mode of A, all theſe ſounds in common with the ſcale of C. In reality, this ſcale is E D C B A G F♯ E, where there occurs a F ſharp which is not in the ſcale of C. We may add, that though the minor mode of E is leſs relative to the major mode of C than that of A; yet the artiſt does not heſitate ſometimes to paſs immediately from the one to the other.

We may ſee beſides, that when we paſs from one mode to another by the interval of a third, whether in deſcending or riſing, as from C to A, or from A to C, from C to E, or from E to C, the major mode becomes minor, or the minor mode becomes major.

73. There is ſtill another minor mode, into which an immediate tranſition may be made in iſſuing from the major mode of C. It is the minor mode of C itſelf in which the perfect minor chord C E♭ G C has two ſounds, C and G, in common with the perfect major chord C E G C. Nor is there any thing more common than a tranſition from the major mode of C to the minor mode, or from the minor to the major.

SECT. IX. *Of Diſſonance.*

74. We have already obſerved, that the mode of C (F, C, G,) has two ſounds in common with the mode of G, (C, G, D); and two ſounds in common with the mode of F (B♮, F, C); of conſequence this procedure of the baſs CG, may belong to the mode of C or to the mode of G, as the procedure of the baſs FC, or C F, may belong to the mode of C or the mode of F. When any one therefore paſſes from C to F or to G in a fundamental baſs, he is ſtill ignorant even to that criſis what mode he is in. It would be however advantageous to know it, and to be able by ſome means to diſtinguiſh the generator from its fifths.

75. This advantage may be obtained by uniting at the ſame time the ſounds G and F in the ſame harmony, that is to ſay, by joining to the harmony G B D of the fifth G, the other fifth F in this manner, G, B, D, F; this F which is added, forms a diſſonance with G (art. 18.) It is for that reaſon that the chord G B D F, is called a diſſonant chord, or a chord of the ſeventh. It ſerves to diſtinguiſh the fifth G from the generator C, which always implies, without mixture or alteration, the perfect chord C, E, G, C, reſulting from nature itſelf. (art. 32.) By this we may ſee, that when we paſs from C to G, one paſſes at the ſame time from C to F, becauſe F is found to be comprehended in the chord of G; and the mode of C by theſe means plainly appears to be determined, becauſe there is none but that mode to which the ſounds F and G at once belong.

76. Let us now ſee what may be added to the harmony F, A, C, of the fifth F below the generator, to diſtinguiſh this harmony from that of the generator. It ſeems probable at firſt, that we ſhould add to it the other fifth G, ſo that the generator C, in paſſing to F, may at the ſame time paſs to G, and that by this the mode ſhould be determined: but this introduction of G, in the chord F, A, C, would produce two ſeconds in ſucceſſion F, G, G, A, that is to ſay, two diſſonances whoſe union would prove extremely harſh to the ear; an inconvenience which ought carefully to be avoided. For if, to diſtinguiſh the mode, we ſhould alter the harmony of the fifth F in the fundamental baſs, it muſt only be altered in the leaſt degree poſſible.

77. For this reaſon, inſtead of G, we ſhall take its fifth D, which is the ſound that approaches it the neareſt; and we ſhall have, inſtead of the fifth F, the chord F, A, C, D, which is called a *chord of the great ſixth*. We may here remark the analogy there is obſerved between the harmony of the fifth G, and that of the fifth F.

78. The fifth G, in riſing above the generator, gives a chord entirely conſiſting of thirds aſcending from G, G, B, D, F; now the fifth F being below the generator C in deſcending, we ſhall find, as we go lower by thirds from C towards F, the ſame ſounds. C, A, F, D, which form the chord F, A, C, D, given to the fifth F.

79. It appear beſides, that the alteration of the harmony in the two fifths conſiſts only in the third minor D, F, which was reciprocally added to the harmony of theſe two fifths.

SECT. X. *The Cromatic Species.*

80. The ſeries or fundamental baſs by fifths produces the diatonic ſpecies in common uſe: now the third major being one of the harmonics of a fundamental ſound as well as the fifth, it follows, that we may form fundamental baſſes by thirds major, as we have already formed fundamental baſſes by fifths.

81. If then we ſhould form this baſs C, E, G✕, the two firſt ſounds carrying each along with it their thirds major and fifths, it is evident that C will give G, and that E will give G✕: now the ſemitone which is between this G and this G✕ is an interval much leſs than the ſemitone which is found in the diatonic ſcale between E and F, or between B and C. This may be aſcertained by calculation; it is for this reaſon that the ſemitone from E to F, is called *major*, aud the other *minor*.

82. If the fundamental baſs ſhould proceed by thirds minor in this manner, C, E♭, a ſucceſſion which is allowed when we have inveſtigated the origin of the minor mode (ſect. 7), we ſhall find this modulation G, G♭, which would likewiſe give a minor ſemitone.

83. The minor ſemitone is hit by young practitioners in intonation with more difficulty than the ſemitone major. For which this reaſon may be aſſigned: the ſemitone major which is found in the diatonic ſcale, as from E to F, reſults from a fundamental baſs by fifths C F, that is to ſay, by a ſucceſſion which is moſt natural, and for this reaſon the eaſieſt to the ear. On the contrary, the minor ſemitone ariſes from a ſucceſſion by thirds, which is ſtill leſs natural than the former. Hence, that ſcholars may truly hit the minor ſemitone, the following artifice is employed. Let us ſuppoſe, for inſtance, that they intend to riſe from G to G✕; they riſe at firſt from G to A, then deſcend from A to G✕ by the interval of a ſemitone major; for this G ſharp, which is a ſemitone major below A, proves a ſemitone minor above G.

84. Every procedure of the fundamental baſs by thirds, whether major or minor, riſing or deſcending, gives the minor ſemitone, This we have already ſeen from the ſucceſſion of thirds in aſcending. The ſeries of thitds minor in deſcending, C, A, gives C, C✕; and the ſeries of thirds major in deſcending, C, A♭, gives C, C♭.

85. The minor ſemitone conſtitutes the ſpecies called *chromatic*; and with the ſpecies which moves by diatonic intervals, reſulting from the ſucceſſion of fifths it comprehends the whole of melody.

SECT. XI. *The Enharmonic Species.*

86. The two extremes, or higheſt and loweſt notes, CG✕, of the fundamental baſs by thirds major, CEG✕, give this modulation CB✕; and theſe two ſounds C, B✕, differ between them ſelves by a ſmall interval, which is called the *dieſis*, or *enharmonic fourth of a tone*, which is the difference between a ſemitone major and a ſemitone minor. This quarter tone is inappretiable by the ear, and impracticable upon ſeveral of our inſtruments. Yet have means been found to put it in practice in the following manner, or rather to perform what will have the ſame effect upon the ear.

87. We have explained in what manner the chord G✕ BDF, may be introduced into the minor mode, entirely conſiſting of thirds minor perfectly true, or at leaſt ſuppoſed ſuch. This chord ſupplying the place of the chord of the dominant (art. 88.) from thence we may paſs to that of the tonic or generator A. But we muſt remark,

1. That this chord G✕ B D F, entirely conſiſting of thirds minor, may be inverted or modified according to the three following arrangements, B D F G✕, D F G✕ B, F G✕ B D; and that in all theſe three different ſtates, it will ſtill remain compoſed of thirds minor; or at leaſt there will only be wanting the enharmonic fourth of a tone to render the third minor between F and G✕ entirely juſt; for a true third minor, as that from E to G in the diatonic ſcale, is compoſed of a ſemitone and a tone both major. Now from F to G there is a tone major, and from G to G✕ there is only a minor ſemitone. There is then a wanting (art. 86.) the enharmonic fourth of a tone, to render the third F G✕ exactly true. 2. But as this diviſion of a tone cannot be found in the gradations of any ſcale practicable upon moſt of our inſtruments, nor be appretiated by the ear, the ear takes the different chords.

B D F G✕
D F G✕ B,
F G✕ B D,

which are abſolutely the ſame, for chords compoſed every one of thirds minor exactly juſt. Now the chord G✕ B D F, belonging to the minor mode of A, where G✕ is the ſenſible note; the chord B D F G✕ or B D F A♭, will, for the ſame reaſon, belong to the minor mode of C, where B is the ſenſible note. In like manner, the chord D F G✕ B, or B D F A♭ C♭, will belong to the minor mode of E♭ and the chord F G✕ B D, or F A♭ C♭ E♭♭, to the minor mode of G♭. After having paſſed then by the mode of A to the chord G✕ B D F one may by means of this laſt chord, and by merely ſatisfying ourſelves to invert it, afterwards paſs all at once to the modes of C minor, of E♭ minor, or of G♭ minor; that is to ſay, into the modes which have nothing, or almoſt nothing, in common with the minor mode of A, and which are entirely foreign to it.

89. It muſt, however, be acknowledged, that a tranſition ſo abrupt, and ſo little expected, cannot deceive nor elude the ear; it is ſtruck with a ſenſation ſo unlooked-for, without being able to account for the paſſage to itſelf. And this account has its foundation in the harmonic fourth of a tone; which is overlooked as nothing, becauſe it is inappretiable by the ear; but of which, though its value is not aſcertained, the whole harſhneſs is ſenſibly perceived. The inſtant of ſurpriſe, however, immediately vaniſhes; and that aſtoniſhment is turned into admiration, when one feels himſelf tranſported as it were all at once, and almoſt imperceptibly, from one mode to another, which is by no means relative to it, and to which he never could have immediately paſſed by the ordinary ſeries of fundamental notes.

SECT. XII. *The Diatonic Enharmonic Species.*

90. If we form a fundamental baſs, which riſes alternately by fifths and thirds, as F, C, E, B, this baſs will give the following modulation, F, E, E, D✕; in which the ſemitones from F to E, and from E to D✕, are equal and major. This ſpecies of modulation or of harmony, in which all the ſemitones are major, is called the *enharmonic diatonical* ſpecies. The major ſemitones peculiar to this ſpecies give it the name of *diatonic*, becauſe major ſemitones belong to the diatonic ſpecies; and the tones which are greater than major by the exceſs of a fourth, reſulting from a ſucceſſion of major ſemitones, give it the name of *enharmonic*.

SECT. XIII. *The Chromatic Enharmonic Species.*

91. If we paſs alternately from a third minor in deſcending to a third major in riſing, as C, C, A, C✕, C✕, we ſhall form this modulation, E♭, E, E, E✕, in which all the ſemitones are minor. This ſpecies is called the *chromatic enharmonical* ſpecies: the minor ſemitones peculiar to this kind give it the name of *chromatic*

matic, becauſe minor ſemitones belong to the chromatic ſpecies; and the ſemitones which are leſſer by the diminution of a fourth reſulting from a ſucceſſion of minor ſemitones, give it the name of *enharmonic*.

92. Theſe new ſpecies confirm what we have all along ſaid, that the whole effects of harmony and melody reſide in the fundamental baſs.

93. The diatonic ſpecies is the moſt agreeable, becauſe the fundamental baſs which produces it is formed from a ſucceſſion of fifths alone, which is the moſt natural of all others.

94. The chromatic being formed from a ſucceſſion of thirds, is the moſt natural after the preceding.

95. Finally, the enharmonic is the leaſt agreeable of all, becauſe the fundamental baſs which gives it is not immediately indicated by nature. The fourth of a tone which conſtitutes this ſpecies, and which is itſelf inappretiable to the ear, neither produces nor can produce its effect, but in proportion as imagination ſuggeſts the fundamental baſs from whence it reſults; a baſs whoſe procedure is not agreeable to nature, ſince it is formed of two ſounds which are not contiguous one to the other in the ſeries of thirds (art. 86.)

SECT. XIV. *Shewing that Melody is the Offſpring of Harmony.*

96. All that we have hitherto ſaid, as it ſeems to us, is more than ſufficient to convince us, that melody has its original principle in harmony, and that it is in harmony expreſſed or underſtood, that we ought to look for the effects of melody.

97. If this ſhould ſtill appear doubtful, nothing more is neceſſary than to pay due attention to the firſt experiment (art. 19.), where it may be ſeen that the principal ſound is always the loweſt, and that the ſharper ſounds which it generates are with relation to it what the treble of an air is to its baſs.

98. Yet more, the diverſification of baſſes produces effects totally different in a modulation which, in other reſpects, remains the ſame.

99. Can it be ſtill neceſſary to adduce more convincing proofs? We have nothing to do but examine the different baſſes which may be given to this very ſimple modulation G C; of which it will be found ſuſceptible of a great many, and each of theſe baſſes will give a different character to the modulation G C, though in itſelf it remains always the ſame; in ſuch a manner that we may change the whole nature and effects of a modulation, without any other alteration except that of changing its fundamental baſs.

M. Rameau has ſhewn, in his *Syſtem of Muſic*, printed at Paris 1726, *p.* 44. that this modulation G C, is ſuſceptible of 20 different fundamental baſſes. Now the ſame fundamental baſs, as may be ſeen in our ſecond part, will afford ſeveral continued or thorough baſſes. How many means, of conſequence, may be practiſed to vary the expreſſion of the ſame modulation?

100. From theſe different obſervations it may be concluded, 1. That an agreeable melody, naturally implies a baſs extremely ſweet and adapted for ſinging; and that reciprocally, as muſicians expreſs it, a baſs of this kind generally prognoſticates an agreeable melody.

2. That the character of a juſt harmony is only to form in ſome meaſure one ſyſtem with the modulation, ſo that from the whole taken together the ear may only receive, if we may ſpeak ſo, one ſimple and indiviſible impreſſion.

3. That the character of the ſame modulation may be diverſified, according to the character of the baſs which is joined with it. But notwithſtanding the dependency of melody upon harmony, and the ſenſible influence which the latter may exert upon the former; we muſt not however from thence conclude, with ſome celebrated muſicians, that the effects of harmony are preferable to thoſe of melody. Experience proves the contrary. [See, on this account, what is written on the licence of muſic, printed in tom. iv. of D'Alembert's *Melanges de Literature*, p. 448.]

GENERAL REMARK.

The diatonic ſcale or gammut being compoſed of twelve ſemitones, it is clear that each of theſe ſemitones taken by itſelf may be the generator of a mode; and that thus there muſt be twenty-four modes in all, twelve major and twelve minor. We have aſſumed the major mode of C, to repreſent all the major modes in general, and the minor mode of A to repreſent the modes minor, to avoid the difficulties ariſing from ſharps and flats, of which we muſt have encountered either a greater or leſſer number in the other modes. But the rules we have given for each mode are general, whatever note of the gammut be taken for the generator of a mode.

PART II.

PRINCIPLES AND RULES OF COMPOSITION.

101. Compoſition, which is likewiſe called *counterpoint*, is not only the art of compoſing an agreeable air, but alſo that of compoſing a great many airs in ſuch a manner that when heard at the ſame time, they may unite in producing an effect agreeable and delightful to the ear; this is what we call *compoſing muſic in ſeveral parts*. The higheſt of theſe parts is called the *treble*, the loweſt is termed the *baſs*; the other parts, when there are any, are termed *middle parts*; and each in particular is ſignified by a different name.

SECT. I. *Of the Different Names given to the ſame Interval*

102. In the introduction (art. 9.), which is at the front of this ſyſtem, we have ſeen a detail of the moſt common names which are given to the different intervals. But there are particular intervals which have obtained different names, according to particular circumſtances; which it is proper to explain.

103. An interval compoſed of a tone and a ſemitone, which is commonly called a *third minor*, is likewiſe ſometimes called a *ſecond redundant*; ſuch is the interval from C to D♯ in aſcending, or that of A to G♮ deſcending. This interval is ſo termed, becauſe one of the ſounds which form it is always either ſharp or flat, and that, if you deduct that ſharp or that flat, the interval will be that of a ſecond.

104. An interval compoſed of two tones and two ſemitones, as that from B to F, is called a *falſe fifth*. This interval is the ſame with the *triton* (art. 9.), ſince two tones and two ſemitones are equivalent to three tones. There are, however, ſome reaſons for diſtinguiſhing them, as will appear below.

105. As the interval from C to D ♯ in aſcending has been called a *ſecond redundant*, they likewiſe call the interval from C to D♯ in aſcending a *fifth redundant*, or from B to E♮ in deſcending, each of which intervals are compoſed of four tones. This interval is, in the main, the ſame with that of the ſixth minor (art. 9.): but in the fifth redundant there is always a ſharp or a flat; inſomuch, that if this ſharp or flat were deducted, the interval would become a true fifth.

106. For the ſame reaſon, an interval compoſed of three tones and three ſemitones, as from G♯ to F in aſcending, is called a *ſeventh diminiſhed*; becauſe, if you deduct the ſharp from G, the interval from G to F will become that of an ordinary ſeventh. The interval of a ſeventh diminiſhed is in other reſpects the ſame with that of the ſixth major (art. 9.)

107. The major ſeventh is likewiſe ſometimes called a *ſeventh redundant*.

SECT. II. *Compariſon of the Different Intervals*

108. If we ſing C B in deſcending by a ſecond, and afterwards C B in aſcending by a ſeventh, theſe two B's ſhall be octaves one to the other; or, as we commonly expreſs it, they will be *replications* one of the other.

109. On account then of the reſemblance between every ſound and its octave (art. 22.), it follows, that *to riſe by a ſeventh*, or *deſcend by a ſecond*, amount to one and the ſame thing.

110. In like manner, it is evident that the ſixth is nothing but a replication of the third, nor the fourth but a replication of the fifth.

111. The following expreſſions either are, or ought to be, regarded as ſynonimous.

To riſe	by a ſecond.	To deſcend	by a ſeventh.
To deſcend		To riſe	
To riſe	by a third	To deſcend	by a ſixth.
To deſcend		To riſe	
To riſe	by a fourth	To deſcend	by a fifth.
To deſcend		To riſe	

112. Thus, therefore, we ſhall employ them indifferently the one for the other; ſo that when we ſay, for inſtance, *to riſe by a third*, it may be ſaid with equal propriety *to deſcend by a ſixth*, &c.

SECT. III. *Of the different Cleffs: of the Value or Quantity; of the Rithmus: and of Syncopation.*

113. There are three cleffs in muſic: for the repreſentation of which ſee the Plate on the Principles of the Science.

The cleff of F is placed on the fourth line, or on the third; and the line upon which this cleff is placed gives the name of F, to all the notes which are upon that line. The cleff of C is placed upon the fourth, the third, the ſecond, or the firſt line; and in theſe different poſitions all the notes upon that line where the cleff is placed take the name of C. Laſtly, the cleff of G is placed upon the ſecond or firſt line; and all the notes upon that line where the cleff is placed take the name of G.

114. As the notes are placed on the lines, and in the ſpaces between the lines, any one when he ſees the cleff, may eaſily find the name of any note whatever. Thus he may ſee, that, in the firſt cleff of F, the note which is placed on the loweſt line ought to be G; that the note which occupies the ſpace between the two firſt lines ſhould be A; and that the note which is on the ſecond line is a B, &c.

115. A note before which there is a ſharp (marked thus ♯) ought to be raiſed by a ſemitone: and if, on the contrary, there is a ♭ before it, it ought to be depreſſed by a ſemitone, (♭ being the mark of a flat.) The natural (marked thus ♮) reſtores to its natural value a note which had been raiſed or depreſſed by a ſemitone.

116. When you place at the cleff a ſharp or a flat, all the notes upon the line on which this ſharp or flat is marked are ſharp or flat. Thus let us take, for inſtance, the cleff of C upon the firſt line, and let us place a ſharp in the ſpace between the ſecond and third line, which is the place of F; all the notes which ſhall be marked in that ſpace will be F♯; and if you would reſtore them to their original value of F natural, you muſt place a ♮ or a ♭ before them. In the ſame manner, if a flat be marked at the cleff, and if you would reſtore the note to its natural ſtate, you muſt place a ♮ or a ♯ before it.

117. Every piece of muſic is divided into different equal times,

which they call *meaſures* or *bars*; and each bar is likewiſe divided into different times. There are properly two kinds of meaſures or modes, of time, the meaſure of two times, or of common time, which is marked by the figure 2 placed at the beginning of the tune; and the meaſure of three times, or of tripple time, which is marked by the figure 3 placed in the ſame manner. The different bars are diſtinguiſhed by perpendicular lines.

118. The longeſt of all notes is a ſemibreve. A minim is half its value; that is to ſay, in ſinging, we only employ the ſame duration in performing two minims which was occupied in one ſemibreve. A minim in the ſame manner is equivalent to two crotchets, the crotchet to two quavers, &c.

119. A note which is divided into two parts by a time, that is to ſay, which begins at the end of a time, and terminates in the time following, is called a *ſyncopated note.* (where the notes C, B, and A, are each of them ſyncopated.)

120. A note followed by a point or dot is increaſed half its value.

SECT. IV. *Containing a Definition of the principal Chords.*

121. The chord compoſed of a third, a fifth, and an octave, as C E G C, is called a *perfect chord.* If the third be major, as in C E G C, the perfect chord is denominated *major:* if the third be minor, as in A C E A, the perfect chord is minor. The perfect chord major conſtitutes what we call the *major mode*; and the perfect chord minor, what we term the *minor mode* (art. 31.)

122. A chord compoſed of a third, a fifth, and a ſeventh, as G B D F, or D F A C, &c. is called a *chord of the ſeventh.* It is obvious that ſuch a chord is wholly compoſed of thirds in aſcending. All chords of the ſeventh are practiſed in harmony, ſave that which might carry the third minor and the ſeventh major, as C E♭ G B; and that which might carry a falſe fifth and a ſeventh major, as B D F A♯.

123. As thirds are either major or minor, and as they may be differently arranged, it is clear that there are different kinds of chords of the ſeventh; there is even one, B D F A, which is compoſed of a third, a falſe fifth, and a ſeventh.

124. A chord compoſed of a third, a fifth, and a ſixth, as F A C D, D F A B, is called a *chord of the greater ſixth.*

125. Every note which carries a perfect chord is called a *tonic*, and the perfect chord is marked by an 8, by a 3, or by a 5, which is written above the note; but frequently theſe numbers are ſuppreſſed. Thus in the example I. the two C's equally carry a perfect chord.

126. Every note which carries a chord of the ſeventh is called a *dominant*; and this chord is marked by a 7 written above the note. Thus in the Example II. D carries the chord D F A C, and G the chord G B D F. It is neceſſary to remark, that among the chords of the ſeventh we do not reckon the chord of the ſeventh diminiſhed, which is only improperly called a *chord of the ſeventh:* and of which we ſhall ſay more below.

127. Every note which carries the chord of the great ſixth, is called a *ſub-dominant*, (art. 77, and 42.) and is marked with a 6. Thus in the Example III. F carries the chord of F A C D. You ought to remark that the ſixth ſhould always be major.

128. In every chord, whether perfect, or a chord of the ſeventh, or of the great ſixth, the note which carries this chord, and which is the flatteſt or loweſt, is called the *fundamental note.*

129. In every chord of the ſeventh, and of the great ſixth, the note which forms the ſeventh or ſixth above the fundamental, that is to ſay, the higheſt note of the chord, is called a *diſſonance.* Thus in the chords of the ſeventh G B D F, D F A C, F and C are the diſſonances, viz. F with relation to G in the firſt chord, and C with relation to D in the ſecond. In the chord of the great ſixth F A C D, D is the diſſonance; but that D is only, properly ſpeaking, a diſſonance with relation to C from which it is a *ſecond,* and not with reſpect to F from which it is a *ſixth major* (art. 17 and 18.)

130. When a chord of the ſeventh is compoſed of a third major followed by two thirds minor, the fundamental note of this chord is called the *tonic dominant.* In every other chord of the ſeventh, the fundamental is called the *ſimple dominant.* Thus in the chord G B D F, the fundamental G is the *tonic dominant*; but in the other chords of the ſeventh, as C E G B, D F A C, &c. the fundamental C and D are *ſimple dominants.*

131. In every chord, whether perfect, or of the ſeventh, or of the ſixth, if you have a mind that the third above the fundamental note ſhould be major, though it is naturally minor, you muſt place a ſharp above the fundamental note. For example, if I would mark the perfect major chord D F♯ A D, as the third F above D is naturally minor, I place above D a ſharp, as you may ſee in Example IV. In the ſame manner the chord of the ſeventh D F♯ A C, and the chord of the great ſixth D F♯ A B, is marked with a ♯ above D, and above the ♯ a 7 or a 6. On the contrary, when the third is naturally major, and if you ſhould incline to render it minor, you muſt place above the fundamental note a ♭.

SECT. V. *Of the Fundamental Baſs.*

132. Invent a modulation at your pleaſure; and under this modulation let there be ſet a baſs compoſed of different notes, of which ſome may carry a perfect chord, others that of the ſeventh, and others that of the great ſixth, in ſuch a manner that each note of the modulation which anſwers to each of the baſs, may be one of thoſe which enters into the chord of that note in the baſs; this baſs being compoſed according to the rules which ſhall be immediately given, will be the *fundamental baſs* of the modulation propoſed. See Part I. where the *nature and principles of the fundamental baſs* are explained.

SECT. VI. *Rules for the Fundamental Baſs.*

133. All the notes of the fundamental baſs being only capable of carrying a perfect chord, or the chord of the ſeventh, or that of the great ſixth, are either tonics, or dominants, or ſubdominants; and the dominants may be either ſimple or tonic. The fundamental baſs ought always to begin with a tonic, as much as it is practicable. And now follow the rules for all the ſucceeding chords; rules which are evidently derived from the principles eſtabliſhed in the *Firſt Part* of this Syſtem.

RULE I.

134. In every chord of the tonic, or of the tonic dominant, it is neceſſary that at leaſt one of the notes which form that chord ſhould be found in the chord that precedes it.

RULE II.

135. In every chord of the ſimple dominant, it is neceſſary, that the note which conſtitutes the ſeventh, or diſſonance, ſhould likewiſe be found in the preceding chord.

RULE III.

136. In every chord of the ſub-dominant, at leaſt one of its conſonances muſt be found in the preceding chord. Thus, in the chord of the ſub-dominant F A C D, it is neceſſary that F, A, or C, which are the conſonances of the chord, ſhould be found in the chord preceding. The diſſonance D may either be found in it or not.

RULE IV.

137. Every ſimple or tonic dominant ought to deſcend by a fifth. In the firſt caſe, that is to ſay, when the dominant is ſimple, the note which follows can only be a dominant; in the ſecond it may be any one you chooſe; or, in other words, it may either be a tonic, a tonic dominant, a ſimple dominant, or a ſub-dominant. It is neceſſary, however, that the conditions preſcribed in the ſecond rule ſhould be obſerved, if it be a ſimple dominant.

RULE V.

138. Every ſub-dominant ought to riſe by a fifth; and the note which follows it may, at your pleaſure, be either a tonic, a tonic dominant, or a ſub-dominant.

REMARK.

139. The tranſition from a tonic dominant to a tonic is called an *abſolute repoſe*, or a *perfect cadence* (53), and the tranſition from a ſub-dominant to a tonic is called an *imperfect* or *irregular cadence* (73).

SECT. VII. *Of the Rules which ought to be obſerved in the Treble with relation to the Fundamental Baſs.*

141. The treble is nothing elſe but a modulation above the fundamental baſs, and whoſe notes are found in the chords of that baſs which correſponds with it.

142. We are juſt about to give the rules for the treble; but firſt we think it neceſſary to make the two following remarks:

1. It is obvious, that many notes of the treble may anſwer to one and the ſame note in the fundamental baſs, when theſe notes belong to the chord of the ſame note in the fundamental baſs. For example, this modulation C E G E C, may have for its fundamental baſs the note C alone, becauſe the chord of that note comprehends the ſounds C, E, G, which are found in the treble.

2. In like manner, a ſingle note in the treble may, for the ſame reaſon, anſwer to ſeveral notes in the baſs.

RULE I. *For the* TREBLE.

143. If the note which forms the ſeventh in a chord of the *ſimple dominant* is found in the treble, the note which precedes it muſt be the very ſame. This is what we call a *diſcord prepared.* For inſtance, let us ſuppoſe that the note of the fundamental baſe ſhall be D, bearing the chord of the ſimple dominant D F A C; and that this C, which is the diſſonance, ſhould be found in the treble; it is neceſſary that the note which goes before it in the treble ſhould likewiſe be an C.

And it is requiſite to obſerve, that, according to the rules which we have given for the fundamental baſs, C will always be found in the chord of that note in the fundamental baſs which precedes the ſimple dominant D.

RULE II.

145. If a note of the fundamental baſs be a tonic dominant, or a ſimple dominant, and if the diſſonance be found in the treble, this diſſonance in the ſame treble ought to deſcend diatonically. But if the note of the baſs be a ſub-dominant, it ought to riſe diatonically. This diſſonance which riſes or deſcends diatonically, is what we have called a *diſſonance ſaved* or *reſolved.*

146. One may likewiſe obſerve here, that, according to the rules for the fundamental baſs which we have given, the note upon which the diſſonance ought to deſcend or riſe will always be found in the ſubſequent chord.

SECT. VIII. *Of the Continued Baſs, and its Rules.*

147. A continued or thorough baſs, is nothing elſe but a fundamental baſs whoſe chords are *inverted.* We invert a chord when

we change the order of the notes which compoſe it. For example, if inſtead of the chord G B D F, I ſhould ſay B D F G, or D F G B, &c. the chord is inverted. Let us ſee then, in the firſt place, all the poſſible ways in which a chord may be inverted.

The Ways in which a PERFECT CHORD *may be* INVERTED.

148. The perfect chord C E G C may be inverted in two different ways. 1. E G C E, which we call a chord of the *ſixth*, compoſed of a third, a ſixth, and an octave, and in this caſe the note E is marked with a 6. 2. G C E G, which we call a chord of the *ſixth and fourth*, compoſed of a fourth, a ſixth, and an octave; and it is marked with a $^{6}_{4}$. The perfect minor chord is inverted in the ſame manner.

The Ways in which the CHORD *of the* SEVENTH *may be* INVERTED.

149. In the chord of the tonic dominant, as G B D F, the third major B above the fundamental note G is called a *ſenſible note* (57); and the inverted chord B D F G, compoſed of a third, a falſe fifth, and ſixth, is called the *chord of the falſe fifth*, and is marked with an 8 or a ♭5.

The chord D F G B, compoſed of a third, a fourth, and a ſixth, is called the *chord of the ſenſible ſixth*, and marked with a 6 or a ♯6. In this chord thus figured, the third is minor, and the ſixth major, as it is eaſy to be perceived.

The chord F G B D, compoſed of a ſecond, a tritone, and a ſixth, is called the *chord of the tritone*, and is marked thus, 4^{+}, thus ×4, or thus ♯4.

150. In the chord of the ſimple dominant D F A C, we find,

1. F A C D, a chord of the great ſixth, which is compoſed of a third, a fifth, and a ſixth, and which is figured with a $^{6}_{5}$.

2. A C D F, a chord of the leſſer ſixth, which is figured with a 6.

3. C D F A, a chord of the ſecond, compoſed of a ſecond, a fourth, and a ſixth, and which is marked with a 2.

The Ways in which the CHORD *of the ſub*-DOMINANT *may be inverted.*

151. The chord of the ſub-dominant, as F A C D, may be inverted in three different manners; but the method of inverting it, which is moſt in practice is the chord of the leſſer ſixth A C D F, which is marked with a 6, and the chord of the ſeventh D F A C.

RULES *for the* CONTINUED BASS.

152. The continued baſs is a fundamental baſs, whoſe chords are only inverted in order to render it more in the taſte of ſinging, and ſuitable to the voice. The continued baſs then is properly nothing elſe but a treble with reſpect to the fundamental baſs. Its rules immediately follow; which are properly no other than thoſe already given for the treble.

RULE I.

153. Every note which carries the chord of the falſe fifth, and which of conſequence muſt be what we have called a *ſenſible note*, ought, (57) to riſe diatonically upon the note which follows it.

RULE II.

154. Every note carrying the chord of the tritone ſhould deſcend diatonically upon the ſubſequent note.

RULE III

155. The chord of the ſecond is commonly put in practice upon notes which are ſyncopated in deſcending, becauſe the notes are diſſonances which ought to be prepared and reſolved 143, 145.

SECT. IX. *Of ſome Licences aſſumed in the Fundamental Baſs.*

1. *Of* BROKEN *and* INTERRUPTED CADENCES.

156. The broken cadence is executed by means of a dominant which riſes diatonically upon another, or upon a tonic by a licence.

157. The interupted cadence is formed by a dominant which deſcends by a third upon another. Theſe cadences ought not to be permitted but rarely and with precaution.

2. SUPPOSITION.

158. When a dominant is preceded by a tonic in the fundamental baſs, we add ſometimes in the continued baſs to the chord of that dominant, a new note which is a third or a fifth below; and the chord which reſults from it in this continued baſs is called *a chord by ſuppoſition*. For example, let us ſuppoſe that in the fundamental baſs we have a dominant G carrying the chord of the ſeventh G B D F; let us add to this chord the note C, which is a fifth below this dominant, and we ſhall have the total chord C G B D F, or C D F G B, which is called *a chord by ſuppoſition.*

Of the different Kinds of Chords by Suppoſition.

159. It is eaſy to perceive, that chords by ſuppoſition are of different kinds. For inſtance, the chord of the tonic G B D F gives,

1. By adding the fifth C, the chord C G B D F, called a *chord of the ſeventh redundant*, and compoſed of a fifth, ſeventh, ninth, and eleventh. It is figured with a ♯7. This chord is not practiſed but upon the tonic. They ſometimes leave out the ſenſible note; it is then reduced to C F G D, and marked with $^{5}_{4}$ or $^{5}_{2}$.

2. By adding the third E, we ſhall have the chord E G B D F, called a *chord of the ninth*, and compoſed of a third, fifth, ſeventh, and ninth. It is figured with a 9. This third may be added to every third of the dominant.

3. If to a chord of the ſimple dominant, as D F A C, we ſhould add the fifth G, we would have the chord G D F A C, called a *chord of the eleventh*, and which is figured with a $^{9}_{4}$ or $^{4}_{9}$.

OBSERVE.

160. When the dominant is not a tonic dominant, they often take away ſome notes from the chord. For example, let us ſuppoſe that there is in the fundamental baſs this ſimple dominant E, carrying the chord E G B D: if there ſhould be added the third C beneath, we ſhall have this chord of the continued baſs C E G B D. In this ſtate the chord is ſimply compoſed of a third, fifth, and ninth, and is marked with a 9.

161. What is more, in the chord of the ſimple dominant, as D F A C, when the fifth G is added they frequently obliterate the ſounds F and A, that too great a number of diſſonances may be avoided, which reduces the chord to G C D. This laſt is compoſed only of the fourth and the fifth. It is called a *chord of the fourth*, and it is figured with a 4.

162. Sometimes they only remove the note A, and then the chord ought to be figured with $^{7}_{4}$ or $^{4}_{7}$.

163. Finally, in the minor mode, for example, in that of A, where the chord of the tonic dominant (109), is E G♯ B D, if we add to this chord the third C below, we ſhall have C E G♯ B D, called the *chord of the fifth redundant*, and compoſed of a third, a fifth redundant, a ſeventh, and a ninth. It is figured with a ♯5, or a +5.

3. *Of the* CHORD *of the* DIMINISHED SEVENTH.

164. In the minor mode, for inſtance, in that of A, E a fifth from A is the tonic dominant, and carries the chord E G♯ B D, in which G is the ſenſible note. For this chord they ſometimes ſubſtitute that other G ♯ B D F, all compoſed of minor thirds; and which has for its fundamental ſound the ſenſible note G♯. This chord is called a *chord of the flat or diminiſhed ſeventh*, and is figured with a $\not7$ in the fundamental baſs, but it is always conſidered as repreſenting the chord of the tonic dominant.

165. This chord in the fundamental baſs produces in the continued baſs the following chords:

1. The chord B D F G♯, compoſed of a third, falſe fifth, and ſixth major. They call it the *chord of the ſixth ſenſible and falſe fifth*; and it is figured thus ♯ $^{6}_{5}$, or + $^{6}_{5}$.

2. The chord D F G♯ B, compoſed of a third, a triton, and a ſixth, they call it the *chord of the triton and third minor*; and they mark it thus $\sharp\flat^{4}$

3. The chord F G♯ B D, compoſed of a ſecond redundant, a tritone, and a ſixth. They call it the *chord of the ſecond redundant*, and they figure it thus ♯2, or + 2.

166. Beſides, ſince the chord G♯ B D F, repreſents the chord E G♯ B D, it follows, that if we operate by ſuppoſition upon the firſt of theſe chords, it muſt be performed as one would perform it upon E G♯ B D; that is to ſay, that it will be neceſſary to add to the chord G♯ B D F, the notes C or A, which are the third or fifth below E, and which will produce,

1. By adding C, the chord C G♯ B D F, compoſed of a fifth redundant, a ſeventh, a ninth, and eleventh, which is the octave of the fourth. It is called a *chord of the fifth redundant and fourth*, and thus marked $^{4}\,^{5}_{4}$, or $\sharp^{5}_{4}$.

2. By adding A, we ſhall have the chord A G♯ B D F, compoſed of a ſeventh redundant, a ninth, an eleventh, and a thirteenth minor, which is the octave of the ſixth minor. It is called the *chord of the ſeventh redundant and ſixth minor*, and marked $\overset{+\,7}{\flat 9}$, or $\sharp^{7}_{\flat}$. It is of all chords the moſt harſh, and the moſt rarely practiſed.

In the *Treatiſe of Harmony* by M. Rameau, and elſewhere, may be ſeen a much longer detail of the chords by ſuppoſition: But here we delineate the elements alone.

SECT. X. *Of ſome Licences uſed in the Treble and Continued Baſs.*

167. Sometimes in a treble, the diſſonance which ought to have been reſolved by deſcending diatonically upon the ſucceeding note, inſtead of deſcending, on the contrary riſes diatonically: but in that caſe the note upon which it ought to have deſcended muſt be found in ſome of the other parts. This licence ought to be rarely practiſed. In like manner, in a continued baſs, the diſſonance in a chord of the ſub-dominant inverted, as A in the chord A C E G, inverted from C E G A, may ſometimes deſcend diatonically inſtead of riſing as it ought to do; but in that caſe the note ought to be repeated in another part, that the diſſonance may be there reſolved in aſcending.

168. Sometimes likewiſe, to render a continued baſs more more agreeable by cauſing it to proceed diatonically, they place between two ſounds of that baſs a note which belongs to the chord of neither.

SECT. XI. *Containing the Method of finding the Fundamental Baſs when the Continued Baſs is figured.*

169. To exerciſe yourſelf with greater eaſe in finding the fundamental baſs, and to render it more familiar to you, it is neceſſary to obſerve how eminent maſters, and above all how M. Rameau, has put the rules in practice. Now, as they never place any thing but the continued baſs in their works, it becomes then neceſſary to know how to find the fundamental baſs when the continued baſs is figured. This problem may be eaſily ſolved by the following rules.

170. 1. Every note which has no figure in the continued baſs, ought to be the ſame, and without a figure in the fundamental baſs; it either is a tonic, or reckoned ſuch.

2. Every note which in the continued baſs carries a 6, ought

in the fundamental baſs to give its third below not figured, or its fifth below marked with a 7. We ſhall diſtinguiſh theſe two caſes below.

3. Every note carrying $^{6}_{4}$ gives in the fundamental baſs its fifth below not figured.

4. Every note figured with a 7 or a $\not{7}$, is the ſame in both baſſes, and with the ſame figure.

Sometimes a note which carries a 7 in the continued baſs, gives in the fundamental baſs its third above, figured with a 6. For example, this continued baſs $\overset{7}{A}\,\overset{8}{B}\,C$ gives this fundamental baſs $\overset{6}{C}\,\overset{7}{G}$ C; but in this caſe it is neceſſary that the note figured with a 6 ſhould riſe by a fifth, as we ſee here C riſe to G.

A note figured with a 2, gives likewiſe ſometimes in the fundamental baſs its fourth above, figured with a 6; but it is neceſſary in that caſe that the note figured with a 6, may even here riſe to a fifth.

5. Every note figured with a 2, gives in the fundamental baſs the diatonic note above figured with a 7.

6. Every note marked with a 4 gives in the fundamental baſs the diatonic note above, figured with a 7.

7. Every note figured with an 8 gives its third below figured with a 7.

8. Every note marked with 6 gives the fifth below marked with a 7; and in the chord of the ſeventh, of which we treat in theſe three laſt articles, the third ought to be major, and the ſeventh minor, this chord of the ſeventh being the chord of the tonic dominant.

9. Every note marked with a 9 gives its third above figured with a 7.

10. Every note marked with a $^{9}_{4}$ gives the fifth above figured with a 7.

11. Every note marked with a ♯5, or with a +5, gives the third above figured with a $\overset{7}{\sharp}$.

12. Every note marked with a ♯7 gives a fifth above figured a 7, or with a $\overset{7}{\sharp}$. It is the ſame caſe with the notes marked $^{7}_{4}$, $\begin{smallmatrix}8\\4\\2\end{smallmatrix}$ or $^{5}_{2}$: which ſhews a retrenchment, either in the complete chord of the eleventh, or in that of the ſeventh redundant.

13. Every note marked with a 4 gives a fifth above figured with a 7, or a $\overset{7}{\sharp}$.

14. Every note marked with a $\sharp^{6}_{8}$ gives the third minor below, figured with $\not{7}$.

15. Every note marked with a $\sharp\overset{4}{\flat}$ gives the tritone above figured with a $\not{7}$.

16. Every note marked with a +2 gives the ſecond redundant above, figured with a $\not{7}$.

17. Every note marked with a $\sharp^{5}_{4}$ gives the fifth redundant above, figured with a $\not{7}$.

18. Every note marked with a $^{\sharp 7}_{\flat 6}$ gives the ſeventh redundant above, figured with a $\not{7}$.

REMARK.

171. We have omitted two caſes, which may cauſe ſome uncertainty.

The firſt is that where the note of the continued baſs is figured with a 6. We now preſent the reaſon of the difficulty.

Suppoſe we ſhould have the dominant $\overset{7}{D}$ in the fundamental baſs, the note which anſwers to it in the continued baſs may be A carrying the figure 6, that is to ſay, the chord A C D F: now if we ſhould have the ſub-dominant $\overset{6}{F}$ in the fundamental baſs, this ſubdominant might produce in the continued baſs the ſame note A figured with a 6. When therefore one finds in the continued baſs a note marked with a 6, it appears at firſt uncertain whether we ſhould place in the fundamental baſs the fifth below marked with a 7, or the third below marked with a 6.

172. The ſecond caſe is that in which the continued baſs is figured with a $^{6}_{5}$. For inſtance, if there ſhould be found $\overset{6}{\overset{5}{F}}$ in the continued baſs, one may be ignorant whether he ought to inſert in the fundamental baſs F marked with a 6, or D figured with a 7.

173. You may eaſily extricate yourſelf from this little difficulty, in leaving for an inſtant this uncertain note in ſuſpence, and in examining what is the ſucceeding note of the fundamental baſs; for if that note be in the preſent caſe a fifth above F, that is to ſay, if it is C, in this caſe, and in this alone, he may place $\overset{6}{F}$ in the fundamental baſs. It is a conſequence of this rule, that in the fundamental baſs every ſub-dominant ought to riſe by a fifth (138).

SECT. XII. *What is meant by being in a Mode or Tone.*

174. In the ſcale C D E F G A B C may be found; the different ſounds which form this ſcale compoſe what we call the *major mode* of C, becauſe the third E above C is major. If therefore we would have a modulation in the major mode of C, no other ſounds muſt enter into it than thoſe which compoſe this ſcale; in ſuch a manner that if, for inſtance, I ſhould find F♯ in this modulation, this F♯ diſcovers to me that I am not in the mode of C, or at leaſt that, if I have been in it, I am no longer ſo.

175. In the ſame manner, if I form this ſcale in aſcending A B C♯ D E F♯ G♯ A, which is exactly ſimilar to the ſcale C D E F G A B C of the major mode of C, this ſcale, in which the third from A to C♯ is major, ſhall be in the major mode of A; and if I incline to be in the minor mode of A, I have nothing to do but to ſubſtitute for C ſharp C natural; ſo that the major third A C♯ may become minor A C; I ſhall have then

A B C D E F♯ G♯ A,

which is the ſcale of the minor mode of A in aſcending; and the ſcale of the minor mode of A in deſcending ſhall be (65).

A G F E C D B A,

in which the G and F are no longer ſharp. For it is a ſingularity peculiar to the minor mode, that its ſcale is not the ſame in riſing as in deſcending.

176. This is the reaſon why, when we wiſh to begin a piece in the major mode of A, we place three ſharps at the cleff upon F, C, and G; and on the contrary, in the minor mode of A, we place none, becauſe the minor mode of A, in deſcending, has neither ſharps nor flats.

177. As the ſcale contains twelve ſounds, each diſtant from the other by the interval of a ſemitone, it is obvious that each of theſe ſounds can produce both a major and a minor mode, which conſtitute 24 modes upon the whole. Of theſe we ſhall immediately give a table, which may be very uſeful to diſcover the mode in which we are.

A TABLE of the DIFFERENT MODES.

Major Modes.

Maj. Mode.	
of C	C D E F G A B C
of G	G A B C D E F♯ G
of D	D E F♯ G A B C♯ D
of A	A B C♯ D E F♯ G♯ A
of E	E F♯ G♯ A B C♯ D♯ E.
of B	B C♯ D♯ E F♯ G♯ A♯ B
of F♯	F♯ G♯ B C♯ D♯ E♯ F♯ (*).
of C♯ or D♭	D♭ E♭ F G♭ A♭ B♭ C D♭.
of G♯ or A♭	A♭ B♭ C D♭ E♭ F G A♭
of D♯ or E♭	E♭ F G A♭ B♭ C D E♭.
of A♯ or B♭	B♭ C D E♭ F G A B.
of E♯ or A	F G A B♭ C D E F.
of B♯ or C♭	C D E F G A B C.

Minor Modes.

	Of A.
In deſcending.	A G F E D C B A.
In riſing.	A B C D E F♯ G♯ A.
	Of E.
In deſcending.	E D C B A G F♯ E.
In riſing.	E F♯ G A B C♯ D♯ E.
	Of B.
In deſcending	B A G F♯ E D C♯ B.
In riſing.	B C♯ D E F♯ G♯ A♯ B.
	Of F♯.
In deſcending.	F♯ E D C♯ B A G♯ F.
In riſing.	F♯ G♯ A B C♯ D♯ E♯ F♯.

(*) The major mode of F♯, of C♭ or D♯, and of G♯ or A♭ are not much practiſed. When a piece begins upon C♯, there ought to be ſeven ſharps placed at the cleff: but it is more convenient only to place five flats, and to ſuppoſe the key D♭, which is almoſt the ſame thing with C♯. It is for this reaſon that we ſubſtitute here the mode of D♭ for that of C♯.

It is ſtill much more neceſſary to ſubſtitute the mode of A♭ for that of G♯; for the ſcale of the major mode of G is

G♯, A♯, B♯, C♯, D♯, E♯, G G♯,

in which you may ſee that there are at the ſame time both a G natural and a G♯: it would then be neceſſary, even at the ſame time, that upon G there ſhould and ſhould not be a ſharp at the cleff; which is ſhocking and inconſiſtent. It is true that this inconvenience may be avoided by placing a ſharp upon G at the cleff, and by marking the note G with a natural through the courſe of the muſic wherever it ought to be natural; but this would become troubleſome, above all if there ſhould be occaſion to tranſpoſe. In the article 179 we ſhall give an account of tranſpoſition. One might likewiſe in this ſeries, inſtead of G natural, which is the note immediately before the laſt, ſubſtitute F♯♯, that is to ſay, F twice ſharp; which, however, is not abſolutely the ſame ſound with G natural, eſpecially upon inſtruments whoſe ſcales are fixed, or whoſe intervals are invariable. But in that caſe two ſharps may be placed at the cleff upon F, which would produce another inconvenience. But by ſubſtituting A♭ for G♯, the trouble is eluded.

Of C♯.
In deſcending. C♯ B A G♯ F♯ E D♯ C♯.
In riſing C♯ D♯ E F♯ G♯ A♯ B♯ C♯.
Of G♯ or A♭.
In deſcending. G♯ F♯ E C♯ B A♯ G♯.
In riſing. A♭ B♭ C♭ D♭ E♭ F G A♭.
Of D♯ or E♭.
In deſcending. E♭ D♭ C♭ B♭ A♭ G♭ F E♭.
In riſing. E♭ F G♭ A♭ B♭ C D E♭.
Of A♯ or B♭.
In deſcending. B♭ A♭ G♭ F E♭ D♭ C B♭.
In riſing B♭ C D♭ E♭ F G A B♭.
Of E♯ or F♭.
In deſcending. F E♭ D♭ C B♭ A♭ G F.
In riſing F G A♭ B♭ C D E F
Of C.
In deſcending. C B♭ A♭ G F E♭ D C.
In riſing. C D E♭ F G A B C.
Of G.
In deſcending. G F E♭ D C B♭ A G.
In riſing. G A B♭ C D E F♯ G.
Of D.
In deſcending. D C B♭ A G F E D.
In riſing. D E F G A B C♯ D.

178. Theſe then are all the modes, as well major as minor. Thoſe which are crowded with ſharps and flats are little practiſed, as being extremely difficult in execution.

179. From thence it follows,

1. That when there are neither ſharps nor flats at the cleff, it is a token that the piece begins in the major mode of C, or in the minor mode of A.

2. That when there is one ſingle ſharp, it will always be palced upon F, and that the piece begins in the major mode of G, or the minor of E, in ſuch a manner that it may be ſung as if there were no ſharp, by ſinging B inſtead of F♯, and in ſinging the tune as if it had been in another cleff. For inſtance, let there be a ſharp upon F in the cleff of G upon the firſt line; one may then ſing the tune as if there were no ſharp: And inſtead of the cleff of G upon the firſt line, let there be the cleff of C; for the F♯, when changed into B, will require that the cleff of G ſhould be changed to the cleff of C, as may be eaſily ſeen. This is what we call *tranſpoſition*.

Though this delicate operation in muſic will be found extremely juſt and compendious; and proceeds upon ſimple principles, and comprehends every poſſible contingency; yet as the manner of thinking upon which it depends may be leſs familiar to thoſe readers, who are not profoundly ſkilled in muſic, it has been thought proper to give a more familiar, though leſs comprehenſive, explanation of the manner in which *tranſpoſition* may be executed.

It will eaſily occur to every reader, that if each of the intervals through the whole diatonic ſeries were equal in a mathematical ſenſe, it would be abſolutely indifferent upon what note any air were begun, if within the compaſs of the gammut; becauſe the ſame equal intervals muſt always have the ſame effects. But ſince, beſides the natural ſemitones, there is another diſtinction of diatonic intervals into greater and leſſer tones; and ſince theſe vary their poſitions in the ſeries of an octave, according as the note from whence you begin is placed, that note is conſequently the beſt key for any tune whoſe natural ſeries is moſt exactly correſpondent with the intervals which that melody or harmony requires. But in inſtruments whoſe ſcales are fixed, notwithſtanding the temperament and other expedients of the ſame kind, ſuch a ſeries is far from being eaſily found, and is indeed in common practice almoſt totally neglected. All that can frequently be done is, to take care that the ear may not be ſenſibly ſhocked. This, however, would be the caſe, if, in tranſpoſing any tune, the ſituation of the ſemitones, whether natural or artificial, were not exactly correſpondent in the ſeries to which your air muſt be tranſpoſed, with their poſitions in the ſcale from which you tranſpoſe it. Suppoſe, for inſtance, your air ſhould begin upon C, requiring the natural diatonic ſeries through the whole gammut, in which the diſtance between E and F, as alſo that between B and C, is only a ſemitone. Again, ſuppoſe it neceſſary for your voice, or the inſtrument on which you play, that the ſame air ſhould be tranſpoſed to G, a fifth above its former keys; then becauſe in the firſt ſeries the intervals between the third and the fourth, ſeventh and eighth notes, are no more than ſemitones, the ſame intervals muſt take the ſame places in the octave to which you tranſpoſe. Now, from *ſol* or G, the note with which you propoſe to begin the three tones immediately ſucceeding are full; but the fourth, *ut* or C, is only a ſemitone; it may therefore be kept in its place. But from *fa* or F, the ſeventh note above, to *ſol* or G the eighth, the interval is a full tone, which muſt conſequently be redreſſed by raiſing your F a ſemitone higher. Thus the ſituations of the ſemitonic intervals in both octaves will be correſpondent; and thus by conforming the poſitions of the ſemitones in the octave to which you tranſpoſe, with thoſe in the octave in which the original key of the tune is contained, you will perform your operation with as much ſucceſs as the nature of fixed ſcales can admit.

180. It is evident, that when F♯ is changed into B, G muſt be changed into C, and E into A. Thus by tranſpoſition, the air has the ſame melody as if it were in the major mode of C, or in the minor mode of A. The major mode then of G, and the minor of E are by tranſpoſition reduced to thoſe of C major, and of A minor. It is the ſame caſe with all the other modes, as any one may eaſily be convinced.

Two ſharps F♯ and C♯, indicate the major mode D, or the minor of B; and then, by tranſpoſition, the C♯ is changed into B, and of conſequence, D into C, and B into A.

Three ſharps, F♯ C♯ G♯, indicate the major mode of A, or the minor of F♯; and it is then G♯, which muſt be changed into B, and of conſequence A into C, and F♯ into A.

Four ſharps, F♯ C♯ G♯ D♯ indicate the major mode of E, or the minor of C♯; then the D♯ is changed into B, and of conſequence E into C, and C♯ into A.

Five ſharps, F♯ C♯ G♯ D♯ A♯, indicate the major mode of B, or the minor G♯; A then is changed into B, and of conſequence B into C, and G♯ into A.

Six ſharps, F♯ C♯ G♯ D♯ A♯ E♯, indicate the major mode of F♯; E♯ then is changed into B, and of conſequence F♯ into C.

Six flats, B♭ E♭ A♭ D♭ G♭ C♭, indicate the minor mode of E♭; C is changed into B, and of conſequence E♭ into A.

Five flats B♭ E♭ A♭ D♭ G♭, indicate the major mode of D♭, or the minor mode of B♭; then the B♭ is changed into F, and of conſequence D♭ into C, and the B♭ into A.

Four flats, B♭ E♭ A♭ D♭, indicate the major mode of A♭, or the minor mode of F; D♭ then is changed into F, and of conſequence A♭ into C, and F into A.

Three flats, B♭ E♭ A♭, indicate the major mode of E♭, or the minor of C; the A♭ then is changed into F, and of conſequence E♭ into C, and the G into A.

Two flas, B♭ E♭, indicate the major mode of B♭, or the minor of G; E♭ then is changed into F, and of conſequence B♭ into C, and the F into A.

One flat, B♭ indicates the major mode of F, or the minor mode of D, and B♭ is changed into F; of conſequence the F is changed into C, and the D into A.

All the major modes then may be reduced to that of C, and the modes minor to that of A minor.

It only remains to remark, that many muſicians, and amongſt others the ancient muſicians of France, as Lulli, Campra, &c. place one flat leſs in the minor mode: ſo that in the minor mode of D, they place neither ſharp nor flat at the cleff; in the minor mode of G, one flat only; in the minor mode of C, two flats, &c.

This practice in itſelf is ſufficiently indifferent, and ſcarcely merits the trouble of a diſpute. Yet the method which we have here deſcribed, according to M. Rameau, has the advantage of reducing all the modes to two; and beſides it is founded upon this ſimple and very general rule. That in the major mode, we muſt place as many ſharps or flats at the cleff, as are contained in the diatonic ſcale of that mode in aſcending; and in the minor mode, as many as are contained in that ſame ſcale in deſcending.

However this be, we here preſent a rule for tranſpoſition, which appears to us more ſimple than the rule in common uſe.

For the Sharps.

Suppoſe G, D, A, E, B, F, and change G into C if there is one ſharp at the cleff, D into C if there are two ſharps, A into C if there are three, &c.

For the Flats.

Suppoſe F, B, E, A, D, G, and change F into C if there is only one flat at the cleff, B into C if there are two flats, E into C if there are three, &c.

SECT. XIII. *To find the Fundamental Baſs of a given Modulation.*

181. As we have reduced to a very ſmall number the rules of the fundamental baſs, and thoſe which in the treble ought to be obſerved with relation to this baſs, it ſhould no longer be difficult to find the fundamental baſs of a given modulation, nay, frequently to find ſeveral; for every fundamental baſs will be legitimate when it is formed according to the rules which we have given (ſect. VI.); and that, beſides this, the diſſonances which the modulation may form with this baſs will both be prepared, if it is neceſſary that they ſhould be ſo, and always reſolved.

We often ſay, that we are upon a particular *key*, inſtead of ſaying *that we are in a particular mode*. The following expreſſions therefore are ſynonimous; *ſuch a piece is in* C *major*, or *in the mode of* C *major*, or *in the key of* C *major*.

We muſt recite a few technical phraſes upon the ſame ſubject, and which if we are not miſtaken, will be found equally conciſe, at the ſame time that they are more natural and intelligible. When we mean to expreſs the fundamental note of that ſeries within the diatonic octave which any piece of muſic demands, we call that note the *key*. When we intend to ſignify its mode, whether major or minor, we denominate the harmony *ſharp* or *flat*. When in a concert we mean to try how inſtruments are in tune by that note upon which, according to the genius of each particular inſtrument they may beſt agree in uniſon, we deſire the muſicians who join us to ſound A.

182. It is of the greateſt utility in ſearching for the fundamental baſs, to know what is the tone or mode of the melody to which that baſs ſhould correſpond. But it is difficult in this matter to aſſign general rules, and ſuch as are abſolutely without exception, in which nothing may be left that appears indifferent or diſcretionary; becauſe ſometimes we ſeem to have the free choice of referring a particular melody either to one mode or another. For example, this melody G C may belong to all the modes, as well major as minor, in which G and C are found together; and each of theſe two ſounds may even be conſidered as belonging to a different mode.

183. For what remains, one may ſometimes, as it ſhould ſeem, operate without the knowledge of the mode, for two reaſons: 1. Becauſe, ſince the ſame ſounds belong to ſeveral different modes, the mode is ſometimes conſiderably undetermined; above all, in the middle of a piece, and during the time of one or two bars. 2. Without giving ourſelves much trouble about the mode, it is often ſufficient to preſerve us from deviating in compoſition, if we obſerve in the ſimpleſt manner the rules above preſcribed (ſect. VI.) for the procedure of the fundamental baſs.

184. In the mean time, it is above all things neceſſary to know in what mode we operate at the beginning of the piece, becauſe it is indiſpenſible that the fundamental baſs ſhould begin in the ſame mode, and that the treble and baſs ſhould likewiſe end in it; nay, that they ſhould even terminate in its fundamental note, which in the mode of C is C, and A in that of A, &c. Beſides, in thoſe paſſages of the modulation where there is a cadence, it is generally neceſſary that the mode of the fundamental baſs ſhould be the ſame with that of the part to which it correſponds.

185. To know upon what mode or in what key a piece commences, our inquiry may be entirely reduced to diſtinguiſh the major mode of C from the minor of A. For we have already ſeen (art. 179. and 180), that all the modes may be reduced to theſe two, at leaſt in the beginning of a piece. We ſhall now therefore give a detail of the different means by which theſe two modes may be diſtinguiſhed.

1. From the principal and characteriſtical ſounds of the mode which are C E G in the one, and A C E in the other; ſo that if a piece ſhould, for inſtance, begin thus, A C E A, it may be almoſt conſtantly concluded, that the tone or mode is in A minor, although the notes A C E belong to the mode of C.

2. From the ſenſible note, which is B in the one, and G♯ in me other; ſo that if G♯ appears in the firſt bars of a piece, one thay be certain that he is in the mode of A.

3. From the adjuncts of the mode, that is to ſay, the modes of its two fifths, which for C are F and G, and D and E for A. For example, if after having begun a melody by ſome of the notes which are common to the modes of C, and of A, (as E D E F E D C B C); I ſhould afterwards find the mode of G, which I aſcertain by the F♯, or that of F, which I aſcertain by the B♭ or C♮, I may conclude that I have begun in the mode of C: but if I find the mode of D, or that of E, which I aſcertain by B♭, C♯, or D♯, &c. I conclude from thence that I have begun in the mode of A.

4. A mode is not in ordinary deſerted, eſpecially in the beginning of a piece; but that we may paſs into one or other of theſe modes which are moſt relative to it, which are the mode of its fifth above, and that of its third below, if the original mode be major, or of its third above if it be minor. Thus, for inſtance, the modes which are moſt intimately relative to the major mode of C, are the major mode of G, and that of A minor. From the mode of C we commonly paſs either into the one or the other of theſe modes; ſo that we may ſometimes judge of the principal mode in which we are, by the relative mode which follows it, or which goes before it, when theſe relative modes are deciſively marked. For what remains, beſides theſe two relative modes, there are likewiſe two others into which the principal mode may paſs, but leſs frequently, viz. the mode of its fifth below, and that of its third above, as, F and E for the mode of C.

It is certain that the minor mode of E has an extremely natural connection with the mode of C, as has been proved (art. 72.) both by arguments and by examples. It has likewiſe appeared in the note upon the art. 73. that the minor mode of D may be joined to the major mode of C; and thus in a particular ſenſe, this mode may be conſidered as relative to the mode of C: but it is ſtill leſs ſo than the major modes of G and F, or than thoſe of A and E minor; becauſe we cannot immediately, and without licence, paſs in a fundamental baſs from the perfect minor chord of C to the perfect chord of D; and if you paſs immediately from the major mode of C, to the minor mode of D in a fundamental baſs, it is by paſſing, for inſtance, from the tonic C, or from C E G C, to the tonic dominant of D, carrying the chord A C♯ E G, in which there are two ſounds, E G, which are found in the preceding chord; or otherwiſe from C E G C to G B♭ D E, a chord of the ſub-dominant in the minor mode of D; which chord has likewiſe two ſounds, G and E, in common with that which went immediately before it.

5. The modes may ſtill be likewiſe diſtinguiſhed by the cadences of the melody. Theſe cadences ought to occur at the end of every two, or at moſt every four bars, as in the fundamental baſs: now the note of the fundamental baſs which is moſt ſuitable to theſe cloſes, is always eaſy to be found. For the ſounds which occur in the treble may be conſulted M. Rameau, p. 54. of his *Nouveau Syſteme de Muſique theorique et pratique.*

All theſe different manners of diſtinguiſhing the modes ought, if we may ſpeak ſo, to give mutual light and aſſiſtance one to the other. But it often happens, that one of theſe ſigns alone is not ſufficient to determine the mode, and may even lead to error. For example, if a piece of muſic begins with theſe three notes, E C G, we muſt not with too much precipitation conclude from thence that we are in the major mode of C, although theſe three ſounds, E C G, be the principal and characteriſtical ſounds in the major mode of C; we may be in the minor mode of E, eſpecially if the note E ſhould be long.

When a perſon is once able to aſcertain the mode, and can render himſelf ſure of it by the different means which we have pointed out, the fundamental baſs will coſt little pains. For in each mode there are three fundamental ſounds.

1. The tonic of the mode, or its principal ſound, which carries always the perfect chord major or minor, according as the mode itſelf is major or minor.

Major mode of C. C E G C.
Minor mode of A. A C E A.

2. The tonic dominant, which is a fifth above the tonic, and which, whether in the major or minor mode, always carries a chord of the ſeventh, compoſed of a third major followed by two thirds minor.

Tonic dominant.

Major mode of C. G B D F

Tonic dominant.

Minor mode of A. E G♯ B D

3. The ſub-dominant, which is a fifth below the tonic, and which carries a chord compoſed of a third, fifth, and ſixth major, the third being either greater or leſſer, according as the mode is major or minor.

Sub dominant.

Major mode of C. F A C D.
Minor mode of A. D F A B.

Theſe three ſounds, the tonic, the tonic dominant, and the ſub-dominant, contain in their chords all the notes which enter into the ſcale of the mode; ſo that when a melody is given, it may almoſt always be found which of theſe three ſounds ſhould be placed in the fundamental baſs, under any particular note of the upper part. Yet it ſometimes happens that not one of theſe notes can be uſed. For example, let it be ſuppoſed that we are in the mode of C, and that we find in the melody theſe two notes A B in ſucceſſion; if we confine ourſelves to place in the fundamental baſs one of the three ſounds C G F, we ſhall find nothing for the ſounds A and B but this fundamental baſs $\overset{6}{F}\ \overset{7}{G}$; now ſuch a ſucceſſion as $\overset{6}{F}$ to $\overset{7}{G}$ is prohibited by the fifth rule for the fundamental baſs, according to which every ſub-dominant, as F, ſhould riſe by a fifth; ſo that $\overset{6}{F}$ can only be followed by C in the fundamental baſs, and not by $\overset{7}{G}$.

To remedy this, the chord of the ſub-dominant F A C D muſt be inverted into a fundamental chord of the ſeventh in this manner D F A C; which has been called the *double employment*, becauſe it is a ſecondary manner of employing the chord of the ſub-dominant. By theſe means we give to the modulation A B, this fundamental baſs $\overset{7}{D}\ \overset{7}{G}$; which procedure is agreeable to rules.

Here then are four chords, C E G C, G B D F, F A C D, D F A C, which may be employed in the major mode of C. We ſhall find in like manner, for the minor mode of A, four chords,

A C E A, E G♯ B D,
D F A B, B D F A.

And in this mode we ſometimes change the laſt of theſe chords into B D F♯ A, ſubſtituting the F♯ for F♮. For inſtance, if we have this melody in the minor mode of A, E F♯ G♯ A, we would cauſe the firſt note E to carry the perfect chord A C E A, the ſecond note F♯ to carry the chord of the ſeventh B D F♯ A, the third note G♯ the chord of the tonic dominant E G♯ B D, and in ſhort, the laſt the perfect chord A C E A.

On the contrary, if this melody is given always in the minor mode A A G♯ A, the ſecond A being ſyncopated, it might have the ſame baſs as the modulation E F♯ G♯ A; with this difference alone, that F♮ might be ſubſtituted for F♯ in the chord B D F♯ A, the better to mark out the minor mode.

Beſides theſe chords which we have juſt mentioned, and which may be regarded as the principal chords of the mode, there are ſtill a great many others; for example, the ſeries of dominants,

$$C\quad \overset{7}{A}\quad D\quad \overset{7}{G}\quad \overset{7}{C}\quad \overset{7}{F}\quad \overset{7}{B}\quad \overset{7}{E}\quad \overset{7}{A}\quad \overset{7}{C}\quad \overset{7}{G}\quad C,$$

which is terminated equally in the tonic C, either entirely belong, or at leaſt may be reckoned as belonging to the mode of C; becauſe none of theſe dominants are tonic dominants except G, which is the tonic dominant of the mode of C; and beſides, becauſe the chord of each of theſe dominants forms no other ſounds than ſuch as belong to the ſcale of C.

They may be reckoned as belonging to this mode, for two reaſons: 1. Becauſe, properly ſpeaking, there are only three chords which eſſentially and primitively belong to the mode of C, viz. C carrying the perfect chord, F carrying that of the ſub-dominant, and G that of the tonic dominant, to which we may join the chord of the ſeventh, D F A C; but we here regard as extended the ſeries of dominants in queſtion, as belonging to the mode of C, becauſe it preſerves in the ear the impreſſion of that mode. 2. In a ſeries of dominants, there are a great many of them which likewiſe belong to other modes; for inſtance, the ſimple dominant A belongs naturally to the mode of G, the ſimple dominant B to that of A, &c. Thus it is only improperly, and by way of extenſion, that we regard theſe dominants, as belonging to the mode of C.

But if we were to form this fundamental baſs,

$$C\ \ \overset{7}{A}\ \ \overset{7}{D}\ \ \overset{7}{G}\ \ \overset{7\flat}{C}$$

conſidering the laſt C as a tonic dominant in this manner, C E G B♭; the mode would then be changed at the ſecond C, and we ſhould enter into the mode of F; becauſe the chord C E G B♭ indicates the tonic dominant of the mode of F; beſides, it is evident that the mode is changed, becauſe B♭ does not belong to the ſcale of C.

In the ſame manner, were we to form this fundamental baſs

$$C\ \ \overset{7}{A}\ \ \overset{7}{D}\ \ \overset{7}{G}\ \ \overset{6}{C}$$

conſidering the laſt C as a tonic dominant, in this manner, C E G A; this laſt C would indicate the mode of G, of which C is the *ſub-dominant*.

In like manner, ſtill, if in the firſt ſeries of dominants, we cauſed the firſt D to carry the third major, in this manner, D F♯ A C; this D, having become a tonic dominant, would ſignify the major mode of G; and the $\overset{7}{G}$ which ſhould follow it, carrying the chord $\overset{7}{B}$ D F would relapſe into the mode of C, from whence we had departed.

Finally, in the ſame manner, if in this ſeries of dominants, one ſhould cauſe B to carry F♯ in this manner, B D F♯ A; this F would ſhew that we had departed from the mode C, to enter into that of G.

From hence it is eaſy to form this rule for diſcovering the changes of mode in the fundamental baſs.

1. When we find a tonic in the fundamental baſs, we are in the mode of that tonic; and the mode is major or minor, according as the perfect chord is major or minor.

2. When we find a ſub-dominant, we are in the mode of the fifth above that ſub-dominant; and the mode is major or minor, according as the third in the chord of the ſub-dominant is major or minor.

3. When we find a tonic dominant, we are in the mode of the fifth below that tonic dominant. As the tonic dominant carries always the third major, one cannot be ſecure by the aſſiſtance of this dominant alone, whether the mode be major or minor: but it is only neceſſary for the compoſer to caſt his eye upon (art. 187.) which muſt be the tonic of the mode in which he is; by the third of this tonic he will diſcover whether the mode be major or minor.

186. Every change of the mode ſuppoſes a cadence; and when the mode changes in the fundamental baſs, it is almoſt always either after the tonic of the mode in which we have been, or after the tonic dominant of that mode, conſidered then as a tonic by favour of a cloſe which ought neceſſarily to be found in that place: Whence it happens that cadences in a melody for the moſt part preſage a change of mode which ought to follow them.

187. All theſe rules, joined with the table of modes which we have given (art. 177), will ſerve to diſcover in what mode we are in the middle of a piece, eſpecially in the moſt eſſential paſſages, as cadences.

188. Two modes are ſo much more intimately relative as they contain a greater number of ſounds common to both; for example, the minor mode of C and the major of G, or the major mode of C and the minor of A: on the contrary, two modes are leſs intimately relative as the number of ſounds which they contain as common to both is ſmaller; for inſtance, the major mode of C and the minor mode of B, &c.

189. When you find yourſelf led away by the current of the modulation, that is to ſay, by the manner in which the fundamental baſs is conſtituted, into a mode remote from that in which the piece was begun, you muſt continue in it but for a ſhort time, becauſe the ear is always impatient to return to the former mode.

SECT. XIV. *Of the Cromatic and Enharmonic.*

190. We call that melody *chromatic* which is compoſed of ſeveral notes in ſucceſſion, whether riſing or deſcending by ſemitones.

191. When an air is cromatic in deſcending, the moſt natural and ordinary fundamental baſs is a concatenated ſeries of tonic dominants; all of which follow one another in deſcending by a fifth, or which is the ſame thing, in riſing by a fourth.

192. When the air is cromatic in aſcending, one may form a fundamental baſs by a ſeries of tonics and of tonic dominants, which ſucceed one another alternately by the interval of a third in deſcending, and of a fourth in aſcending. There are many other ways of forming a chromatic air, whether in riſing or deſcending; but theſe details in an elementary eſſay are by no means neceſſary. With reſpect to the harmonic, it is very rarely put in practice.

SECT. XV. *Deſign, Imitation, and Fugue.*

193. In muſic, the name of *deſign*, or *ſubject*, is generally given to a particular air or melody, which the compoſer intends ſhould prevail through the piece; whether it is intended to expreſs the meaning of words to which it may be ſet, or merely inſpired by the impulſe of taſte and fancy. In this laſt caſe, deſign is diſtinguiſhed into *imitation* and *fugue*.

194. *Imitation* conſiſts in cauſing to be repeated the melody of one, or of ſeveral bars in one ſingle part, or in the whole harmony, and in any of the various modes that may be choſen. When all the parts abſolutely repeat the ſame air or melody, and beginning one after the other, this is called a *canon*. *Fugue* conſiſts in alternately repeating that air in the treble, and in the baſs, or even in all the parts, if there are more than two.

195. Imitation and fugue are ſometimes conducted by rules merely deducible from taſte, which may be ſeen in the 332d and following pages of M. Rameau's *Treatiſe on Harmony*; where will likewiſe be found a detail of the rules for compoſition in ſeveral parts. The chief rules for compoſition in ſeveral parts are, that the diſcords ſhould be found, as much as poſſible, prepared and reſolved in the ſame part; that a diſcord ſhould not be heard at the ſame time in ſeveral parts, becauſe its harſhneſs would diſguſt the ear; and that in no particular part there ſhould be found two octaves or two fifths in ſucceſſion, with reſpect to the baſs. Muſicians, however, do not heſitate ſometimes to violate this precept, when taſte or occaſion require. In muſic, as in all the other fine arts, it is the buſineſs of the artiſt to aſſign and to obſerve rules; the province of men who are adorned with taſte and genius is to find the exceptions.

SECT. XVI. *Definitions of the Different Airs.*

196. We ſhall finiſh this ſyſtem by giving in a few words the characteriſtic diſtinctions of the different airs to which names have been given, as *chacoon*, *minuet*, *rigadoon*, &c. The *chacoon* is a long piece of muſic, containing three times in each bar, of which the movement is regular, and the bars ſenſibly diſtinguiſhed. It conſiſts of ſeveral couplets, which are varied as much as poſſible. Formerly the baſs of the chacoon was a *conſtrained baſs*, or regulated by a rythmus terminating in 4 bars, and proceeding again by the ſame number; at preſent compoſers of this ſpecies no longer confine themſelves to that practice. The chacoon begins, for the moſt part, not with the perfect time, which is ſtruck by the hand or foot, but with the imperfect, which paſſes while the hand or foot is elevated. The *villanelle* is a chacoon a little more lively, with its movement ſomewhat more briſk than the ordinary chacoon. The *paſſacaille* only differs from a chacoon as it is more ſlow, more tender, and beginning in ordinary with a perfect time. The *minuet* is an air in treple time, whoſe movement is regular, and neither extremely briſk nor ſlow, conſiſting of two parts or ſtrains, which are each of them repeated; and for which reaſon they are called by the French *repriſes*: each ſtrain of the minuet begins with a time which is ſtruck, and ought to conſiſt of 4, of 8, or of 12 bars; ſo that the cadences may be eaſily diſtinguiſhed, and recur at the end of each 4 bars.

The *ſarabando* is properly a ſlow minuet; and the *courant* a very ſlow ſarabando: this laſt is no longer in uſe. The *paſſepied* is properly a very briſk minuet, which does not begin like the common minuet, with a ſtroke of the foot or hand; but in which each ſtrain begins in the laſt of the three times of which the bar conſiſts.

The *loure* is an air whoſe movement is ſlow, whoſe time is marked with $\frac{6}{4}$, and where two of the times in which the bar conſiſts are beaten; it generally begins with that in which the foot is raiſed. For ordinary the note in the middle of each time is ſhortened, and the firſt note of the ſame time pointed.

The *jig* is properly nothing elſe but a loure very briſk, and whoſe movement is extremely quick.

The *forlana* is a moderate movement, and in a mediocrity between the loure and the jig.

The *rigadoon* has two times in a bar, is compoſed of two ſtrains, each to be repeated, and each conſiſting of 4, of 8, or of 12 bars: its movement is lively; each ſtrain begins not with a ſtroke of the foot but at the laſt note of the ſecond time.

The *bourée* is almoſt the ſame thing with the rigadoon.

The *gavotte* has two times in each bar, is compoſed of two ſtrains, each to be repeated, and each conſiſting of 4, of 8, or of 12 bars: the movement is ſometimes ſlow, ſometimes briſk; but never extremely quick, nor very ſlow.

The *tambourin* has two ſtrains, each to be repeated, and each conſiſting of 4, of 8, or of 12 bars, &c. Two of the times that make up each bar are beaten, and are very lively; and each ſtrain generally begins in the ſecond time.

The *muſette* conſiſts of two or three times in each bar; its movement is neither very quick nor very ſlow; and for its baſs it has often no more than a ſingle note, which may be continued through the whole piece.

This Syſtem is principally an Abridgment from the works of Meſſrs. Rameau, Roſſeau, and D'Alembert, which are conſidered by the amateurs of the ſcience as the beſt treatiſes on the ſubject. We have introduced Plates to illuſtrate the relative Value of the Notes and Reſts; the different Cleffs, and Scales; and the Scales of the ſeveral ſtringed Inſtruments now in uſe; which addition it is preſumed will facilitate the progreſs of the practitioner.

MUSK, a very ſtrong ſcented ſubſtance found under the belly of an Eaſt India animal. See MOSCHUS.

According to Tavernier, the beſt and greateſt quantities of muſk come from the kingdom of Bouton, from whence it is carried for ſale to Patna, the chief town of Bengal. After killing the animal, the peaſants cut off the bag, which is about the ſize of an egg, and is ſituated nearer the organs of generation than the navel. They next take out the muſk, which has then the appearance of clotted blood. When they want to adulterate it, they put a maſh of the animal's blood and liver into the place of the blood and muſk they had extracted. In two or three years this mixture produces certain ſmall animals, which eat the good muſk; ſo that, when opened, a great conſumption is perceived. Others, after extracting a portion of the muſk, put it in ſmall pieces of lead to augment the weight. The merchants, who tranſport the muſk to foreign countries are leſs averſe to this trick than the former; becauſe in this caſe none of the animals abovementioned are produced. But the deceit is ſtill worſe to diſcover, when, of the ſkin taken from the belly of a young animal, they make little bags, which they ſew ſo dexterouſly with threads of the ſame ſkin, that they reſemble genuine bags. Thoſe they fill with what they take out of the genuine bags, and ſome fraudulent mixture, which it is extremely difficult for the merchants to detect. When the bags are ſewed immediately on their being cut, without allowing any part of the odour to diſſipate in the air, after they have abſtracted as much of the muſk as they think proper, if a perſon applies one of theſe bags to his noſe, blood will be drawn by the mere force of the odour, which muſt neceſſarily be weakened or diluted in order to render it agreeable without injuring the brain. Our author brought one of the animals with him to Paris, the odour of which was ſo ſtrong, that it was impoſſible for him to keep it in his chamber. It made every head in the houſe giddy; and he was obliged to put it in a barn, where the ſervants at laſt cut away the bag: the ſkin, notwithſtanding, always retained a portion of the odour. The largeſt muſk-bag ſeldom exceeds the ſize of a hen's egg, and cannot furniſh above half an ounce of muſk: three or four of them are ſometimes neceſſary to afford a ſingle ounce. In one of his voyages to Patna, Tavernier purchaſed 1663 bags, which weighed 1557 ounces and a half; and the muſk when taken out of the bags, weighed 452 ounces. Muſk affords the ſtrongeſt of all known odours. A ſmall bit of it perfumes a large quantity of matter. The odour of a ſmall particle extends through a conſiderable ſpace. It is likewiſe ſo fixed and permanent, that at the end of ſeveral years it ſeems to have loſt no part of its activity. When it comes to us it is dry, with a kind of unctuoſity of reddiſh-brown or ruſty blackiſh colour, in ſmall round grains, with very few hard black clots, and perfectly free from any ſandy or other viſible foreign matter. If chewed, and rubbed with a knife on paper, it looks ſmooth, bright, yellowiſh, and free from bitterneſs. Laid on a red-hot iron, it catches flame, and burns almoſt entirely away, leaving only an exceeding ſmall quantity of light greyiſh aſhes: if any earthly ſubſtances have been mixed with the muſk, the quantity of the reſiduum will readily diſcover them. Muſk has a bitteriſh ſubacrid taſte; a fragrant ſmell, agreeable at a diſtance, but when ſmelt near to, ſo ſtrong as to be diſagreeable unleſs weakened by the admixture of other ſubſtances. If a ſmall quantity be infuſed in ſpirit of wine in the cold for a few days, it imparts a deep, but not red tincture; this, though it diſcovers no great ſmell of the muſk, is nevertheleſs ſtrongly impregnated with its virtues; a ſingle drop of it communicates to a whole quart of wine a rich muſky flavour. The degree of flavour which a tincture drawn from a known quantity of muſk communicates to vinous liquors, is perhaps one of the beſt criteria for judging of the goodneſs of this commodity. Neuman informs us, that ſpirit of wine diſſolves ten parts out of thirty of muſk, and that water takes up twelve; that water elevates its ſmell in diſtillation, whilſt pure ſpirit brings over nothing.

Muſk is a medicine of great eſteem in the eaſtern countries; among us, it has been ſome time pretty much out of uſe, even as a perfume, on a ſuppoſition of its occaſioning vapours, &c. in weak females, and perſons of a ſedentary life. It appears, however, from late experience, to be, when properly managed, a remedy of good ſervice even againſt thoſe diſorders which it has been ſuppoſed to produce. Dr. Wall has communicated (in the Philoſophical Tranſactions, No. 474.) an account of ſome extraordinary effects of muſk in convulſive and other diſeaſes, which have too often baffled the force of medicine. The doctor obſerves, that the ſmell of perfume is often of diſſervice, where the ſubſtance, taken inwardly and in conſiderable quantity, produces the happieſt effects. The author of the New Diſpenſatory ſays, he has frequently given it with remarkable ſucceſs; and ſometimes increaſed the doſe as far as twenty grains every four hours, with two or three ſpoonfuls of the muſk julep between. The julep is the only officinal preparation of it.

MUSK *Animal*. See MOSCHUS.

MUSK *Rat*. The Engliſh name of a ſpecies of the Genus Caſtor. For the Deſcription ſee CASTOR. For repreſentation ſee plates to the Syſtem of Mammalia.

MUSLIN, a ſort of cotton cloth, which bears a downy knot in its ſurface. There are ſeveral ſorts of muſlins brought from the Eaſt Indies, and more particularly from Bengal; ſuch as doreas, betelles, mulmuls, tanjebs, &c.

MUSSULMAN, or MUSULMAN, a title by which the Mahometans diſtinguiſh themſelves; ſignifying, in the Turkiſh language, "true believer, or orthodox." See MAHOMETANISM.

MUSTELA, in the Linnean Syſtem, the 15th Genus, and belonging to the 3d order of Feræ, in the claſs of Mammalia. They are ſix erect, ſharp, diſtinct teeth in the upper jaw, and an equal number in the under jaw, but blunter and cloſer together, and two of them are ſituated a little farther within the mouth; and the tongue is ſmooth. The moſt remarkable ſpecies are the following.

The lutris, or ſea-otter, hath palmated feet, and the tail about one-fourth of the length of the body; the hair thick, long, and exceſſive black and gloſſy: beneath that is a ſoft down; the colour ſometimes varies to ſilvery. The biggeſt of theſe animals weigh 70 or 80 pounds. They inhabit, in vaſt abundance, the coaſts of Kamtſchatka, and the parts of America oppoſite to it, diſcovered by the Ruſſians: it is alſo met with in a moſt remote part of the continent of America, along the rivers of Braſil and Paraguay, and in the Oroonoko. It is a harmleſs animal; very affectionate to its young, inſomuch that it will pine to death at the loſs of them, and die on the very ſpot where they have been taken from it. Before the young can ſwim, they carry them in their paws, lying in the water on their backs: they run very ſwiftly; ſwim often on their back, their ſides, and even in a perpendicular poſture: are very ſportive; embrace, and kiſs each other: they inhabit the ſhallows, or ſuch places as abound with ſea-weeds; feed on lobſters, and other ſhell-fiſh, as well as ſepiæ and common fiſhes: they breed but once a-year, and have but one young one at a time, ſuckle it for a year, and bring it on ſhore. They are dull-ſighted, but quick-ſcented; are hunted for their ſkins; which are of great value, being ſold to the Chineſe for 70 or 80 rubles apiece; each ſkin weighs 3½ lb. The young are reckoned very delicate meat, ſcarce to be diſtinguiſhed from a ſucking lamb. The cry of this creature is nearly ſimilar to a young dog; and it is ſometimes interrupted by another cry ſimilar to that of the ſaki or fox-tailed monkey. It may be nouriſhed with the flour of manioc diluted in water.

The lutra, or otter, has palmated feet, the tail one half the length of the body; the whole colour is a deep brown, except two ſmall ſpots on each ſide of the noſe, and another below the chin; the legs are ſhort and thick, and looſely joined to the body: the length from the noſe to the tail is 23 inches. The otter inhabits all parts of Europe, the north and the north-eaſt of Aſia, even as far as Kamtſchatka; it abounds in North America, particularly in Canada, from whence the moſt valuable furs of this kind are brought. He is a voracious animal, but fonder of fiſh than of fleſh: he doth not willingly quit the margins of rivers or lakes, and often depopulates fiſh-ponds; but if fiſh happens to fail, he makes excurſions on land, and preys on lambs and poultry. It is obſervable, that the otter always ſwims againſt the ſtream to meet its prey; and two of them it is ſaid will hunt a ſalmon in concert. One ſtations itſelf above, and the other below the place where the fiſh lies, and continue chaſing it inceſſantly, till the creature, quite wearied out, becomes their prey. Sometimes the otter preys in the ſea, but not far from ſhore. It hath been obſerved, however, in the Orkneys to bring in cod, congers, &c. Properly ſpeaking, he is not an amphibious animal; for like other terreſtrial creatures, he requires the aid of reſpiration. When in purſuit of a fiſh, if he chances to be entangled in a net, he drowns; and we perceive that he has not had time to cut a ſufficient quantity of the meſhes to effectuate his eſcape. For want of fiſhes, crabs, frogs, or other animal food, he knaws the young twigs, and eats the bark of aquatic trees; he likewiſe eats the young herbage in the ſpring. The female frequently comes in ſeaſon in winter, brings forth in March, and the litter conſiſts of three or four. The young otters are leſs handſome than the old. The otter is capable of being tamed; he will follow his maſter like a dog, and even fiſh for him, and return with his prey.

Though the otter doth not caſt his hair, his ſkin is browner, and ſells dearer in winter than in ſummer; and makes very fine fur. His fleſh has a diſagreeable fiſhy taſte. His retreats exhale a noxious odour from the remains of putrid fiſhes; and his own body has a bad ſmell. The dogs chace the otter ſpontaneouſly, and eaſily apprehend him when at a diſtance from water or from his hole. But, when ſeized, he defends himſelf; bites the dogs moſt cruelly, and ſometimes with ſuch force as to break their leg-bones, and never quits his hold but with life. The beaver, however, who is not a very ſtrong animal, purſues the otters, and will not allow them to live on the ſame banks with himſelf.

The lutreola, or ſmall otter, has hairy palmated feet, and a white mouth, the ſame form with an otter, but thrice as ſmall. It inhabits Poland and the north of Europe; lives on fiſh, frogs, and water-inſects: its fur is very valuable, next to the ſable; is caught in Baſkiria with dogs and traps; is exceedingly fœtid. This is the ſame animal with the minx of America, which, Mr. Collinſon tells us, frequents the water like the otter, and very much reſembles it in ſhape and colour, but is leſs; it leaves its watery haunts to come and rob hen-rooſts: it bites off the heads of the poultry, and ſucks their blood; when vexed, it has a ſtrong, loathſome ſmell; its length from noſe to tail 20 inches; the tail four: is of a ſhining dark-brown colour.

The barbara, or Guinea-weaſel: the toes are not connected with a membrane: he is of a black colour, with coarſe hair, of the ſize of a martin; digs an habitation in the earth with his fore-feet, in which he has great ſtrength, and which are much ſhorter than thoſe behind. It inhabits Guinea, Braſil, and Guiana: when it rubs itſelf againſt trees, it leaves behind an unctuous matter that ſmells of muſk. It is very fierce; and if driven to neceſſity, will fly at man or beaſt: it is very deſtructive to poultry.

The gulo, or glutton, is of a duſky red colour, and blackiſh on the middle of the back: it is a moſt voracious animal; but very ſlow of foot, ſo is obliged to take its prey by ſurpriſe. In America it is called the *beaver-eater*; becauſe it watches thoſe animals as they come out of their houſes, and ſometimes breaks into their habitations and devours them. It often lurks on trees, and falls on the quadrupeds that paſs under; will faſten on a horſe, elk, or ſtag, and continue eating a hole into its body, till the animal falls down with pain, or elſe will tear out its eyes: no force can diſengage it; yet ſometimes the deer, in their agony, have been known to deſtroy the glutton by running its head violently againſt a tree. This animal alſo devours the iſatis, or white fox; ſearches for the traps laid for the ſables and other animals, and is often beforehand with the huntſmen, who ſuſtain great loſs by the glutton. He avoids water; and dreads horſes, and men dreſſed in black. He walks by a kind of a leap, and eats pretty voraciouſly. After taking a full meal, he covers himſelf in his cage with ſtraw. When drinking, he laps like a dog. He utters no cry. After drinking, with his paws he throws the remainder of the water on his belly. He is almoſt perpetually in motion. If allowed, he would devour more than four pounds of fleſh every day. He eats no bread; and devours his food ſo voraciouſly, and almoſt without chewing, that he is apt to choak himſelf.

The glutton is common in moſt of the northern regions of Europe, and even of Aſia; but in Norway, according to Pontoppidan, he is chiefly confined to the dioceſe of Drontheim. The ſame author remarks, that the ſkin of the glutton is very valuable; that he is not ſhot with fire-arms, to prevent his ſkin from being damaged; and that the hair is ſoft, and of a black colour, ſhaded with brown and yellow. In Siberia the ſkin is ſold for 4*s.* or 6*s.*; at Jakutſk for 12*s.*; and in Kamtſchatka ſtill dearer, becauſe the women dreſs their hair with its paws, which they eſteem as a great ornament: the fur is greatly eſteemed in Europe; and thoſe produced in the North of Europe and Aſia are much preferable to the American kind. In its wild ſtate, Mr. Pennant informs us, that the glutton is vaſtly fierce; a terror both to the wolf and bear, which will not prey upon it when they find it dead; perhaps on account of its being ſo very fœtid that it ſmells like a pole-cat: it makes a ſtrong reſiſtance when attacked; will tear the ſtock from the gun, and pulls the trap in which it is caught to pieces: notwithſtanding which, it is capable of being tamed, and of learning ſeveral tricks. M. Buffon remarks, that though the glutton employs conſiderable art and addreſs in ſeizing other animals, he ſeems to poſſeſs no other talents but thoſe which relate to appetite. "It would (ſays he) appear, that the glutton even wants the common inſtinct of ſelf-preſervation. He allows himſelf to be approached by men, or comes up to them without betraying the ſmalleſt apprehenſions." This indifference, which ſeems to be the effects of imbecility, proceeds perhaps from a different cauſe. It is certain that the glutton is not ſtupid, ſince he finds means to ſatisfy his appetite, which is always vehement and preſſing. Neither is he deficient in courage, ſince he attacks moſt animals he meets with, and betrays no ſymptoms of fear at the approach of men. Hence, if he wants attention to himſelf, it proceeds not from indifference to his own preſervation, but from the habit of ſecurity. As he lives in a country which is almoſt deſert, he ſeldom ſees men, who are his only enemies. Every time he tries his ſtrength with moſt animals, he finds himſelf their ſuperior. He goes about with perfect confidence; and never diſcovers the ſmalleſt mark of fear, which always ſuppoſes ſome experience of weakneſs. Of this we have an example in the lion, who never turns away from man, unleſs he has experienced the force of his arms: and the glutton, trailing along the ſnows of his deſart climate, remains always in perfect ſafety, and reigns, like the lion, not ſo much by his own ſtrength, as by the weakneſs of the animals around him.

The martes, or martin, is of a blackiſh yellow colour, with a pale throat, and the toes are not webbed. Theſe animals are found in great numbers in all temperate countries, and even in warm regions, as in Madagaſcar and Maldivia iſlands, and are never ſeen in high latitudes. The martin has a fine countenance, a lively eye, ſupple limbs, and a flexible body. His movements are all exceedingly nimble: he rather bounds and leaps than walks. He climbs rough walls with eaſe and alacrity; enters the pigeon or hen-houſes, eats the eggs, pigeons, fowls, &c. and the female often kills great numbers, and tranſports them to her young. He likewiſe ſeizes mice, rats, moles, and birds in their neſts. M. Buffon kept one of theſe animals for a conſiderable time. He tamed to a certain degree, but never formed any attachment, and continued always ſo wild, that it was neceſſary to chain him. He was then about a year and a half old, ſeemingly the age at which nature aſſumes her full aſcendancy. He eat every thing preſented to him, except ſallad and herbs; was fond of honey, and preferred hempſeed to every other grain. It was remarked that he drank very often; that he ſometimes ſlept two days ſucceſſively, and at other times would ſleep none for two or three days; that, before ſleeping, he folded himſelf in a round form, and covered his head with his tail; and that, while awake, his motions was violent and perpetual. The ſame author informs us, that he has had in his poſſeſſion ſeveral martins of an advanced age, which had been taken in nets; but they continued to be totally ſavage, bit all who attempted to touch them, and would eat nothing but raw fleſh.

Martins, it is ſaid, go with young as long as cats. We meet therefore with young ones from ſpring to autumn; and therefore it is probable they bring forth more than once a-year. The younger females bring only three or four at a time; but the more aged produce ſix or ſeven. The martin has an agreeable muſky odour, which proceeds from a matter contained in two veſicles, one on each ſide of the extremity of the rectum. The ſkin is a valuable fur, and much uſed for the linings to the gowns of magiſtrates.

The putorius, pole-cat, or fitchet, has unconnected toes, is of a dirty yellow colour, with a white mouth and ears. He is a native of moſt parts of Europe; and has a great reſemblance to the martin in temperament, manners, diſpoſition, and figure. Like the former he approaches our habitations, mounts on the roofs, takes up his abode in haylofts, barns, and unfrequented places, from which he iſſues during the night only in queſt of prey. He burrows under ground, forming a ſhallow retreat about two yards in length, generally terminating under the roots of ſome large tree. He makes greater havock among the poultry than the martin, cutting off the heads of all the fowls, and then carrying them off one by one to his magazine. If, as frequently happens, he cannot carry them off entire, on account of the ſmallneſs of the entry to his hole, he eats the brains, and takes only the heads along with him. He is likewiſe very fond of honey, attacks the hives in winter, and forces the bees to abandon them. The females come in ſeaſon in the ſpring; and bring forth three, four, or five at a time, but does not caſt them off till the end of ſummer. The pole-cat is exceſſively fœtid; yet the ſkin is dreſſed with the hair on, and uſed as the other furs, for tippets, &c. and is alſo ſent abroad to line cloaths.

The furo, or ferret, has red eyes, and unconnected toes; the colour of the whole body is of a very pale yellow; the length from noſe to tail is about 14 inches, the tail five. In its wild ſtate it inhabits Africa; from whence it was originally brought into Spain, in order to free that country from multitudes of rabbits with which it was over-run; and from thence the reſt of Europe was ſupplied with it. This creature is incapable of bearing the cold, and cannot ſubſiſt even in France unleſs in a domeſtic ſtate. The ferret is not in our climates endowed with the ſame capacity of finding his ſubſiſtence as other wild animals, but muſt be carefully nouriſhed within doors, and cannot exiſt in the fields; for thoſe who are loſt in the burrows of rabbits never multiply, but probably periſh during the winter. Like other domeſtic animals, he varies in colour. The female ferret is leſs than the male; and when in ſeaſon, we are aſſured ſhe is ſo extremely ardent, that ſhe dies if her deſires are not gratified. Ferrets are brought up in caſks or boxes, where they are furniſhed with beds of hemp or flax. They ſleep almoſt continually. Whenever they awake, they ſearch eagerly for food; and brawn, bread, milk, &c. are commonly given them. They produce twice every year; aud the female goes ſix weeks with young. Some of them devour their young as ſoon as they are brought forth, inſtantly come again in ſeaſon, and have three litters, which generally conſiſt of five or ſix, and ſometimes of ſeven, eight, or nine. This animal is by nature a mortal enemy to the rabbit. Whenever a dead rabbit is for the firſt time preſented to a young ferret, he flies upon it, and bites it with fury; but if it be alive, he ſeizes it by the throat or the noſe, and ſucks its blood. When let into the burrows of rabbits, he is muzzled, that he may not kill them in their holes, but only oblige them to come out, in order to be caught in the nets. If the ferret is let in without a muzzle, he is in danger of being loſt: for, after ſucking the blood of the rabbit, he falls aſleep; and even ſmoking the hole is not a certain method of recalling him; becauſe the holes have often ſeveral entries which communicate with each other, and the ferret retires into one of thoſe when incommoded with the ſmoke. Boys likewiſe uſe the ferret for catching birds in the holes of walls, or of old trees. The ferret, though eaſily tamed, and rendered docile, is extremely iraſcible: his odour is always diſagreeable; but when he is irritated, it becomes much more offenſive. His eyes are lively, and his aſpect is inflammatory; all his movements are nimble; and he is at the ſame time ſo vigorous, that he can eaſily maſter a rabbit, though at leaſt four times larger than himſelf.

The zibellina, or ſable, has divided toes: the body is of a duſky yellow colour; with a white forehead, and an aſh-coloured throat. It is found in Tartary and the northern parts of Aſia. The ſables inhabit the banks of rivers, and the thickeſt parts of the woods. They leap with great agility from tree to tree: and avoid the rays of the ſun. They live in holes of the earth, or beneath the roots of trees: ſometimes they will form neſts in the trees, and ſkip with great agility from one to the other: they are very lively, and much in motion during the night. Mr. Gmelin tells us, that after eating they generally ſleep half an hour or an hour, when they may be puſhed, ſhaken, and even pricked, without awaking. During the night they are exceſſively active and reſtleſs: a tame one kept by Mr. Gmelin was accuſtomed to riſe upon its hind legs, on ſight of a cat, in order to prepare for the combat. During ſummer the ſables prey on ermines, weaſels, and ſquirrels, but eſpecially on hares; in winter on birds; in autumn on hurtleberries, cranberries, and the berries of the ſervice-tree: but during that ſeaſon their ſkins are at the worſt; that diet cauſing their ſkins to itch, and to rub off their fur againſt the trees: they bring forth at the end of March or beginning of April, and have from three to five at a time, which they ſuckle for four or five weeks.

At preſent the hunters of ſables form themſelves into troops, from 5 to 40 each: the laſt ſubdivide into leſſer parties, and each chooſes a leader; but there is one that directs the whole: a ſmall covered boat is provided for each party, loaded with proviſions, a dog and net for every two men, and a veſſel to bake their bread in: each party, alſo has an interpreter for the country they penetrate into: every party then ſets out according to the courſe their chief points out: they go againſt the ſtream of the rivers, drawing their boats up, till they arrive in the hunting country; there they ſtop, build huts, and wait till the waters are frozen, and the ſeaſon commences: before they begin the chaſe, their leader aſſembles them, they unite in a prayer to the Almighty for ſucceſs, and then ſeparate; the firſt ſable they take is called *God's ſable*, and is dedicated to the church.

They then penetrate into the woods; mark the trees as they advance, that they may know their way back; and in their hunting quarters form huts of trees, and bank up the ſnow round them: near theſe they lay their traps; then advance farther, and lay more traps, ſtill building more huts in every quarter, and return ſucceſſively to every old one to viſit the traps and take out the game to ſkin it, which none but the chief of the party muſt do: during this time they are ſupplied with proviſions by perſons who are employed to bring it on ſledges, from the places on the road, where they are obliged to form magazines, by reaſon of the impracticability of bringing quantities through the rough countries they muſt paſs. The traps are a ſort of pit-fall, with a looſe board over it, baited with fiſh or fleſh: when ſables grow ſcarce, the hunters trace them in the new-fallen ſnow, to their holes; place their nets at the entrance; and ſometimes wait, watching two or three days for the coming out of the animal: it has happened that theſe poor people have, by the failure of their proviſions, been ſo pinched with hunger, that, to prevent the cravings of appetite, they have been reduced to take two thin boards, one of which they apply to the pit of the ſtomach, the other to the back, drawing them tight together by cords placed at the ends: ſuch are the hardſhips our fellow-creatures undergo to ſupply the wantonneſs of luxury.

The ſeaſon of chace being finiſhed, the hunters reaſſemble, make a report to the leader of the number of ſables each has taken; make complaints of offenders againſt their regulations; puniſh delinquents; ſhare the booty; then continue at the head quarters till the rivers are clear of ice; return home, and give to every church the dedicated furs.

The erminea, or ermine, is ten inches long from the noſe to the origin of the tail; the tail itſelf is five inches and an half long. The colours bear a near reſemblance to thoſe of the weaſel.

In the moſt northern parts of Europe, theſe animals regularly change their colour in winter; and become totally white, except the end of the tail, which continues invariably black; and in that ſtate are called *ermines:* we are informed that the ſame is obſerved in the Highlands of Scotland. The ſkins and tails are a very valuable article of commerce in Norway, Lapland, Ruſſia, and other cold countries, where they are found in prodigious numbers. They are alſo very common in Kamtſchatka and Siberia. In Siberia they burrow in the fields, and are taken in traps baited with fleſh. In Norway they are either ſhot with blunt arrows, or taken in traps made of two flat ſtones, one being propped up with a ſtick, to which is faſtened a baited ſtring, which when the animals nibble, the ſtone falls down and cruſhes them to death. The Laplanders take them in the ſame manner, only inſtead of ſtones make uſe of two logs of wood.

The vulgaris, or foumart, is a variety of the ermine, and the leaſt of the weaſel kind; the length of the head and body not exceeding ſix, or at moſt ſeven inches. The tail is only two inches and a half long, and ends in a point; the ears are large; and the lower parts of them are doubled in. The whole upper part of the body, the head, tail, legs, and feet, are of a very pale tawny brown. The whole under ſide of the body from the chin to the tail is white; but beneath the corners of the mouth, on each jaw, is a ſpot of brown. It is a remarkably active animal; and will run up the ſides of walls with ſuch eaſe, that ſcarce any place is ſecure from it; and the body is ſo ſmall, that there is ſcarce any hole but what is pervious to it. This ſpecies is much more domeſtic than any of the reſt, and frequents out-houſes, barns, and granaries. It clears its haunts in a ſhort time from mice and rats, being a much greater enemy to them than the cat itſelf. It may be perfectly tamed, and rendered as careſſing and frolickſome as a dog or a ſquirrel. The method of taming is to ſtroke them often and gently over the back; and to threaten, and even to beat them when they bite. In the domeſtic ſtate their ordure is never offenſive but when irritated. They are fed with milk, boiled fleſh, and water. In moſt other reſpects this animal reſembles the weaſel kind in general.

The natural hiſtory of this creature is much the ſame with that of the weaſel; its food being birds, rabbits, mice, &c. its agility the ſame, and its ſcent equally fœtid.

The nivalis, or ſtoat according to Linnæus, is a diſtinct ſpecies of the Genus Muſtela; we have therefore, in conformity to our plan, adopted his mode of claſſification: though more modern naturaliſts differ from him, and conſider it only as a variety of the erminea: nay, Linnæus himſelf deſcribes it as entirely ſimilar to the ermine, excepting in ſize, being ſmaller by the half. For the repreſentation of the moſt remarkable ſpecies of the Genus *Muſtela*, ſee the Syſtem of MAMMALIA, Plate V.

MUTATION, the act of changing, or ſometimes the change itſelf. It is one of the laws of nature, that the *mutation* of motion is ever proportional to the moving force impreſſed. See MOTION.

MUTE, in a general ſenſe, ſignifies a perſon that cannot ſpeak, or has not the uſe of ſpeech.

MUTE, in law, a perſon that ſtands dumb or ſpeechleſs, when he ought to anſwer, or to plead. See ARRAIGNMENT.

MUTE, in grammar a letter which yields no ſound without the addition of a vowel. The ſimple conſonants are ordinarily diſtinguiſhed into mutes and liquids, or ſemi-vowels.

The mutes in the Greek alphabet are nine, three of which, *viz.* Φ, κ, τ, are termed *tenues*; three β, γ, δ, termed *mediæ*, and three π, χ, θ, termed *aſperates.*

The mutes of the Latin alphabet are alſo nine, *viz.* B, C, D, G, I, K, P, Q, T.

MUTILATION, the retrenching or cutting away any member of the body. This word is alſo extended to the ſtatutes and buildings, where any part is wanting, or the projecture of any member, as a corniche or impoſt, is broken off. It is ſometimes alſo uſed in a more immediate manner for CASTRATION.

MUTILLA, in entomology, a genus of animals belonging to the order of inſecta hymenoptera. There are 10 ſpecies; the moſt remarkable of which is, the occidentalis, or velvet-ant, an inhabitant of North America. For claſſification ſee the Syſtem, Order V. Genus 63. For repreſentation ſee the Plates.

MUTINY, in a military ſenſe, denotes an inſurrection againſt authority. An act is annually paſſed by parliament, called the *mutiny* act, to puniſh *mutiny* and deſertion, and for the better payment of the army and their quarters. This regulates the manner in which they are to be diſperſed among the ſeveral inn-keepers and victuallers through the kingdom, and eſtabliſh a law-martial for their government. By this, beſides other things, it is enacted, that if any officer or ſoldier ſhall excite or join any *mutiny*, or knowing of it, ſhall not give notice to the commanding officer; or ſhall deſert, or liſt in any other regiment, or ſleep upon his poſt, or leave it before he is relieved, or hold correſpondence with a rebel or an enemy, or ſtrike or uſe violence to his ſuperior officer, or ſhall diſobey his lawful commands; ſuch offender ſhall ſuffer ſuch puniſhment as a court-martial ſhall inflict; though it extend to death itſelf.

MUTTON, the common name of the fleſh of a ſheep after the animal has been killed. Mutton has been commonly preferred to all the fleſh of quadrupeds. And indeed, beſides its being more perfect, it has the advantage over them of being more generally ſuited to different climates; whereas beef, *e. g.* requires a very nice intermediate ſtate, which it ſeems to enjoy chiefly in England; for although Scotland ſupplies what are reckoned the beſt cattle, it is in the rich Engliſh paſtures that they are brought to perfection. Now the ſheep can be brought almoſt to the ſame perfection in this bleak northern region as in the ſouthern countries.

MUTULE, in architecture, a kind of ſquare modillion ſet under the corniche of the Doric order. See the Syſtem on that Order.

MYA, in conchology, the 4th Genus, &c. belonging to the 2d order, bivalves. For the generic and ſpecific characters, ſee the Syſtem, Order II. For the claſſification ſee the Synoptical Table.

This ſhell is noted for producing quantities of pearl. There have been regular fiſheries for the ſake of this precious article in ſeveral of our rivers. Sixteen have been found within one ſhell. They are the diſeaſe of the fiſh, analogous to the ſtone in the human body. On being ſqueezed they will eject the pearl, and often caſt it ſpontaneouſly in the ſand of the ſtream. The Conway was noted for them in the days of Camden. A notion alſo prevails, that Sir Richard Wynne of Gwydir, chamberlain to Catherine queen to Charles II. preſented her majeſty with a pearl (taken in this river) which is to this day honoured with a place in the regal crown. They are called by the Welſh *cregin diluw*, or "deluge ſhells," as if left there by the flood. The Irt in Cumberland was alſo productive of them. The famous circumnavigator, Sir John Hawkins, had a patent for fiſhing in that river. He had obſerved pearls plentiful in the Straits of Magellan, and flattered himſelf with being enriched by procuring them within his own iſland. In the laſt century, ſeveral of great ſize were got in the rivers of the counties of Tyrone and Donegal in Ireland. One that weighed 36 carats was valued at 40*l.* but being foul, loſt much of its worth. Other ſingle pearls were ſold for 4*l.* 10*s.* and even for 10*l*. The laſt was ſold a ſecond time to Lady Glenlealy, who put it into a necklace, and refuſed 80*l*. for it from the dutcheſs of Ormond.

MYLOGLOSSI, in anatomy, a pair of muſcles thus called becauſe ariſing about the backſide of the molares, or grinding-teeth, and inſerted into the ligament of the tongue, helping to pull it upwards. Theſe are the ſame with what Mr. Cowper calls STYLOGLOSSI. For the origin, inſertion, and uſe of which, ſee the Syſtem, Part III. Sect. XI.

MYLOHYOIDEUS, in anatomy, a broad, but ſhort muſcle, lying immediately under the biventer muſcle of the jaw, and which, ſpringing from the lower margin on each ſide of the under jaw, is inſerted in the baſis of the OS HYOIDES. See the Syſtem, Part III. Sect. X. and XI.

MYOLOGY, formed of μυς μυος, a muſcle, and λογος, diſcourſe, in anatomy, a deſcription of the muſcles; or the knowledge of what relates to the muſcles of the human body, See the Syſtem, Part III. throughout; and for general repreſentation Plate II. III. and IV.

MYRIAD, the number of ten thouſand. Whence *myriarcha*, captain to a commander of ten thouſand men.

MYRMECOPHAGA, or *Ant Bear*, in the Linnæan Syſtem, the 8th Genus, and belonging to the Order Bruta, in the Claſs of MAMMALIA; the characters are theſe: There are no teeth in the mouth; the tongue is long and cylindrical: the head terminates in a long ſnout or muzzle; and the body is covered with pretty long hair. There are four ſpecies, viz.

1. The *didactyla*, or little ant-eater, hath a conic noſe bending a little down; ears ſmall, and hid in the fur; two hooked claws on the fore-feet, the exterior being much the largeſt; four on the hind-feet; the head, body, limbs, and upper part and ſides of the tail, covered with long ſoft ſilky hair, or rather wool, of a yellowiſh brown colour: from the noſe to the tail it meaſures ſeven inches and an half; the laſt four inches of which on the under ſide are naked. It is thick at the baſe, and tapers at a point. It inhabits Guinea, climbs trees in queſt of a ſpecies of ants which build their neſts among the branches: has a prehenſible power with its tail.

2. The *trydactyla*, tamandua-guaca, or tamanoir, has three toes on the fore-feet, five on the hind-feet, and long hair on the tail. This animal is about four feet long, and the head and ſnout about 15 inches: it is a native of the Eaſt Indies, and feeds on ants, &c. in the ſame manner as the former.

3. The *jubata*, or great ant-eater, hath a long ſlender noſe, ſmall black eyes; ſhort round ears; a ſlender tongue two feet and an half long, which lies double in the mouth; the legs ſlender; four toes on the fore-feet; five on the hind-feet; the two middle claws on the fore-feet very large, ſtrong and hooked: the hair on the upper part of the body is half a foot long, black mixed with grey; the fore-legs are whitiſh, marked above the feet with a black ſpot; the tail is cloathed with a very coarſe black hair, a foot long: the length from the noſe to the tail about four feet; the tail two feet and an half.

4. The *tetradactyla*, or middle ant-eater, has four toes on the fore-feet, and five on the hind, with a tail naked at the extremity; the length from the noſe to the tail is one foot ſeven inches, and the tail ten inches.

Theſe animals have many properties in common with each other, both in their ſtructure and manners. They all feed upon ants, and plunge their tongues into honey and other liquid or viſcid ſubſtances. They readily pick up crumbs of bread, or ſmall morſels of fleſh. They are eaſily tamed, and can ſubſiſt for a long time without food. They never ſwallow all the liquor which they take for drink; for it falls back through their noſtrils. They run ſo ſlowly that a man may eaſily overtake them in an open field. Their fleſh, though its taſte be very diſagreeable, is eaten by the ſavages. At a diſtance the great ant-eater has the appearance of a fox; and for this reaſon ſome travellers have given him the name of the *American fox*. He has ſtrength ſufficient to defend himſelf from a large dog, or even from the jaquar or braſilian cat. When attacked, he at firſt fights on end, and, like the bear, annoys his enemy with the claws of his fore-feet, which are very terrible weapons. He then lies down on his back, and uſes all his four feet; in which ſituation he is almoſt invincible; and continues the combat to the laſt extremity. Even when he kills his enemy, he quits him not for a long time after. He is enabled to reſiſt better than moſt other animals; becauſe he is covered with long buſhy hair; his ſkin is remarkably thick; his fleſh has little ſenſation; and his principle of life is very tenacious.

MYRRH, in the materia medica, a concrete, gummy, reſinous juice, brought from the Eaſt Indies in globes or drops of various colours and magnitudes. The beſt ſort is of a brown reddiſh or yellow colour, ſomewhat tranſparent; of a light pungent bitter taſte, with an aromatic flavour, though not ſufficient to prevent its proving nauſeous to the palate; and a ſtrong diſagreeable ſmell. The medical effects of this aromatic bitter are, to warm and ſtrengthen the viſcera, and diſſolve thick tenacious juices: it frequently occaſions a mild diaphores, and promotes the fluid ſecretions in general. Hence it proves ſerviceable in languid caſes; diſeaſes ariſing from a ſimple inactivity; thoſe female diſorder which proceed from a cold, mucous, ſluggiſh indiſpoſitions of the humours; ſuppreſſions of the uterine diſcharges; cachetic diſorders, where the lungs and thorax are oppreſſed by viſcid phlegm. Myrrh is likewiſe ſuppoſed in a peculiar manner to reſiſt putrefaction in all parts of the body; and in this light ſtands recommended in malignant, putrid, and peſtilential fevers, and in the ſmall-pox; in which laſt it is ſaid to accelerate the eruption. Rectified ſpirit extracts the fine aromatic flavour and bitterneſs of this drug, and does not elevate any thing of either in evaporation: the gummy ſubſtance left by this menſtruum has a diſagreeable taſte, with ſcarce any thing of the peculiar flavour of the myrrh; and diſſolves in water, excepting ſome impurities which remain. In diſtillation with water, a conſiderable quantity of ponderous eſſential oil ariſes, reſembling in flavour the original drug.

MYRTIFORMES *Carunculæ*, in anatomy. See CARUNCULÆ, and the Syſtem, Part V. Sect. XIII.

MYRTUS, in botany, the MYRTLE; a genus of the monogynia order, belonging to the Iſchondria claſs of plants. The moſt remarkable ſpecies are, The *communis*, or common myrtle-tree, riſes with a ſhrubby, upright, firm ſtem, branching numerouſly all around into a cloſe full head, riſing eight or ten feet high; very cloſely garniſhed with oval-lanceolate, entire, moſtly oppoſite leaves, from half an inch to an inch and an half long, and one broad, on ſhort foot-ſtalks; and numerous ſmall, pale flowers from the axillas, ſingly on each footſtalk, having diphyllous involucrums; each flower ſucceeded by a ſmall oval, dark-purple berry.

The moſt material varieties are broad-leaved Roman myrtle, with oval, ſhining, green leaves, an inch and an half long, and one broad: and is remarkably floriferous. Gold-ſtriped broad-leaved Roman myrtle. Broad-leaved Dutch myrtle, with ſpear-ſhaped, ſharp-pointed, dark green leaves, an inch long, and about three-quarters of one broad. Double flowered Dutch myrtle. Broad-leaved jews myrtle, having the leaves placed by threes at each joint; by which particular circumſtance this ſpecies is in univerſal eſtimation among the Jews in their religious ceremonies, particularly in decorating their tabernacles; and for which purpoſe many gardeners about London cultivate this variety with particular care, to ſell to the above people, who are often obliged to purchaſe it at the rate of ſixpence or a ſhilling for a ſmall branch; for the true ſort, having the leaves exactly by threes, is very ſcarce, and is a curioſity; but by care in its propagation, taking only the perfectly ternate-leaved ſhoots for cuttings, it may be increaſed faſt enough; and is worth the attention of the curious, and particularly thoſe who raiſe myrtles for the London markets. Orange-leaved Spaniſh myrtle, with oval ſpear-ſhaped leaves, an inch and a half long or more, and one broad, in cluſters round the branches, and reſemble the ſhape and colour of orange tree leaves. Gold-ſtriped-leaved orange myrtle. Common upright Italian myrtle, with its branches and leaves growing more erect, the leaves oval, lanceolate-ſhaped, acute-pointed, and near an inch long, and half a one broad. Silver-ſtriped upright Italian myrtle. White-berried upright Italian myrtle. Portugal acute leaved myrtle, with ſpear-ſhaped, oval, acute-pointed leaves, about an inch long. Box-leaved myrtle, with weak branches, ſmall, oval, obtuſe, lucid-green, cloſely placed leaves. Striped box-leaved myrtle. Roſemary leaved myrtle, hath erect branches, ſmall, narrow, lanceolate, acute-pointed, ſhining, green, very fragrant leaves. Silver-ſtriped roſemary-leaved myrtle. Thyme-leaved myrtle, with very ſmall cloſely-placed leaves. Nutmeg-myrtle, with erect branches and leaves; the leaves oval, acute-pointed, and finely ſcented like a nutmeg. Broad-leaved nutmeg-myrtle. Silver-ſtriped leaved ditto. Criſtated or cock's comb-myrtle, frequently called *bird's neſt myrtle*, hath narrow, ſharp-pointed leaves, criſtated at intervals.

Theſe are the principal varieties of the *myrtus communis*; but of which ſorts there are ſeveral intermediate varieties of leſs note; and more may ſtill be obtained from ſeed, though the plants are rarely raiſed from ſeed in this country, but moſtly by ſlips and cuttings. They are all beautiful ever-green ſhrubs of exceeding fragrance; exotics originally of the ſouthern parts of Europe, and of Aſia and Africa, and conſequently in this country require ſhelter of a green-houſe in winter: all of which, though rather of the ſmall-leaved kind, have their foliage cloſely placed, and remain all the year, and are very floriferous in ſummer; and when there is a collection of the different ſorts, they afford an agreeable ſource of variety with each other. They therefore claim univerſal eſteem as principal green-houſe plants, eſpecially as they are all ſo eaſily raiſed from cuttings, and of ſuch eaſy culture as to be attainable in every garden, where there is any ſort of green-houſe, or garden-frames furniſhed with glaſſes for protecting them in winter from froſt: but ſome of the broad-leaved ſorts are ſo hardy as to ſucceed in the full ground, againſt a ſouth wall and other warm expoſures, all the year, by only allowing them ſhelter of mats occaſionally in ſevere froſty weather: ſo that a few of theſe ſorts may alſo be exhibited in a warm ſituation in the ſhrubbery: obſerving, however, all the ſorts are principally to be conſidered as green houſe plants, and a due portion of them muſt always remain in pots to move to that department in winter.

MYSTERY, ſomething ſecret or concealed, impoſſible or difficult to comprehend. All religions, true or falſe, have their myſteries. The pagan religion was remarkably full of them. Ovid reckons it a great crime to divulge the myſtic rites of Ceres and Juno. The eleuſinia, or ſacred rites of Ceres, ſolemnized at Eleuſis, were called, by way of eminence, the myſteries; and ſo ſuperſtitiouſly careful were they to conceal theſe ſacred rites, that if any perſon divulged any part of them, he was thought to have called down ſome divine judgment on his head, and it was accounted unſafe to abide under the ſame roof with him; and Horace declares, that he would not put to ſea in the ſame ſhip with one who revealed the myſteries of Ceres. The pagan myſteries, it is true, were generally myſteries of iniquity, and concealed only becauſe their being publiſhed would have rendered their religion ridiculous and odious. Thus the ſacred writings often ſpeak of the infamous myſteries of the pagan deities, in which the moſt ſhameful crimes were committed under the ſpecious veil of religion.

The whole religion of the Egyptians was myſterious from the beginning to the end, and both their doctrine and worſhip wrapped up in ſymbols and hieroglyphics. The religion of the Jews is ſuppoſed to be full of myſteries. The whole nation, according to St. Auguſtin, was a myſtery, as it repreſented or was a type of the people of Chriſt, and the Chriſtian religion. Whatever was commanded or forbidden them was figurative; and their ſacrifices, prieſthood, &c. including myſteries. The prophecies concerning Jeſus Chriſt in the Jewiſh books, are likewiſe figurative and myſterious. The Chriſtian religion has alſo its myſteries: but in the ſcripture language the word myſtery is uſed with ſome latitude, and denotes whatever is not to be known without a divine revelation, and all the ſecret things which God has diſcovered by his miniſters, the prophets, by Jeſus Chriſt and his apoſtles. The myſteries of the Chriſtian church are, the incarnation of the Word; the hypoſtatical union of the divine and human natures; the miraculous birth, death, and reſurrection of the Son of God; the doctrine of the Trinity, &c. St. Paul often ſpeaks of the myſteries of the Chriſtian religion; as the myſtery of the goſpel, the myſtery of the croſs of Chriſt, the myſtery which was kept ſecret ſince the world began: and he calls the preachers of the goſpel, the ſtewards of the myſteries of God.

MYSTICAL, ſomething myſterious or allegorical. Some of the commentators on the ſacred writings, beſides a literal, find alſo a myſtical, meaning. The ſenſe of ſcripture, ſay they, is either that immediately ſignified by the words and expreſſions in the common uſe of language; or it is mediate, ſublime, typical, and myſtical. The literal ſenſe they again divide into proper literal, which is contained in the words taken ſimple and properly; and metaphorical literal, where the words are to be taken in a figurative and metaphorical ſenſe. The myſtical ſenſe of ſcripture they divide into three kinds: the firſt correſponding to faith, and called *allegorical*; the ſecond to hope, called *anagogical*; and the third to charity, called the *tropological ſenſe*. And ſometimes they take the ſame word in ſcripture in all the four ſenſes: thus the word *Jeruſalem*, literally ſignifies the capital of Judæa; allegorically, the church militant; tropologically, a believer; and anagogically, heaven. So that paſſage in Geneſis, *let there be light, and there was light*, literally ſignifies corporeal light; by an allegory, the Meſſiah; in the tropological ſenſe, grace; and anagogically, beatitude, or the light of glory.

MYTHOLOGY. The word *mythology* is a Greek compound, that ſignifies a *diſcourſe on fables*; and comprehends, in a collective ſenſe, all the fabulous and poetical hiſtory of pagan antiquity. It follows therefore, that this ſcience teaches the hiſtory of the gods, demi-gods, and fabulous heroes of antiquity; the theology of the pagans, the principles of their religion, their myſteries, metamorphoſes, oracles, &c. By this definition it appears ſufficiently what are the objects of which we are to treat in this article.

If we well conſider the matter, we ſhall find, that there were, in pagan antiquity, three different religions. *Firſt*, That of the philoſophers, who treated metaphyſically of the nature, the attributes, and of the works of the Supreme Being. They endeavoured to diſcover the true God, and the manner in which he ought to be worſhipped. It is not wonderful, that theſe men of exalted genius ſhould in ſome degree ridicule, in their works, the two other poſitive religions, and thoſe gods on whom they were founded: at the ſame time that they outwardly profeſſed the eſtabliſhed religion, in order to preſerve the peace of ſociety, and to avoid the perſecutions of the legiſlature, and the inſults of the populace. For in fact, was it poſſible for them to believe the pagan fables? Muſt they not foreſee, that their religion would one day give place to another, while their own works would paſs with their names to the lateſt poſterity? And could they ſuffer the thought, that their reputation would be tarniſhed in the eyes of that poſterity, by having it imagined they believed ſuch idle tales as were broached by the prieſts of their times? Could Plato, Socrates, Seneca, and Cicero, be unconcerned for their fame among future generations and future philoſophers? And what ſhould we at this day have ſaid of thoſe great men, had they been ſo political, or hypocritical, as to have entirely concealed their ſentiments with regard to theſe matters?

The ſecond religion was that of paganiſm, which was the eſtabliſhed religion of all the ancient nations except the Jews. This was the doctrine that was taught by the prieſts, and protected by the ſovereigns. Its dogmas were demonſtratively falſe, but not always ſo abſurd as may at firſt appear; eſpecially if we annex to the divinities and to the religious ceremonies of the pagans, a ſenſe that is frequently myſtic, and always allegoric; if we remember that the firſt heathens deified thoſe great men to whom the reſt of mankind were indebted for any ſignal benefits, as Jupiter, Apollo, Ceres, Bacchus, Hercules, Æſculapius, &c. in order to induce others, as well of the preſent as of future ages, to reverence and to imitate them. Would not an ancient pagan, if he were to return upon the earth, have ſpecious arguments, at leaſt, to ſupport his religion, when he ſaw weak mortals beatify or canonize, merely by their own authority, other weak mortals (frequently mere pedants), and place them in heaven, without the permiſſion or approbation of the Supreme Being? Happy is it for mankind, when at different times ſagacious pontiffs purge the kalendar, and the brains of the people, from a herd of pretended ſaints, and prevent them, at leaſt after their death, from doing injury to ſociety, by interrupting the induſtry of the laborious inhabitants with keeping their feſtivals.

The third religion was idolatry, or the religion of the populace. For the common people, born to be deceived in every thing, confounding in their imaginations the ſtatues of the gods, the idols of their divinities, the emblems of their virtues and of religious worſhip, with the gods, divinities, virtues, and worſhip themſelves, adored theſe images, and proceeded to extravagancies moſt ridiculous, and frequently moſt criminal, in their ceremonies, feaſts, libations, ſacrifices, &c. It is to be feared, that as long as there are upon the earth men of our limited capacities, this triple religion will conſtantly ſubſiſt under different forms; and we are much deceived if it may not be found under the empire of Chriſtianity itſelf, notwithſtanding the purity of its doctrine. It will be eaſily conceived, that it is not of the religion of philoſophers, nor that of the populace, of which we are to treat in this article of Mythology; but of that which ſubſiſted under the authority of the magiſtracy and the prieſthood, and conſequently of paganiſm in general.

As far as we are able to judge by all the ancient authors we have read the pagans adored the ſovereign Lord of the univerſe under the name of *Fate* or *Deſtiny*, which we muſt not confound with Fortune, who was regarded as a ſubaltern divinity. Jupiter himſelf, all the gods, every animated being, the heavens, the earth, the whole frame of nature, was ſubſervient to Deſtiny, and nothing could reverſe its decrees. This divinity was ſo highly adoreable, as to be above all rank; and was regarded as too ſupreme to be repreſented under any ſenſible image or ſtatue, or to have any temple erected for its worſhip. We do not remember to have read, that ever any ſacrifice was offered to this Deſtiny, or that any temple or city was ever dedicated to its name. We are almoſt inclined to think, that the pagans were ſenſible, that the temple and the worſhip of the God of gods ought to be in the heart of man. Mention is made, indeed, of a temple that was dedicated to the Unknown God; but we are ignorant whether or not Deſtiny were thereby meant. We muſt not confound this Deſtiny, moreover, with the goddeſs of chance, of which there are ſome antique ſtatues that repreſent her in a recumbent poſture, and playing with little bones; for this was nothing more than an invention of ſome ſtatuary.

After this general and philoſophical idea of the Supreme Being, comes the poſitive religion of the pagans. This was entirely founded on fable, which took its riſe either from ancient traditions, or hiſtorical events, altered or augmented by the imaginations of the poets, by ſuperſtition, or by the credulity of the people; or elſe it conſiſted of allegoric or moral fictions. A crowd of writers, and among the reſt *Noel le Compte*, (Natalis Comes) the abbots Bannier and Pluche, &c. have made many reſearches into the origin of fable: and they think they have diſcovered its ſource, 1. In the vanity of mankind; 2. In the want of letters and characters; 3. In the deluſive eloquence of orators; 4. In the relations of travellers; 5. In fictions of poets, painters, ſtatuaries, and dramatic writers; 6. In the diverſity and uniformity of names; 7. In the ignorance of true philoſophy; 8. In the foundation of colonies, and the invention of arts; 9. In the deſire of having gods for our anceſtors; 10. In the imperfect or falſe interpretation of the holy ſcriptures; 11. In the ignorance of the ancient hiſtory; 12. In a like ignorance of chronology; 13. In that of foreign languages; 14. In the tranſlation of the religion of the Egyptians and Phœnicians into Greece; 15. In the ignorance of geography; and 16. In the belief which the firſt people had of the intercourſe of gods with men. It is certain, that all theſe matters taken together are ſufficient to produce many thouſands of fables; are more than ſufficient to enable us to deceive ourſelves and others, and to give riſe to infinite reveries. But we ſhould take care how we draw from theſe ſources demonſtrations that might be uſed, by infidels, as arguments to overthrow the hiſtory of the Jews; a people the moſt ſtupid, moſt credulous, and oſtentatious of all others. In the mean time, the pagan philoſophers themſelves aſſerted that it was a god who invented the fable: ſo much were they convinced of its ingenuity, and of its ſtrong tendency to inſtruct mankind in their duty.

Mythology therefore, when properly treated, begins with making learned reſearches into the real origin of fable, of paganiſm, and that idolatry which was its conſequence. It recurs for this purpoſe even to the beginning of the world: and after finding that Laban, the father-in-law of the patriarch Jacob, was a maker of idols, and that he had his little images, or houſehold gods, which he formed of baked earth, and which ſhews that idolatry exiſted in the greateſt antiquity; it then explains coſmogony, and theogony, or the belief that the firſt inhabitants of the earth entertained of the creation of the univerſe, and what the pagan theology taught of the genealogy of their falſe gods. It begins with the tradition of the Chaldeans, a people ſo ancient, that Nimrod was their firſt king; but at the ſame time ſo credulous and ſuperſtitious, that we may regard them as the authors of all thoſe fables, and the propagators of all thoſe viſions, that have ſince blinded human reaſon. According to this tradition, a monſter named *Oannes* or *Oes*, half fiſh and half man, ſprang from the ſea, before the chaos was completely diſperſed, and gave laws to the Chaldeans. A woman called *Omorka*, reigned over all the earth. *Bel* cut her in two, and made of one moiety the heavens, and of the other the earth. They likewiſe invented the two primitive beings; of which the good one, who was named *Oraſmaſdes*, had the direction of heaven; and the other, called *Arimanius*, that of hell.

The ſcience of mythology then teaches the theogony of the Phœnicians; concerning whom it draws great lights from Sanchoniathon, a prieſt of Beryte, who lived before the Trojan wars, more than 400 years before Heſiod and Homer, and of whom Euſebius has preſerved conſiderable fragments. From thence it paſſes to the theogony of the Egyptians; of whom *Thot* or *Thaut*, the founder of that nation, was likewiſe, they ſay, their firſt hiſtorian; that Sanchoniathon even copied from him; and of whom we find many relations in the Greek hiſtorians, eſpecially in Herodotus, Diodorus Siculus, and in Euſebius of Cæſarea. It then examines the theogony of the Atlantides, who dwelt on the weſtern part of Africa, and of whom Diodorus alone has preſerved any account. From thence it proceeds to the theogony of the Greeks, which is far better known to us, as we find accounts of it more or leſs particular, in numberleſs Greek and Latin writers. This theogony had the ſame foundation as that of the Romans; the latter having only extended it, by adding to the Greek divinities certain gods or demi-gods, formed of their heroes, and certain ſymbolic and allegoric divinities, which mythology explains at the ſame time: and it is on this occaſion that it enters into a particular explication of the coſmogony and theogony of Ovid; whoſe book of metamorphoſes contains as copious deſcriptions as we could deſire of the fables of the ancients: what was their belief concerning the habitations of the bleſſed after their death, or of the Elyſian fields; as well as of their hell or Tartarus; of the dog Cerberus; of the ferryman Charon; of the furies; of the four rivers, Cocytus, Lethe, Phlegethon, and Styx, which water the Tartarian regions, &c.

Mythologiſts then continue their reſearches into the time, the epoch, and place, of the real origin of paganiſm and idolatry; and they prove that the pagans began by adoring the heavenly bodies, the ſtars and planets. They next examine into the progreſs of idolatry: what were the temples of the pagans, their altars, their incloſures, their ſacred groves, their aſylums, the idols and ſtatues of their deities; in what manner they were repreſented; what were their ſacrifices, the victims that were offered; what the days of penitence and ſupplication, the feaſts or the gods of electiſternia, their invocations or incantations and exorciſms, the religious ceremonies obſerved at laying the foundations of cities, &c.

Divination, or the prediction of future events, a weakneſs that has at all times poſſeſſed the human mind, forms alſo an important article of pagan theology. It is therefore in this place that mythology conſiders the nature of oracles, and in what manner theſe oracles gave their anſwers; the ceremonies that were obſerved in conſulting them; the frantic emotions of the prieſteſs Pythia on her tripod, and thoſe of other prieſts. See DIVINATION and ORACLES. It then endeavours to inveſtigate the hiſtory of the Sibyls, and of their prophecies. See SIBYLS. It next paſſes to the examen of the nature of auguries, auſpices, haruſpices, prodigies, &c.; of expiations and ablutions; of the magic and aſtrology of the ancients, &c. See AUGURY, &c. It then proceeds to the examination of the nature of the pagan divinities themſelves.

The celebrated treatiſe of Cicero *De natura Deorum*, will here furniſh great lights: but modern authors, who have treated on theſe matters, have not been contented with this alone: they have, ſo to ſay, extracted the eſſence of all antiquity, of which they have formed ſyſtems; but unluckily theſe ſcarce ever agree with each other. As philoſophers, it is of very little importance for us to know what was the nature of theſe gods, ſeeing we know that they were merely fabulous: but as hiſtorians and antiquaries, it concerns us to know what was the nature that was attributed to them in general; and, in particular, what were the origin, genealogy, rank, functions, authority, and operations, that were attributed to each divinity; and it is on thoſe matters that we have ſtill ſome remarks to make.

The gods of the ancient Greeks and Romans were all either *Dii majorum gentium*, or *Dii minorum gentium*; that is, of the firſt or ſecond order. The former were alſo called *conſentes, magni conſultores*, &c. According to Ennius, they were 12 in number, and are included in theſe verſes:

Juno, Veſta, Minerva, Ceres, Diana, Venus, Mars,
Mercurius, Jovis, Neptunus, Vulcanus, Apollo.

To theſe were added eight others, under the title of *Selecti*, which were Sol, Luna, Tellus, Genius, Janus, Saturnus, Liber, and Pluto. The ſecond order, or *minorum gentium*, were called *Adſcriptitii, Medioximi, Minuſcularii, Putatitii, Indigetes, Semones, &c.* the principal of which were Æſculapius, Bacchus, Caſtor, Fauna, Hercules, the Lares or Penates, Pollux, Quirinus. See theſe under their ſeveral articles, &c.

According to the ſecond diviſion, all their divinities were claſſed into, 1. Celeſtial gods; 2. Terreſtrial gods; 3. Sea gods; and, 4. The infernal deities, or *inferi*. The celeſtial gods were Jupiter, Juno, Apollo, Aurora, Cupid, Cybele, the Graces, Hebe, Iris, Luna, Mars, Mercury, Minerva, Nemeſis, Saturn, Themis, Venus, &c. The terreſtrial gods were Æolus, Aſtræa, Ceres, Diana, the Fauni, Feronia, Flora, Janus, Momus, the Muſes, Pales, Pan, Pomona, Priapus, the Satyrs, Silenus, the god Terminus, Veſta or Rhea, Vulcan, &c. The ſea-gods were Neptune, Amphitrite, Thetis, Canopus, Glaucus, Ino, the Nereids, Nereus, Oceanus, Palæmon, Triton, &c. The infernal gods were Pluto, Proſerpine, Charon, Minos, Æacus, Rhadamanthus, the Furies, Death, Night, the Fates, Plutus, &c.

The third diviſion ranged the divinities according as they preſided, 1. Over the pregnancy of women, (*Pregnantium*;) 2. At partutitions (*Parturientium*;) 3. At births, (*Naſcentium*;) 4. At adulteries; 5. At marriages: to which they added, 6. Dii morales, or moral gods; and 7. Funeral gods. The gods of pregnancy were Pilumnus, Intercidonia, and Deverra: the gods of parturition, Juno, Lucina, Diana, Egerio, Proſa, Poſtverta, Menagenatta, Latona, the gods that were called *Nixi*, or of *labour*, &c. The gods of birth were Janus, Opis, Naſcion, Cunina, Carmenta, Vaginianus, Levana, Rumia, Potina, Educa, Oſſilago, Carnea, Nundina, Statilinus, Fabulinus, Paventia, &c. The gods of adultery were Juventus, Agenoria, Strenua, Stimula, Horta, Quies, Murcia, Adeona, Abeona, Voluptas, Orbona, Pellonia, Numeria, Camoena, Sentia, Angerona, Heres, Martea, Laverna, the god Averruncus, Conſus, Catius, Volumnus and Volumna, Honorius, Aius Locutius, &c. The nuptial gods were Diana, Domiduca, Domitius, Hymanæus or Hymen, Jugatinus, Jupiter perfectus, Juno perfecta, Juno cinxia, Juno unxia, Lucina, Manturna, Mutinus, Dea Mater prima, Suada, Thalaſſius, Venus, &c. The moral gods were called *Virtus, Honor, Fides, Spes, Juſtitia, Pietas, Miſerecordia, Clementina, Pudicitia, Veritas, Mens, Concordia, Pax, Salus, Felicitas, Libertas, Pecunia, Riſus, Invidna, Contumelia, Impudentia, Calumnia, Fraus, Diſcordia, Furor, Fama, Fortuna*, with all their epithets good or bad, *Febris, Pavor* and *Palor, Paupertas, Neceſſitas, Tempeſtas, Silentium, &c.* The funeral gods were Pluto, Libitina, Nænia, Death, the Fates, &c.

Heſiod indeed pretends, that all theſe gods derived their origin from chaos; but we have already pointed out more juſt ſources. It is almoſt incredible to what a prodigious number the ſuperſtition and weakneſs of the Greeks and Romans multiplied theſe divinities; there have been 30,000 of them enumerated. It will not be expected that we ſhould here attempt to deſcribe them, nor will it be remarkable if we have forgotten to mention even ſome of the firſt rank: although, vaſt as this company of gods is, mythology does not omit to trace the hiſtory of the greateſt part of them, as is taught by paganiſm; and they who are deſirous of particular information in theſe matters may conſult with advantage the theogony of Heſiod, the catalogue of Apollodorus, the metamorphoſis of Ovid, the fables of Hygina, Lylii Gregorii Gyraldi Syntagma de diis Gentilium, the mythology of Natalis Comes, the books of Gerard Voſſius de idolatria Gentilium, Johannis Boccatii Genealogia-deorum, the Pantheon of Pompey, the hiſtory of heaven by Abbé Pluche, the hiſtoric explanation of fables by Abbé Banier, and Bryant's Mythology.

There were ſtill many other diſtinctions, of which the pagans made uſe to mark the rank, the functions, and nature of their ſeveral divinities. For example, the goddeſs Veſta, or the mother of all the gods, was adored by all people in general. Mars, Bellona, Victoria, Fortunata, &c. aſſiſted all parties. The topical gods, on the contrary, were ordered in particular countries only; as Aſtarte in Syria, Derceto and Semiramis among the Aſſyrians, Iſis and Oſiris by the Egyptians, Quirinus at Rome, &c. The title *Semones*, which was given to a certain claſs of divinities, was doubtleſs derived from *Semi-homines*, that is, *demi-men*; and ſignified the ſame as *ſemi-dii*, or *demi-gods*. Theſe were monarchs and illuſtrious heroes, or thoſe great men who were the founders of cities and nations, that were deified by way of apotheoſis. Pythagoras had taught the Chaldeans the doctrine of tranſmigration; and that, after their death, thoſe who were virtuous would be elevated to the rank of divinities. This doctrine was adopted by all the Pagan world. The apotheoſis, after they had erected temples and altars to the new gods, was celebrated with much ſolemnity. In the laſt ceremony, an eagle was fixed on the catafalk, or funeral pile, on which was placed the image of the hero: and when the pile began to burn, the eagle was let looſe, who mounting into the air with the flames, ſeemed to carry the ſoul of the departed hero up to heaven.

Mythology informs us alſo, who thoſe perſons were that antiquity regarded as the children of the gods, ſuch as Theſeus, Hippolytus, Paris, &c. what the pagans believed with regard to the nature of their genii and demons, of their dryades, hamadryades, nymphs, tritons, ſirens, fauns, ſylvans, centaurs, and other ſubaltern divinities; and in this manner it explains all the ſyſtems of the poſitive religion of the Greeks and Romans. They who are deſirous of extending their knowledge of paganiſm ſtill further, of knowing the dogmas of each particular people, what were their gods, and the various manners in which they were worſhipped, ſuch as Apis, Iſis, Oſiris, &c. the adoration of crocodiles and onions, &c. among the Egyptians, muſt ſtudy the different theogonies of theſe people; and notwithſtanding all the informations which ancient and modern authors afford, this ſtudy is yet boundleſs, and attended with many difficulties and uncertainties: though it appears demonſtrative, that the origin of paganiſm, and of idolatry in general, was derived from the Chaldeans, from whom the Egyptians drew that doctrine which they after tranſmitted to all other nations; and conſequently that the primordial divinities were the ſame, under different denominations, among all the idolatrous nations of the earth.

The nature of this work will not permit us to deſcend to further particulars. But to give our readers an idea of the manner in which mythology treats its ſubjects, and of the method that ſhould be obſerved in ſtudying fable, or the hiſtory of the gods of antiquity, we ſhall here give, by way of example, a curſory deſcription of Parnaſſus and its inhabitants.

Parnaſſus was a mountain of Phocis, that had two ſummits, one of which was called *Tithoreus*, and the other *Hyampeus*. Others ſay, that one of theſe hills was named *Helicon*, and the other *Cytheron*; and that it is an error to imagine, that Helicon was a mountain of Bœotia. However that be, this double hill was conſecrated to Apollo and the muſes, who there held their uſual reſidence. According to fable, there had been a very remarkable combat on this hill, between Helicon and Cytheron. Whoever ſlept on Parnaſſus, when he waked, became a poet. Apollo had there a temple. There alſo was the fountain Caſtalia, into which Apollo had metamorphoſed a nymph that he loved, and had given to its waters the power of making all who drank of them poets. At the foot of Parnaſſus flowed the River Hippocrene, that had the ſame virtue; and the ſcource of which was opened by a ſtroke of the foot of the horſe Pegaſus. This river nouriſhed a great number of ſwans, that were regarded as ſacred. Pegaſus was a winged horſe, that belonged to Apollo, and grazed on the ſummit of Parnaſſus. He ſprang from the blood of Meduſa, when Perſeus cut off her head, which was placed among the ſtars. Such was the delicious abode of Apollo, the ſon of Jupiter and Latona, who was born, with his twin ſiſter Diana, in the Iſland of Delos. He killed the Cyclops, who forged the thunderbolts with which Jupiter had overthrown his ſon Æſculapius; but for that preſumption he was forced to leave heaven, and became an inhabitant of the earth. He guarded the oxen of Admetus; he aided Neptune to build the walls of Troy, and Alcotheus in forming the Labyrinth. He killed the dragon or ſerpent Pythor. He invented muſic and phyſic; and was honoured as the god of poets and phyſicians. He was repreſented as a young man without a beard, his head ſurrounded with rays, and bearing in his hand a bow, or a lyre. As the ancients denoted the ſun by the name of *Apollo*, they ſometimes repreſented him alſo as ſeated in a chariot, drawn by two white horſes, preceded by Aurora and the ſtar Venus: Phaeton his ſon, being deſirous of conducting theſe horſes, was thrown into the ſea. Apollo was alſo called *Phœbus*, *Titan*, and *Sol*. He is known to have had amours with Arſinoe, Corycia, Melœne, Cyrene, Mantho, Sinope, Calliope, and others; by whom he had Delphe, Naxe, Niletus, Arabe, Garamas, Sirus, Linus, Orpheus, and other children. He had peculiar honours paid him in the Pythian games at Delphos, and in the ſecular games at Rome.

The muſes were the companions of Apollo in his rural abode. They were likewiſe called the *learned ſiſters*; as alſo the *Camœnion*, *Heliconian*, *Parnaſſian*, *Aonian*, *Pierian*, *Pegaſian*, *Aganippian*, *Theſpian*, *Libethrian*, and *Caſtalian ſiſters*. They were the daughters of Jupiter and Mnemoſyne, and were regarded as the goddeſſes of ſciences and arts in general. There were nine of thoſe muſes; to whom they attributed; 1. To Clio, hiſtory; 2. To Melpomene, tragedy; 3. To Thalia, comedy; 4. To Euterpe, flutes and other pneumatic inſtruments of muſic; 5. To Terpſichore, the harp and the dance; 6. To Erato, the lyre and the lute; 7. To Calliope, heroic verſe; 8. To Urania, aſtronomy; and 9. To Polyhymnia, rhetoric and eloquence. The Graces alſo ſometimes quitted Venus to pay their court to Apollo.

Such was the idea they entertained of Parnaſſus and its inhabitants. There is no doubt but that, under theſe fabulous repreſentations, theſe ſenſible images, were concealed allegoric and moral meanings; nor can it be denied but that their method of cultivating the arts and ſciences, by this manner of expreſſing their ideas, was as ingenious and pleaſing as it is poſſible to imagine. Every other ſubject that paganiſm embraced, it treated with the ſame genius, and in a manner equally pleaſing; and though that religion was altogether fallacious, yet we muſt allow that it was extremely well calculated to promote the polite arts, by thoſe refined, noble, graceful, brilliant, images, by thoſe charming ſubjects, which it conſtantly preſented, and which it ſtill offers to the poet, painter, ſculptor, and every other artiſt.

But this was not a power ſufficiently ſtrong to ſecure paganiſm againſt that viciſſitude, that decline and diſſolution, which finally attends all the productions of this world. This religion, which had ſubſiſted near 5000 years, and almoſt from the origin of the human race, gradually declined in proportion as the lights of Chriſtianity and philoſophy illumined the minds of mankind. For though the pagan religion, and the fables on which it was founded, were pleaſing and favourable to the polite arts, they were not however calculated to ſatisfy the minds of philoſophers, nor to promote the real good of mankind, by ſecuring their temporal and eternal happineſs. It is even ſurpriſing that ſo great a genius as the emperor Julian ſhould attempt to revive the embers of paganiſm, which inſenſibly declined, and had received a mortal blow at the beginning of the fourth century by the emperor Conſtantine the great. Julian employed all the reſources of his imagination, of his eloquence, of his power, and even of his own fatal example to revive it; but in vain. The period of paganiſm was arrived, and nothing could ſave it from deſtruction. The furious Theodoſius, to whom bigotted prieſts and hiſtorians have aſſigned the name of *great*, totally overthrew it toward the cloſe of the ſame century, deſtroyed thoſe temples and altars which yet ſubſiſted, diſperſed its colleges, and exterminated its prieſts. From that dire epoch, nothing of paganiſm has remained, except ſome ruins diſperſed in the remote parts of the earth, and among people wretched and almoſt unknown; where this religion, once ſo flouriſhing and univerſal, is now degenerated into groſs and diſguſtful idolatry.

MYTILUS, the MUSCLE, a genus belonging to the third order *Teſtacea*, of the third Claſs of the animal kingdom *Vermes*. The order Teſtacea comprehends thoſe animals which have ſhells, and are therefore called Teſtaceous, and by many formed into a ſeparate branch of Natural Hiſtory, termed Conchology; for a deſcription of the genus Mytilus and the order at large, ſee the Syſtem of CONCHOLOGY, for the Claſſification ſee the Synoptical Table.

The common ſea or edible muſcle has, from its being always found faſtened to the rocks, been ſuppoſed by many wholly incapable of progreſſive motion; but this is an erroneous opinion. It is a common practice in France, at ſuch ſeaſons of the year as do not afford ſun enough to make ſalt, to throw the common ſea-muſcles, which the fiſhermen catch about the coaſts, into the brine-pits. They have an opinion that this renders their fleſh the more tender and delicate, as the rain which falls at theſe ſeaſons makes the water of the pits much leſs ſalt than the common ſea-water. The muſcles are on this occaſion thrown careleſsly in, in ſeveral different parts of the pits; yet, at whatever diſtances they have been thrown in, the fiſhermen when they go to take them out, always find them in a cluſter together; and as there is no current of water in theſe places, nor any other power of motion which can have brought the muſcles together, it ſeems very evident that they muſt voluntarily have marched from the places where they were at firſt, to have met thus together. This progreſſive motion is wholly performed by means of what we call the *tongue* of the muſcle, from its ſhape; but, from its uſe in this caſe, appears rather to merit the name of a *leg*, or an *arm*, as by laying hold of any diſtant ſubſtance, aud then forcibly contracting itſelf again, it draws along the whole body of the fiſh; the ſame part, when it has moved the animal to a proper place, ſerves alſo to fix it there, being the organ by which it ſpins the threads which we call its *beard*, by which it is held to a rock, or to another muſcle. The motion of the muſcle, by means of this part, is juſt the ſame with that of a man laid flat on his belly, who would draw himſelf along by laying hold of any thing with one hand, and then drawing himſelf to it. Muſcles are well known to have a power of faſtening themſelves either to ſtones, or to one another's ſhells, in a very ſtrong and firm manner; but the method of doing this was not well underſtood till the obſervations of Mr. Reaumur explained it.

Every one who opens and examines a common muſcle, will find, that in the middle of the fiſh there is placed a little blackiſh or browniſh body reſembling a tongue. This in large muſcles is near half an inch long, and a little more than a ſixth of an inch in breadth, and is narrower at the origin than at the extremity: from the root of this tongue, or that part which is faſtened to the body of the fiſh, there are produced a great number of threads, which, when fixed to any ſolid ſubſtance, hold the muſcle firmly in its place: theſe threads are uſually from an inch to two inches in length, and in thickneſs from that of a hair to that of a hog's briſtle. They iſſue out of the ſhell in that part where it naturally opens, and fix themſelves to any thing that lies in their way, to ſtones, to fragments of ſhells, or, which is the moſt common caſe, to the ſhells of other muſcles; whence it happens that there are uſually ſuch large parcels of muſcles found together. Theſe threads are expanded on every ſide, and are uſually very numerous, 150 having been found iſſuing from one ſhell: they ſerve the office of ſo many cables; and, each pulling in its proper direction, they keep the muſcle fixed againſt any force that can be offered from whatever part it comes. The filaments are well known to all who that muſcles, whoever carefully ſeparate them under the name of the beard; and Mr. Reaumur has found, that while the animal is living in the ſea, if they are all torn away, the creature has a power of ſubſtituting others in their room: he found, that if a quantity of muſcles were detached from one another and put into a veſſel of any kind, and in that plunged into the ſea, they in a little time faſtened themſelves both to the ſides of the veſſel, and to one another's ſhells; the extremity of each thread ſeemed in this caſe to ſerve in the manner of a hand to ſeize upon any thing that it would fix to, and the other part which was ſlenderer and ſmaller to do the office of an arm in conducting it.

To know the manner of the muſcles performing this operation, this diligent obſerver put ſome muſcles into a veſſel in his chamber, and covered them with ſea-water; he there ſaw that they ſoon began to open their ſhells, and each put forth that little body before deſcribed by its reſemblance to a tongue, and at the root of which theſe threads grow; they extended and ſhortened this part ſeveral times, and thruſt it out every way, often giving it not leſs than two inches in length, and trying before, behind, and on every ſide with it, what were the proper places to fix their threads at: at the end of theſe trials they let it remain fixed for ſome time on the ſpot which they choſe for that purpoſe, and then drawing it back into the ſhell with great quickneſs, it was eaſy to ſee that they were then faſtened by one of theſe threads to the ſpot where it had before touched and remained fixed for a few minutes; and in repeating this workmanſhip the threads are increaſed in number once at every time, and being fixed in different places they ſuſtain the fiſh at reſt againſt any common force.

The ſeveral threads were found to be very different from one another; the new formed ones being ever whiter, more gloſſy, and more tranſparent than the others: and it appeared on a cloſe examination, that it was not, as might have been moſt naturally ſuppoſed, the office of the tongue to convey the old threads one by one to the new places where they were now to be fixed, but that theſe in reality were now become uſeleſs; and that every thread we ſee now formed, is a new one made at this time; and in fine, that nature has given to ſome ſea-fiſhes, as well as to many land-inſects, a power of ſpinning thoſe threads for their neceſſary uſes; and that muſcles and the like fiſh are under water, what caterpillars and ſpiders are at land. To be well aſſured of this, however, Mr. Reaumur cut off the beard or old threads of a muſcle as cloſe as he could, without injuring the part; and the proof of the opinion of their ſpinning new ones at pleaſure was now brought to this eaſy trial, whether theſe muſcles, ſo deprived of their old ones, could fix themſelves as ſoon as others which were poſſeſſed of theirs, and could throw out their threads to as conſiderable diſtances. The experiment proved the truth of the conjecture; for thoſe whoſe beards or old threads were cut off, fixed themſelves as ſoon as thoſe in which they were left, and ſpread their threads to as great a diſtance every way.

When the mechaniſm of this manufacture was thus far underſtood, it became a natural deſire to inquire into the nature of the part by which it was performed: this has hitherto been mentioned under the name of the tongue, from its ſhape; but it is truly the arm of the fiſh; and whenever it happens to be looſened from its company, or fixed in a wrong place, it ſerves the animal to drag its whole body, ſhell and all along, and to perform its ſeveral motions. It fixes itſelf to ſome ſolid body; and then ſtrongly contracting its length, the whole fiſh muſt neceſſarily follow it, and be pulled toward the place where it is fixed. This is an uſe, however, that this part is ſo rarely put to, that it is not properly to be eſteemed a leg or an arm, for this; but, according to its more frequent employment, may much better be denominated the organ by which the threads are ſpun.

Though this body is flat in the manner of a tongue for the greater part of its length, it is however rounded or cylindric about the baſe or inſertion, and it is much ſmaller there than in any other part; there are ſeveral muſcular ligaments faſtened to it about the root or baſe, which hold it firmly againſt the middle of the back or ſhell; of theſe ligaments there are four which are particularly obſervable, and which ſerve to move the body in any direction. There runs all along this body a ſlit or crack, which pierces very deeply into its ſubſtance, and divides it as it were into two longitudinal ſections; this is properly a canal, and along this is thrown the liquor which ſerves to form the threads; and it is in this canal or ſlit that theſe threads are moulded into their form. Externally, this appears only a ſmall crack or ſlit, becauſe the two fleſhy ſections of the parts almoſt meet and cover it, but it is rounded and deep within, and is ſurrounded with circular fibres. This canal is carried regularly on from the tip of the tongue, as it is called, to its baſe, where it becomes cylindric; the cylinder in this part, being no other than a cloſe tube or pipe, in which this open canal terminates. The cylindric tube contains a round oblong body, of the nature of the threads, except that it is much larger; and from the extremity of this all the threads are produced, this ſerving as a great cable to which all the other little cordages diſperſed towards different parts are fixed. The tube or pipe in which this large thread is lodged, ſeems the reſervoir of the liquor of which the other threads are formed; all its internal ſurface being furniſhed with glands for its ſecretion.

The muſcle, like many other ſea-fiſhes abounds in this liquor; and if at any time one touch with a finger the baſe of this ſpinning organ, one draws away with it a viſcous liquor in form of ſeveral threads, like thoſe of a caterpillar, ſpider, and the other ſpinning land animals. The threads fix themſelves with equal eaſe to the moſt ſmooth and gloſſy, as to rougher bodies; if the muſcles are kept in glaſs-jars of ſea-water, they as firmly faſten themſelves to the glaſs as to any other body.

Muſcles, be they ever ſo young, have this property of ſpinningand by this means they faſten themſelves in vaſt numbers to any thing which they find in the ſea. Mr. Reaumur has ſeen them when as ſmall as millet ſeeds, ſpin plentifully; though their threads, proportioned to their own weight, are much finer and ſmaller than thoſe of larger muſcles. It is a queſtion yet undetermined, whether the muſcle has a power of breaking or otherwiſe getting rid of its threads, in order to its removing from the place where it is once fixed; but it appears probable that they have not, and that they muſt remain where they have once faſtened themſelves, though their deſtruction be the conſequence of it. Mr. Reaumur tried this experiment in his jars: when they had well fixed themſelves to the ſides of them, he poured off part of the ſalt-water, ſo that it became the intereſt of the fiſh to leave their hold and go lower down, but they ſeemed to have no power to effect this.

The common muſcle affords the curious obſerver a very pleaſing object of examination by the microſcope. The tranſparent membrane, which immediately appears on opening the ſhell, ſhews the circulation of blood for a long time together through an amazing number of veſſels. And Mr. Lewenhoek, in ſeveral which he diſſected, diſcovered numbers of eggs or embryo muſcles in the ovarium, appearing as plainly as if he had ſeen them by the naked eye, and all lying with their ſharp ends faſtened to the ſtring of veſſels by which they receive nouriſhment. The minute eggs, or embryos, are by the parent placed in due order, and in a very cloſe arrangement on the outſide of the ſhell, where, by means of a gluey matter, they adhere very faſt, and continually increaſe in ſize and ſtrength, till becoming perfect muſcles, they fall off and ſhift for themſelves, leaving the holes where they were placed, behind them.

This abundance of muſcle ſhells, plainly ſhew when examined by the microſcope, and ſometimes they are in a number of 2000 or 3000 on one ſhell; but it is not certain that theſe have been all fixed there by the muſcle within; for theſe fiſh uſually lying in great numbers near one another, the embryos of one are often affixed to the ſhell of another. The fringed edge of the muſcle, which Lewenhoek calls the *beard*, has in every the minuteſt part of it ſuch variety of motions as is inconceivable; for being compoſed of longiſh fibres, each fibre has on both ſides a vaſt many moving particles.

MYXINE, the HAG; a genus of inſects belonging to the order of vermes inteſtini. It hath a ſlender body, carinated beneath; mouth at the extremity, cirrated; the two jaws pinnated; an adipoſe or rayleſs fin round the tail and under the belly. The only remarkable ſpecies is the glutinoſa, about eight inches long. It inhabits the ocean; enters the mouths of fiſh when on the hooks of lines that remain a tide under water, and totally devours the whole, except ſkin and bones. The Scarborough fiſhermen often take it in the robbed fiſh, on drawing up their lines. Linnæus attributes to it the property of turning water into glue.

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END OF THE SECOND VOLUME.